Community-Based Home Injury Risk Assessment in Rural Nepal

Santosh Bhatta

A thesis submitted in partial fulfilment of the requirements of the University of the West of England, Bristol for the degree of Doctor of Philosophy

Faculty of Health and Applied Sciences
University of the West of England, Bristol
United Kingdom

July 2017

ABSTRACT

Background: Unintentional injuries in the home are an important cause of death and disability among young children globally. However, in many parts of the world, particularly in the Low and Middle-Income Countries (LMICs) like Nepal, there is dearth of data regarding home injuries and home hazards to guide the development of effective interventions, and policies for preventing childhood home injuries.

Aims: To explore the environmental risks associated with unintentional injuries amongst children aged 0-59 months in the Makwanpur district of Nepal, and to explore the potential for changes to the home environment to prevent injury occurrence.

Methods: This study employed a multi-method approach. First, a literature review was undertaken to understand what environmental hazards had previously been identified and whether environmental change interventions are effective in reducing home hazards or home injuries in LMICs. Next, community-based studies were designed to collect both quantitative and qualitative information to best understand the problem of home injury risks in the study area. For this, quantitative data were collected through a community-based household survey (740 households) to understand home injury hazards and the injuries, and qualitative data were collected through five focus groups (FGs) to obtain perceptions on injuries and community-identified solutions to improve the safety of the home environment.

Results: The literature review highlighted the limited evidence available from studies exploring the effectiveness of environmental change interventions in reducing childhood home injuries or injury hazards in LMICs. The household survey and home hazard assessment revealed a significant burden of hazards for childhood injuries within the home environment. Total of 242/1042 children <5y (injury rate 232.2/1000 children) were reported to have sustained an injury in the previous 3 months, severe enough to require treatment or for them to be unable to take part in usual activities for at least 1 day. The most common mechanism of injury was falls (n=89/242; rate of 85.4/1000 children), followed by burns/scalds (n=67/242; rate of 64.3/1000 children) and cuts/crushes (n=53/242; rate of 50.9/1000 children) and then animal related injuries (n=24/242; rate of 23/1000 children). Most surveyed households had hazardous environments that had the potential to contribute to injuries in children <5 years. In total, the mean number of injury hazards was 14.98 (SD = 4.48) in the 740 surveyed households with a range of 3 - 31.

Results of regression analysis found a positive relationship between the number of home hazards and the number of childhood injuries. There was an estimated increase of 31% in the odds of injury occurrence associated with each additional injury hazard found in the home (AOR 1.31; 95%CI: 1.20 – 1.42). FG discussions, with different group of people revealed important insights into a community's knowledge and perception of home injury and home hazards and their suggestions for effective environmental change interventions including the barriers and facilitators.

Conclusion: Overall, this thesis provides a robust baseline from which it will be possible to design targeted and culturally relevant environmental change interventions to reduce the number of home hazards in Nepal, with the potential to be adapted for similar socio-cultural settings in other low-income countries.

ATTESTATION

I declare that, this thesis is an original work by me as a result of my own investigations during my Doctor of Philosophy. This work has not been carried out in before for any extent. I understand the nature of plagiarism, and I am aware of the University of The West of England policy on this. All references to ideas and work of other researchers have been specifically acknowledged. All quotations used in this thesis have been distinguished by using quotation marks and the sources are clearly acknowledged.

Signature date

ACKNOWLEDGEMENTS

I feel so proud to write the following statements of gratitude because I have achieved life-time ambition in education through this PhD. This achievement is the product of many individuals who I met, worked and interacted during the entire journey of this doctoral study.

My Director of Studies Dr Toity Deave and supervisor Dr Julie Mytton: Thank you very much for all your help and constant guidance throughout the last four years of my doctorate. Your continual encouragement, thoughts, insights, time, and the way you have challenged me to reach higher has been invaluable to me. I am greatly indebted to you for your support for this PhD study and for the post-doctoral opportunity. Any success I have during my career will be in part down to the foundations you have provided me with.

Prof Elizabeth Towner: Thank you very much for providing me an opportunity to pursue higher education in injury research.

The participants and institutions: My heartfelt thanks go to all the participants who took part in this study. I would like to thank Nepal Health Research Council (NHRC) Nepal, for providing ethical approval for this study and Village Development Committees (VDCs) office for allowing me to conduct this study.

Mother and Infant Research Activities (MIRA): Thank you very much Prof Dharma Manandhar and all the colleagues of MIRA for offering your support for the field work of this study in Nepal. I am very grateful to have all of your support in achieving the data collection work on time.

Centre for Injury Prevention and Research Bangladesh (CIPRB): Thank you very much Prof AKM Fazlur Rahman, Dr Aminur Rahman, Dr. Saidur Rahman Mashreky, Dr. Salim Mahmud Chowdhury, and Dr. Md. Kamran Ul Baset for providing invaluable advice for preparation of data collection tools and feedback on finalising the recommendations. I would also like to thank all the members of CIPRB staffs for organising a workshop in Dhaka and field visit in Raigunj.

University of West of England (UWE): My special gratitude goes to Faculty of Health and Applied Sciences (HAS), Department of Nursing and Midwifery, UWE, for awarding me the three-year full scholarship for this PhD study.

Centre for Child and Adolescent Health (CCAH): Thank you very much all the colleague and friends of CCAH for sharing your invaluable knowledge and experience of research with me, that was helpful. Thank you very much Dr. Puspa Raj Pant, for your continuous support and encouragement throughout my PhD journey.

University of Bristol: Thank you very much Dr Matthew Ellis for providing overall feedback on final draft of thesis. Thank you very much Prof Margaret May and Dr Tom Norris for your statistical advice and useful discussion. I am very grateful to have support of the School of Social and Community Medicine, University of Bristol, for providing access to various training courses.

My father and mother: No word could be found to express my thanks to you. There are no words to express your care from the beginning of my existence up to present. Your moral support and care during my Doctorate study is invaluable. Your unconditional love and support has meant, and continues to mean, to me. I will continue contributing to improve people's lives with your blessings.

Finally, I would like to thank my brother Kishor, my sister-in-law Janaki and my cousins Roshan and Rohan, for their love and support to cheer me up. My daughters Yashna and Harsika who were born during my PhD study deserve lot of love, I owe you both the times I spent off for the field work. To my wife Anamika, the most selfless, generous and loving woman - your love, care and support throughout this degree have made me a better man. Thank you for believing in me.

EXTERNAL OUTPUTS

Publications

Bhatta, S., Pant, P.R. and Mytton, J. 2016. Usefulness of hospital emergency department records to explore access to injury care in Nepal. *International journal of emergency medicine*, *9* (1), pp.1-9

Conference Abstracts

Bhatta, S., Deave, T. and Mytton, J. 2017. Potential for environmental change at community level to prevent child unintentional injuries in the home: A qualitative study [Poster]. In: *Health and Applied Sciences Post-Graduate Research Conference*, University of the West of England. Bristol, UK. 19 Jun 2017.

Bhatta, S., Deave, T. and Mytton, J. 2017. Potential for environmental change at community level to prevent child unintentional injuries in the home: A qualitative study [Oral]. In: *Britain Nepal Academic Council (BNAC) Conference,* Bournemouth University. Bournemouth, UK. 12-13 April 2017.

Bhatta, S., Deave, T. and Mytton, J. 2017. Potential for environmental change at community level to prevent child unintentional injuries in the home: A qualitative study [Oral]. In: *Centre for Health and Clinical Research (CHCR) Conference*, University of the West of England. Bristol, UK. 19 January 2017.

Bhatta, S., Deave, T. and Mytton, J. 2016. Environmental change intervention to reduce child injury in low and middle-income countries: A systematic review [Poster]. In: *12th World Conference on Injury Prevention and Safety Promotion,* Tampere, Finland 18–21 September 2016.

Bhatta, S., Deave, T. and Mytton, J. 2016. Environmental change intervention to reduce child injury in low and middle-income countries: A systematic review [Oral]. In: *2nd National Summit of Health and Population Scientists*, Kathmandu, Nepal 11-12 April 2016.

Bhatta, S., Deave, T. and Mytton, J. 2015. Environmental change intervention to reduce child injury in low and middle-income countries: A systematic review [Poster]. In: *Centre for Health and Clinical Research (CHCR) Conference,* University of the West of England. Bristol, UK. 9 Dec 2015. **[Best poster award winner]**

Bhatta, S., Deave, T. and Mytton, J. 2015. Community based home injury risk assessment in rural Nepal: A cross sectional study [Oral]. In: *Health and Applied Sciences Post-Graduate Research Conference,* University of the West of England. Bristol, UK. 26 Jun 2015.

Bhatta, S., Deave, T. and Mytton, J. 2015. Community based home injury risk assessment in rural Nepal: A cross sectional study [Poster]. In: *1st National Summit of Health and Population Scientists,* Kathmandu, Nepal 11-12 April 2015.

AWARDS AND FINANCIAL SUPPORT

This PhD is fully funded by Faculty of Health and Applied Science (FHAS), Department of Nursing and Midwifery, University of the West of England (UWE). I have also received support from the FHAS, Department of Nursing and Midwifery, UWE to cover the survey activities in Nepal. In addition, I have been privileged to receive the funding from HAS Faculty Research Degrees Committee and Centre for Child and Adolescent Health (CCAH) to present the findings from this study at national and international research conference.

Module/professional courses

I completed two master level modules in UWE with total 60 credits which are as follow:

1. Module title: Systematic Review in Health Behaviour
   Module code: USPJKH-30-M
   Credit value: 30
   Credit level: Master level
   Completed: 17 July 2015
   Faculty of Health and Applied Sciences, UWE

2. Module title: Research in Contemporary Context (RCC)
   Module code: USSJLK-30-M
   Credit value: 30
   Credit level: Master level
   Completed: 20 May 2016
   Graduate School, UWE

Training and short courses

I have completed the following short-courses offered by UWE:

- NVivo10: software for qualitative data analysis (10 and 11 October 2013)

I have completed the following short-courses offered by the School of Social and Community Medicine, University of Bristol:

- Systematic Literature Searching (1-day course in January 2014)
- Critical Appraisal of Quantitative Research (1-day course in February 2014)
- Questionnaire Design, Application and Data Interpretation (3 days course in April 2014)
- Systematic Reviews and Meta-Analysis (4 days course in June 2014)
- Introduction to linear and logistic regression models (5 days course in May 2015)

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GLOSSARY OF TERMS

Active prevention: "Injury prevention measures that requires individuals to change their behaviour or to take action repeatedly are known as active measures" (Hayes et al., 2014b).

Child: Children under 5 years (0-59 months) were included in the survey. Children with this age group are also defined as pre-school children in many research.

Home environment: The immediate environment of a home including roof, courtyard and kitchen garden including inside the home.

Home/environmental hazard: A physical or structural hazard in the home environment (defined above) that has potential to cause injury.

Household: A group of people living together and sharing a kitchen

Passive prevention: "Protection that is provided without an individual needing to do anything or not having to act repeatedly is called passive prevention. Permanent changes to the environment or to products usually provide such protection against injury" (Hayes et al., 2014b).

Proxy Respondents: Any persons responding to the survey on behalf of the injured child, preferably the parents or any responsible adult of the family.

Risk assessment: A term used to describe following three processes. (i) Hazard identification: Identify hazards and risk factors with the potential to cause harm. (ii) Risk analysis and evaluation: Assess the risk associated with a particular hazard. (iii) Risk control: Determine appropriate ways to either eliminate the hazard, or control the risk when the hazard cannot be removed (HSE, 2014).

Risk Factor: Characteristic of an individual/object (e.g. genetic, behavioural, environmental exposures and sociocultural living conditions) that increases the probability that they will experience injury (HSE, 2014).

Risk of injury: The statistical probability of an injury occurring in a given circumstance. It is usually expressed as the injury rate relative to a unit of a given population over time (HSE, 2014).

Injury: According to the world report of child injury (2008) and excerpts of a conference report, injury is defined as "the physical damage that results when a human body is subjected to energy that exceeds the threshold of physiological tolerance or results in lack of one or more vital elements, such as oxygen" (Peden et al., 2008). The terms intentional and unintentional denote whether or not an injury was meant to harm the victim (Christoffel et al., 1992) or not. Intentional injuries include suicide and self-harm, homicide, assault and child abuse or purposeful neglect.

Unintentional injury: Any injury originated suddenly without any intent of self-harm, homicide, or suicide. Includes, for example; Falls, road traffic collisions, accidental poisoning, fire/burns, animal related injuries (bite, sting, crush or attack).

Injury cases: Operational definition of an injury in order to be included in the survey was set out as: any type of unintentional injury occurring in the home environment that did not cause death, such as physical damage caused by transport (e.g. road traffic collision, bicycle injury, injury as a pedestrian whilst on the road), falls, falling objects, cuts or wounds, burns or scalds, drowning, suffocation, accidental poisoning, electric shocks, animal-related injuries including bites, stings or crush injuries, sprains or strains that required medical attention or at least 1 day's loss of usual activities or absence from school.

LIST OF ABBREVIATIONS

ASCs	Ayurvedic Services Centres
CCAH	Centre for Child and Adolescent Health
CDO	Chief District Officer
CIPRB	Centre for Injury Prevention and Research in Bangladesh
CRC	Convention of The Rights of The Child
DALYs	Disability Adjusted Life Years
DoS	Director of Studies
ECED	Early Childhood Education and Development
ED	Emergency Department
EHCS	Essential Health Care Services
FCHV	Female Community Health Volunteers
FGDs	Focus Group Discussions
GBD	Global Burden of Disease
GDP	Gross Domestic Product
HHs	Households
HICs	High-Income Countries
IHME	Institute for Health Metrics and Evaluation
LICs	Low-Income Countries
LMICs	Low-And Middle- Income Countries
MDGs	Millennium Development Goals
MIRA	Mother and Infant Research Activities
MoHP	Ministry of Health and Population
NCD	Non-Communicable Diseases
NHP	National Health Policy
NHSPIP	Nepal Health Sector Programme Implementation Plan
NHSS	Nepal Health Sector Strategy
PHCs	Primary Healthcare Centres
RTIs	Road Traffic Injuries
SHP	Sub-Health Post
UHC	Universal Health Coverage
UNICEF	United Nations Children's Fund
UWE	University of The West of England
VDC	Village Development Committee
WHO	World Health Organisation

CHAPTER 1: INTRODUCTION

This chapter describes the problem of child injury with data and references at a global level, at a low and middle-income country level (LMIC) and at the Nepal level. The magnitude of problem is explored predominantly using mortality data and comparisons are made between high income countries (HICs) and LMICs. This chapter also describes the Nepalese context by reporting the country profile, the health system, risk factors for child injury and the current health plan and health policies in Nepal. In the last section of this chapter I present the overall structure of this thesis.

1.1 CHILD INJURY: A PUBLIC HEALTH PROBLEM

"Every child in the world matters, every child around the world has the right to a safe environment and to protection from injury" (Peden et al., 2008). Today's children are the future of tomorrow. They are the building blocks of families, communities and entire populations. Children and adolescents constitute about a third of the world's population and their health status is important for every country and society. Unfortunately, worldwide, thousands of children lose their life due to unintentional injuries every day. Unintentional injuries do not just contribute to child mortality, they can also have other consequences such as lifelong disability, discomfort, distress and traumatic psychological disorders as well as an increased economic burden on family. Injury is one of the world's most preventable and pressing public health problems, although finding ways to reduce this is currently under-researched.

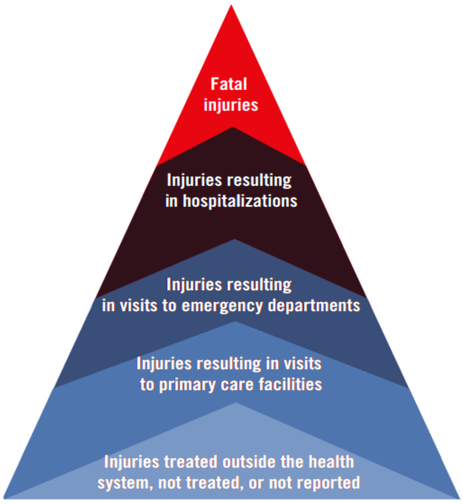
Mortality from infectious diseases has decreased in many countries but mortality from injuries still has a significant impact on children worldwide. Despite this, childhood injury is a frequently neglected issue in comparison to diseases, both infectious and non-infectious. The majority of injury events occur in children living in economically disadvantaged counties and in lower socioeconomic circumstances (Laflamme et al., 2009a). One third of the world's morbidity and mortality due to injury occurs in 11 countries in South East Asia (Dhillon et al., 2012), of which Nepal is one of the poorest. Nepal has a high incidence of unintentional injury due to natural disasters (Sanderson and Ramalingam, 2015), road injury (Karkee and Lee, 2016) and other unintentional injury. In 2015, earthquakes killed almost 9000 people and injured over 22,000 people in April 2015.

In most of developing countries, preventive safety measures are limited not only by economic situation, but also affected by a cultural tendency to view injuries as random events which are unpredictable and uncontrollable. However, most injuries are avoidable (Davis and Pless, 2001). In fact, like with many disease, many unintentional injuries are caused by events that are understandable so are predictable, therefore preventable. Detailed information on the causes of death and non-fatal health outcomes due to injury in children enable the development of effective injury prevention and control programs. Recognising and applying a combination of preventive approaches such as increasing public awareness, behavioural change programmes (active approach), environmental changes (passive approach) and legislative changes for those who are most vulnerable to injury could potentially prevent injury and reduce injury inequality worldwide (World Health Organization, 2002, Peden et al., 2008, Watson and Errington, 2016).

1.2 THE INJURY PYRAMID

Non-fatal injuries are much more frequent than fatal ones. Death is only the tip of iceberg. For each death, due to unintentional injury, there are many non-fatal injuries which result in hospital admissions and emergency department (ED) visits, often with far-reaching health and social consequences (Peden et al., 2008, Chandran et al., 2010). This has been modelled in a pyramid (Figure 1.1) to demonstrate the gravity of injury problem. The European Report on Child Injury Prevention estimated that there is an average ratio of 1 death to 129 hospital admissions, 1635 ED attendances and many millions more visits to general practitioners or self-treatment (Unicef, 2001). This estimated pyramid for Europe was derived from studies conducted in the Netherlands, Sweden and the United Kingdom (UK). A study conducted in the Netherlands (Rogmans, 2000) showed that for every injury-related death, there were 160 hospital admissions and 2000 ED attendances. Another study conducted in the UK (Walsh et al., 1996) demonstrated a similar ratio; of 1 death to 151 hospital admissions and 1947 ED attendances. The ratio for Sweden was 1 death to 75 hospital admissions and 959 ED attendances (Ekman et al., 2005). Sweden has the lowest all-cause child injury-related mortality rate, in the world at 5.2 per 100,000 children <15 years (Unicef, 2001). In the United States of America (USA), an average of 12,175 children aged 0-19 years die from unintentional injury per year but >9.2 million are treated in the ED for non-fatal injuries (Borse et al., 2008a).

Figure 1.1 Injury pyramid showing hierarchy of fatal and non-fatal injuries



Source: Injuries and violence: The facts.(World Health Organization, 2010)

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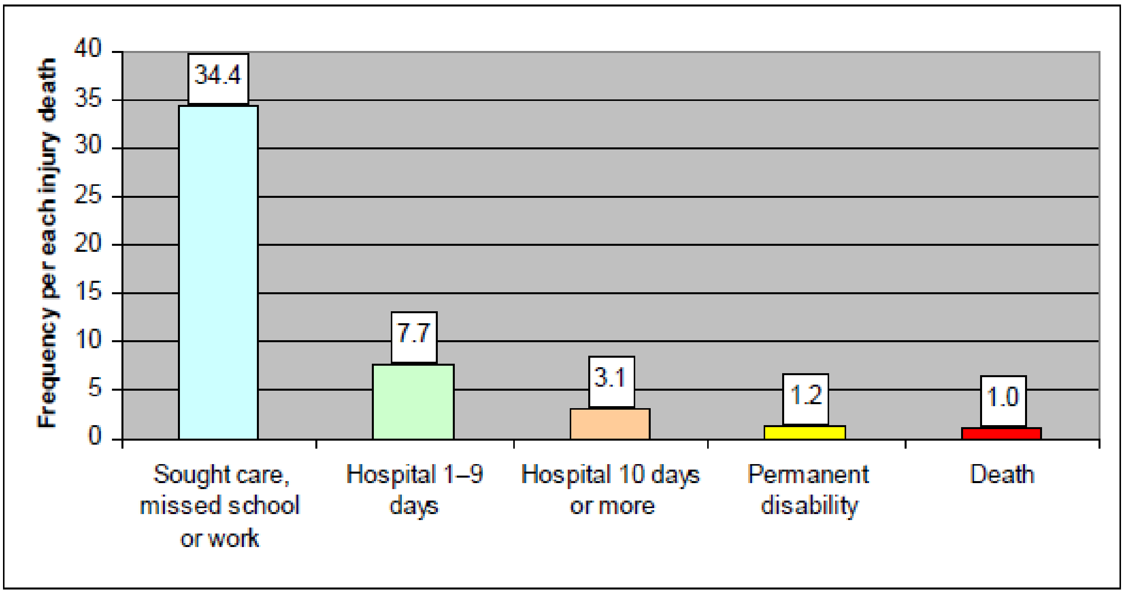
There are number of factors, variable between countries that determine the layers and the slope of the pyramid. These factors include the age group of the injured person, the type of injury, access to healthcare services or the quality of the data completeness. A report on the Thai National Injury Survey (2006) found that for every child who died due to injury, 23 children sought medical care or missed three days of work or school (Sitthi-Amorn et al., 2006). The Bangladesh Health and Injury Survey (BHIS) conducted during January-December, 2003, reported that for every injury-related death, there were 32 injured children who lived (Rahman et al., 2005). The cumulative data from surveys in 5 Asian countries, (Bangladesh, China, Philippines, Thailand and Viet Nam) estimated that the ratio of non-fatal injuries to injury-related death was 34:1 (Linnan et al., 2007)

1.3 CONSEQUENCES OF CHILD INJURIES

Mortality is an important indicator that allows the magnitude of a health problem to be recognised but it excludes the burden of non-fatal consequences to the survivors and their communities (Peden et al., 2008). There are no clear data to demonstrate the exact incidence of non-fatal injury in many LMICs. The Bangladesh Health and Injury Survey (Rahman et al., 2005) showed that non-fatal injury was responsible for >13,000 permanent disabilities per year amongst children aged 0-17 years. The overall annual child injury rate was 1,592/100,000 children; Thus, two in every 100 children had a severe injury that required medical care or lost at least three days of school or work that year.

The ratios of non-fatal injury by severity level to one death (Figure 1.2) is well described in the Child Mortality and Injury in Asia: Innocenti Working papers (Linnan et al., 2007).

Figure 1.2 Ratio of non-fatal injuries to death by severity level



Source: Taken from Innocenti Working paper (Linnan et al., 2007)

(Used with permission of the author)

Serious and severe non-fatal injury can result in lifelong disability and impact on child health and education in the short- and long-term. If an injury occurs in childhood, the consequence of living with a disability can be lifelong. The more severe the injury, the higher the risk of permanent disability and this can be complicated by significant psychological consequences. Injury also increases the economic and social burden to the family, either due to the direct or indirect cost (Lao et al., 2012, Saito et al., 2014). Direct costs are those associated with the required medical care including emergency medical services, hospitalization and administrative costs, as well as other resources like the cost of repairing damage to, or loss of property. Indirect costs from child injury include lost productivity, reduced quality of life, unknown costs of care and the psychological wellbeing of the family (World Health Organization, 2011a). Several studies report that the greatest burden of injury remains in poorer countries and injury can further escalate poverty due to the added costs of treatment (Peden et al., 2008, Gosselin et al., 2009). However, there are only a few studies in the literature that address adverse health outcomes in children that result from both fatal and non-fatal injury due to the inadequacy of data available.

1.4 UNINTENTIONAL CHILDHOOD INJURY

1.4.1 Global overview

Substantial progress that has been made towards reducing communicable disease, neonatal health problems and child malnutrition over the past few decades, therefore injury has emerged as one of the leading causes of morbidity, mortality and lifelong disability in children worldwide. The contribution of injury to mortality, hospitalization, lifelong disability and the burden on the population as a whole is increasingly recognised. The World Report on Child Injury Prevention prepared by the WHO and United Nations Children's Fund (UNICEF) (Peden et al., 2008) reported that more than 950,000 children <18 years die each year as a result of injury, with or without intent, worldwide. Unintentional injury accounts for about 90% (about 830,000) of all injury-related deaths in children under 18 years of age. This means that worldwide, >2,000 children die each day from unintentional injuries due to transport accidents, drowning, foreign body inhalation, mechanical forces, falls, contact with fire, heat or hot substances, animal contact and unintentional poisoning (Peden et al., 2008).

The Global Burden of Diseases (GBD) study is the most comprehensive source of data estimating epidemiological studies including injury-related mortality and morbidity at a global and national or regional level. It examines data from 1990-2015 (IHME, 2016). Estimates from the GBD study indicate that in 2015, there were about 700,300 deaths amongst children <20 years of age resulting from injury, with or without intent (IHME, 2016). Of these, 85% (596,609) were due to unintentional injury and 15% (103,690) to self-harm or interpersonal violence. The difference in estimates of death rates illustrated by these two well respected studies exemplify the challenge for injury researchers when making international comparisons and comparisons over time. Unless there is a standardized agreed definition of what constitutes a death due to injury, there is possibilities to have variations in estimates and makes unable to accurately map trends in injury incidence unless the same source is used consistently. However, this data source indicates that unintentional injury resulting from transport accidents, drowning, foreign body inhalation, mechanical forces, falls, contact with fire, heat or hot substances, animal contact and accidental poisoning were the important causes of mortality in children <20 years of age. Transport injuries (29%) and drowning (18%) were the predominant causes of mortality amongst these children. They therefore accounted for almost 50% of all deaths due to unintentional injury (Table 1.1).

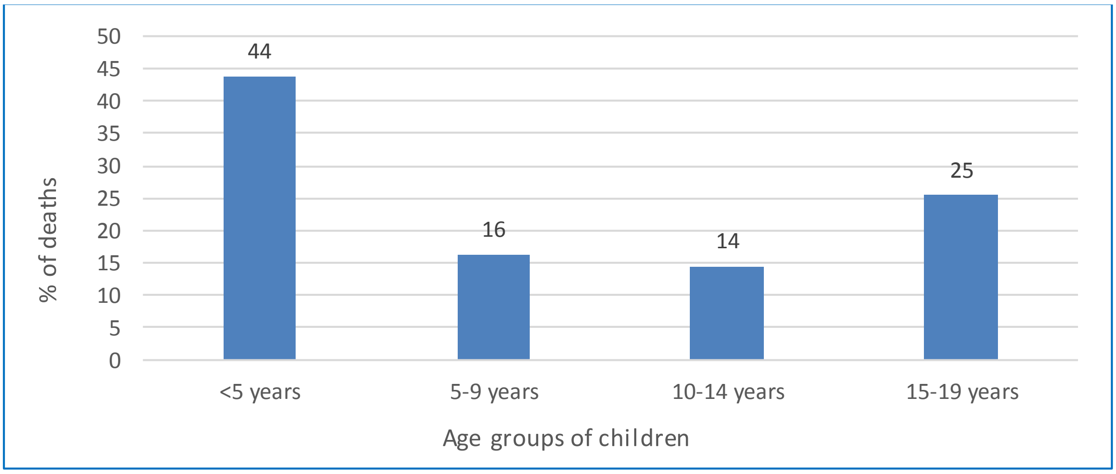
Table 1.1 Global causes of child (<20 yrs.) deaths due to injury, by injury type. GBD, 2015 (n=700,300)

Intent of injury	Types of injury	Proportion (%)	Numbers
Unintentional Injury	Transport injuries	28.9	202,482
	Drowning	18.2	127,577
	*Foreign body	7.3	51,137
	**Exposure to mechanical forces	7.0	49,270
	Falls	6.6	46,211
	Fire, heat, and hot substances	5.7	40,068
	***Animal contact	3.8	26,304
	Poisonings	3.7	25,712
	Other unintentional	4.0	27,848
	Total	**85.2**	**596,609**
Intentional Injury	Self-harm or interpersonal violence	**14.8**	**103,690**

Source: Authors calculation from Global Burden of Diseases study, 2015
**Includes pulmonary aspiration, foreign body in eye and other foreign body injury*
***Includes unintentional firearm, unintentional suffocation, and other mechanical forces*
****Includes venomous and non-venomous animals*

All age groups of children are affected by the unintentional injury burden; however, children <5 years of age are more susceptible to death due to unintentional injury than other ages. Of these 596,609 children, about 44% (261,284) of the deaths due to unintentional injury occurred amongst children aged <5 years, about 6% (97,249) amongst children aged 5-9 years, about 14% (86,388) amongst those aged 10-14 years and 25% (151,688) amongst those aged 15-19 years. These estimates indicate that the highest burden of injury is in children aged <5 years (Figure 1.3).

Figure 1.3 Proportion of deaths due to unintentional injury in children <20 years, stratified by age group (n=596,609)



Source: Authors calculation from Global Burden of Diseases Study, 2015

The world report on child injury prevention stated that unintentional injury caused about 349,000 deaths in children aged <5 years each year (Peden et al., 2008); This is 37% of the total of 950,000 deaths due to unintentional injury that occurred in children aged <20 years. This was also found by the GBD Study (IHME, 2016), which estimated that worldwide, in 2015, about 261,284 children <5 years (95% Uncertainty Interval (UI): 193,861 – 325,995) died due to unintentional injury. The leading causes of death due to unintentional injury in children <5 years were drowning (53,733 deaths; 95% UI: 46,687 – 61,408), transport-related injuries (56,088 deaths; 95% UI: 44377 – 65,699), foreign body-related injuries (39,573 deaths; 95% UI: 27653 - 53206), exposure to mechanical forces (28,751 deaths; 95% UI: 22,043 – 33,577), falls (23,344 deaths; 95% UI: 15,184 – 30,322) and fire, heat, or hot substance exposure-related injuries (22,485 deaths; 95% UI: 17,938 – 26,194) (IHME, 2016). In 2015, the mortality rate due to unintentional injury amongst children aged <5 years was 38.9 per 100,000 (95% UI: 28.9 – 48.5). Child mortality due to drowning and transport-related injury was higher than other causes of unintentional injury; drowning 8.4 per 100,000 (95% UI: 6.6 – 9.8) and transport-related injury 8.0 per 100,000 (95% UI: 7.0 – 9.1) (Table 1.2).

Table 1.2 Global number and rates (per 100,000) of unintentional injury in children aged <5 years, with 95% Uncertainty Intervals (UI) (GBD, 2015)

Unintentional injuries	**Numbers (95% UI)**	**Rate per 100,000 (95% UI)**
Transport injuries	53,733 (46,687 – 61,408)	8.0 (7.0 – 9.1)
Drowning	56,088 (44,377 – 65,699)	8.4 (6.6 – 9.8)
*Foreign body	39,573 (27,653 – 53,206)	5.9 (4.1 – 7.9)
**Exposure to mechanical forces	28,751 (22,043 – 33,577)	4.3 (3.3 – 5.0)
Falls	23,344 (15,184 – 30,322)	3.5 (2.3 – 4.5)
Fire, heat, and hot substances	22,485 (17,938 – 26,194)	3.3 (2.7 – 3.9)
***Animal contact	9,855 (5,859 – 13,424)	1.5 (0.9 – 2.0)
Poisonings	18,412 (6,406 – 31,516)	2.7 (1.0 – 4.7)
Other unintentional injuries	9,042 (7,713 – 10,647)	1.3 (1.1 – 1.6)
Total	**261,284 (193,861 – 325,995)**	**38.9 (28.9 – 48.5)**

Source: Authors calculation from Global Burden of Diseases study, 2015
**Includes pulmonary aspiration, foreign body in eye and other foreign body injury*
***Includes unintentional firearm, unintentional suffocation, and other mechanical forces*
****Includes venomous and non-venomous animals*

In addition to mortality, millions of children suffer non-fatal injuries that often require long-term hospitalisation and rehabilitation. A substantially number of injuries result in a potentially lifelong disability (Peden et al., 2008). "The DALY, developed for the GBD study, is an example of a health gap indicator that extends the notion of mortality gaps to include time lived in states other than excellent health." (Lopez et al., 2006). According to the estimates of GBD study, in 2015, unintentional injuries were responsible for 23,200,187 disability-adjusted life years (DALYs) (95% UI: 17,404,429 – 28,742,352) amongst children <5 years. The DALYs rate due to the unintentional injury amongst children <5 years was 3455 per 100,000 (95% UI: 2,592 – 4,280). Also in 2015, it was reported that drowning (4,753,996 DALYs: 95% UI: 3,760,132 – 5,563,200) and transport injury (4,590,453 DALYs: 95% UI: 3,989,393 – 5,248,059) remained the leading cause of DALYs amongst children <5 years. The rate of DALYs due to drowning was 708 per 100,000 (95% UI: 560 – 828) and transport injury-related DALYs was 684 per 100,000 (95% UI: 594 – 782) (Table 1.3).

Table 1.3 Global number and rates (per 100,000) of DALYs due to unintentional injury in children <5 years with 95% Uncertainty Intervals (UI) (GBD, 2015)

DALYs due to unintentional injury	DALYs Number (95% UI)	DALYs Rate per 100,000 (95% UI)
Transport injuries	4,590,453 (3,989,393 – 5,248,059)	684 (594 – 782)
Drowning	4,753,996 (3,760,132 – 5,563,200)	708 (560 – 828)
*Foreign body	3,477,764 (2,460,267 – 4,615,198)	518 (366 – 687)
**Exposure to mechanical forces	2,626,939 (2,052,419 – 3,051,713)	391 (306 – 454)
Falls	2,206,947 (1,504,971 – 2,789,270)	329 (224 – 415)
Fire, heat, and hot substances	2,028,348 (1,640,228 – 2,349,862)	302 (244 – 350)
***Animal contact	876,988 (538,167 – 1,186,292)	131 (80 – 177)
Poisoning	1,603,221 (570,949 – 2,730,340)	239 (85– 407)
Other unintentional injuries	1,035,530 (887,902 – 1,208,417)	154 (132 – 180)
Total	**23,200,187 (17,404,429 – 28,742,352)**	**3455 (2,592 – 4,280)**

Source: Authors calculation from Global Burden of Diseases study, 2015
**Includes pulmonary aspiration, foreign body in eye and other foreign body injury*
***Includes unintentional firearm, unintentional suffocation, and other mechanical forces*
****Includes venomous and non-venomous animals*

1.4.2 HICs and LMICs overview

The pattern of inequality in injury varies both within countries and internationally. Injury has the greatest impact on those living in poorer countries and those from deprived backgrounds and minority groups. Community-based surveys of child mortality conducted in 5 South East Asian countries (Bangladesh, China, Thailand, the Philippines and Viet Nam), found that the incidence of deaths due to childhood injury was much higher than previously supposed (Linnan et al., 2007). More than 95% of 830,300 deaths due to unintentional injury in children aged 0-18 years occur every year in LMICs (Peden et al., 2008). This is partly because a higher proportion of the world's population lives in these countries but also because the incidence of death from injury is higher in these countries in comparison to global rates and to rates from high income countries. Similarly, DALY rates due to unintentional injury in LMICs were 2,398/100,000 population compared with 774/100,000 population in HICs (Chandran et al., 2010). Injury data collected in HICs tend to be through injury surveillance systems, whilst that in LMICs tend to be collected through one-off surveys or hospital based data. Therefore, statistics about child injury incidence are likely to be under-reported events in majority of LMICs due to the lack of injury surveillance systems (Schopper et al., 2006). Injury in LMICs is considered as a less significant issue when compared to infectious diseases and nutritional issues (Bartlett, 2002, Hyder et al., 2007). Although many HICs have reduced the number of childhood deaths due to injury by ≤50% in the past three decades by implementing multisector and multifaceted approaches to preventing child injury, it still remains a problem in these countries, accounting for about 40% of all child deaths (Peden et al., 2008, Sethi et al., 2008).

Injury inequality is related to socioeconomic, cultural and environmental factors. For example, people with a low level of education, low-paid or low-skilled occupation, low income, poor housing quality and limited access to safety information and healthcare, have both a higher risk of unintentional injury and of suffering from post-traumatic consequences of injury (Peden et al., 2008, Laflamme et al., 2009b). The World Report on Child Injury Prevention (2008) reported that the rate of death due to unintentional injury in children in LMICs (41.7 per 100,000) is nearly four times higher than in HICs (12.2 per 100,000). The ratio for mortality rate between LMICs and HICs is greatest for RTIs (10.7), drowning (7.2) and fire-related burns (3.9). The differences in injury rate and ratio between LMICs and HICs shown in Table 1.4 demonstrate that children from deprived communities have a higher risk of sustaining a severe injury or death (Peden et al., 2008).

Table 1.4 Rate of death due to unintentional injury per 100,000 children (<20 years) by cause of injury and country income level (World, 2008)

	Type of Unintentional Injury						
	RTIs	**Drowning**	**Fire burns**	**Falls**	**Poisons**	**Other***	**Total**
HIC	7.0	1.2	0.4	0.4	0.5	2.6	12.2
LMIC	11.1	7.8	4.3	2.1	2.0	14.4	41.7
LMIC: HIC	1.59	6.50	10.75	5.25	4.00	5.54	3.42
World	10.7	7.2	3.9	1.9	1.8	13.3	38.8

Table adapted from World report on child injury prevention (2008)
"Other" includes categories such as smothering, asphyxiation, choking, animal or snakebites, hypothermia and hyperthermia as well as natural disasters

The unintentional injury death rate varies between age groups but is consistently higher in LMICs when compared to HICs. In LMICs, children aged <1-year-old and aged 1-4 years have higher risk of death due to unintentional injury than other age groups (Table 1.5).

Table 1.5 Rates of death due to unintentional injury per 100,000 children (<20 years) by age group and country income level (World, 2008)

	Age (years)					
	<1	**1-4**	**5-9**	**10-14**	**15-19**	**<20**
HIC	28.0	8.5	5.6	6.1	23.9	12.2
LMIC	102.9	49.6	37.6	25.8	42.6	41.7
LMIC: HIC	3.68	5.84	6.71	4.23	1.78	3.42
World	96.1	45.8	34.4	23.8	40.6	38.8

Table adapted from World report on Child Injury Prevention (2008)

The GBD study also demonstrates a similar pattern of child injury in 2015. Although worldwide injury mortality rate has declined significantly in the past 20 years, child mortality rates remain high in LMICs. The study estimated that in 2015, the unintentional injury death rate in children <5 years was 8.9 per 100,000 children in HIC, whilst it was 3-8 times higher in Middle and Lower Income countries. Similarly, unintentional injury death rates in children aged 5-9 years were 3.6 per 100,000 children in HIC whilst it was 4-7 times higher in Middle and Lower Income countries. The unintentional injury death rates in children aged 10-14 years was 3.9 per 100,000 children in HIC whilst it was 4-6 times higher in Middle and Lower Income countries. The rate of death due to unintentional injury for children aged 15-19 years was more than double in Middle and Lower Income countries than HIC (Tables 1.6).

Table 1.6 Rates of death due to unintentional injury per 100,000 children (<20 years) by age group and country income level (World, GBD 2015)

	Age (years)			
	Under 5	**5-9**	**10-14**	**15-19**
HIC	8.9	3.6	3.9	14.1
UMIC	31.6	15.7	15.2	24.6
LMIC	38.5	15.1	14.2	29.0
LIC	74.2	24.1	21.5	27.1
HIC: UMIC: LMIC: LIC	3.6: 4.3: 8.3	4.4: 4.2: 6.7	3.9: 3.6: 5.5	1.7: 2.1: 1.9
Global	38.9	15.3	14.3	25.7

HIC: High Income Countries, UMIC: Upper Middle-Income Countries, LMIC: Lower Middle-Income Countries, LIC: Low Income Countries.

More detail rate of death due to unintentional injury for children aged <20 years is presented in the table 1.7.

Table 1.7 Rate of death due to unintentional injury per 100,000 children (<20 years) by age group and country income level (World, GBD 2015)

World Bank countries	Transport	Drowning	*Foreign body	**Exposure to mechanical forces	Falls	Fire, heat, and hot substances	***Animal contact	Poisoning	Other unintentional	Total
					Global					
<5	8.0	8.4	5.9	4.3	3.5	3.3	1.5	2.7	1.3	**38.9**
5-9	5.4	4.1	0.8	1.0	1.3	0.9	0.9	0.3	0.6	**15.3**
10-14	5.3	3.8	0.6	0.9	1.2	0.6	0.8	0.4	0.8	**14.3**
15-19	14.0	3.8	0.5	1.5	1.3	1.4	1.0	0.5	1.6	**25.7**
					HIC					
<5	2.3	1.5	1.8	1.6	0.5	0.7	0.1	0.3	0.1	**8.9**
5-9	1.9	0.6	0.2	0.3	0.2	0.3	0.0	0.1	0.0	**3.6**
10-14	2.3	0.6	0.2	0.3	0.2	0.2	0.0	0.1	0.1	**3.9**
15-19	11.2	1.1	0.2	0.5	0.4	0.2	0.0	0.3	0.1	**14.1**
					UMIC					
<5	8.3	6.9	4.6	5.5	2.0	1.9	0.4	1.4	0.6	**31.6**
5-9	6.8	5.1	0.4	0.9	1.0	0.5	0.2	0.4	0.4	**15.7**
10-14	6.2	5.2	0.4	0.9	0.9	0.4	0.1	0.5	0.5	**15.2**
15-19	15.5	3.9	0.3	1.4	1.3	0.5	0.1	0.6	1.0	**24.6**
					LMIC					
<5	7.4	9.0	6.1	3.4	4.1	3.1	1.8	2.3	1.3	**38.5**
5-9	4.7	3.8	0.9	1.0	1.4	0.9	1.4	0.3	0.6	**15.1**
10-14	4.9	3.4	0.7	0.8	1.4	0.6	1.1	0.3	0.9	**14.2**

15-19	13.7	4.6	0.5	1.7	1.5	2.4	1.8	0.5	2.2	**29.0**
LIC										
<5	13.2	13.6	10.2	6.6	6.2	8.7	3.5	8.4	3.8	**74.2**
5-9	7.6	5.5	1.3	1.8	2.3	2.0	1.6	0.5	1.6	**24.1**
10-14	6.9	4.9	1.1	1.4	2.3	1.3	1.3	0.4	2.0	**21.5**
15-19	14.6	3.5	1.1	2.1	1.0	1.1	0.8	0.6	2.4	**27.1**

Source: Authors calculation from Global Burden of Diseases study, 2015
**Includes pulmonary aspiration, foreign body in eye and other foreign body injury*
***Exposure to mechanical forces includes unintentional firearm, unintentional suffocation, and other mechanical forces*
****Includes venomous and non-venomous animals*
HIC: High Income Countries, UMIC: Upper Middle-Income Countries, LMIC: Lower Middle-Income Countries, LIC: Low Income Countries.

The data from a large amount of research has demonstrated that the biggest burden of injury remains in LMICs (Peden et al., 2008, Gosselin et al., 2009). However, there are fewer studies conducted in LMICs that explore the differences between the socioeconomic groups within the specific countries themselves. Some studies conducted in LMICs reported that a higher proportion of children with a lower socioeconomic status (SES) suffer injuries (Hang et al., 2003, Mock et al., 2003, Thanh et al., 2003, Giashuddin et al., 2009). A study in Bangladesh found that children from poorer families were 2.8 times (95%CI: 1.1 – 7.9) more likely to suffer from injury-related mortality when compared to children from wealthier backgrounds (Giashuddin et al., 2009). Research in European countries have confirmed this association of poverty with child injury (Laflamme et al., 2009a, Laflamme et al., 2010).

Worldwide, about 341,000 children <5 years of age who died from injuries were from LMICs (Peden et al., 2008); this is 98% of the total 349,000 deaths due to injury in children <5 years of age. The GBD study also shows a similar pattern; about 98% (254,875 in 260,896) of unintentional injury-related deaths amongst <5 year-olds occurred in LMICs (IHME, 2016). Only 2% (6021) of unintentional injury-related deaths occurred in children aged <5 years in HICs. These data clearly suggest that the burden of child injury is much higher in LMICs compared to HICs.

Furthermore, the GBD study demonstrates that almost all causes of unintentional injury-related deaths were more common in low and middle-income countries when compared to HICs. The mortality rate for children <5 years due to unintentional injuries was 8.9 per 100,000 in HICs. Compared to HICs, the mortality rate for children <5 years was 3.4 times higher in upper middle-income countries (31.6/100,000), 4.4 times in lower middle-income countries (38.5/100,000) and 8.4 times in low income countries (74.2/100,000). The pattern of mortality rate for children <5 years is similar for the all causes of unintentional injuries. (Table 1.8).

Table 1.8 Deaths rates (per 100,000) caused by unintentional injury in children <5 years in High, Middle and Low-Income Countries (GBD, 2015)

Causes of unintentional injury	**Child deaths <5 years per 100,000**			
	High Income	Upper middle income	Lower middle income	Low income
Transport-related injuries	2.3	8.3	7.4	13.2
Drowning	1.5	6.9	9.0	13.6
*Foreign body	1.8	4.6	6.1	10.2
**Exposure to mechanical forces	1.6	5.5	3.4	6.6
Falls	0.5	2.0	4.1	6.2
Fire, heat, and hot substances	0.7	1.9	3.1	8.7
***Animal contact	0.1	0.4	1.8	3.5
Poisoning	0.3	1.4	2.3	8.4
Other unintentional injuries	0.1	0.6	1.3	3.8
Total	**8.9**	**31.6**	**38.5**	**74.2**

Source: Authors calculation from Global Burden of Diseases study, 2015
**Includes pulmonary aspiration, foreign body in eye and other foreign body injury*
***Includes unintentional firearm, unintentional suffocation, and other mechanical forces*
****Includes venomous and non-venomous animals*

The DALYs lost due to unintentional injury in children aged <5 years was about 3-8 times higher in LMICs when compared to HICs. The DALYs lost due to unintentional injuries was 818 per 100,000 in HICs which was 3 times higher (2770) in upper middle-income countries, 4 times (3428) in lower middle-income countries and 8 times (6525) in low income countries. These estimates from the GBD study data demonstrates that unintentional injury-related mortality and loss of DALYs is higher in LMICs (Table 1.9).

Table 1.9 DALYs lost (per 100,000) due to unintentional injury in children <5 years of age in High, Middle and Low-Income Countries (GBD, 2015)

Causes of unintentional injuries	**DALYs lost per 100,000 in children <5 years of age**			
	High Income	Upper middle income	Lower middle income	Low income
Transport injuries	199	706	632	1,128
Drowning	125	585	761	1,152
*Foreign body	157	403	541	892
**Exposure to mechanical forces	145	487	321	603
Falls	74	191	387	565
Fire, heat, and hot substances	66	170	280	765
***Animal contact	5	31	158	307
Poisonings	26	118	197	723
Other unintentional	20	78	151	388
Total	**818**	**2,770**	**3,428**	**6,525**

Source: Authors calculation from Global Burden of Diseases study, 2015
**Includes pulmonary aspiration, foreign body in eye and other foreign body injury*
***Includes unintentional firearm, unintentional suffocation, and other mechanical forces*
****Includes venomous and non-venomous animals*

Injury affects the most disadvantaged and the consequences of injury can aggravate poverty, so efforts to reduce injury could contribute to meeting the criteria of the following Sustainable Development Goals (SDGs): reducing inequality within and among countries (SDG10) and to end poverty in all its forms everywhere (SDG1) (Osborn et al., 2015). Despite this potential impact, injury is not a priority in public health research in most LMICs. Consequently, information about injury epidemiology is limited and this is a major obstacle in effective injury prevention interventions in LMICs. In recent years, unintentional injury in childhood has gradually become recognised as a public health issue in some LMICs across the world but there is still much scope for research, particularly of planning for injury prevention activities.

1.4.3 Unintentional child injuries in Nepal

In the absence of a robust death registration system estimates of injury death rates in Nepal are unclear. National level studies of mortality can provide some indication of fatal child injury events. In this regard, the GBD study estimated that, in 2015, about 1240 Nepalese children aged <5 years died from injury, with or without intent, which was 23% of the total of all injury-related deaths (5,280) in children (aged 0-19 years) in that year (IHME, 2016). In 2010, the injury-related mortality rate, with or without intent, for children aged <5 years was 29 per 100,000 children (Males: 31 per 100,000; Females: 28 per 100,000) and this increased in the subsequent 5 years to 43 per 100,000 children (Males: 45 per 100,000; Females: 42 per 100,000) (IHME, 2016). The child injury rate in Nepal has been recorded as 3 times more than in developed countries. In 2010, injuries were responsible for 3% (95%UI: 1.8% - 5%) of all deaths amongst children aged <5 years and this increased by 2.8% by 2015 to 5.8% (95%UI: 3.9% - 8.2%) of all deaths.

Of the total deaths, 3% (95%UI: 1.4% - 5.6%) resulted from unintentional injuries due to road traffic incidents, drowning, contact with a foreign body, exposure to mechanical forces, falls, fire, heat and hot substances, animal contact or poisoning (IHME, 2016). However, these data might be underreported due to the absence of injury surveillance systems in Nepal (Bhalla et al., 2010). There is also a lack of robust birth and death registration system. In the absence of robust birth registration, it is difficult to know the true population size (denominator) and in the absence of death registration, it is difficult to know accurate numerator to estimate death rates. Therefore, it is highly likely that these figures underestimate the true number of child deaths due to injury.

[1]The Annual Report of the Department of Health Services (DoHS) is the main source of data to estimates the burden of diseases in Nepal (Ministry of Health, 2015). The GBD study used these data to estimate the burden of disease and injury in Nepal.

According to the GBD study, 602/1240 (48.8%) injury deaths in children <5 years (95% UI: 231 - 1472) in Nepal were due to unintentional causes, which is 34% of the total unintentional injury-related deaths (1,785) in children aged <20 years. Unintentional injuries were responsible for 246 deaths amongst children aged 5-9 years, 292 in those aged 10-14 years and 645 amongst those aged 15-19 years. These estimates demonstrate that the number of deaths due to unintentional injury is highest in children aged <5 years and 15-19 years (Table 1.10).

[1] The Annual Report of the Department of Health Services (DoHS) is the main source of data to estimates the burden of diseases in Nepal. Information and statistics used in DoHS report are based on the data collected through the Health Management Information System (HMIS) from health institutions including Public/Private Hospitals, Primary Health Care Centres (PHCC), Health Posts (HP), Primary Health Care/outreach Clinics (PHC/ORC), Expanded Programme of Immunisation (EPI) clinics, Female Community Health Volunteers (FCHV) NGO/INGOs and Private Health Institutions across the country.

Table 1.10 Numbers of deaths due to unintentional injury amongst children aged < 20 years in Nepal (GBD, 2015)

Causes of unintentional injury	**<5 years**	**5 - 9 years**	**10 - 14 years**	**15 - 19 years**
Transport injuries	207	107	144	337
Drowning	32	16	18	34
*Foreign body	100	13	14	16
**Exposure to mechanical forces	46	15	10	33
Falls	105	30	34	45
Fire, heat, and hot substances	40	20	15	79
***Animal contact	29	34	36	52
Poisonings	36	7	9	12
Other unintentional	7	4	12	37
Total (n = 1785)	**602 (34%)**	**246 (14%)**	**292 (16%)**	**645 (36%)**

Source: Authors calculation from Global Burden of Diseases study, 2015
**Includes pulmonary aspiration, foreign body in eye and other foreign body injury*
***Includes unintentional firearm, unintentional suffocation, and other mechanical forces*
****Includes venomous and non-venomous animals*

Of the 602-unintentional injury-related deaths <5 years, 207 (95% UI: 80 - 539) were due to road traffic incidents, 105 (95% UI: 29 - 278) due to falls, 100 (95% UI: 61 - 172) from a foreign body. The estimated all-cause mortality rate due to unintentional injury was 21.1 (95% UI: 8.1 – 51.7) for children aged <5 years. Leading causes of death due to unintentional injury in children <5 years of age had mortality rates as follows; Death due to transport-related injury was 7.3 per 100,000 (95% UI: 2.8 – 19.0), to falls was 3.7 per 100,000 (UI: 1.0 – 9.8) and due to foreign body contact was 3.5 per 100,000 (95% UI: 2.1 – 6.1) (Table 1.11).

Table 1.11 Number and rate of deaths per 100,000 due to unintentional injury in children <5 years, with 95% Uncertainty Intervals (UI) (GBD, 2015)

Causes of unintentional injury	Number (95% UI)	Rate per 100,000 (UI)
Transport injuries	207 (80 - 539)	7.3 (2.8 – 19.0)
Drowning	32 (11 - 77)	1.1 (0.4 – 2.7)
*Foreign body	100 (61 - 172)	3.5 (2.1 – 6.1)
**Exposure to mechanical forces	46 (22 - 95)	1.6 (0.8 – 3.3)
Falls	105 (29 - 278)	3.7 (1.0 – 9.8)
Fire, heat, and hot substances	40 (14 - 74)	1.4 (0.5 – 2.6)
***Animal contact	29 (5 - 66)	1.0 (0.2 – 2.3)
Poisonings	36 (5 - 159)	1.2 (0.2 – 5.6)
Other unintentional	7 (4 - 11)	0.2 (0.1 – 0.4)
Total	**602 (231 – 1,472)**	**21.1 (8.1 – 51.7)**

Source: Authors calculation from Global Burden of Diseases study, 2015
Includes pulmonary aspiration, foreign body in eye and other foreign body injury
**Includes unintentional firearm, unintentional suffocation, and other mechanical forces*
***Includes venomous and non-venomous animals*

Similarly, 55,951 children (95% UI: 23,941 – 130,209) <5 years lost DALYs due to unintentional injury in Nepal in 2015. The rate of DALYs for children aged <5 years was 1,967 per 100,000 (95% UI: 842 – 4,578). Unintentional injuries were responsible for about 3% of the total DALYs lost for children of this age group. The leading causes of DALYs lost due to unintentional injury were from road traffic incidence, falls and foreign body contact (Table 1.12).

Table 1.12 Number and rates of DALYs per 100,000 due to unintentional injury in children <5 years of age, with 95% Uncertainty Intervals (UI) (GBD, 2015)

Causes of unintentional injury	Number (95% UI)	Rate per 100,000 (UI)
Transport injuries	17,731 (6,899 – 45,990)	623 (243 – 1,617)
Drowning	2,747 (974 – 6,588)	97 (34 - 232)
*Foreign body	9,006 (5,601 – 15,242)	317 (197 - 536)
**Exposure to mechanical forces	4,771 (2,606 – 8,988)	168 (92 - 316)
Falls	10,209 (3,683 – 24,687)	359 (129 - 868)
Fire, heat, and hot substances	3,958 (1,692 – 6,865)	139 (59 - 241)
***Animal contact	2,851 (788 – 6,099)	101 (28 - 214)
Poisonings	3,232 (653 – 13,814)	114 (23 - 486)
Other unintentional	1,436 (1,045 – 1,936)	50 (37 - 68)
Total	**55,951 (23,941 – 130,209)**	**1,967 (842 – 4,578)**

Source: Authors calculation from Global Burden of Diseases study, 2015
Includes pulmonary aspiration, foreign body in eye and other foreign body injury
**Includes unintentional firearm, unintentional suffocation, and other mechanical forces*
***Includes venomous and non-venomous animals*

Along with mortality data, the data for non-fatal injury, hospital visits or hospital admission due to injury, are also important in developing a complete understanding of the burden of injury in Nepal. However, little work has been done on child injury in Nepal and most studies conducted in Nepal specifically examined hospital data.

A hospital based retrospective study conducted in Manipal Hospital, Pokhara found that 94 children aged <15 years (56 males & 38 females) were admitted due to poisoning (18 per 1,000 paediatric admissions). Ninety five percent of poisoning cases were accidental. The main cause of poisoning was organophosphorus compounds (OPC) (27%) and kerosene oil (23%). Metacid (Meyhtl parathion) was the major cause of fatal poisoning in children (Malla et al., 2011). About 6% of children admitted to hospital due to poisoning died (mortality rate 60 per 1,000 paediatric admissions). The results of this study might not be generalized to the total child population in Pokhara, since the catchment area of the hospital is limited. Manipal is a private teaching hospital where treatment cost is higher than governmental hospital and therefore people with low income might have not taken their children to this hospital.

A study conducted in 11 hospitals across the country to assess the magnitude of injury in Nepal found that about 38,000 non-fatal injury cases of all ages were recorded during a period of one year (2008–2009). About 23% of all injured people visiting hospitals were children aged <15 years (Nepal Health Research Council, 2009). However, hospital data as a whole cannot be used to estimate a national injury burden since not all people with injuries attend hospital. That means hospital studies are unable to capture injury cases that were presented in private hospitals or injuries that did not seek medical assistance Therefore the, findings of this study cannot represent the true burden of injury in Nepal. In a study conducted by the author of this thesis (Bhatta et al., 2016) to assess the feasibility of using hospital injury data to understand inequalities in injury incidence, found that 4,739 people of all age visited ED of a hospital due to unintentional injuries in a year. Of total, 389 (8%) were children aged 0-4 years and 1408 (30%) were children aged 5-19 years. Fall was the main cause of injury among the children of age 0-4 years (167/389, 43%) and 5-19 years (524/1408, 37%). Children with minor injury who did not seek medical attention and those who attended other health facilities like private hospitals and health posts was not represented by this study.

There is limited community based survey to estimate the child injury burden in Nepal. However, certain data from national census and household survey are available to understand injury epidemiology in Nepal. A report from national census sample survey by (Sharma, 2006) found that 7,000 people of all ages died due to external causes of injury in Nepal in 2001. Of these deaths, 21% were reported among the children <15 years age, with the injury mortality rate of 13.0 per 100,000 population. This report also stated that injury was the 5th leading cause of death of children 0-15 years old. Census data in Nepal are based on verbal response of family member in the household. Census data are less likely to have recall error as the family member could remember death cases. However, this data might have some error relating to actual cause of death. For example, someone falls over and cuts themselves and later dies of septicaemia – the cause of death could be recorded as either the fall, cut or the infection.

An epidemiological study conducted in 13,853 households in Dharan municipality, Nepal reported a prevalence of minor injuries of 45 per 1,000 children per month among the children age 0-9 years and 30 per 1,000 children per month among 10-19-year olds. Similarly, prevalence of major injuries was 6 per 1,000 children per month for both (Ghimire et al., 2009). This study categorised severity of injury in two groups: 'minor' injury if resulting in less than 30 days of loss of activity and 'major' if resulting in 30 or more days of lost activity. This study might be representative to provide the magnitude of injury problem in Dharan municipality (used 10% households sample from each 19 wards of municipality), however, findings of this study might not be generalised outside of the municipality (not a representative of other municipalities of Nepal).

A recent community-based study conducted by Pant et al. (2015a) identified 193 cases of non-fatal, unintentional child injuries from 181 households in the Makwanpur district of Nepal. They reported that, in Makwanpur, the annual rate of non-fatal injuries amongst children <18 years was 24.6 per 1000 children and specifically 29 per 1000 children <5 years of age. Falls and burns were the most common cause of non-fatal injury in children <5 years of age, whilst RTIs were most common in adolescence.

A school-based survey conducted with 1,557 students aged 10-17 years in Kathmandu reported that the incidence of self-reported injuries among children was: falls (n=1017, 65%), cuts (n=974, 63%), transport-related injuries (n=563, 36%), and burns (n=350, 22%). This study collected the most serious episode of each injury that the students had experienced in 12 months prior to the survey (Poudel-Tandukar et al., 2006).

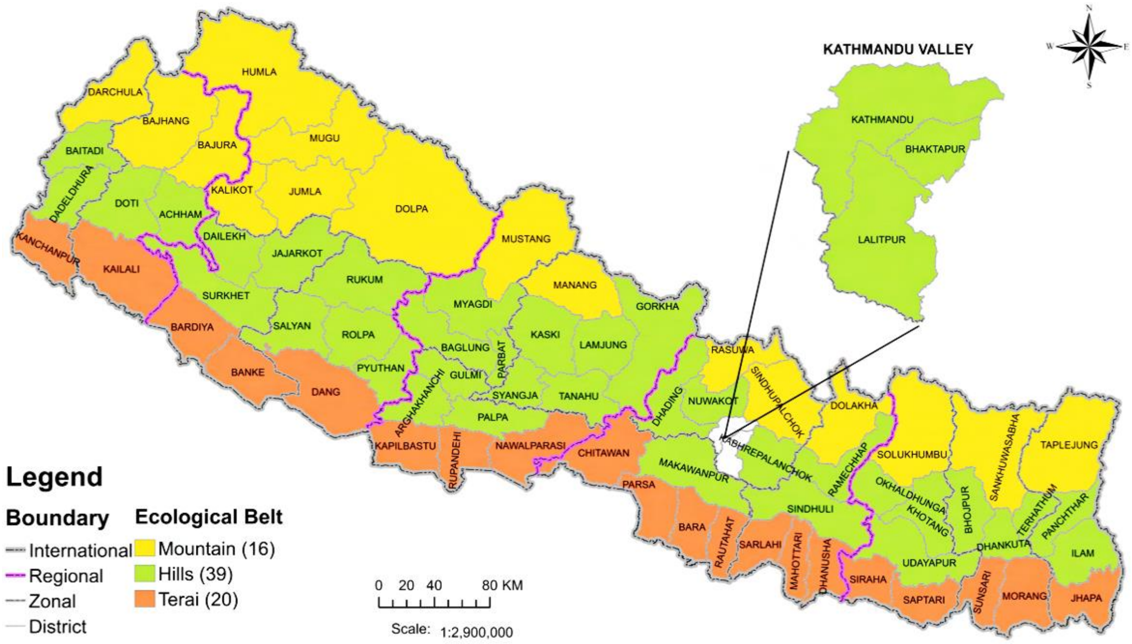
1.5 THE CONTEXT OF INJURIES IN NEPAL

1.5.1 Country profile

Nepal is a landlocked, central Himalayan country in South Asia. It is located between China in the north and India in the south, east and west. It covers a total area of 147,181 km^2 and is geographically characterised by diverse physiographical and ecological features. The distance from east to west is 885 km and from north to south is 193 km (Central Bureau of Statistics, 2014c). Nepal has a population of about 26.5 million (Ratio of 94 males: 100 females). In 2011, the crude birth rate was estimated to be about 22 per 1,000 and the death rate was recorded as 7.3 per 1,000. In the whole population, the proportion of children about 5 years of age is 10% and 44% were children and young people <19 years (Central Bureau of Statistics, 2014a).

Topographically, the country is divided into 3 regions. They are the mountains, the hills and the terai (plains) running north to south; altitude ranges from about 70 m in the south to about 8,848 m in the north. The altitude in the mountain area ranges from 4877 m-8848 m above sea level. Only 7% of the total population live in this region because of its geographical and climatic conditions. The hill region lies between the mountain and terai regions with altitudes rising to about 610 meters above sea level. About 43% of the total population lives in this region. This region is also divided into high hill and mid hill areas according to altitude. The terai region is in the southern part of Nepal. It comprises low land and about 50% of the total population live in this area. As well as the topographical divisions, the country is divided into 5 development regions and 14 zones. The development regions stretch from north to south across the 3 topographical regions (Central Bureau of Statistics, 2014c).

Figure 1.4 Map of Nepal with Administrative divisions and ecological belt



Source: Annual report of the Department of Health Services (2014/15) (Ministry of Health, 2015)

(Used with permission of the author)

In terms of administrative division, Nepal has a total of 75 districts; 16 districts in the mountainous region, 39 districts in the hill region and 20 districts in the terai region. Likewise, the development regions are categorised based on the number of districts; There are 16 districts in the Eastern Development region, 19 in the Central region, 16 in the Western region, 15 in the Mid-Western region and 9 in the Far-Western Development region. These districts are then further divided into local units called Village Development Committees (VDC). VDCs are considered to be rural areas in Nepal. Currently, there are 3633 VDCs, 130 municipalities or urban areas, 1 metropolitan city and 4 sub-metropolitan cities. However, the number of administrative units may change over time. VDCs and municipalities are further divided into smaller units, called wards. VDCs have, on average, 9 wards, but the number of wards in a municipality depends on the population size of the municipality. Generally, the number of wards in a municipality ranges from 9-35. For administrative purposes, each district is headed by a Chief District Officer (CDO) (Central Bureau of Statistics, 2014c).

Nepal is known to be among the 48 least developed countries (LDCs) in the world (DAC List of ODA Recipients, 2016), where about 80% of the country’s population lives in rural areas. Urbanisation is expanding, and the urban population is rapidly growing. The Gross Domestic Product (GDP) of Nepal is about US $714 (2011-2012). The Nepal Living Standards Survey (2010-11) found that around a quarter of the population (25.2%) live below the poverty line ($1.25 per person per day). Within the employed population, 60% work in the agricultural sector. In 1981, the contribution of the agricultural sector to the GDP was 61% but this declined to 31% in 2011. Conversely, the contribution of the service sector has increased from 27% to 48% during this period. The overall literacy rate in 2011 was recorded to be 67%, but it was 82.3% in urban areas and 62.5% in rural areas, demonstrating a large difference in education between the areas. Literacy is improving in subsequent generations with about 90% of adolescents in Nepal now being literate and 69% of the child population attending school. Access to education is a challenge for many children from some deprived social groups and to those living in particularly remote areas of the country. In 2011, it was found that only 51% of children from the lowest-income quintile attend primary education, whereas 87% of those from the high-income quintile attend primary education (Central Bureau of Statistics, 2014b).

In Nepal, housing structure varies due to geography, caste or ethnicity, culture and economic condition. Most houses in the mountainous and high hill areas, especially those that are remote, tend to be made from stone; conversely, in urban areas, concrete structures are common. Most households own their own house but there has been a gradual increase in households that rent, particularly in the urban and terai regions of Nepal. Most houses in Nepal are 11- 20 years old with a single floor (Central Bureau of Statistics, 2014b) and the majority of the houses are built according to the financial capacity and need of the family that own it and live there. Home safety is not an issue that has been considered in the building of houses in either the urban or rural areas of Nepal.

There are national building codes (http://www.dudbc.gov.np/buildingcode), building byelaws and standards for the building of houses but these do not fully address all considerations for safe construction and the creation of safer communities and settlements. For example, the Building Act (1998), Codes (Structural and building) and the Local Self Governance Act (1998) as well as other relevant regulations cover general building design requirements. Importantly, these regulations are only applied to urban areas; Towns and villages, which fall under village development committees (VDCs) are not included in these regulations. Recently, the Nepalese government has formulated a National Plan of Action for Safer Building Construction in Nepal (2015) and the

Guidelines for Settlement Development, Urban Planning and Building Construction (2015). Unfortunately, these plans and guidelines predominately focus on safer building construction with regards the impacts of future disasters like earthquakes (Ministry of Physical Planning and Works, 2009, Ministry of Urban Development, 2015) and safety in the home remains a neglected issue.

Figure 1.5 Topography and typical houses in rural area of Makwanpur district, Nepal

Source: Taken by researcher (SB) during the household survey

(Used with permission of the household owners)

1.5.2 Health system in Nepal

Nepal has experienced social, political and economic upheaval and continuing development since the establishment of its democracy in 1990. Political instability has hindered developmental work. Since 2007, governments have changed on average, annually. The new constitution that was recently established in Nepal, requires an ongoing series of elections until 2018 which will result in frequent changes of ministers and this will ultimately hamper efforts to improve injury prevention policy and legislation.

However, between the period of 1990 and 2014, Nepal has made impressive progress on improving overall health outcomes. For example, the child mortality in those <5 years of age has reduced by 73% and infant mortality by 67%. The maternal mortality reduced by 76% between the period of 1996 and 2013. Prevalence of many communicable diseases like leprosy, which was eliminated in 2010 at a national level, tuberculosis (TB), human immunodeficiency virus (HIV) and malaria has decreased substantially in the last two decades. Some progress has also been made in reducing neonatal mortality and children malnutrition. Despite this progress, the inadequate access to healthcare services and the need to improving the overall quality of healthcare, remain a major challenge for Nepal (Ministry of Health and Population, 2015).

The injury burden in Nepal may be worsened by the lack of available health service facilities and quality emergency care. For a population of 27 million, Nepal has only 743 hospitals which includes both public (102) and private (641) ones. There are however, an additional 2175 health posts (HP), 1615 sub-health posts (SHPs), 204 primary healthcare centres (PHCCs), and 293 Ayurvedic Services Centres (ASCs) (Central Bureau of Statistics, 2014c). In contrast, in Bangladesh, for the total population of 144 million, there are 63 district hospital (DH), 93 Maternal and child welfare centres (MCWC), 419 Upazila health complex (UHC), 3287 Union health and family welfare centres (UHFWC), 1306 Union sub-centre/rural dispensary (USC/RD), 12,506 Public community clinics (CC), 1,011 NGO clinic/hospital and 499 Private hospital (Ministry of Health and Family Welfare, 2016). This shows that in Nepal there are limited health service facilities as compare to neighbour country like Bangladesh. In Nepal, All HPs, SHPs and PHCCs are funded solely by the government. SHP is the lowest government institutional and are set up in VDC level. HP is set up at VDC or the municipality level. SHP and HP are the first institutional contact point for basic health services. They provide curative and preventive services to people. PHCC is an upper level health care setting, and can provide emergency and maternity care. All hospitals in the country fall under the jurisdiction of the Ministry of Health (MoH). Most of the public hospitals are funded by the Nepalese government, local communities, local business and by local religious organisations. Government-funded health facilities offer Essential Health Services (EHS), including basic services that are free of charge to the poor, disadvantaged and indigenous groups. Other services, or those not meeting the criteria for subsidised care, require payment at the point of care. Many patients choose to attend the government-funded hospitals because the care is subsidised. However, the facilities and services available in these hospitals vary, and some specialised care is only available in the government hospital in Kathmandu or in private hospitals outside of the capital. The existing health system in Nepal also does not offer ambulance services. Thus, many victims of injury have no access to first aid or emergency pre-hospital medicine prior to transportation to a hospital; Many die on the journey to hospital (Pandey, 2016). Recently, the Nepalese government has announced it will provide free treatment for specific major health problems such as heart diseases and kidney transplants, whilst favouring those who cannot afford to pay.

1.5.3 National health plans, policies and strategies

Until the early 1950s, there was no robust healthcare system in Nepal and most healthcare was provided by family members and indigenous practitioners. During the 1960s, many projects with a curative focus were implemented (Marasini, 2003). In the last few years, national plans have been developed in various sectors to address health-related issues (Table 1.13).

Nepal initiated the concepts of strategic planning into health in its First Long-Term Health Plan (1975–1990), with the emphasis on delivery of consistent and functional health services. The first National Health Policy was formulated in 1991 with the aim of achieving Health for All (HFA) by 2000. It focused on the decentralization of health resources and services in accordance with the Alma Ata Declaration (1978) (World Health Organisation, 2007). Therefore, it created a health service structure with impact at a VDC level for the first time. Six years after the formulation of the National Health Policy, the Second Long-Term Health Plan (1997-2017) was formulated, with the objective of ensuring universal primary care by the year 2017. This plan introduced central, regional, zonal and district hospitals along with the aim of building Primary healthcare centres, Health posts and Sub-health posts.

The Health Sector Strategy: Agenda for Reforms (2004) put an emphasis on the health sector contribution to poverty reduction and to improving health outcomes for the poor and those living in remote areas (Ministry of Health, 2004). This strategy was formulated to build upon The National Health policy (1991) and Second Long-Term Health Plan (1997–2017). The first Nepal Health Sector Programme Implementation Plan (NHSP-IP-I) was also developed during this period for 2004-2009 (Ministry of Health and

Population, 2004). The NHSP-IP-I is the operational guideline for achieving the goals and visions of the Health Sector Reform Strategy. Its emphasis was the achievement of the health sector Millennium Development Goals (MDGs) within Nepal. It also aimed to improve health outcomes for the poor and those living in remote areas and to reduce poverty overall.

The Nepal Health Sector Programme Implementation Plan - II (2010–2015) (NHSP-IP-II) has been formulated to build upon the Three-year Government Interim Health Plan, (2007/08 – 2009/10) Three-year Government Interim Health Plan was focused to develop special program to improve social and economic conditions of the disadvantaged groups including persons with disability, women, Dalit, Adibasi, Janajatis, Madhesi, Muslim community, and disadvantaged regions. NHSP-IP-II is also an extension of the (NHSP-IP-I), although it focuses on partnerships, mitigating access barriers, promoting equality and inclusion, local governance and decentralization of service delivery (Ministry of Health and Population, 2010). The NHSP-IP-II listed non-communicable diseases (NCD) and injury as Essential Health Care Services (EHCS). However, it still does not detail how the problem of injury in children (or adults) will be addressed.

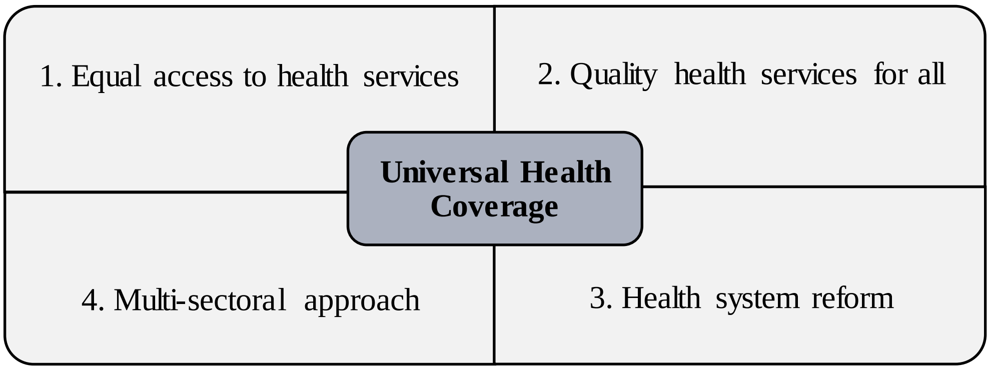
Table 1.13 Timeline of the Nepal's health policies

Years	Plan or strategies
1975	First Long-Term Health Plan (1975–1990)
1991	The National Health policy (1991)
1997	Second Long-Term Health Plan (1997–2017)
2004	The Health Sector Strategy: Agenda for Reforms (2004)
2004	Nepal Health Sector Programme Implementation Plan - I (2004–2009)
2007	Three-year government Interim Health Plan, 2007/08 – 2009/10
2007	Interim Constitution of the Federal Republic Nepal (2007)
2010	Nepal Health Sector Programme Implementation Plan - II (2010–2015)
2014	National Health Policy (2014)
2015	Nepal Health Sector Strategy (2015-2020) (NHSS)

In 2014, the National Health Policy (NHP) (1991) was updated (NHP, 2014). The Interim Constitution of the Federal Republic Nepal (2007) established health as a fundamental right of all people and stressed children's rights were as fundamental as for adults. The NHP (2014) articulates the nation's commitment towards achieving this Universal Health Coverage (UHC) through maintaining the achievements previously made in the control of communicable diseases and reduction of infant and child mortality rate, and then aim to control NCDs. It also aims to provide better management of medical emergencies and ensure that quality health services are available to all people (Ministry of Health and Population, 2014).

Recently, the Nepal Health Sector Strategy (NHSS) (2015-2020) was formulated under the umbrella of the NHP (2014). The NHSS is now a primary instrument in guiding the health sector to address the social determinants of health until 2020. It follows the vision and mission set forth by the NHP (2014) and says that a guarantee of constitutional provision of basic health services is fundamental right for every citizen of Nepal. It stands on 4 overarching principles (Figure 1.6).

Figure 1.6 NHSS 2015 - 2020 Strategic direction and approaches



From 2015-20, the NHSS seeks to provide Universal Health Coverage (UHC) by making quality health services available to the entire population, involves sectors beyond health and identifies basic health as a right for every citizen. It aims to promote a healthy lifestyle and behaviours, a healthy environment and to reduce death and injury using a multi-sectoral approach (Ministry of Health and Population, 2015). However, the deaths and injuries mentioned in this strategy only included road traffic accidents so other mechanisms of injury are still not recognised as a public health problem in national policies and plans. There are no specific policies to protect children from injury. Child protection, according to the Convention of the Rights of the child (CRC), is found to be practised for children's welfare in Nepal, but injury prevention is not usually recognised as a part of this agenda.

1.5.4 Summary of the issue of child injury in Nepal

Although, more children in Nepal are surviving today from infectious diseases, they are still exposed to an increased risk of death, illness and disability due to non-communicable diseases and injury. Therefore, child injury is becoming one of the leading public health problems in Nepal. The increasing incidence of child injury in Nepal may be related with rising population (1.35% per year), rapid urbanisation (5% per year), industrialisation, migration and the changing of lifestyle choices in Nepal (Muzzini and Aparicio, 2013). In addition, Nepal has the challenging topographical and climatic environments, which further increase child exposure to risk of injury. Children in low-income settings are more at risk of injury due to the hazardous living environment and lack of parental knowledge and skills regarding prevention of injury (Pant et al., 2014).

Furthermore, In Nepal, injuries are often believed to be the consequence of unavoidable accidents and prevention is rarely considered as an option. The true burden of injury in Nepal is poorly understood due to a lack of injury data and research studies. Consequently, publication of injury research findings are very limited in both national and international journals (Joshi and Shrestha, 2009); This inhibits the scope and understanding of injury amongst policy makers in Nepal. Thus, Nepal has many factors that have the potential to increase the risk of injury, including the fact that a large proportion of children are exposed to poverty, urbanisation and prevalent inequalities in access to health services. Overall, the context of child injury in Nepal highlights the importance and need of child injury research.

1.6 THESIS ORGANISATION

This thesis is structured into 8 chapters, each contributing to the overall aim of the work. It comprises mainly three studies: a systematic review, a household survey and a qualitative study in the Makwanpur district of Nepal. A brief structure of thesis is presented below.

Chapter 1 is introductory chapter, sets the scene for the work that has been carried out by briefly describing the gaps in knowledge and how each chapter seeks to address these. **Chapter 2** brings together a wide array of the relevant literature for review. This overview of literature illustrates the currently known home environmental hazards associated with childhood injury. It also emphasises or highlights further the gaps in the evidence-base.

Chapter 3 is a systematic review of studies evaluating the effectiveness of home environmental change interventions in preventing childhood injury in LMICs.

Chapter 4 describes the methodology used for two community based studies in Nepal.

Chapter 5 describes the methods used for the household survey, including data collection, analysis and results.

Chapter 6 describes the method used for conducting the qualitative study and presents the findings.

Chapter 7 integrates the findings from all three studies, places them within the context of current literature, discusses the strengths and limitations of the overall thesis and interpret results from all three studies.

Chapter 8 is the last chapter and presents the overall conclusion and recommendations for future research, practice and policy.

The bibliographic references and appendices are provided at the end of the thesis.

CHAPTER 2: BACKGROUND/ OVERVIEW OF LITERATURE

2.1 INTRODUCTION

This chapter describes the risk factors for unintentional home injuries, where environmental hazards in the home fit into those risk factors and what is known about preventing injuries through the management of environmental hazards in the home. This chapter also justify the reasons for conducting this PhD research and sets out the aims and objectives.

2.2 RISK FACTORS FOR UNINTENTIONAL HOME INJURIES

Most injuries amongst preschool children occur in the home environment in both developing (Mohammadi et al., 2006, Hyder et al., 2008b, Fatmi et al., 2009, Hyder et al., 2009, Halawa et al., 2015) and developed countries (Gulliver et al., 2005, Sengoelge et al., 2011) because that is where they spend the majority of their time (Peden et al., 2008, Zia et al., 2012). Serious injuries in a child due to falls, poisonings, burns, and pedestrian RTIs are significantly associated with future injuries to occupants of that household (Donroe et al., 2009). This might be because of interaction among the underlying host, agent, environment and social factors that cause increased household odds of injury. Injuries at home occur due to the complex combination of factors such as developmental characteristics of the child, socio-economic factors of the family and home environmental conditions; Thus injury risk is perceived as multifaceted in nature (Munro et al., 2006).

2.2.1 Individual factors

Injury patterns are closely related to the child's age and the stage of development and behaviours at different ages are associated with different patterns of injury (Linnan et al., 2007). Children are highly dependent on their carer in early childhood whilst they are developing, both physically and mentally. Children are vulnerable to injury because they are curious in nature and like to explore the environment around them. Lack of developmental skills to understand risks and lack of physical and cognitive skills to manage those risks that increase their vulnerability. The likelihood of child injury and accidents is also determined by the changing level of supervision in accordance with age, the environment in which they live and the way they are nurtured (Towner et al., 2005). Poisoning, drowning, fire-related injury and burns, falls, suffocation and choking on small objects are major causes of injury for young children in the home environment, whereas RTIs are more common amongst older children when they start to explore their environment, for example by walking and cycling (Rahman et al., 2005, Towner et al., 2005, Borse et al., 2008b, Peden et al., 2008).

Additionally, gender affects injury risk. Many studies have found that injury prevalence is higher amongst male children than in females. Injury due to falls, drowning, accidental poisoning, RTIs and other causes are more common amongst boys because male children are known to take more risks and are more impulsive in nature than girls. Traditionally, boys were also exposed to more hazardous environments than girls (Towner et al., 2005) and were given greater freedom to explore their environment (Peden et al., 2008). However, this pattern did not carry for all mechanisms of injury. In most LMICs, girls have a higher incidence of fire-related injuries (Bartlett, 2002, Fatmi et al., 2007, Mashreky et al., 2008) due to exposure to unsafe cooking practices at home whilst helping their mothers (Peden et al., 2008).

2.2.2 Family factors

Environmental factors affecting risk of injury are often related to the socio-economic status of the household. The difference in socioeconomic status of a community also influences what types of environmental hazard exist there (Kisida et al., 2001, Ramsay et al., 2003). Several studies have reported that low-income communities present with more hazards than high-income communities (Peden et al., 2002, Peden et al., 2008). Socio-economic factors of the family are also associated with injury risk, particularly in LMICs (Mytton et al., 2009). The injury burden remains highest for children who live in poverty (Bartlett, 2002, Peden et al., 2008). Poorer families are less likely to use or have access to safety information and exposed to a larger range of hazards in the home environment, thus increasing the likelihood of injury in their children (Cubbin and Smith, 2002, Dowswell and Towner, 2002, Thanh et al., 2005, Turner et al., 2006).

Few studies in LMICs have investigated the relationship between the socioeconomic status of a family and their risk of child injury. However, a study in Bangladesh (Giashuddin et al., 2009) found that children aged 1-4 years that were from the poorest backgrounds experienced a higher rate of mortality (OR 2.8; 95%CI: 1.1–7.9) and morbidity (OR 1.30; 95%CI: 1.0 – 1.6) due to injury when compared to a wealthier group. Households with ≥4 living children were also reported as having a higher risk of child mortality (OR 4.14; 95%CI: 1.4 – 11.8) than those with <4. Data used in this Bangladeshi study were derived from Bangladesh Health and Injury Survey (BHIS), which was nationally representative, large community-based survey (Rahman et al., 2005). Similarly, a community-based survey in Lima, Peru found that poorer (OR 1.66; 95%CI: 1.2 – 2.2) and overcrowded households (OR 1.9; 95%CI: 1.2 – 2.9) had increased odds of the occurrence of multiple injuries in children (Donroe et al., 2009). This survey was aimed to identify individual and household characteristics associated with serious injuries among the children <18 years with the sample of 5061 households consisting of 10,210 children.

A frequently reported type of injury in children within LMICs is burns. Some studies have investigated the risk factors associated with this. For instance, a case-control study in Ghana (Forjuoh et al., 1995) found that the presence of a pre-existing impairment in a child (OR: 6.7; 95%CI: 2.8 - 16.2), a history of burns in siblings (OR: 1.8; 95%CI: 1.2 - 2.6) and a history of a sibling death from burns (OR: 4.4; 95%CI 1.2 - 16.7) were the predominant factors predisposing to burn injuries in children. Another case-control study in Brazil (Werneck and Reichenheim, 1997) reported that factors including overcrowding (OR: 2.2; 95%CI: 1.1–4.7), not being the firstborn child (OR: 2.5; 95%CI: 1.2–5.2), the mother being pregnant or recently dismissed from a job (OR: 7.0; 95%CI: 1.5–33.9), or recent family relocation (OR: 4.9; 95%CI: 1.7–14.3) increased the likelihood of childhood burns. A Bangladeshi case-control study (Daisy et al., 2001) included parental illiteracy ($p <0.01$), living in slums and congested areas ($p < 0.01$), the presence of a pre-existing impairment in a child ($p <0.05$), a history of a sibling burn injury ($p < 0.05$) and the low socioeconomic status of parents ($p <0.05$) to increase the likelihood of burn injury in children. A case-control study by Delgado et al. (2002) reported that in Peru, having a low income (OR: 2.8; 95%CI: 2.0–3.9) and overcrowding (OR: 2.5; 95%CI: 1.7–3.6) were risk factors for burn injuries and that maternal education was protective (OR: 0.6; 95%CI: 0.4–0.8). However, study sample of case studies are often not representative of the true population, so the results may not be appropriate to generalize to entire population or other population.

In developed countries like the UK, the poorest in society suffer the most and are less capable of preventing injury in their children due to exposure to environmental risks (Towner et al., 2005). Child injury may be more frequent in rural areas in many countries, but they are also often under-reported. A population-based study in Scotland (Leyland et al., 2007) found that unintentional injury was a leading cause of inequality in childhood death for both sexes. Similarly in Canada, a population-based epidemiological study (Faelker et al., 2000) reported that socioeconomic gradients exist for childhood injuries; Children living in the most poverty experienced higher rates of non-fatal injury by 1.67 times than a more affluent group. Another Canadian study reported that children living in the lowest income quintiles had a 2.15 times greater risk of death from injury when compared to children in the highest income quintiles (Birken et al., 2006). In England and Wales, it was found that children whose parents were unemployed were 9 times more likely to die due to unintentional injury in comparison to those with parents in the highest income occupations (Edwards et al., 2006). A national report jointly published by the Audit Commission for local authorities and the National Health Service (NHS) in England (Audit Commission, 2007) revealed that children of never-employed or long-term unemployed parents were 13 times more likely to die from an unintentional injury than children whose parents were employed in managerial or any other professional occupation. Low maternal age has also been identified as a factor that is associated with an increased risk of childhood injury (Hjern et al., 2001, Kendrick et al., 2005a, Towner et al., 2005, Mytton et al., 2009, Orton et al., 2012). Similarly, an association was found between poorly-educated parents and a substantial risk of injury in their children (Gielen et al., 2002, Richardson et al., 2005, Thein et al., 2005). These results provide confirmatory evidence that children from low socioeconomic family background were more likely to suffer unintentional injuries or deaths when compared with children from high socioeconomic family background. However, findings of the studies from HICs have limited suitability for generalization to LMIC settings due to the difference in socio-economic condition of studied population.

2.2.3 Environmental factors

Hazardous living environments such as poor housing infrastructure, lack of barriers to cooking or washing areas, inadequate recreational space, use of open fires and paraffin stoves, lack of safe storage for harmful substances, stairs and window without safety grills and open water reservoirs are among the major risk factors for child injury in low-income settings (Hyder et al., 2008b, Balan and Lingam, 2012). A study in New Zealand found a significant association between the number of hazards in the home and number of injuries that require medical attention (Keall et al., 2008). This study demonstrated that an additional associated hazard in the home increases the odds of injury by 22% (95%CI: 6–

41%), even when findings were adjusted for confounding factors such as age, gender and deprivation level. However, small sample size (100 households) for a study of home hazards and injury is limited in its ability to detect an association. This study was looking at hazards in a HIC and there is therefore a question if it is generalizable to a LMIC where the hazards and home structure are likely to be different. A community-based cross-sectional study conducted in West Bengal, India also found a significant association between the number of injury hazards in a household and unintentional injuries in children aged 12-59 months (Adjusted Odds Ratio (AOR): 1.6; 95%CI: 1.3 – 1.8) even when adjusted with socio-economic variables (Banerjee et al., 2016). A total of 163 households (one child from each household) were included in this study.

The presence of an environmental hazard does not necessarily mean that it will contribute injuries; it is the exposure of children to those hazards that is likely to contribute injuries. Different risk factors are associated with different types of injury. For example, key risk factors for injuries related to drowning in young children, include a lack of barriers around bodies of water and inadequate supervision (World Health Organization, 2014). However, the specific potential risk factors for drowning vary due to geographical, social, cultural and behavioural differences (Rahman et al., 2005). For instance, child drowning in HICs often occurs in recreational water settings in urban areas, including pools, spas and hot tubs (Peden et al., 2008, Sethi et al., 2008). In contrast, drowning in children living in LMICs frequently occur in canals, ditches, rivers and ponds (Hyder et al., 2003, Rahman et al., 2006, Hyder et al., 2008a). The majority of drowning incidents in children within Bangladesh occur in natural bodies of water like ponds (Rahman et al., 2005, Rahman et al., 2006) and the majority of these occur whilst the child is playing (Borse et al., 2011). A cross-sectional study conducted to identify the pattern of household unsafe behaviour in different socioeconomic strata, in Pune city, India found that 32.5% (n=65/200) households had unprotected bodies of water near to houses (Mirkazemi and Kar, 2009). Drowning in small buckets of water or a bath tub is also reported in children aged <2 years and storing water in a bucket for purposes in the household is normal practice in LMICs. A pilot study by Khan et al. (2013) conducted in low-income urban setting of Karachi, Pakistan reported that 18% (n=91/503) of households had open buckets of water left within reach of children in a courtyard and 48% (n=240/503) in a bathroom.

Burns are the second most common childhood injury in rural Nepal, accounting for 5% of disabilities (World Health Organisation, 2016a). In some LMICs like Bangladesh, Colombia, Egypt and Pakistan, 17% of children with burns have a temporary disability and 18% have a permanent disability (World Health Organisation, 2016a). In low-income countries, cooking equipment in the kitchen or flammable substances are commonly left within reach of children in the home and these are significant risk factors for children sustaining burns or fire-related injuries (Forjuoh et al., 1995, Daisy et al., 2001). A community-based study conducted in India found that 53% of households (n=87/163) had open fires, fireplaces or stoves within reach of children (Banerjee et al., 2016). Similar results were found in another community-based study conducted in urban resettlement colony in Delhi, India, which reported that 53.7% of households (n=121/225) had a cooking stove within the reach of children (Parmeswaran et al., 2016). This study was aimed to assess the presence of home hazards for childhood injuries in households. These findings are consistent with a previous study conducted in India (Mirkazemi and Kar, 2009). The study reported that about 28% (n=55/200) of households did not have a separate, protected kitchen, 37.5% (75/200) of households cooked at ground level, 12% (n=24/200) of households used unprotected open fire as a source of warmth in winter and 34.5% (n=69/200) of households stored flammable substances at home; all of these increase risk of injury to young children A study in Pakistan also reported children were left in reach of cooking stoves, increasing the likelihood of burns or heat-related injury (Khan et al., 2013). They found that about 56% (n=279/503) of households had cooking stoves located in reach of children and 44% (n=221/503) of households stored matches, lighters or cooking fluids within reach of children. A qualitative study that interviewed parents, crèche workers and crèche owners from 2 low-income settings in South Africa, also reported similar hazards for increasing the risk of burns in children. They reported that children regularly had access to hot liquids, cords from boiling kettles, open fire heaters (called gellies or imbawula), electric wiring and plugs and candles and matches, which are potential environmental risk factors for burn or fire-related injury in children (Munro et al., 2006).

Falls are not only the leading causes of child morbidity, they are also important causes of long term disability in children. For example, about 40% of the total DALYs lost due to falls worldwide occurs in children. There are several reasons that contribute towards an increased incidence of fall injuries as compared to other types of injuries among children.

Apart from individual and family factors, hazardous home environments are important risk factors for childhood falls (World Health Organisation, 2016b). In LMICs, the lack of protective railings on balconies and stairs, grills in windows and inadequate lighting inside the home are common risk factors for falls in the home environment. In addition, lack of developmental skills to understand risks and lack of physical and cognitive skills to manage those risks increases child vulnerability for fall injury. Most falls have been found to occur when children attempt to climb on containers, trees and fences to explore their surroundings. The physical home environment such as the height of swings and slippery surfaces are also associated with the risk of falling in childhood (Munro et al., 2006). A study from India reported there to be poor lighting in the bathroom in 83% (n=189/225) of households. In the balcony areas, 67% (n=90/134) of households had an object available with which a young child could climb over balcony railings. In 95% (n=214/225) of households, staircases had no railings and 42.2% (n=95/225) of households had inadequate lighting on the stairs (Parmeswaran et al., 2016). Banerjee et al. (2016) found that 58% (n=95/163) of households had unstable furniture that may fall on the child. Similarly, a study in Pakistan reported that 50.3% of households (n=253/503) with stairs did not have a stair gate (50.5%, n=129/253). Also, balconies were unprotected in 41.9% (n=18/43) of households that had a balcony (8.5%, n=43/503), accessible rooftops (38.2%, n=192/503) lacked a protective barrier in 47.3% (n=91/192) of households (Khan et al., 2013).

The main risk factors for childhood poisoning in developing countries are storage of poisonous chemicals and fertilizers at ground level or in unsafe containers (World Health Organization, 2002). Children <2 years of age are particularly susceptible to ingestion of poison because they are curious and put most objects in their mouth without understanding the consequences (Peden et al., 2008). Kerosene, phenyl cleaner, drugs and pesticides are the frequently reported chemicals causing childhood poisoning in low-income countries. In African countries like Malawi, Jordan and Kenya, majority of childhood poisonings occurred due to paraffin ingestion (Chibwana et al., 2001, Shotar, 2005, Lang et al., 2008). Other studies in South Africa have demonstrated that paraffin poisoning was related to the physical accessibility of paraffin to children (Ellis et al., 1994, Krug et al., 1994, Reed and Conradie, 1997). This pattern was also seen in a hospital-based descriptive study conducted in Pakistan which found that kerosene was the most common household agent; it caused about 50% of childhood poisoning. Other household agents resulting in childhood poisoning were medicine (38%), insecticides (7%) and bathroom cleaners (5%) (Manzar et al., 2010). In India, it was found that 91% (n=182/200) of households did not have locked storage for poisonous chemicals and 35% of households had unsafe containers for the storage of kerosene at home (Mirkazemi and Kar, 2009). Another study in New Delhi had similar results; It showed that 78.7% (n=177/225) of households did not have a lockable cupboard to store hazardous chemicals and they were left in easily accessible locations (Parmeswaran et al., 2016). Khan et al. (2013) also found that 56% (n=282/503) of households did not have cupboards with locks for storage of hazardous products (n=282, 56.1%). A South African study also reported that chemicals were stored in unsafe or non-standard containers which misled children and increased the likelihood of poisoning. Easy chemical accessibility for children contributed to the risk of poisoning, even if it was stored in its original container (Munro et al., 2006).

Different hazards varied in prevalence. For example, in India, medicines within reach of children was found only in 6% of (n=10/163) households and only in 8% (n=13/163) of households, cosmetics, safety pins or other choking hazards were within reach of the child (Banerjee et al., 2016). Similarly, in Pakistan (Khan et al., 2013) 15% (n=77/503) of households left medicines within reach of children and 19% (n=97/503) of households left small choking hazards in accessible places.

Another mechanism of injury relates to the accessibility of sharp objects to children in low-income communities. In India, Banerjee et al. (2016) found that 66% (n=108/163) had knives or other sharp objects within reach. Similarly, pedestal fans in living rooms where children can easily trap their fingers, were found in 9.8% (n=22/225) of households in India (Parmeswaran et al., 2016) and 48% (n=242/503) of households in Pakistan (Khan et al., 2013). Khan also reported that 37% (n=186/503) of households had knives or sharp objects within reach of children (Khan et al., 2013).

Parmeswaran et al. (2016) found that 64% (n=144/225) of households had plug sockets within reach of children in the living room and 50.7% (n=114/225) of households had hazardous water heating appliances like immersion rods without proper insulation within easy reach. Khan et al. (2013) also reported that 27% (n=137/503) of households had water heaters (geyser), pumps or machines within reach of children in the bathroom and 70% (n=354/503) households had these items in courtyard within reach. More than 45%

(n=227/503) of households also had irons or other hot appliances in easily accessible places.

Although there has been much argument as to whether physical hazards and poor quality housing are independent risk factors for injury, it is clear from systematic reviews of HICs that exposure in a hazardous home environment can contribute to the occurrence of an injury (Turner et al., 2011, Kendrick et al., 2013a). There are few studies that have measured the association between home hazards and home injury in both HICs and LMICs. Most low-income countries lack comprehensive data about home injury risk. Some studies in LMICs have assessed home hazards but there is no standardized / agreed way to assess whether hazards are within reach of a child which means that comparisons between studies cannot easily be made. It was up to the data collectors to assess accessibility of hazards for children and this might have produced subjective bias while assessing home hazards. Therefore, home hazards should be identified and quantified by using agreed definitions to understand the actual types and most common hazards for child injury.

2.3 FRAMEWORK FOR PREVENTION OF CHILDHOOD INJURY

2.3.1 Public health approach

Research on injury epidemiology and injury prevention are considered to be multidisciplinary in their approach because of the complexity of the factors involved. Injury prevention requires co-ordination of expertise from many disciplines such as epidemiology, disease prevention, health promotion, rehabilitation, law and public administration (Razzak et al., 2005). Such research generally follows the traditional public health approach which involves 4 generic steps (Figure 2.1).

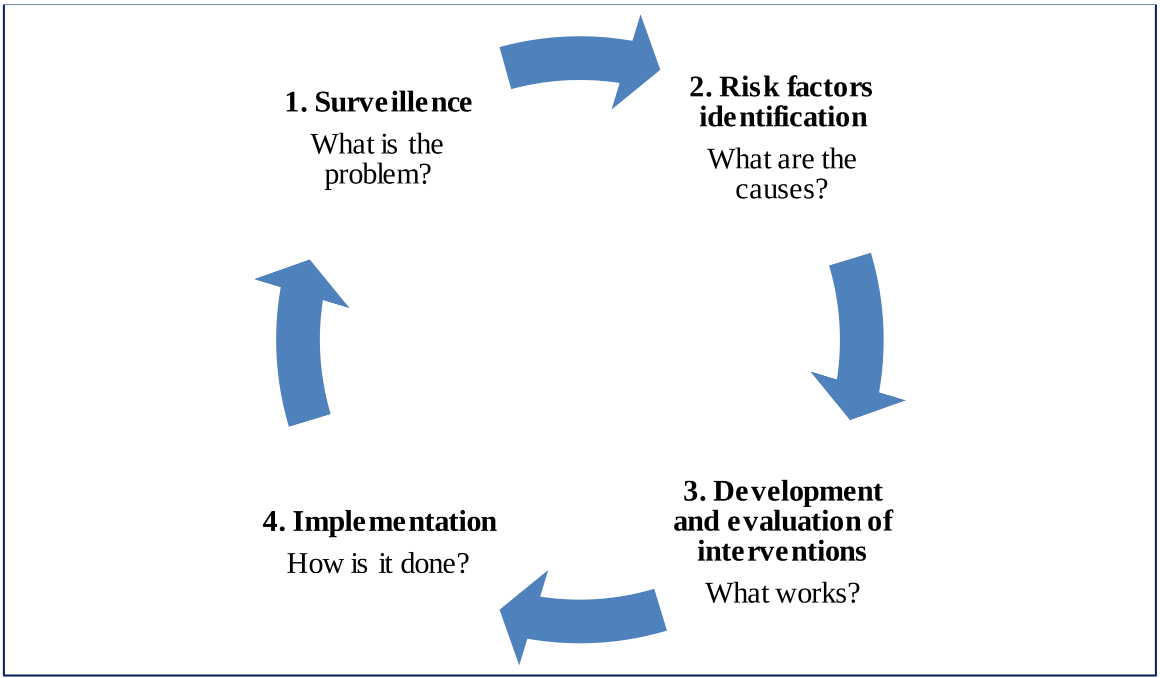
Step 1 involves defining the health problem. The process starts with the monitoring of injury incidence and the interpretation of data to identify the problem. Several sources of information may be used to describe the scope of an injury problem such as death registration systems, hospital-based data, trauma registries, emergency department (ED) data and police reports or a combination of these.

Step 2 identifies the causes and risk factors involved in the problem. It may be achieved through examining routinely collected or available data specifically. Descriptive epidemiological data may give information about who is injured, the nature of injuries sustained, and where, when, how and why that injury occurred. Risk factors for injury can also be investigated further using descriptive data and analytical studies.

Step 3 then develops and tests preventative interventions by using a deeper understanding of the problem, its causes and the associated risk factors. Whilst developing an intervention, it is important to consider factors such as the target population, the feasibility and acceptability to the target population and the associated costs for implementation. Pilot programmes can be used to evaluate the cost-effectiveness and efficacy of an intervention before implementing it on a wider scale.

Finally, step 4, which is implementation of the successful interventions and evaluation of their impact on the initial problem. Ongoing monitoring using surveillance systems helps determine whether the intervention has had the desired preventative effect. Prevention programs can be evaluated by determining their impact on morbidity or mortality in the target population by using pre- and post-intervention data collected through a range of observational or experimental study designs.

Figure 2.1 The public health approach to child injury prevention



Source: The World report on child injury prevention (Peden et al., 2008)

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Nowadays, a public health approach promotes action towards primary, secondary and tertiary prevention of injury. The use of this approach towards injury prevention was promoted by Gordon (1949) who claimed that, just like infectious diseases, the description of injuries by time, place and person could lead to greater understanding and stimulate preventative action. Injury can be avoided by preventing the event from which it resulted or by reducing the likelihood of the injury occurring as a result of such an event. Injury prevention activities are grouped into 3 different levels.

Primary prevention aims to prevent the occurrence of the accident from which an injury can result. It involves the removal or reduction of the injury hazard so that the injury event does not occur. Examples of primary prevention of injury include activities such as using a stair gate to prevent a child falling, child-resistant containers for protection of children from poisoning, using protective cooking stoves to reduce the risk of fire-related injuries or implementing drink-driving legislation to reduce the risk of RTI.

Secondary prevention aims to reduce the risk and impact of injury once the event has occurred. Therefore, it limits the severity of the injury sustained during the injury event. Examples of secondary prevention include installation and use of child seats, seat belts and air bags in cars; Using a child seat or seat belt does not prevent car accidents but reduces the risk of injury to children if an accident does happen. Smoke alarms and the use of cycle helmets are also examples of secondary prevention.

Tertiary prevention aims to provide appropriate treatment and/or care after an accident to reduce the adverse effects and long-term consequences of that injury such as disfigurement, disability or death. This requires high quality evaluation of interventions used to treat injuries. Examples of tertiary prevention include first aid responses and pre-hospital emergency care, hospital treatments and community care services for rehabilitation.

2.3.2 Haddon's matrix

Communicable diseases are the result of harmful interactions between the host, the disease vector and the environment and injury control require a similar understanding in terms of the individual at risk, the agent causing harm and the environment in which that injury occurs. A physician called William Haddon established a "host, agent, environment" triad in the research field of injury by applying the core principles of public health specifically to the prevention and mitigation of road injury (Haddon, 1972). He showed how the 3 same factors as described with respect to communicable diseases, can also be identified in the causes of injury and described injury prevention intervention as having 3 temporal phases; These are pre-event phase, the injury-producing event phase itself and the post-event phase. He produced a "phase-factor" matrix of 9 discrete cells which was later named the "Haddon matrix" (Table 2.1) and this has since become an invaluable tool for injury prevention and control. One of the key ways in which the Haddon matrix can be used is to consider the potential reach of an injury prevention programme – a robust programme is likely to have interventions in all 9 cells of the matrix. If some cells are incomplete this may give an indication of where a programme of injury prevention activity could be strengthened.

Table 2.1 Haddon matrix for the prevention of injuries to car drivers and occupants

	Host	Agent	Environment
Pre-event	Driver training, licensing and testing of eyesight	Car road worthiness Speed limiters	Road planning and signage Traffic calming Speed limits & cameras
Event	Driver does not speed Car occupant use of seatbelts Driver avoidance of drink, drugs and use of mobile phone	Age-appropriate car seats and use of seatbelts Air bags Impact bars Antilock brakes	Crash barriers Soft verges Gravel traps
Post-event	Evidence-based trauma care	Response of emergency services	Access to emergency services

Later, Haddon outlined 10 generic injury-control strategies known as an "options analysis" (Table 2.2) which can be used to prevent 'energy damage' to persons or property as he described injury in terms of the transfer of energy. These 10 strategies can be used to break the chain of injury causation, either by using a single best option or in combination (Haddon, 1973). Often, use of a combination of these strategies is superior to any single one. The strategies were used for injury prevention in the World Report on Child Injury Prevention (Peden et al., 2008). Specifically, they can be used to identify activities and approaches to injury prevention that can then systematically impact on all cells within the Haddon matrix. The majority of the 10 strategies highlight changing of the physical environment to prevent injury, which is a passive approach, that does not require individuals to take direct action or an active approach in preserving personal safety (Runyan and Baker, 2009).

Table 2.2 Ten countermeasures to injury (Haddon, 1973) with examples (Child Injury Prevention)

	Countermeasure strategy	**Examples related to child injury prevention**
1	Prevent creation of the hazard in the first place	Banning production and sale of unsafe products and toys
2	Reduce the amount of energy contained in the hazard	Speed reduction of vehicles
3	Prevent the release of the energy	Child-resistant containers for medicines and chemicals
4	Modify the rate or spatial distribution of the hazard from its source	Use seat belts and child-restraints in vehicles
5	Separate people, in time and space, from the hazard and its release	Separate bicycles and pedestrians from other road users
6	Separate people from the hazard by interposing a material barrier	Bars on windows, fencing around pools, covers over wells
7	Modify the relevant, basic qualities of the hazard	Softer playground surfaces, thermostatic mixing valves
8	Make the person more resistant to damage	Good nutrition and health
9	Counter the damage already done by the hazard	First aid treatment for burns
10	Stabilise, repair and rehabilitate the injured person	Burn grafting, reconstructive surgery and rehabilitation

Source: The World Report on Child Injury Prevention (Peden et al., 2008)

More recently, another dimension of the matrix has been proposed (Runyan, 2015) to facilitate its use for making decisions about which countermeasures should be applied, from the total of the potential interventions originally identified in Haddon's matrix. The components of this third dimension are called "decision criteria" and are values that help to determine which, out of a range of potential interventions, should be prioritised with regards to efficacy, cost, freedom, equity, stigmatisation, the preferences of the affected community or individuals as well as those constructing the policy and its overall feasibility. For example, the cost of the intervention may be an important criterion in comparison to the efficacy of that intervention. The importance of one over another is dependent on the specific injury problem, the setting and the types of information available for assessment of each option.

2.3.3 Opportunities for prevention: The E's

A multi-faceted approach has been the most effective in preventing child injury and has the greatest chance of achieving long-term and sustainable injury prevention (Peden et al., 2008). Interventions have been categorised mainly into four E’s, that is, education, environment/engineering, enforcement and empowerments. Economics and evaluation are also considered as part of intervention. A multi-component approach containing elements from each of these is the most effective for injury prevention (Peden et al., 2008). Each element is explained in more detail below.

Education and raising of awareness is a widely-used and cost-effective approach affecting all aspects of society, from the children themselves and their parents to policy-makers, budget-holders and national representatives. This approach aims to increase public awareness about the risk of injuries and how to prevent them. Education may influence attitudes and beliefs and therefore has the potential to influence the behaviour of people. It can make people more aware of a problem, enable them to understand how and why injuries occur and then how they can prevent such injuries by choosing an appropriate course of action to reduce the risk. This approach is used to persuade high-risk groups to change their behaviour, by increasing the knowledge about injuries and helping them to choose effective and acceptable methods of injury prevention within their own community. Public awareness campaigns and training are part of this educational approach. With respect to child injury prevention, this approach enables parents and carers to understand how risk changes in relation to their child’s stage of development and how this informs the need for age-appropriate supervision. Education may also help them to understand the importance of safety devices for prevention of injury. However, it is important to note that just because people know the safest option, it doesn’t guarantee they will change their behaviour. It is for this reason that public health approaches rarely rely on health education alone and it is usually delivered alongside environmental change and/or enforcement of legislation.

Environmental modification and engineering aims to change the environments, including the home, and products that increase safety, to decrease the likelihood of injury. Making an environment safe and the use of safety equipment is often a key aspect of unintentional injury prevention. Changes to the design and manufacture of products can reduce the risk of injury, limit access to a hazard and therefore reduce the severity of an injury. Examples of this approach include separating cyclists from motor vehicles by the installation of cycle paths to reduce injuries from RTIs, installing a child seat in a car and the use of energy-absorbing surfaces in playgrounds that reduce the severity of fall injury. Installation of safety gates, fireguards, window catches, cupboard locks and lockable cabinets are examples of home environmental modification. However, most of the evidence regarding efficacy of environmental modification and engineering comes from HICs and the interventions shown to be effective in HICs may be too expensive, not available or inapplicable in LMICs. Environmental modification and engineering are examples of passive protection from injury and are often more effective than the other elements discussed. However, as previously discussed, most effective approach often involves a combination of several types of intervention.

Enforcement refers to the establishment and regulation of safety standards, guidelines, legislation and public policy to promote safer behaviour, environments or safer products to reduce injury risk. For example, these strategies have been proven to reduce RTIs in many countries, by enforcing road safety laws and regulations including occupational safety laws, highway traffic laws, zero tolerance for young drivers, speed limit enforcement and sobriety checkpoints amongst other measures. The introduction and enforcement of legislation can also be used in the home environment to reduce the risk of injury in children. Examples might include fencing around swimming pools, regulation around manufactured products like child resistant medicine containers and standards for the sale of play equipment or children's products (e.g. the lead content of paint used on cots, toys, pushchairs, or outdoor play equipment). However, legislation alone cannot fully reduce the risk of child injury. This is an active countermeasure and the success of this approach depends on the compliance and practical enforcement of that legislation. Injury prevention in HICs primarily involves legislation for the prevention of exposure to hazards and enhancement of medical systems for treatment of injuries post-event. Legislation for safety and enforcement of legislation is difficult in LMICs for several reasons, including limited capacity and lack of resources.

Empowerment aims to provide confidence, skills and knowledge to the family or community, so they can undertake injury prevention activities for themselves. Giving parents access to safety equipment through low-cost schemes, or enabling them to persuade landlords to make repairs to their homes are just two examples of the empowerment approach. This approach is similar to another element, economics.

Economics involves using financial incentives to implement injury prevention strategies. For example, car insurance discounts are given to families whose teenagers complete safer driving programs.

Evaluation aims to measure the efficacy of an intervention. Not every potential intervention has been proven effective and not every proven intervention will be effective in every circumstance. As described previously, most of the evidence for efficacy of interventions comes from HICs and these may not be effective in LMICs, due to the considerable differences resulting from the physical, social, cultural and economic conditions. Therefore, it is best practice in injury prevention to use interventions that have been evaluated for that situation. Evaluation also must consider any circumstance that may limit the effect of the intervention not just the outcome of intervention.

2.3.4 Environmental Health approach

Risk assessment is one of the important environmental health approach for injury prevention. It is an integral part of successful health and safety management. It can be done in various places like home, work place or playground. Risk assessment is a systematic process to identify hazards and minimise the risk of harm resulting from those hazards (HSE, 2014).

"A hazard is any physical situation or object that has the potential to cause harm to people, and risk is the likelihood/chance of a specific undesired event occurring within a specified period. Risk is therefore a function of both the likelihood and consequence of a specific hazard being realised" (Gadd et al., 2003).

According to the Health and Safety Executive (HSE, 2014), "risk assessment is simply a careful examination of what could cause harm to people, so that you can weigh up whether you have taken enough precautions or should do more to prevent harm." There are different ways of doing a risk assessment, however, HSE suggests a five-step approach:

1. Identification of hazards: Accurately identifying potential hazards is the first and most crucial step of the risk assessment process. Hazard identification involve observation of area to find, list, and characterise potential hazards. Hazard might be the activities, process, structure or substances that could contribute injury or harm people's health. In context of childhood home injury in LMICs, potential hazards could be a house structure like balcony without protective railing, household substances like poisoning chemicals kept/stored within child reach, or an open fire accessible to child.
2. Identification of risk of hazards: Risk is the likelihood of potential harm realised from the hazard. Risk identification involves the process of understanding the nature of the

hazards and determining the possible consequences of the risks. For example, identifying the risk (possible consequence) associated with a balcony without protective bars or railings, or identifying the risk associated with poisonous chemicals kept/or stored within child reach. This provides a basis for risk evaluation and making decisions about risk control. This step identifies who might be harmed and how.

3. Evaluation of risk: This is the process of determining the significance of the risk in terms of likelihood and severity. Some hazards have the potential to produce a higher frequency of injury events, but the injury may be less severe. In contrast, some hazards are less likely to produce injury events, but the injury may be severe. Knowing the likelihood and severity of the risk helps to evaluate the risk. This can be done by using a risk matrix as shown in tables below.

Table 2.3 Ranking the risk by multiplying likelihood by the severity
(Adapted from Health and Safety Executive guidance http://www.hse.gov.uk/risk/index.htm)

Likelihood of Occurrence			**Hazard Severity**		
1	**Remote**	Almost never	**1**	**Trivial**	(e.g. discomfort, slight bruising, self-help recovery)
2	**Unlikely**	Occurs rarely	**2**	**Minor**	(e.g. small cut, abrasion, basic first aid need)
3	**Possible**	Could occur, but uncommon	**3**	**Moderate**	(e.g. strain, sprain, incapacitation > 3 days)
4	**Likely**	Recurrent but not frequent	**4**	**Serious**	(e.g. fracture, hospitalisation >24 hrs, incapacitation >4 weeks)
5	**Very likely**	Occurs frequently	**5**	**Fatal**	(e.g. deaths)

Likelihood	**Severity**				
	Trivial	**Minor**	**Moderate**	**Serious**	**Fatal**
Remote	1	2	3	4	5
Unlikely	2	4	6	8	10
Possible	3	6	9	12	15
Likely	4	8	12	16	20
Very likely	5	10	15	20	25

Ranking the risks (Likelihood × Severity)		
Low risk (1 - 8)	Medium risk (9 - 12)	High risk (15 - 25)
Low Priority	Medium Priority	High Priority

Risk evaluation helps to know the main risks, so the risk control measure can be applied by prioritising the level of overall risk. If risk assessment identifies a number of hazards, risk ranking can help to put them in order of importance, so the most serious risk can be addressed first.

4. Risk control and management: this is the process of determining appropriate ways to eliminate the hazard if possible, or reduce the risk to acceptable levels when the hazard cannot be eliminated. For this, it is helpful to work through the 'hierarchy' of controls which are as follow:
    i. Elimination – get rid of the risk altogether
    ii. Substitution – exchange one risk for something less likely or severe
    iii. Physical controls - separation/isolation, eliminate contact with the hazard
    iv. Administrative controls - safe systems of work, rules in place to ensure safe use/contact with hazard
    v. Information, instruction, training and supervision – warn people of hazard and tell/show/help them how to deal with it

    It is important to consider that control measures should be practical, easy to understand, applicable to the hazard, able to reduce the risk to acceptable levels, and easy to operate. In addition, control measures should be as low as reasonably practicable (ALARP). ALARP is balancing the level of risk against the measures needed to control the real risk in terms of money, time or trouble.
5. Record the assessment and update if necessary: It is important to record the significant findings of risk assessment to ensure that proper checks were made to identify potential hazards and associated risks, vulnerable groups were identified, obvious significant hazards were taken into account, and that control measures were applied as low as reasonably practicable. Risk control can involve periodic review of risk assessment and decide on appropriate measures according to the updated identified hazards. Risk is part of everyday life and it will not be possible to eliminate all the risks. Therefore, risk control activities should be reasonably practicable to protect people from harm.

This approach was adapted in the current study for conducting a household risk assessment to identify the hazards along with the possible consequence of that hazards in children.

2.3.5 Injury prevention policies

For effective home injury prevention and control, comprehensive programmes incorporating many factors are essential. For example, safety education is an important component of injury prevention programmes, but on its own, it is insufficient if not supported by safety regulations and their enforcement (Galal, 1999). Unlike in developed countries, safety regulations and laws in developing countries often exist, but enforcement of these measures is rare. An intervention including a guideline or law developed in HICs is likely to be applicable in LMICs but careful evaluation is necessary to assess affordability, feasibility and sustainability (Forjuoh and Guohua, 1996). National policies, strategies and improvements in existing legislation can help to reduce the incidence of injury in a sustainable way (Forjuoh and Gyebi-Ofosu, 1993, Forjuoh and Guohua, 1996). The WHO has guidelines on "developing policies to prevent injuries and violence" for those whose responsibility it is to create policy and strategy for injury prevention. This guideline outlines the necessary phases and steps needed for creating an injury and violence prevention policy (Schopper et al., 2006) (Table 2.4).

Table 2.4 Guideline for developing policies to prevent injuries and violence

Phase I	**Initiating the policy development process**
Step 1	*Assess the situation*
Step 2	*Raise awareness*
Step 3	*Identify leadership and foster political commitment*
Step 4	*Invololve stakeholders and create owenership*
Phase II	**Formulating the policy**
Step 1	*Define a framework*
Step 2	*Set objectives and select interventions*
Step 3	*Ensure that policy leads to action*
Phase III	**Seeking approval and eddorsement**
Step 1	*Stakeholder approval*
Step 2	*Government approval*
Step 3	*State endorsement*

Source: World Health Organization (Schopper et al., 2006)

Forjuoh and Gyebi-Ofosu (1993) suggested that governments in low-income countries should formulate policies that "cover all five major injury control areas" (Table 2.5).

Table 2.5 Five major Injury Control Areas (Forjuoh and Gyebi-Ofosu, 1993)

I	*Transport injury including motor vehicle accidents, bicycle accidents, and pedestrian injuries*
II	*Occupational injury and worker protection including farm and agricultural injuries*
III	*Home and leisure injury, including school and sports injury, fires and burns, falls and poisonings*
IV	*Intentional injury such as homicide, suicide and other violence including political violence, and*
V	*Acute care systems and injury rehabilitation*

All areas are linked to childhood injuries, with the third component being predominantly relevant to child injury prevention and the fifth for post-injury management.

Similarly, the World Report on Child Injury Prevention (2008) outlined seven recommendations for developing child injury prevention programmes (Table 2.6), along with specific actions needed to accomplish these recommendations (Peden et al., 2008).

Table 2.6 Recommendations for the development of child injury prevention programmes

I	*Integrate child injury into a comprehensive approach to child health and development*
II	*Develop and implement a child injury prevention policy and plan of action*
III	*Implement specific action to prevent and control child injuries*
IV	*Strengthen health systems to address child injuries*
V	*Enhance the quality and quantity of data for child injury prevention*
VI	*Define priorities for research and support research on the causes, consequences, costs and prevention of child injuries*
VII	*Raise awareness of and target investment towards child injury prevention*

Source: World Report on Child Injury Prevention (2008) (Peden et al., 2008)

The 64th World Health Assembly adopted a resolution on child injury prevention (2011) and highlighted the need to expand current child survival programming and ensure financing streams included child injury prevention. It made it obligatory for all WHO member states to develop and implement a child injury prevention policy and practical plan at a national level with realistic targets (World Health Organization, 2011b). This included the involvement of governments along with other stakeholders like communities, non-governmental organisations and civil society. This multi-level collaboration can facilitate the implementation of both active and passive injury preventive strategies and enables better source management for child injury prevention programmes in each member country.

2.4 HOME INJURY IN CHILDREN AND INJURY PREVENTION MEASURES

2.4.1 Perceptions of childhood injury

According to theories of health-related behaviour change, individuals change their behaviour only when they perceived the severity and likelihood of negative health effects from existing risk factors (for example, a mother who does not feel her children may be susceptible to injury may be less likely to adopt preventive measures). If the individual perceives there are benefits to behaviour change (for example, making home environment safe can reduce the child injury incidence) and the required barriers to behaviour change are removed or removable then the behaviour has the potential to change (barriers could be associated cost, time, and labour of changing the home environment). The individual's perceived capacity to adopt the behaviour (self-efficacy) and cues to action also known as "triggers" which prompt certain behaviour are further key component of the health-related behaviour change (Rosenstock, 1974). Thus, behavioural science is an integral part of any comprehensive injury prevention strategy (Gielen and Sleet, 2003). Qualitative studies are considered to be the best way to understand people's perceptions or experiences, attitudes, beliefs and the meaning of experiences to them. Findings of qualitative study are useful in conceptualising risk factors and working out the possibilities for injury prevention (Green and Hart, 1998). Qualitative research methods provide a wealth of options for investigation, hypothesis generation, and for understanding how and why interventions do, or do not, yield the anticipated responses, However, the subjective nature of the analysis along with the small sample sizes and lack of statistical weight are common criticisms of qualitative research (Pope and Mays, 1995, Walker, 2014).

Anticipation of the risk of injury by families and their community is important for injury prevention in the home. An absence of this creates a major barrier for prevention of child injury (Gärling and Gärling, 1995, Smithson et al., 2011). In many LMICs and in some low-income communities within HICs, childhood injury is not considered as an important public health issue. It is commonly believed that injury is part of child development and consequently prevention remains less prioritise by parents and caregivers. For instance, a Canadian study assessed parent knowledge, attitudes and beliefs in relation to childhood injury and found that they perceived non-fatal injury to be a natural consequence of childhood. They believed minor injury as part of child development and children learned to avoid risk by experiencing injury events (Morrongiello and Dayler, 1996).

A qualitative study in the UK that also explored parents' perceptions of injury risks to their children, found that although the majority of parents were able to identify potential risks to their children and the preventative measures they could take, they did not believe that injuries were preventable; they perceived injury to be an inevitable part of child development. (Whitehead and Owens, 2012). Another qualitative study in the UK supported the findings of previous study (Ablewhite et al., 2015b). It revealed that parents anticipated injury risks to some extent, but did not take prevention action because they believed that some injury events are inevitable and related to child age and development.

Other studies have had similar results, including a qualitative study conducted in 2 low-income neighbourhoods in South Africa (Munro et al., 2006). Furthermore, another qualitative study in a low-income setting in South Africa that explored perceptions about the causes and solutions of injuries noted that child injury was a consequence of the parent's negligence or ignorance about engaging in supervisory behaviours. The lack of knowledge regarding identifying injury risk and improving family safety was found to be the cause of child injury in this setting (Butchart et al., 2000).

In Nepal, studies exploring perceptions about child injury and injury prevention are very limited. One qualitative study by Pant et al. (2014) explored community's perceptions of unintentional child injury found that parents perceived injury to be due to a bad coincidence, bad luck, witchcraft or ill fate. Parents believed that having minor injuries like bumps and bruises made children stronger for their future, so they ignored child injury in their daily lives and only injuries deemed to be serious received attention. Participants also either blamed the children or parent's behaviour to be the cause of injury. Hazardous environments where children were living and playing were rarely suggested as a risk factor for injury.

To develop injury prevention interventions, it is crucial to understand what people know about injury risk, how serious they perceive the risks are, what their current practices to overcome injury risk are and what they can do to protect themselves and their children from those risks. Furthermore, an understanding of which strategies would be appropriate, feasible and acceptable in a particular community is essential for developing and implementing an effective injury prevention intervention (Roberts, 1997, Dowd, 1999). However, perceptions of injury risk and prevention measures varies between different people, depending upon their professional, social and personal backgrounds (Rothe, 2000, Stone and Morris, 2010). Any factors such as individual, family, social, economic, physical or the political environment that can contribute to an injury is considered as a risk factor. However, the definition of risk is subjective and depends upon an individual's understanding. The anticipation of risk factors and their consequences affects the consideration of prevention and safety measures that are applied.

2.4.2 Home injury prevention interventions and their efficacy

As previously described (Section 2.2), there are many risk factors responsible for unintentional child injury in the home environment, including the physical home environment itself. Reducing the risk of injuries at home is challenging, but altering the home environment would be beneficial in reducing home injury risk for children and young people (Irving, 2011, Phelan et al., 2011, Gururaj, 2013). Several studies have explored the efficacy of some home interventions in terms of reduced injury rate, injury hazards or increased use of safety equipment or safety practices in HICs (Elkan et al., 2000, Kendrick et al., 2000, Sznajder et al., 2003, Babul et al., 2007, Kendrick et al., 2007, Kendrick et al., 2013b). Interventions included home visits, safety education given to parents or caregivers, provision of free or low-cost safety devices or a combination of one or more of these and other components.

Not all environmental interventions have been evaluated for efficacy and for some of those that have, the intervention has been shown to produce mixed or no reduction of injury (Watson et al., 2005, Sangvai et al., 2007). A systematic review by Towner et al. (2001) identified little evidence that educational campaigns to prevent general home accidents were effective in reducing the likelihood of injury in young children. However, there was also evidence suggesting that these campaigns may be an effective means of environmental and behavioural change. Another systematic review by Turner et al. (2011) assessed the efficacy of home environment modification for the reduction of injuries, although predominantly in HICs. There was little evidence to determine whether environmental change in the home, such as the fitting of locks on cupboards, installing of stair gates, improvement of lighting in halls and stairways and the removal of trip hazards reduced the number of injuries; however, it concluded that these interventions were likely to be effective. Another review found that home safety education with the provision of free, low cost or discounted safety equipment was an effective way to enhance safety practice, but did not conclude whether such intervention also reduced injury rates (Kendrick et al., 2013b). The majority of studies included in the review measured the effects of intervention to reduce injury hazards or increase safety practice, but few specifically measured the efficacy of such interventions in reducing cases of child injury.

Some studies have shown that parental safety behaviours and changing the physical home structure were associated with a reduced number of childhood injuries in the home environment (Abboud Dal Santo et al., 2004, Morrongiello et al., 2004, Kendrick et al., 2005b, Phelan et al., 2011). In a systematic review by Kendrick et al. (2013a) where 10 RCTs were included in a meta-analysis found that parenting interventions, most commonly provided within the home using multi-faceted interventions significantly reduced the risk of injury in intervention families as compared to families with no intervention (RR: 0.83; 95%CI: 0.73 - 0.94). However, three RCTs pooled into the meta-analysis found no difference in home safety between families receiving parenting programmes and those not receiving these programme (mean difference 0.57, 95%CI -0.59 to 1.72). Overall, these studies suggest that even general parenting programmes could reduce the number of unintentional injuries to children in the home.

In both HICs and LMICs, falls are the most common childhood injury (Peden et al., 2008) and the majority of fall injuries in pre-school children occur within the home. Most of the falls occur on the same level and the injury sustained due to falls on same level are not usually serious. Falls from heights are more likely to contribute serious injury. Some safety interventions including removal of fall-related hazards have shown a positive effective in reducing fall-related injuries, but some interventions led to no significant reduction in fall-related injuries. For example, an RCT in Pakistan reported that home inspection and safety education was effective in reducing the number of fall-related hazards in comparison to groups without those interventions (Rehmani and LeBlanc, 2010). The mean number of fall hazards was reduced from 3.1 (Standard deviation (SD): 0.7) at baseline to 2.4 (SD: 0.8) in the fall intervention counselling group. Fourteen percent of homes (n = 19/141) had no fall hazards at follow-up after fall intervention counselling in comparison to 3.5% homes (n = 5/142) that had no fall hazards in the control group (RR: 3.8; 95%CI 1.5 - 10.0; $P < 0.002$). However, experimental studies from South Africa reported that home inspection, safety education and safety devices had no significant effect in reducing the number of fall-related hazards in the home (Swart et al., 2008, Odendaal et al., 2009). The difference in results between Pakistani study and South African studies might be due to the difference in methodology used. For example, Rehmani used 6 months post intervention follow-up period and that might had allowed enough time for people to change their home structure. Whereas, the post intervention follow-up period in Swart and Odendaal studies were 4 and 3 months respectively. This might be the reason that people were not able to change their home structure within short period of time after intervention.

Young et al. (2013) carried out a review to synthesise evidence from all reviews, systematic reviews and meta-analyses of experimental and controlled observational studies on falls in the home; they reported that home safety interventions were effective in improving some childhood fall-related outcomes in the home. Specifically, this included encouraging the use of safety gates and furniture corner covers as well as reduction in unsupervised baby walker use. However, the efficacy of intervention targeting the use of window safety devices, non-slip bath mats and reducing tripping hazards was mixed. There was also insufficient evidence to determine the efficacy of interventions in improving lighting in corridors, altering furniture layout and restricting the access to roofs. Therefore, there was limited evidence to support the use of many interventions to reduce childhood falls or fall-related injuries in the home. However, almost all the interventions included in the overview were from HICs, therefore the findings have limited suitability to be generalised to LMICs.

These findings were further supported by a network meta-analysis that also evaluated the efficacy of increasing possession of safety equipment or behaviour changes, in preventing childhood falls in the home (Hubbard et al., 2015). This study reported that intensive intervention including education and providing low cost or free equipment with home safety inspections and fitting of safety equipment was the most effective way to reduce falls; this included the possession of a fitted stair gate (Intervention Group OR: 7.8; 95% Credible Interval (CrI): 3.08 - 21.3). Education as a sole intervention was most effective in reducing the likelihood of possession or use of a baby walker in the intervention group (OR: 0.48; 95% CrI: 0.31 - 0.84). However, findings were inconclusive for the possession of window locks (OR: 1.56; 95% CrI: 0.02 - 89.8) and parental or caregiver education to ensure a child was not left unsupervised on a high surface (OR: 0.89; 95% CrI: 0.10 - 9.67) in comparison to control groups without these interventions. There was insufficient evidence for the efficacy of possession and use of bath mats in fall prevention. Most of the papers used in this meta-analysis were from HICs so findings are less likely to generalizable to LMICs.

In terms of burn and scald prevention, a systematic review reported that educational campaigns were effective in increasing knowledge of how to prevent burn or scald injuries and the distribution of smoke alarms was an effective in reducing fire-related injuries. However, there was little evidence to suggest that educational campaigns were effective in reducing injuries from hot water, or burns or scalds in the home (Towner et al., 2001). A meta-analysis and meta-regression found that home safety education, in conjunction with the provision of safety equipment is effective in increasing some thermal injury prevention practices (Kendrick et al., 2009); Families receiving safety education and equipment were more likely to have and use functional smoke alarms (OR: 1.83;

95%CI: 1.22 – 2.74) and use safe hot tap water temperatures (OR: 1.35; 95%CI: 1.01 – 1.80) around the home. Some evidence suggests that education increases the likelihood of families to install fireguards (OR: 1.39; 95%CI: 1.00 - 1.94) around their fires. However, there was a lack of evidence show that home safety education was effective to reduce the actual incidence of thermal injury rate (Incident Rate Ratio (IRR): 1.12; 95%CI: 0.81 - 1.56) in children that occur in the home. Similarly, home safety education was not effective to change parent's behaviour regarding keeping matches and lighters or hot food and drinks out of reach of children. Out of 24 studies included in the meta-analysis, only one Control Before and After (CBA) (from Mexico) study was from LMICS, therefore the findings would have limited suitability for generalization to LMIC settings.

This findings were further supported by studies that evaluated the effect of interventions on the possession and use of smoke alarms and the usage of a safe hot tap water temperature. Cooper et al. (2012) concluded that education, providing and fitting low cost or free safety equipment, and home inspections were most likely to result in the installation of functional smoke alarms (estimated OR: 7.15; 95% CrI: 2.40 - 22.73) than if there was no intervention. Likewise, an overview of systematic reviews and a systematic review of primary studies both reported that interventions including education, home safety checks and the provision of discounted or free safety equipment were effective in promoting safe hot tap water temperature use in the home (Zou et al., 2015). However, there was insufficient evidence to show that these interventions actually reduced the incidence of scalds in children within the home environment.

Like environmental change, modification of products used in the home can reduce child injury risk. For example, a study in the USA reported that child-resistant packaging reduced child mortality from the unintentional ingestion of medicines (Rodgers, 1996); it reduced the mortality rate by 1.40 in 100,000 (95%CI: 0.85-1.95) amongst children <5 years of age. A similar study in the USA found that use of child-resistant packaging was associated with a 34% reduction in the aspirin-related mortality rate for children <5 years of age (Rodgers, 2002). Several studies in HICs have found that education and engineering are effective in improving poison prevention practices, but there is limited evidence to show whether this intervention reduces poisonings rates in children within the home environment (Wynn et al., 2016).

Research evidence suggests that safety education alone is likely to result in limited or short-term behaviour change only. Therefore, a multi-faceted intervention i.e. an educational component combined with environmental change and access to free or low-cost equipment are more likely to be more successful in reducing injuries in the home. However, most of this evidence comes from HICs. These limits the generalisability of findings to LMICs, where housing conditions, family characteristics, living arrangements and cultural practices are very different than those in the HICs. Some interventions from HICs may be adapted and used in LMICs with careful examination. Most of these interventions in HICs appeared to increase the likelihood that safety devices would be used, or safety practice would be promoted. However, findings remain inconclusive as to whether these interventions reduce the incidence of childhood injuries measured in the home environment.

2.4.3 Barriers to and facilitators of prevention of home injury

Understanding the barriers to and facilitators of injury prevention is essential in the successful development and delivery of injury prevention interventions. However, little research has been undertaken in LMICs to explore this. In contrast, several studies in HICs have identified key facilitators and barriers for parents or carers in keeping children safe from unintentional injury within home environment. For example, a systematic review of quantitative research explored the barriers and facilitators to home safety education, with or without the provision of safety equipment, for home injury prevention (Ingram et al., 2012). Interventions were provided by health or social care professionals, lay workers or voluntary or other organizations, to individual, or groups of, children or families. Results of this study has identified the barriers for home injury prevention interventions that were related to the socioeconomic circumstances of the families, including having a low income so making it difficult to afford safety equipment. Having parents who were illiterate or had low literacy abilities, using complex interventions using multiple messages in one programme, language and cultural differences, having a lack of safety behaviours and living in rented accommodation where parents were unable to install safety equipment in homes also prevented them from making changes that would have prevented home injury. Facilitators that enabled home injury prevention interventions were generally related to the free provision of safety equipment, along with safety education and environmental changes; this was a combination of active and passive intervention, delivering a clear and simple message, targeting a specific high risk population based on factors such as child age, family circumstance and individual behaviour, community involvement and raising safety awareness and delivering other interventions using child health professionals or others such as family caseworkers that were trusted or familiar. A summary of the barriers and facilitators identified is in table 2.7.

Table 2.7 Facilitator and barrier themes and sub-themes identified from 57 intervention papers on home injury prevention for pre-school children (Ingram et al., 2012)

Facilitators	Barriers
Approach Home visits; combined educational and environmental; community involvement; partnership working; tailored methods	**Cultural barriers** Distrust of home visits; language barriers; lifestyle; generalisability
Focused message One injury type; tailored to the individual; simple message	**Socio-economic** Literacy ability; low income; ethnicity
Minimal change Educational; physical	**Complex intervention** Multiple injuries; multiple methods
Role of the deliverer Benefits to participants: using health professionals, other professionals or volunteers; Benefits to the deliverer: time and place	**Deliverer constraints** Training; time involved; sustainability; communication
Accessibility to equipment Free provision and fitting of safety equipment; coupons; information	**Physical barriers** Rented accommodation; multiple occupancy; frequent moves; access to devices; faulty devices
Behaviour change Reinforcing messages; motivational techniques; theoretical models; organisational change; community involvement and awareness	**Behavioural barriers** Existing behaviour; behaviour change
Incentives Financial incentives; free first aid training; crèche facilities	

A systematic review of qualitative research also explored the barriers and facilitators to the success of intervention in the reduction of childhood home injuries (Smithson et al., 2011). Intervention included the supply and/or installation of home safety equipment with or without home risk assessments. Researchers grouped barriers and facilitators into three levels; external (legal, policy and organisational), physical or environmental and individual. At the legal, policy and organisational level, barriers to injury prevention included weak legislation and a lack of appropriate information given to parents or households. Barriers identified at the physical or environmental level included living in rented or extended family accommodation, with a limited possibility for adaptation of the home, poor quality housing and the cost of installing safety devices. At the individual level, barriers included a lack of awareness amongst parents about injury risk, the perception that injuries were inevitable, differences in parent cultural and socioeconomic background and differences in practices, experiences and expectations. Further barriers identified at this level were the mistrust of officials, fear of being accused of abuse or neglect and not trusting neighbours or non-family members to look after their child.

Facilitators for change identified at the legal, policy and organisational level included policy drivers and legislation, collaboration with many agencies, good communication between organisations and their target audiences and involving local people (e.g. mothers) and relevant populations (e.g. schoolchildren) in policy making and education. At the physical or environmental level, facilitators for change were living in stable and child-friendly accommodation, ownership of a home that enabled parents to modify homes and landlords that paid attention to safety issues. Furthermore, provision of safety equipment, including training for installation, ongoing support for use, maintenance of equipment and safety checks were also identified as facilitators. At the individual level, the main facilitators for change were parental awareness about the potential risk factors for child injury and their daily management, proper safeguarding practice for children, teaching children about safety practices and building trust and social relationships within the community, as opposed to isolation of a family. A summary of the barriers and facilitators for change identified in this review is shown in table 2.8.

Table 2.8 Main themes emerging from 9 articles on barriers to, and facilitators of, prevention of unintentional injury to children in the home (Smithson et al., 2011)

Level	Main facilitators identified	Main barriers identified
External: Legal, policy or organisational	Policy drivers and legislation. Multi-agency partnerships, linking with other health messages or initiatives Good communication between organisations and target audiences. Involving local people (e.g. mothers) to be trained in health initiatives. Targeting of population (e.g. schoolchildren) to share information	Weak legislation. Absence of policy drivers influencing resources Lack of appropriate information to parents or households about legislation and policies
Physical or environmental	Stable and child-friendly accommodation. Control/ownership of home environment. Landlords' attention to safety issues. Provision of appropriate and durable equipment. Maintenance of and confidence in other safety devices Training in installation and equipment use and repair or replacement	Disempowering effects of living in rented or overcrowded living conditions Practical barriers due to poor quality (often rented) housing Lack of maintenance of smoke alarms Cost of installing safety devices. Costs of accessing treatment
Individual	Awareness of risk Mothers' work in safeguarding children. Mothers' commitment to vigilance. Teaching children about safety Culturally sensitive information and advice systems Building of social relationships within the community, s as opposed to isolation. Building trust in officials via peer education	Lack of awareness of risk. Fatalism about nature of injuries Cultural differences in experiences and expectations. Cultural practices in different cultural context. Language barriers Relationship with partner. Mistrust of officials. Fear of being accused of abuse or neglect. Not trusting neighbours or non-family members to look after child

Ablewhite et al. (2015b) investigated the key facilitators and barriers for parents in keeping their children safe from unintentional injury in the home and came with similar results identified in previous research. In this qualitative study, semi-structured interviews were conducted with parents with a child aged <5 years at parent's homes. The main barriers to injury prevention found in this study were lack of parental anticipation of injury-producing events and lack of knowledge about consequences of injury, treating injury as inevitable events in childhood, interruption of supervision due to distraction, maternal fatigue or presence of older siblings, difficulties with adapting the home environment and inappropriate timing or targeting of safety information in relation to the age and stage of child development. Main facilitators to injury prevention included the ability of parents to predict injury risk, adequate supervision, teaching children about injury risk and safety practices, adapting the home by installing safety equipment or removing hazards and learning about injury events from the experiences of other parents.

2.5 JUSTIFICATION OF THIS STUDY

Guidance on how to develop injury prevention policies at a regional or national level specifies the need for data collection on the risk factors for injury in a particular country and the use of that information to develop interventions (Schopper et al., 2006). A lack of data on child injury, particularly in LMICs, has also been identified by the World Report on Child Injury Prevention as a key challenge. There is very limited community-based information and this has been a major obstacle in the estimation of the scale of the injury burden in many LMICs (Peden et al., 2008). The epidemiology of injury in Nepal is poorly-documented. There is no formal death registration process and although police data on road traffic incidents are available, this is known to underestimate the true incidence. Collecting injury information is a challenging task due to the lack of formal injury surveillance systems (Schopper et al., 2006) in Nepal. A systematic review (Pant et al., 2015b) stated that, out of 11 Southeast Asian countries, national injury surveys were found in only two countries, Bangladesh (Rahman et al., 2005) and Thailand (Sitthi-Amorn et al., 2006).

Although, the Global Burden of Diseases (2004) update (Mathers et al., 2008) and the World Report of Child Injury Prevention (Peden et al., 2008) have highlighted the need to look into possible causes of death and disability in low income countries, persisting challenges remain in relation to home injury statistics. A number of research studies conducted in HICs have found that childhood injuries occur in the home environment (Morrongiello et al., 2004, Thein et al., 2005, LeBlanc et al., 2006, Desapriya et al., 2009, Phelan et al., 2009). Also, several RCTs have shown that home safety programmes could be effective in reducing a substantial number of childhood injuries or increase parental safety behaviours (Clamp and Kendrick, 1998, Gielen et al., 2002, Sznajder et al., 2003, Posner et al., 2004, Hendrickson, 2005, King et al., 2005, Babul et al., 2007, Phelan et al., 2011).

Conversely, there is limited research in LMICs that assesses adequately the association of home hazards with childhood injuries. Some observational studies in LMICs, such as India (Chaudhari et al., 2009, Mirkazemi and Kar, 2009, Jetten et al., 2011, Banerjee et al., 2016, Parmeswaran et al., 2016), Pakistan (Chandran et al., 2013, Khan et al., 2013), Iran (Mohammadi et al., 2006, Arshi et al., 2012), South-Africa (Jordaan et al., 2005), and China (Qiu et al., 2014) have reported the incidence of home injury hazards. However, there is a large gap in availability of any comprehensive injury incidence data related to hazards, particularly those occurring in the home environment. Household surveys and hospital data suggest that home injuries (e.g. falls, burns, poisoning) and occupational and animal injuries are significant issues in Nepal (Pant et al., 2015a, Bhatta et al., 2016) but true estimates are unclear. Currently, no research study has been conducted to explore the prevalence of home injury hazards in Nepal and therefore this was chosen as a focus for this doctoral study.

Whilst it is true that much is known about what is effective in injury prevention in HICs and settings, interventions cannot be directly transferred to low income settings without local adaptation and evaluation. There are considerable differences between the two due to physical, social, cultural and economic conditions that influence transferability (World Health Organization, 2002, Peden et al., 2008). Understanding the context in which the injuries occur, and the mechanism of injury can be obtained through community-based research and it is essential to design and implement any interventions locally and to demonstrate their impact. Consequently, community-based surveys are considered to be an excellent approach in ascertaining the ‘invisible’ cases of injury and their risk factors in rural Nepal. A systematic review (Towner and Dowswell, 2002), stated that “important elements of community-based programmes are a long-term strategy, effective and focused leadership, multi-agency collaboration, the use of local injury surveillance to develop locally appropriate interventions and tailoring interventions to the needs of the community.”

Therefore, a community-based study was conducted in rural Nepal to generate knowledge through collection of comprehensive information on home injury hazards for child injury. This study also hoped to fill in the research gap by exploring effective home environmental change interventions used in LMICs, with the aim of reducing incidence of childhood injury or presence of injury hazards. Understanding the potential environmental change intervention in the home including barriers and facilitators from the perspective of community's people is crucial to the successful development and delivery of injury prevention interventions. However, this information was lacking in Nepal and therefore this study attempted to fill this research gap. The overall findings of this PhD can be used as a basis for future studies and the development of effective and cost-effective interventions for the prevention of injury in children within Nepal.

2.6 AIM AND OBJECTIVES

Aim

The aim of this PhD was to explore the home environmental risks associated with unintentional injuries amongst children aged 0-59 months in the Makwanpur district of Nepal, and to explore the potential for environmental change in the home at a community level to prevent injury occurrence.

Objectives

The objectives of this study were as follows:

1. Undertake an overview of the literature regarding currently known home environmental risks that are associated with childhood injury in LMICs
2. Undertake a systematic review of existing studies for evaluation of the environmental change interventions in the home for childhood injury prevention in LMICs
3. Liaise with the Centre for Injury Prevention Research Bangladesh (CIPRB) for support, development for the carrying out of a household survey as well as for consultation on the proposed final recommendations
4. Conduct and analyse a community-level survey of home environmental risks for childhood injuries in the Makwanpur district of Nepal
5. Identify the barriers and facilitators for local change by exploring the potential for utilisation of the survey data through focus groups with community members
6. Recommend culturally appropriate interventions for environmental behaviour change and strategies for future development and evaluation

To achieve the aim and objectives of this PhD, a literature review was undertaken to understand what environmental hazards in the home had previously been identified and whether environmental change interventions in the home have been shown to be effective to reduce home hazards or home injuries in LMICs. After this, community based studies were designed to collect both quantitative and qualitative information to best understand the problem of home injury risk in Nepal. For this, quantitative data was collected through a community-based household survey to understand home injury hazards and home injury and then qualitative data was collected through focus groups to obtain the community-identified solution to improve home environment for preventing home injury.

2.7 DEFINITIONS USED IN THIS THESIS

Injury: According to the world report of child injury prevention (2008) and excerpts of a conference report, injury is defined as "the physical damage that results when a human body is subjected to energy that exceeds the threshold of physiological tolerance or results in lack of one or more vital elements, such as oxygen" (Peden et al., 2008). The terms intentional and unintentional denote whether or not an injury was meant to harm the victim (Christoffel et al., 1992) or not. Intentional injuries include suicide and self-harm, homicide, assault and child abuse or purposeful neglect.

For household survey of this study, non-fatal injury cases were defined as 'any type of unintentional injury occurring in the home environment that did not cause death, and required medical attention or at least 1 day's loss of usual activities or absence from school'. Injuries included physical damage caused by transport (e.g. road traffic collision, bicycle injury, injury as a pedestrian whilst on the road), falls, falling objects, cuts or wounds, burns or scalds, drowning, suffocation, accidental poisoning, electric shocks, animal-related injuries including bites, stings or crush injuries, and sprains or strains. The recall period for non-fatal injury was 3 months and fatal injury was 12 months.

A home environmental risk in this study is anything that represents a physical or structural that hazard has the potential to cause injury.

CHAPTER 3: A SYSTEMATIC REVIEW AND META-ANALYSIS

3.1 INTRODUCTION

This section presents the findings of a systematic review designed to summarise and appraise current published and unpublished evidence of the effectiveness of environmental change interventions to prevent unintentional child injury in Low and Middle-Income Countries (LMICs). The definition of LMICs used in this review is based on the World Bank 2009 country list of low income economies and lower-middle-income economies. The list of LMICs was updated and put together for systematic review authors by Norwegian Satellite of the Cochrane Effective Practice and Organisation of Care Group in 2013.

Systematic reviews are a well-established method of collating evidence from research where it follows a predefined and explicit protocol design to promote rigour, transparency, and repeatability (Pope et al., 2007). This systematic and repeatable methodology attempts to minimise bias and present meaningful, up-to-date information relating to healthcare interventions (Moher et al., 2009, Higgins et al., 2011). The structure of this review is based on reporting guidance from the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) (Moher et al., 2009) and the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2011).

3.2 OBJECTIVE

To identify and critically appraise current published and unpublished evidence of the effectiveness of environmental change interventions in the home to prevent unintentional child injury in LMICs.

3.3 METHODS

3.3.1 Review protocol

This systematic review was completed according to a predefined protocol.

3.3.2 Inclusion criteria

A structured approach, PICOS, was used to divide the research question to develop the five components (Moher et al., 2009, Higgins et al., 2011). Population/participants (P), Intervention (I), Comparison (C), Outcomes (O), and Study design (S). These components were used as criteria to include the studies in this review.

3.3.2.1 Types of participants

The recipients (and or delivery) of interventions in LMICs. This included recipient of environmental change interventions living in LMICs, parents, grandparents, and/or children. No restriction in age, sex, ethnicity. It included any level either individual or government level.

3.3.2.2 Types of intervention

Any environmental change interventions designed/intended to reduce injury and/or injury hazard for children. Visiting home for hazard risk assessment, providing safety education to parents/child and installation of safety devices were consider as environmental change interventions for this review. (At the stage of screening, all ages were considered and later just child interventions were selected).

3.3.2.3 Comparison

Participants or settings who do not receive the environmental change interventions. This means, comparing an intervention group who is getting environmental change interventions with a control group who is getting any other interventions or only one component, or a limited number of components, of a multi-component intervention or not getting any intervention/placebo.

3.3.2.4 Types of outcome measures

Primary outcomes: *Number of child injuries*

Secondary outcomes: *Number of child injury hazards*

Studies were included if they had either outcomes or both.

3.3.2.5 Types of studies

Experimental design studies [Randomized Controlled Trials (RCTs), quasi experimental Design] including Controlled Before and After (CBA) study

3.3.3 Definition used in this review

Children: Children under the age of 18 years.

Injury: Number of unintentional injuries.

Injury hazards: Any physical environment in and around the home that has potential to cause injuries.

Injury severity: Any injury severity defined by authors (i.e. both fatal and non-fatal).

3.3.4 Other criteria

Searches were not restricted by language, publication date, or status (examples: inclusion of unpublished material and abstracts).

3.3.5 Exclusion criteria

- Studies with only intentional injury outcomes
- Studies from countries not classified as low or middle income by the World Bank
- Studies that do not mention a home environment change/modification
- Non-intervention studies e.g. survey
- Studies without a control group
- Studies focussing on only non-child age categories, e.g. mature adults or older people
- Studies that address child health issues other than injury
- Studies that do not meet all the inclusion criteria

3.3.6 Search methods for identification of studies

Studies for the review were identified by following sources:

3.3.6.1 Electronic databases

The following databases were searched. Searched were carried out from 18/03/2014 to 01/04/2014.

MEDLINE (Ovid) (1947 - 2014)

EMBASE (Ovid) (1947 - 2014)

Cumulative Index to Nursing and Allied Health Literature (CINAHL Plus) via EBSCO (1937 - 2014)

Psych INFO (EBSCO) (1806 - 2014)

Applied Social Sciences Index and Abstracts (ASSIA) via ProQuest (1987 - 2014)

Websites (Safety Lit; a Weekly Literature Update Bulletin). http://www.safetylit.org/

3.3.6.2 Key words and Search strategy

Key words were developed based on each research objective component and from similar reviews published in The Cochrane Library (Turner et al., 2011). A LMIC filter 2013 developed by Norwegian Satellite of the Cochrane Effective Practice and Organisation of Care Group was used for participants (http://epoc.cochrane.org/lmic-filters). Initially, one database (Medline (Ovid)) was used to develop the search strategy (Appendix 3.1), which was then adapted for the other databases.

3.3.6.3 Other resources/grey literature

Hand searching was carried out. Reference lists of included studies and systematic and non-systematic reviews were also searched for modifications to the home environment, particularly for interventions to modify environmental injury hazards. Google scholar was also used. In addition, corresponding authors of all included studies were contacted by email to find out any other recently published, in press or unpublished studies that met the inclusion criteria (Appendix3.2).

3.4 DATA COLLECTION AND ANALYSIS

3.4.1 Selection of studies

A selection of studies by reading titles and abstracts was performed independently by the reviewer (SB) according to the pre-defined inclusion/exclusion criteria and going through the following steps:

3.4.1.1 Identification

Personal accounts were set up for electronic resources used to enable a permanent record of searches to be kept. Studies identified in the searches of each electronic database were imported into RefWorks (web-based bibliographic management software). Exact and close duplicates were removed carefully by deleting the duplicates page by page to minimize the risk of error in the process.

3.4.1.2 Screening

Within RefWorks, titles and abstracts were screened to identify those that potentially met the inclusion criteria. Studies that had potential relevance were retrieved and those that were not directly relevant to the review were excluded.

3.4.1.3 Eligibility

The list of inclusion criteria was used to develop an eligibility form (Appendix 3.3). After reading the full text of studies, the eligibility form was used to exclude those studies that did not meet all the criteria. Any uncertainty or ambiguity regarding inclusion of a study was discussed with the supervisory team (TD and JM) at this stage.

3.4.1.4 Inclusion of the studies for review

After identification, screening, and eligibility assessment, the remaining studies were included in the review for data extraction.

3.4.2 Data extraction and management

A standardised data extraction form was prepared for extracting the key characteristics of studies including outcome data (Appendix 3.4). The reviewer developed the form in accordance with the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2011). This form was pilot–tested by a supervisory team using a randomly selected study to check consistency and accuracy of data extraction and quality appraisal. Discrepancies were subsequently discussed with supervisors and the form was finalized for use. Data was extracted in two ways: (1) general description about the study; and (2) the main findings of each study using a standard format. Data was extracted mainly by the reviewer from included studies. However, the supervisory team also replicated the data extraction work independently to minimize errors and reduce potential biases.

3.4.3 Data synthesis

Narrative synthesis for the combined synthesis of qualitative and quantitative evidence and statistical procedures were used to analyse the data. The Narrative synthesis approach is useful to demonstrate some of the issues that occur during local implementation of interventions, specifically which aspects are effective and those that impede their efforts (Popay et al., 2006).

Meta-analysis was also undertaken where two or more studies (RCTs or CBA) were sufficiently homogenous in terms of study design, participants, interventions and outcomes. Meta-analysis is a useful statistical approach that combines the results from several homogenous studies to develop a single result with greater statistical power (Moher et al., 2009). Meta-analysis was produced with the Cochrane Collaboration

Review Manager 5.3.5 software (RevMan 5.3.5, 2014). Calculations were based on the post-intervention mean scores of injury hazards in the intervention and control groups as reported by the author in included studies.

The mean difference (MD) was used as the effect measure for estimated continuous summary data. Assuming that there was heterogeneity in the studies with respect to their design and implementation, the random-effects model was considered as appropriate and used (Hedges and Vevea, 1998). 95% Confidence Intervals (95%CI) were calculated. Statistical heterogeneity (I^2) and test for overall effect was calculated and p-values <0.05 were regarded statistically significant.

Assessment of heterogeneity: heterogeneity of the trials was assessed through visual inspection of forest plots and calculation of the I^2 statistic in RevMan. Fifty percent limit was used to indicate substantial heterogeneity (Higgins et al., 2011) and intended to explore the reasons for statistical variation if results exceeded this limit. Because of a small number of studies included in the meta-analysis, no sensitivity analyses were performed.

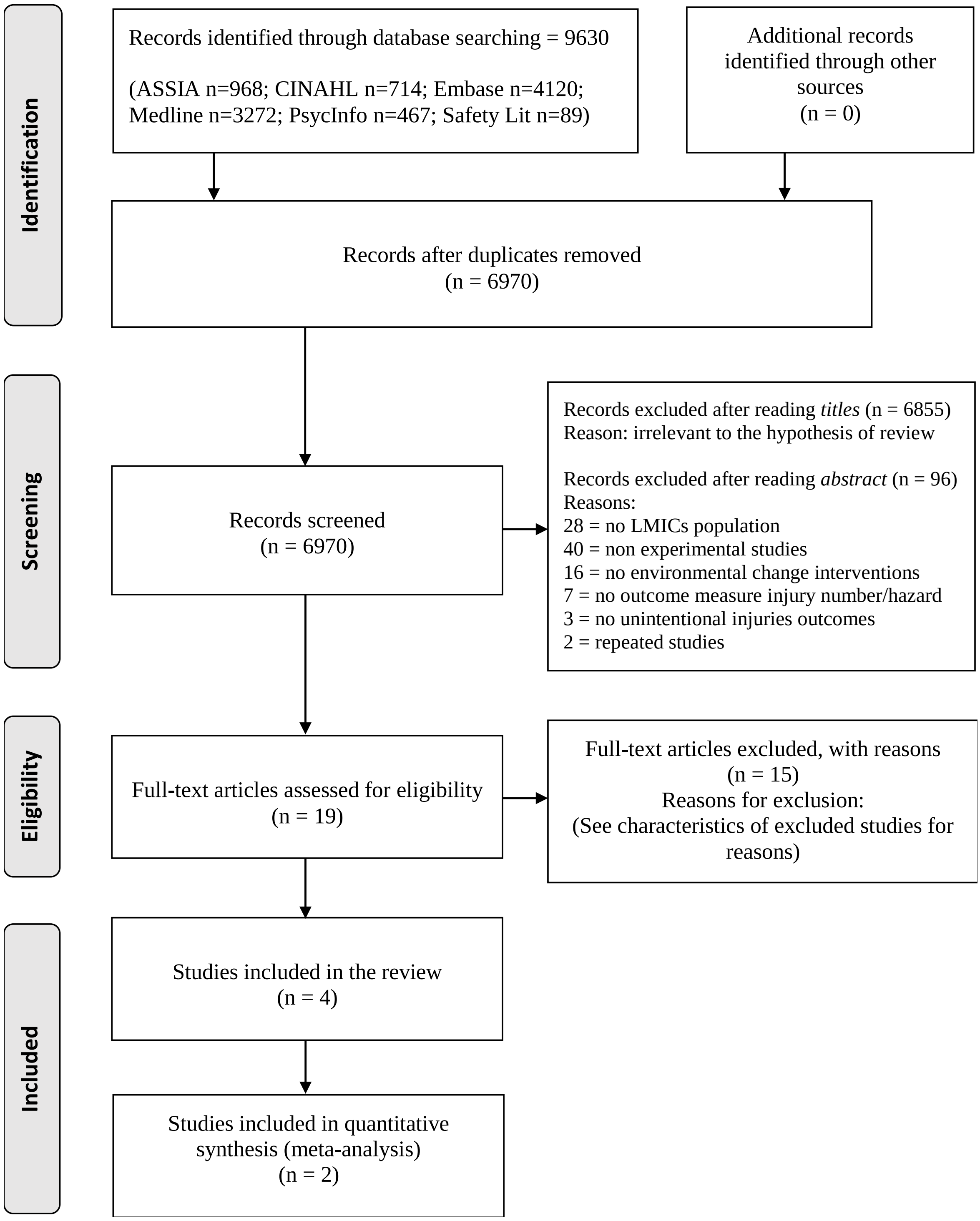
3.4.4 Critical appraisal methods

Risk of bias in included studies was assessed by using the appropriate tool based on study type. The response for each criterion was reported as low risk, high risk, and unclear risk of bias. For CBA study, the Effective Practice and Organization of Care (EPOC) tool for assessing risk of bias was used (Mowatt et al., 2001). For the other three RCTs, the risk of bias tools for the Cochrane review was used (Higgins et al., 2011). Graphic representations of potential bias within and across studies were computed using RevMan 5.3.5 software. (Detail in results section).

3.5 Results

3.5.1 Description of studies

Figure 3.1 PRISMA 2009 Flow Diagram (Moher 2009)



3.5.2 Result of the search

Figure 1 represents the process of identification and selection of studies. A total of 9630 records were identified through the electronic database search and no additional studies were found from any other sources. The high sensitivity of the search method would be the reason for identifying huge amounts of records from the database search and no records from other sources. 6970 records were obtained after duplicates were removed. 6855 records were excluded after reading titles and 96 records after reading the abstract. If the abstract met two or more inclusion criteria, they were retained for full text screening. 19 full text articles remained to assess for eligibility criteria. Finally, 15 records were excluded, and 4 records were included for review. Based on the type and format of the data available, two studies were included in the narrative synthesis and two studies were included in the meta-analysis.

3.5.3 Excluded studies

Several studies were excluded after reading titles and abstract and only 19 studies that appeared to meet the eligibility criteria were remained. After full text inspection of these 19 studies, again 15 studies were excluded as they did not meet all the inclusion criteria. Characteristics of excluded studies are presented in Appendix 3.5.

3.5.4 Included studies

3.5.4.1 Study design

Three studies included in the review were an individual RCT (Odendaal et al., 2009), a cluster RCT (Swart et al., 2008), and a non-blinded RCT (Rehmani and LeBlanc, 2010). One study (Krug et al., 1994) was a controlled before and after study, not a RCT.

Duration of the three RCTs varied from 3 months to 6 months and for the CBA study it was 28 months. All included studies were conducted in developing countries: One study in Pakistan (Rehmani, 2010) and the other three in South Africa. Three studies had one intervention group and one control group (Krug, 1994; Swart, 2008; Odendaal, 2009). The fourth (Rehmani, 2010) consisted of two intervention groups where each intervention group acted as a control for the other intervention group.

3.5.4.2 Study participants

The three RCT studies all delivered the intervention at the level of the household; a total of 961 households were included across these three studies. One CBA study had not reported the number of participants. The sample size of three RCTs range from 211 to 410 households/families whereas the sample size of the CBA study was not reported clearly for both intervention and control group (Krug, 1994). All studies, except Krug (1994), reported a sample size calculation. The numbers of eligible and randomly assigned participants were detailed in all three RCTs. Swart (2008), assessed 731 households; 515 were eligible and 410 were randomly assigned (105 eligible households did not participate due to unavailability of caregiver or refusal to participate in study). Odendaal (2009) visited 265 households; 211 of whom were eligible households, and all 211 were randomly assigned. Rehmani (2010) enrolled 414 households; 370 were eligible, and 340 were randomly assigned (30 eligible households did not participate). All these three RCTs provided a flow diagram of households approached, households excluded, and number of households lost to follow-up (Swart, 2008; Odendaal, 2009; Rehmani, 2010). Reasons for loss to the post-intervention assessment was provided only in one study (Odendaal, 2009).

The participants in the four included studies were drawn from heterogeneous populations; urban areas (Rehmani, 2010) as well as rural areas of low income communities (Krug, 1994; Swart, 2008; Odendaal, 2009). The participants were the families with children ≤10 years (Swart, 2008; Odendaal, 2009), <5 years (Krug, 1994) and ≤3 years old (Rehmani, 2010). All studies included both male and female parents. Exclusion criteria were not reported in one study (Rehmani, 2009) but were reported for the three others.

3.5.4.3 Intervention

All three RCTs delivered an intervention that used a combined approach for reducing injury hazards in the home environment. All three RCTs included home inspection and safety education as a combined intervention to reduce household hazards for injury (Swart, 2008; Odendaal, 2009; Rehmani, 2010). Two of the three RCTs used a combined approach of home inspection with recommended modification by providing safety education and safety devices (Swart, 2008; Odendaal, 2009).

All interventions except Krug (1994), included home inspection by trained community workers to identify injury hazards. Household hazards were assessed by the data collectors using a standardized instrument consisting of several items related to household hazards (child safety checklist). Home visitors provided caregivers with information of safety practices and discussed possible changes to reduce risks for child injury. In two studies (Swart, 2008; Odendaal, 2009), caregivers were also given free or discounted safety devices, such as child-proof locks, paraffin containers safety caps, a bag and hook for safe storage of poisonous substances etc. In one study (Krug, 1994), only child-resistant containers were distributed with health education about paraffin poisoning prevention to reduce the incidence of paraffin ingestion.

3.5.4.4 Outcome measures

3.5.4.4.1 Number of injury cases

Only one study assessed the primary outcome of number of injury cases (Krug, 1994).

3.5.4.4.2 Injury hazards

Three RCTs (Swart, 2008; Odendaal, 2009; Rehmani, 2010) assessed number of injury hazards present in the home environment. Two collected data on burns, poisoning and fall hazards (Swart, 2008; Odendaal, 2009), and one study collected data on ingestion hazards (poisoning and choking) and fall hazards (Rehmani, 2010). One outcome, burn hazards, was further categorized into burn safety practices, paraffin, and electrical hazards (Table 3.1).

Table 3.1 Description of the included studies

References		**Intervention**			**Outcome**				
Author	Types	Home inspection	Safety education	Safety devices	Burn hazards	Poisoning hazards	Fall hazards	Poison cases	Safe home
Swart (2008)	RCT	✓	✓	✓	✓	✓	✓		
Odendaal (2009)	RCT	✓	✓	✓	✓	✓	✓		
Rehmani (2010)	RCT	✓	✓			✓	✓		✓
Krug (1994)	CBA		✓	✓				✓	

Table 3.2 Characteristics of included studies

Authors	Methods	Participants	Intervention	No. per arm	Outcomes and follow-up period
Swart (2008)	RCT (cluster) Study duration = 4 months Settings = low-income communities in South Africa	Population = Households with children ≤10 years. Parent's age = 34 years in average Parent's sex = male and female Exclusion = Not specified Sample size calculation = Yes Required = 120 HHs per arm (80% power and 5% significance level with 1.2 cluster design inflation factor) Approached = 731 Eligible = 515 Randomized = 410	Home inspection, safety education & safety devices I = Trained home visitors provided caregivers with information on safety practices, completed an injury hazard checklist with the caregiver, and discussed possible changes to reduce risks associated with burns, poisoning, and falls injuries. Caregivers were also given safety devices, such as child-proof locks and paraffin container safety caps, along with demonstrations on how they should be used. C = Not visited. And were given safety devices after the injury risk post-assessment.	Randomized I = 202 HHs C = 208 HHs Completed I = 189 HHs C = 188 HHs 92% follow-up	Injury cases = Not reported Injury hazards = Number of household hazards for -burns (safety practices, paraffin, and electrical), -poisoning, and -falls injury Measured at 4 months.
Odendaal (2009)	RCT Study duration = 3 months Settings = low-income neighbourhood in South Africa	Population = Households with children ≤10 years. Parent's age = Not specified Parent's sex = male and female Exclusion = Not specified Sample size calculation = Yes Required = 120 HHs per arm (80% power and 5% significance level) Approached = 265 Eligible = 211 Randomized = 211	Home inspection, safety education & safety devices. I = Intervention by trained paraprofessional included educational inputs (sharing information and printed materials on household hazards to caregivers), enforcement (completing the checklist on household hazards inducing self-initiated behavioural and home environment changes), and engineering (distribution of free safety devices with a demonstration of their use). C = The control households received a courtesy visit after the post-intervention assessment, and were furnished with the same information and at least one of the safety devices.	Randomized I = 112 HHs C = 99 HHs Completed I = 112 HHs C = 91 HHs 91% follow-up	Injury cases = Not reported Injury hazards = Number of household hazards for -burns (safety practices, paraffin, and electrical), -poisoning, and -falls injury Measured at 3 months.

Rehmani (2010)	RCT (non-blinded) Study duration = 6 months Settings = Urban area within 45-min driving distance from the Aga Khan University Hospital (AKUH), Karachi, Pakistan	Population = Household with children ≤3 years old discharged home from the ED following a visit for any reason other than an injury Parent's age = 30 years in average Parent's sex = male and female Exclusion = Household with those children who presented with an injury were excluded. Sample size calculation = Yes Required = 142 HHs per arm (80% power and 5% significance level) Approached = 414 Eligible = 370 Randomized = 340	Home inspection and safety education Research assistants administered the questionnaire after which s/he inspected the home for hazards in the presence of the family. The family was then assigned to either the falls (group 1) or poisoning/ingestion (group 2) intervention branches of the study. I1 = Parents in group 1 received falls safety and prevention counselling only; I2 = Parents in group 2 received ingestion safety and prevention counselling only. Each intervention group acted as a control for another intervention group.	Randomized I1 = 170 HHs I2 = 170 HHs Completed I1 = 153 HHs I2 = 151 HHs 90% follow-up	Injury cases = Not reported Injury hazards = Number of household hazards for -ingestion (poisoning and choking) and -falls injury Measured at 6 months.
Krug (1994)	CBA Study duration = 28 months (14 months for pre-intervention and for 14 months for post-intervention). Settings = Western Transvaal in Bophuthatswana, South Africa	Population: Any household living in study area (Gelukspan district) and control areas (Lehurutshe district) Parent's age: Not specified Parent's sex: Not specified Exclusion: Not specified Sample size calculation = Not specified Required = Not specified Approached = Not specified Eligible = Not specified Randomized = NA	Safety education and safety devices I = Specifically designed child-resistant container (CRC) was introduced to evaluate whether its use would decrease the incidence of paraffin ingestion. CRCs were distributed to 20 000 households in the study area (Gelukspan district) (both households with and without small children) C = No CRCs were distributed in the control area (Lehunutshe district). Health education about paraffin poisoning prevention was given in both the control and the study areas.	I = Not reported C = Not reported	Injury cases = Incidence rate of paraffin ingestion per 100,000 population Measured for 14 months for pre-intervention and for 14 months for post-intervention. Injury hazards = Not reported.

***Note:** RCT = Randomized Control trial; CBA = Control Before and After; I = Intervention group; C = Control group; NA = Not Applicable*

3.5.5 Risk of bias in included studies

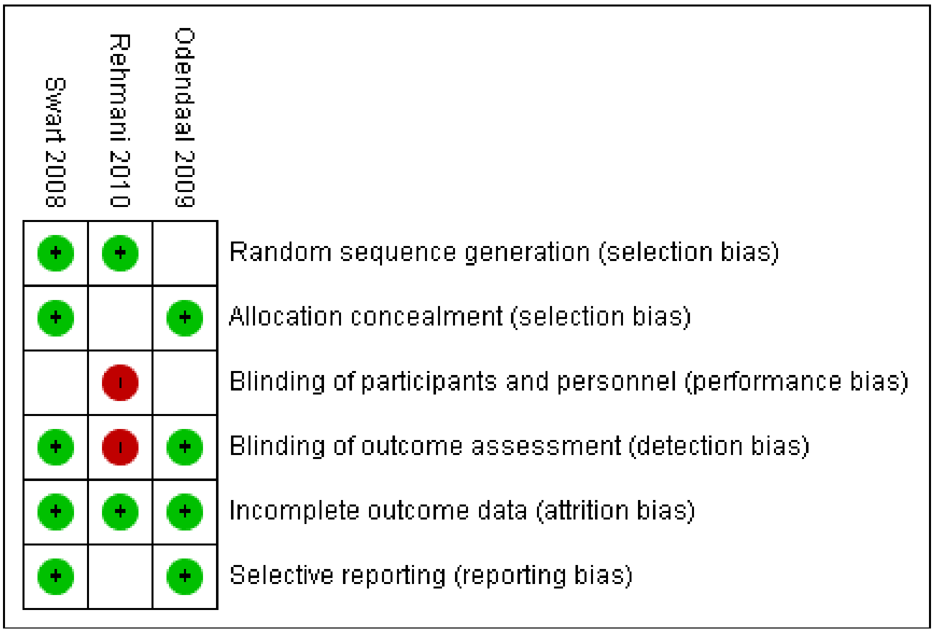
For one CBA study (Krug, 1994), the Effective Practice and Organization of Care (EPOC) tool for assessing risk of bias for CBA is used (Appendix 3.6).

Generation of randomized sequence and concealment of sequence allocations prior to assignment are not a part of CBA study, therefore this study had a high risk of selection bias in terms of generating a random sequence and allocation concealment. There was low risk of selection bias in terms of baseline outcome measurement because the incidence rate in study area were not significantly different from those in the control area during the pre-intervention period. Risk of confounding bias was unclear because the study had not reported enough data on population characteristics to see the similarity on baseline characteristics across the groups. Risk of performance bias in terms of contamination was not clear but high in terms of blinding as participants and personnel were not blinded. Lack of blinding of outcome assessors and incomplete outcome data made the study high risk in terms of detection bias and attrition bias respectively. The risk of reporting bias was unclear as the study protocol was not available.

For other three RCTs, the risk of bias tools for the Cochrane review is used. Graphic representations of potential bias within and across studies were computed using RevMan 5.3.5 software.

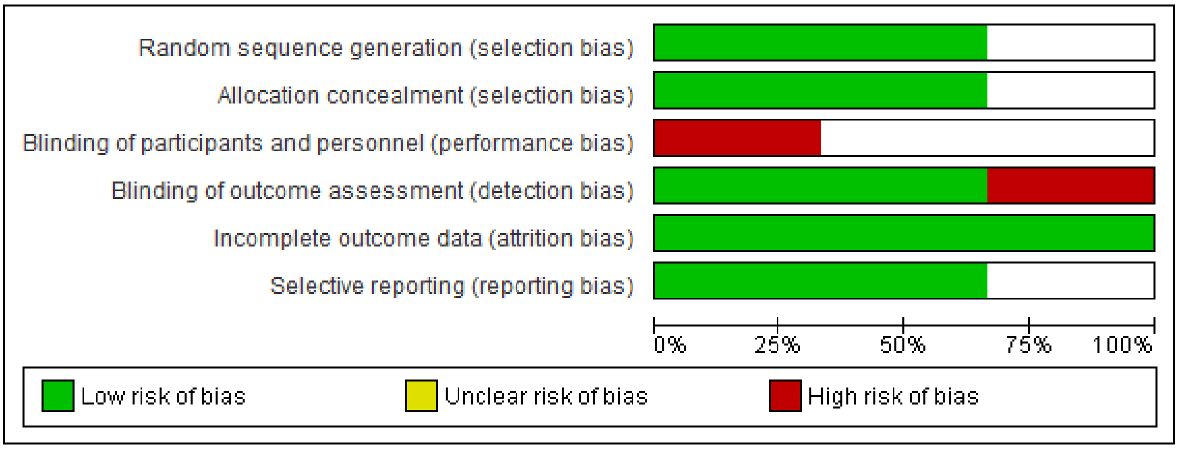
Figure 3.2 shows the risk of bias summary of the three RCTs studies and figure 3.3 shows the risk of bias across all included studies. The Risk of Bias table for these studies is presented in Appendix 3.7.

Figure 3.2 Risk of bias summary: review authors' judgements about each risk of bias item for each included study



Symbols: green+ = low risk of bias, red- = high risk of bias and empty box = unclear risk of bias.

Figure 3.3 Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies



3.5.5.1 Selection bias (Random sequence generation and allocation concealment)

The risk of selection bias was assessed on whether the generation of a randomised sequence and concealment of sequence allocations prior to assignment were adequate or not. One study provided sufficient information to judge low risk of selection bias (Swart, 2008). This study had used computer generated lists for household selection and data collectors were masked to group assignment. The risk of selection bias in terms of random sequence generation was unclear for Odendaal (2009), and low risk for Rehmani (2010). Allocation concealment was poorly reported by Rehmani (2010) and was judged low risk in the study by Odendaal (2009).

3.5.5.2 Performance bias (Blinding of participants and personnel)

The risk of performance bias was assessed based on knowledge of the allocated interventions by participants and personnel during the study. Poor reporting of blinding of participants and personnel in two studies (Swart, 2008; Odendaal, 2009) prevented clear judgement of the risk of performance bias. Performance bias was judged high for the non-blinded study (Rehmani, 2010) due to the lack of blinding of participants and personnel during the study.

3.5.5.3 Detection bias (Blinding of outcome assessment)

The risk of detection bias was assessed based on knowledge of the allocated interventions by outcome assessors. In two studies (Swart, 2008; Odendaal, 2009), data collectors were not informed of the intervention or control status of households at the post-intervention assessment. Hence, these two studies were judged to be at low risk of bias. Outcome assessors were not blinded in the other study (Rehmani, 2010) so, was judged high risk.

3.5.5.4 Attrition bias (Incomplete outcome data)

The risk of attrition bias was assessed based on the amount, nature or handling of incomplete outcome data. All three studies had similar numbers of dropouts in the intervention and control groups and similar reasons for missing data were provided in one study (Odendaal, 2009). Reasons for loss to follow-up was not reported in two studies (Swart, 2008; Rehmani, 2010) but it is unlikely to affect true outcomes. In both studies, the number of households that were lost to follow-up for intervention and control group were similar. Therefore, all these studies were judged as having low risk of attrition bias.

3.5.5.5 Reporting bias (Selective reporting)

The risk of reporting bias was assessed based on selective outcome reporting. Although the study protocol was not available to confirm all outcomes reported, all possible outcomes stated in the methods section were reported in the results section of two studies (Swart, 2008; Odendaal, 2009); hence these two studies were judged to be at low risk of bias. Risk of selective reporting bias was unclear for one study (Rehmani, 2010) due to the lack of study protocol.

3.5.6 Effect of home environmental change intervention

The effect of intervention on reported outcomes are presented in table 3.3 and described in text by outcome measured. *(See also: Findings on Injury cases and Injury Hazards)*.

Table 3.3 Summary of result of included studies

Study ID	Intervention	Results
Swart (2008) **RCT**	Home inspection, safety education & safety devices.	Results for post-intervention, mean scores for intervention and control households: In the case of total household hazards, intervention households obtained a lower total injury risk mean score of 13.9 (SE 0.53) than the control households 14.2 (SE 0.54) but the intervention effect (IE) of -0.31 was not statistically significant (95% CI -1.18 to 1.2, P=0.68). Significant changes were observed for burns related to unsafe practices (IE=−0.41, 95% CI −0.76 to −0.07, P=0.02), Where mean scores for I was 2.5 (SE 0.12) and C was 2.9 (SE 0.12). However, no significant differences were noted for the injury risks related to electrical burns (IE=−0.19, 95% CI −0.54 to 0.16) with mean scores 1.1 (SE 0.14) for I and 1.3 (SE 0.14) for C, paraffin burns (IE=−0.03, 95% CI −0.64 to −0.57), with 3.2 (SE 0.21) for I and 3.2 (SE 0.21) for C, and poison ingestion (IE=−0.45, 95% CI −1.01 to 0.11), with 1.9 (SE 0.20) for I and 2.4 (SE 0.20) for C. No decline was observed in mean scores for fall-related risks (IE=0.09, 95% CI −0.60 to 0.78) where mean was 3.7 (SE 0.24) for I and 3.6 (SE 0.24) for C Follow-up: 92% (n=377, I=189, C=188) similar on both group
Odendaal (2009) **RCT**	Home inspection, safety education & safety devices.	Results for post-intervention mean scores for intervention and control households: In the case of total household hazards, intervention households obtained a lower total injury risk mean score of 20.3 (SE) than the control households 23.9 (SE) and the intervention effect (IE) of -3.64 was also statistically significant (95% CI -6.16 to -1.12, P<0.05). A significant difference was noted in the hazards associated with electrical burns (IE = 0.93, 95% CI -1.70 to -0.15, P=0.02), with mean scores 3.0 (SE 0.27) for I and 3.9 (SE0.29) for C, paraffin appliances (IE = 0.71, 95% CI -1.37 to -0.04, P=0.037) with 2.6 (SE 0.24) for I and 3.3 (SE 0.23) for C, as well as in hazards related to poisoning (IE = 1.10, 95% CI -1.77 to -0.44, P<0.05) with 2.9 (SE 0.23) for I and 4.0 (SE 0.25) for C. Significant reduction was observed for total burns hazards (IE = 1.9, 95% CI -3.41 to -0.35, P=0.01) with 12.4 (SE 0.53) for I and 14.3 (SE 0.57) for C. However, no significant changes were observed for burn safety household practices (IE = 0.25, 95% CI -0.80 to 0.31) with mean scores 6.8 (SE 0.19) for I and 7.1 (SE 0.21) for C. Similarly, no significant changes fall injury hazards (IE = 0.65, 95% CI -1.47 to 0.16) with mean scores 5.0 (SE 0.29) for I and 5.6 (SE 0.0.30) for C. Follow-up: 91% (n=192, I=101, C=91) similar on both group

Rehmani (2010) **RCT**	Home inspection and safety education.	The mean number of fall hazards was reduced from 3.1 (SD 0.7) at baseline to 2.4 (SD 0.8) in the fall intervention counselling group, and the mean number of ingestion hazards decreased from 2.3 (SD 1.2) to 1.9 (SD 1.3). Significant reduction in both hazards (P < 0.001). For fall related hazards, a significant difference was observed at post-intervention between the intervention and control households (IE = -0.5, 95% CI -0.66 to -0.33, P<0.001), with mean scores of 2.4 (SD 0.8) for I and 2.9 (SD 0.7) for C. However, there was no significant difference in ingestion hazards (IE = -0.1, 95% CI -0.36 to 0.16, P=0.45), with mean scores 1.9 (SD 1.3) for I and 2.0 (SD 1.0) for C. The percentage of homes deemed "safe" (no injury hazards at follow-up) in which the families had received fall intervention counselling was 13.5% (19 homes became safe out of 141 unsafe) compared to 3.5% (5 out of 142) in the control group (RR 3.8, 95% CI 1.5 to 10.0, P = 0.002), whereas the percentage of homes deemed "safe" in which the families had received the ingestions intervention counselling was 18.8% (24 homes became safe out of 128 unsafe) compared to 2.4% (3 out of 125) in the control group (RR 7.8, 95% CI 2.4 to 25.3, P < 0.001). Follow-up: 90% (n=304, I1= 153, I2=151) similar on both group
Krug (1994) **CBA**	Safety education & safety devices.	The mean of the monthly incidence rates in the study area for pre-intervention period (14 months) was 8.63 (SD 4.87) and for the intervention period (14 months) was 4.54 (SD 3.46). Incidence of paraffin ingestion dropped by 47% in the study area during the intervention period. It showed a statistically significant difference (P = 0.022). During the pre-intervention period, the incidence rate in study area was not statistically significantly different from those in the control area: mean 8.63 (SD 4.87) for intervention Vs 7.94 (SD 4.26) for the control area. After the CRC distribution, the incidence rates in the study area were less than half of those in the control area (mean 4.54 ± 3.46 v. 9.80 ± 5.63). Statistically significant (P = 0.015). Follow-up: Pre-intervention 14 months and post intervention 14 months.

I = Intervention group; C = control group; SD = Standard Deviation; SE = Standard Error; IE = Intervention Effect; n = number of households

Note: Numerical data of three RCTs were presented in Appendix 3.8.

3.5.6.1 Injury Cases

3.5.6.1.1 Poisoning incidence

Only one CBA study (Krug, 1994) reported the number of injuries data. This study included the multifactorial paraffin ingestion prevention intervention.

This study found that incidence of paraffin ingestion dropped significantly by 47% (p = 0.022) in the study area where child resistant containers were distributed during the intervention period. The mean of the monthly incidence rates in the study area for the pre-intervention period was 8.63 (SD 4.87) and for the intervention period was 4.54 (SD 3.46).

There was a statistically significant difference (p=0.015) in the incidence rate of paraffin ingestion in the study area (m=4.54, SD=3.46) compared to the control area (m=9.80, SD=5.63).

3.5.6.2 Injury Hazards

Three other RCTs reported data on household hazard reduction (Swart, 2008; Odendaal, 2009; Rehmani, 2010). These studies used a multifactorial intervention approach to reduce the household hazards.

Two studies (Swart, 2008; Odendaal, 2009) were considered sufficiently methodologically and clinically homogenous to undertake a meta-analysis. Both studies used the multifactorial intervention comprising of home inspection, safety education and safety devices and were compared with a control group that received no intervention. The third RCT (Rehmani, 2010) had a similar outcome measure but was not included in the meta-analysis. Rehmani (2010), did include the home inspection, safety education but did not include the safety devices as an intervention. Unlike other two RCTs, Rehmani (2010) was a non-blinded RCT, therefore there is potential of high risk of methodological bias. For the meta-analysis, relevant data was entered in RevMan and forest plots were created. Pooled results of two studies (Swart, 2008; Odendaal, 2009) on 621 households and a separate result from a single study (Rehmani, 2010) on 340 households are presented below.

3.5.6.2.1 Poisoning hazards

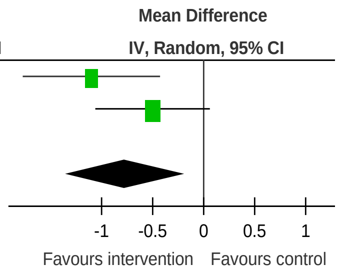
Two studies (Swart, 2008; Odendaal, 2009) reported on the poisoning hazards data and one study (Rehmani, 2010) reported on ingestion hazards (poisoning and choking). A pooled result from two studies (Swart, 2008; Odendaal, 2009) found significant differences in post-intervention mean scores for poisoning hazards in between the intervention and control groups (MD -0.77, 95%CI -1.36 to -0.19). Statistical heterogeneity between the studies was moderate (I^2 = 46%, p = 0.010) (Figure 3.4). The result of another single study not included in the meta-analysis (Rehmani, 2010) reported no significant difference in the post-intervention mean scores between the intervention and control groups for the ingestion hazards (MD -0.1; 95%CI -0.36 to 0.16, P=0.45).

Figure 3.4 Forest plot of comparison: 1 Environmental change intervention Versus Control, outcome: 1.1 Post-intervention mean scores for poisoning hazards.

	Experimental			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Odendaal 2009	2.9	2.4341	112	4	2.4875	99	45.1%	-1.10 [-1.77, -0.43]
Swart 2008	1.9	2.8844	208	2.4	2.8425	202	54.9%	-0.50 [-1.05, 0.05]
Total (95% CI)			**320**			**301**	**100.0%**	**-0.77 [-1.36, -0.19]**

Heterogeneity: $Tau^2 = 0.08$; $Chi^2 = 1.84$, df = 1 (P = 0.17); $I^2 = 46\%$

Test for overall effect: Z = 2.58 (P = 0.010)



The width of the line shows the confidence intervals of the effect estimate of individual studies. The width of the diamond shows the confidence intervals for the overall effect estimate. SD = standard deviation, Mean Difference (MD) = post-intervention mean scores for poisoning hazards between the intervention and control groups, total = total number of participants.

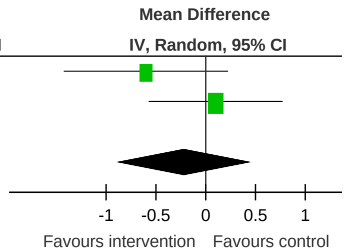
3.5.6.2.2 Fall hazards

All three studies (Swart, 2008; Odendaal, 2009; Rehmani, 2010) reported fall hazards data. A pooled result from two studies (Swart, 2008; Odendaal, 2009) found no significant difference in the post-intervention mean scores for fall hazards in between the intervention and control groups (MD -0.21, 95%CI -0.89 to 0.47). Statistical heterogeneity between the studies was moderate (I^2 = 41%, p = 0.19) (Figure 3.5). The single study (Rehmani, 2010) found significant difference in post-intervention mean scores between the intervention and control groups for fall-related hazards (MD -0.5; 95%CI -0.66 to -0.33, P<0.001).

Figure 3.5 Forest plot of comparison: 1 Environmental change intervention Versus Control, outcome: 1.2 Post-intervention mean scores for fall hazards

	Experimental			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Odendaal 2009	5	3.0691	112	5.6	2.985	99	44.0%	-0.60 [-1.42, 0.22]
Swart 2008	3.7	3.4613	208	3.6	3.411	202	56.0%	0.10 [-0.57, 0.77]
Total (95% CI)			**320**			**301**	**100.0%**	**-0.21 [-0.89, 0.47]**

Heterogeneity: Tau² = 0.10; Chi² = 1.69, df = 1 (P = 0.19); I² = 41%
Test for overall effect: Z = 0.60 (P = 0.55)



The width of the line shows the confidence intervals of the effect estimate of individual studies. The width of the diamond shows the confidence intervals for the overall effect estimate. SD = standard deviation, Mean Difference (MD) = post-intervention mean scores for fall hazards in between the intervention and control groups, total = total number of participants.

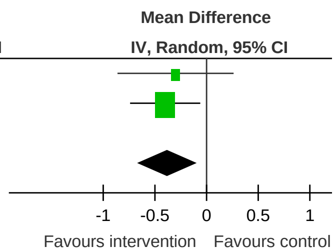
3.5.6.2.3 Burn hazards

There were only two studies (Swart, 2008; Odendaal, 2009) that reported the burn hazards data by measuring the burn hazards related to unsafe practices, electrical burns and paraffin burns. A pooled analysis of the homogenous data ($I^2 = 0\%$; $p = 0.01$), indicated statistically significant differences in post-intervention mean scores for burn related unsafe practice between the intervention and control groups (MD -0.37, 95%CI -0.66 to -0.09). (Figure 3.6). The result showed no significant difference for electrical burn hazards (MD -0.47, 95%CI -1.13 to 0.20). (Figure 3.7) and paraffin burn hazards (MD -0.33, 95%CI -1.02 to 0.35). (Figure 3.8).

Figure 3.6 Forest plot of comparison: 1 Environmental change intervention Versus Control, outcome: 1.3 Post-intervention mean scores for burn related unsafe practice

	Experimental			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Odendaal 2009	6.8	2.0108	112	7.1	2.0895	99	26.4%	-0.30 [-0.86, 0.26]
Swart 2008	2.5	1.7307	208	2.9	1.7055	202	73.6%	-0.40 [-0.73, -0.07]
Total (95% CI)			**320**			**301**	**100.0%**	**-0.37 [-0.66, -0.09]**

Heterogeneity: Tau² = 0.00; Chi² = 0.09, df = 1 (P = 0.76); I² = 0%
Test for overall effect: Z = 2.57 (P = 0.01)



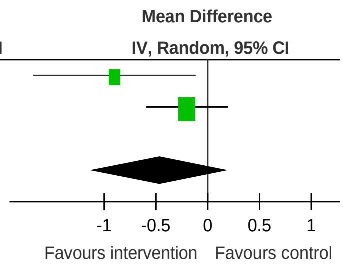
The width of the line shows the confidence intervals of the effect estimate of individual studies. The width of the diamond shows the confidence intervals for the overall effect estimate. SD = standard deviation, Mean Difference (MD) = post-intervention mean scores for burn related unsafe practice in between the intervention and control groups, total = total number of participants.

Figure 3.7 Forest plot of comparison: 1 Environmental change intervention Versus Control, outcome: 1.4 Post-intervention mean scores for burn electrical hazards

	Experimental			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Odendaal 2009	3	2.8574	112	3.9	2.8855	99	38.0%	-0.90 [-1.68, -0.12]
Swart 2008	1.1	2.0191	208	1.3	1.9898	202	62.0%	-0.20 [-0.59, 0.19]
Total (95% CI)			**320**			**301**	**100.0%**	**-0.47 [-1.13, 0.20]**

Heterogeneity: Tau² = 0.15; Chi² = 2.50, df = 1 (P = 0.11); I² = 60%

Test for overall effect: Z = 1.37 (P = 0.17)



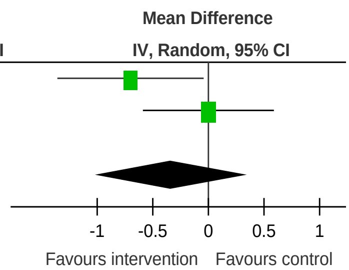
The width of the line shows the confidence intervals of the effect estimate of individual studies. The width of the diamond shows the confidence intervals for the overall effect estimate. SD = standard deviation, Mean Difference (MD) = post-intervention mean scores for burn electrical hazards in between the intervention and control groups, total = total number of participants.

Figure 3.8 Forest plot of comparison: 1 Environmental change intervention Versus Control, outcome: 1.5 Post-intervention mean scores for burn paraffin hazards

	Experimental			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Odendaal 2009	2.6	2.5399	112	3.3	2.2885	99	47.7%	-0.70 [-1.35, -0.05]
Swart 2008	3.2	3.0287	208	3.2	2.9847	202	52.3%	0.00 [-0.58, 0.58]
Total (95% CI)			**320**			**301**	**100.0%**	**-0.33 [-1.02, 0.35]**

Heterogeneity: Tau² = 0.15; Chi² = 2.47, df = 1 (P = 0.12); I² = 59%

Test for overall effect: Z = 0.96 (P = 0.34)



The width of the line shows the confidence intervals of the effect estimate of individual studies. The width of the diamond shows the confidence intervals for the overall effect estimate. SD = standard deviation, Mean Difference (MD) = post-intervention mean scores for burn paraffin hazards in between the intervention and control groups, total = total number of participants.

3.5.6.2.4 Total hazards (burns, poisoning and falls)

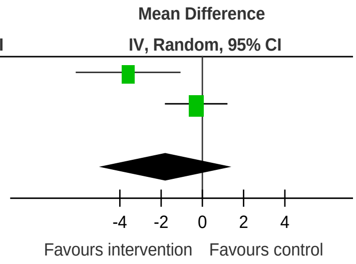
The pooled analysis of two studies (Swart, 2008; Odendaal, 2009) suggested no statistically significant differences in post-intervention mean scores for total household hazards (burns, poisoning and falls) between the intervention and control groups (MD -1.79, 95%CI, -5.01 to 1.43). Statistical heterogeneity between the studies was high (I^2 = 80%, p = 0.04). (Figure 3.9).

Figure 3.9 Forest plot of comparison: 1 Environmental change intervention Versus Control, outcome: 1.6 Post-intervention mean scores for total household hazards (burns, poisoning and fall)

	Experimental			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Odendaal 2009	20.3	9.4189	112	23.9	9.1539	99	45.1%	-3.60 [-6.11, -1.09]
Swart 2008	13.9	7.6438	208	14.2	7.6748	202	54.9%	-0.30 [-1.78, 1.18]
Total (95% CI)			**320**			**301**	**100.0%**	**-1.79 [-5.01, 1.43]**

Heterogeneity: Tau² = 4.34; Chi² = 4.93, df = 1 (P = 0.03); I² = 80%

Test for overall effect: Z = 1.09 (P = 0.28)



The width of the line shows the confidence intervals of the effect estimate of individual studies. The width of the diamond shows the confidence intervals for the overall effect estimate. SD = standard deviation, Mean Difference (MD) = post-intervention mean scores for total household hazards in between the intervention and control groups, total = total number of participants.

3.6 SUMMARY OF THE CHAPTER

This review has identified and evaluated the effectiveness of environmental change interventions to reduce child injuries and injury hazards in the home in LMICs. Seven electronic databases were searched for randomized controlled trials (RCTs) and controlled before and after (CBA) studies of environmental change interventions designed to reduce child injuries and home hazards and published up to 1 April 2014. Where possible, meta-analysis was conducted using RevMan 5.

In total four studies were included in the review. Only one study (CBA) reported child injury and three studies (RCTs) home hazards. In the CBA study, child resistant containers were found effective to reduce the incidence of paraffin ingestion by 47% during the intervention period and by 50% after the intervention. However, this result should be interpreted with caution as the analysis was based on non-randomized participants. Also, this study was at high risk of bias due to issues in the design of the study. Three RCT studies in this review (Swart, 2008, Odendaal, 2009 and Rehmani, 2010) assessed the reduction in injury hazards or improvement of safety features without reporting the intervention effect on the number of injury cases. Data from two RCTs pooled in a meta-analysis found that a multifactorial intervention (home inspection, safety education and safety device) significantly reduced the post intervention mean scores in the intervention group for poisoning hazards (Mean Difference (MD) -0.77; 95%CI -1.36, -0.19) and burn related unsafe practices (MD -0.37; 95%CI -0.66, -0.09) but not for fall, electrical and paraffin burn hazards. The intervention (home inspection and safety education, not safety device) used in a single RCT significantly reduced the post-intervention mean scores in the intervention group for fall hazards (MD -0.5; 95%CI -0.66, -0.33) but not for ingestion hazards.

Findings suggested that there is only a limited amount of high grade evidence that environmental change interventions in and around the home provides significant benefit to reduce child injuries in LMICs. However, some evidence suggested that environmental change interventions may reduce home hazards. It is understandable that home hazards are potential risk factors that can contribute to the number of injury cases. However, it is not possible to conclude that the reduction/modification of such hazards will reduce the occurrence of injury. More evidence is needed to determine if altering the physical home environment by removing potential hazards reduces injuries.

CHAPTER 4: COMMUNITY-BASED STUDIES

4.1 INTRODUCTION

This chapter mainly describes the overall aim of community based studies and overall methodology; the methodology includes the study site and reasons for selecting the location and the preparatory work for the survey and ethical approval for the whole study. The household survey and qualitative studies are presented in different chapters.

4.2 OVERALL AIM

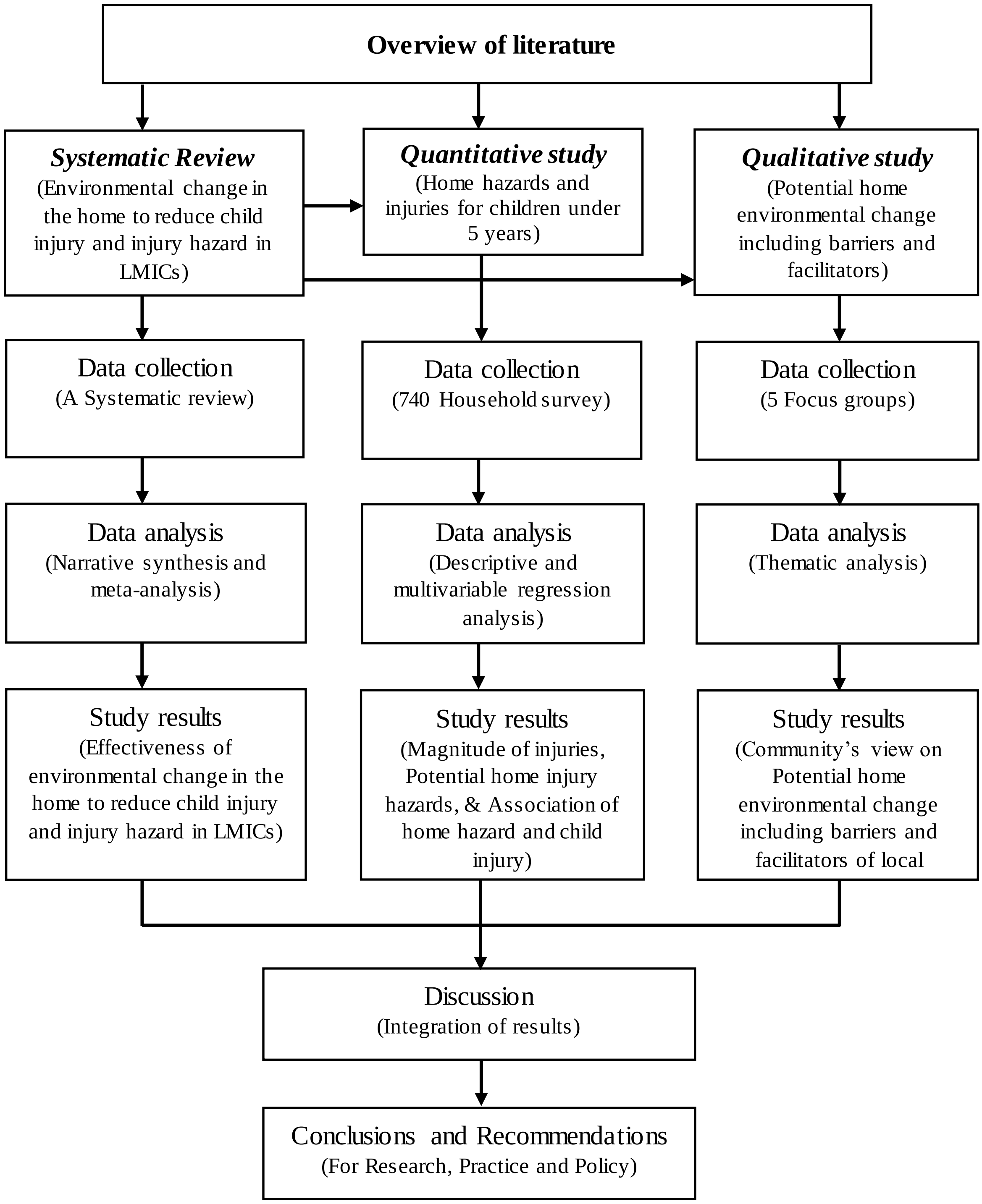
The overall aim of this study was to explore the environmental risks associated with unintentional injury amongst children aged 0-59 months in Makwanpur district of Nepal. This study also aimed to explore the potential for environmental change, at a community level, to prevent injury occurrence in the future and identify barriers to, and facilitators of this change.

4.3 METHODOLOGY

4.3.1 Multi-method approach

A multi-method approach was used to collect both quantitative and qualitative data, in order to understand the problem with home injury hazards in Nepal. Data were collected through a community-based household survey (quantitative) to identify household risks leading to child injuries and focus groups (qualitative) for community insight. Figure 4.1 demonstrates how the quantitative and qualitative study methods address each of the study aims.

Figure 4.1 Flow diagram of study using multi-method approach



4.3.2 Study site and reasons for selection

The Makwanpur district of Nepal was selected as the study site because of its geographical location, composition of its population (population size or demographic) and the fact that it represents variety of terrains including hills and plains, which is similar to the vast majority of Nepal (Figure 4.2).

Figure 4.2 Map of Nepal showing study site (Makwanpur district)

Source: Initial Environmental Examination (IEE) Report Sanitation and Sewerage Work Sub-Project (Government of Nepal, 2007)

(Used with permission of the author)

The Makwanpur district, at an area of area 2,426 km^2, makes up 1.6% of the total land area of Nepal. Hetauda, the municipal town of Makwanpur, is located at the country's major highway intersection, between the East-West (Mahendra) and North-South (Tribhuvan) highways (Central Bureau of Statistics, 2012). The Makwanpur district represents a range of different environments in Nepal (Osrin et al., 2003). The population consists of 75 ethnic groups. The district is composed of 35 Village Development Committees (VDCs) and a municipal town. Makwanpur district has a population estimated at 420,477 living in 86,127 households, with an average number of household occupants of 4.88, and the rural population is 83%. Around 9% (38,209) of the population living in this district, are children aged 0-4 years Agriculture is the predominant livelihood of its population (Central Bureau of Statistics, 2012).

4.3.3 Set-up for field activities

Field activities for this study involved collaboration with the Mother and Infant Research Activities (MIRA) organisation, a non-governmental organisation that has been working in the field of neonatal and maternal health improvement in Nepal for over 20 years (http://www.mira.org.np/mira/). MIRA has an existing health research infrastructure and the main office is in Kathmandu. There is also a branch office in Hetauda. MIRA operate field work of Makwanpur district from this office, which was established in 1999. Since its inception, MIRA has supported many researchers, allowing them to conduct studies using their infrastructure research.

The co-ordinator of the MIRA project was consulted to discuss available support for field activities and data management for this study. A contract between MIRA and the University of the West of England (UWE) was agreed in order to conduct the survey with participants living in Nepal. An appropriate budget was allocated from UWE in order to compensate MIRA employees for their time and contribution to completing field activities. This set-up period for field activities (prior to data collection) was completed by the end of November 2014, a month before data collection. Name of the staffs involved in overall field activities including their role is presented in Appendix 4.1.

4.3.4 Ethical clearance

This study involved human participation in Nepal in order to accomplish its research objectives so required ethical approval from its inception through to completion and publication of results and beyond (Ashcroft et al., 2007). Therefore, written ethical approval was obtained from the Ethical Review Board (ERB) of Nepal Health Research Council's (NHRC) (Appendix 4.2) and every VDC office within the study area (Appendix 4.3) of Makwanpur district. Ethical approval also had to be obtained from the Faculty Research Ethics Committees (FRECs) at UWE (Appendix 4.4). Approval from all institutions was obtained before data collection began.

CHAPTER 5: HOUSEHOLD SURVEY (QUANTITATIVE STUDY)

5.1 Introduction

This chapter describes the detail of main households' survey that includes the objectives, method of data collection, methods of analysis and results.

5.2 Objectives

To conduct and analyse a community-level survey of environmental hazards in the home for child injury in the Makwanpur district of Nepal. The specific objectives of the household survey were to:

- explore the surveyed households
- estimate the rates and proportions of different types of injuries
- identify potential home injury hazards
- investigate relationship between home hazard and child injury

5.3 Methods

5.3.1 Study design

Community-based surveys are considered a valid way of finding 'invisible' cases of injury and their risk factors from a specific sample from the population of interest. It is usually using a pre-designed questionnaire or diary (Bowling, 2014). A community-based cross-sectional survey was conducted to achieve the aims and objectives of this research. The major advantages of survey methodology are that they are often carried out in natural settings, data are collected from a randomly selected sample and results can be used to calculate descriptive measures and associations between variables (Bowling and Ebrahim, 2005). The disadvantages of survey methodology listed in Sethi et al. (2004) were considered in the early phases of this study to minimize potential risk and maximize the impact of the advantages (Table 5.1).

Table 5.1 Advantages and disadvantages of survey methodology used in this study

Advantages	Disadvantages
Data is collected on all injures regardless of location or if treatment was sought. (home environment in the case of this study) Useful for calculating mortality rate. Potential for characterising injuries by various demographic subpopulations (e.g. by age and sex), by location of occurrence, and by type and nature of injury. Study sample can be representative of the general population. Survey can be used to define the denominator population (the denominator population determines the survey population sampled in this study). Allows for computation of incidence prevalence rates by demographic and other parameters. Allows for direct comparison of injury rates between different demographic or geographic regions. Provides the opportunity to examine individual perceptions with regard to the causes and prevention of injuries. Can provide estimates on injury burden in terms of cost, disability and mortality. Can obtain information on health care utilization. Provides opportunities to examine sociocultural determinants of injuries. Provides baseline data that can be used for surveillance of different types of injury.	Poses various practical and logistical difficulties, for example, safety and security concerns (of data collectors and respondents), difficulty in accessing homes in heavily protected high-income areas, and daytime absence of respondents (especially in urban settings when the desired respondents are likely to be at work). Relatively high cost; requires more effort in terms of resources (i.e. human, financial, and time). Can only be done periodically. Prone to recall bias (longer recall periods significantly underestimate injury rates). Prone to selection bias or sampling error and/or measurement error. Raises certain ethical issues: care has to be taken not to violate confidentiality. Use of proxy respondents can undermine the reliability of data collected. Use of non-standardised terms and protocol limits usefulness of results, especially comparability with other studies.

Source: Guidelines for conducting community surveys on injuries and violence (Sethi et al., 2004)

5.3.2 Study population

Households with at least one child aged 0-59 months were included in the study.

5.3.3 Sample size

The sample size of 708 households was calculated using the standard formula suggested in guidelines provided by the United Nations (UN) for conducting community-based surveys in low-income countries (United Nations, 2008).

Sample size formula by United Nations (2008): Nh = (z2) (r) (1−r) (f) (k) / (p) (ň) (e2)

Key

NH = sample size in terms of number of households to be selected
z = 1.96; the statistic that defines the level of confidence desired; (95 % Confidence Interval)
r = 0.72; estimate of key indicator (percentage of household with 6 or more hazards) to be measured by the survey
f = 2.0; sample design effect (deff) assumed to be 2.0 (default value)
k = 1.10; multiplier required to account for the anticipated non-response rate (1+0.1); (10% of non-response rate)
p = 0.09; proportion of the population (0-4years). Parameter r is based on this
ň = 4.88; the average household size (number of persons per household)
e = 0.10r; margin of error to be attained (10% of the estimate (r))

Sample household numbers: Nh = (3.8416) (0.74) (0.28) (2.0) (1.1)/ (0.09) (4.88) (0.005476)

= 708

The main survey indicator measured was the proportion of households with the average number of hazards for child injury (r).

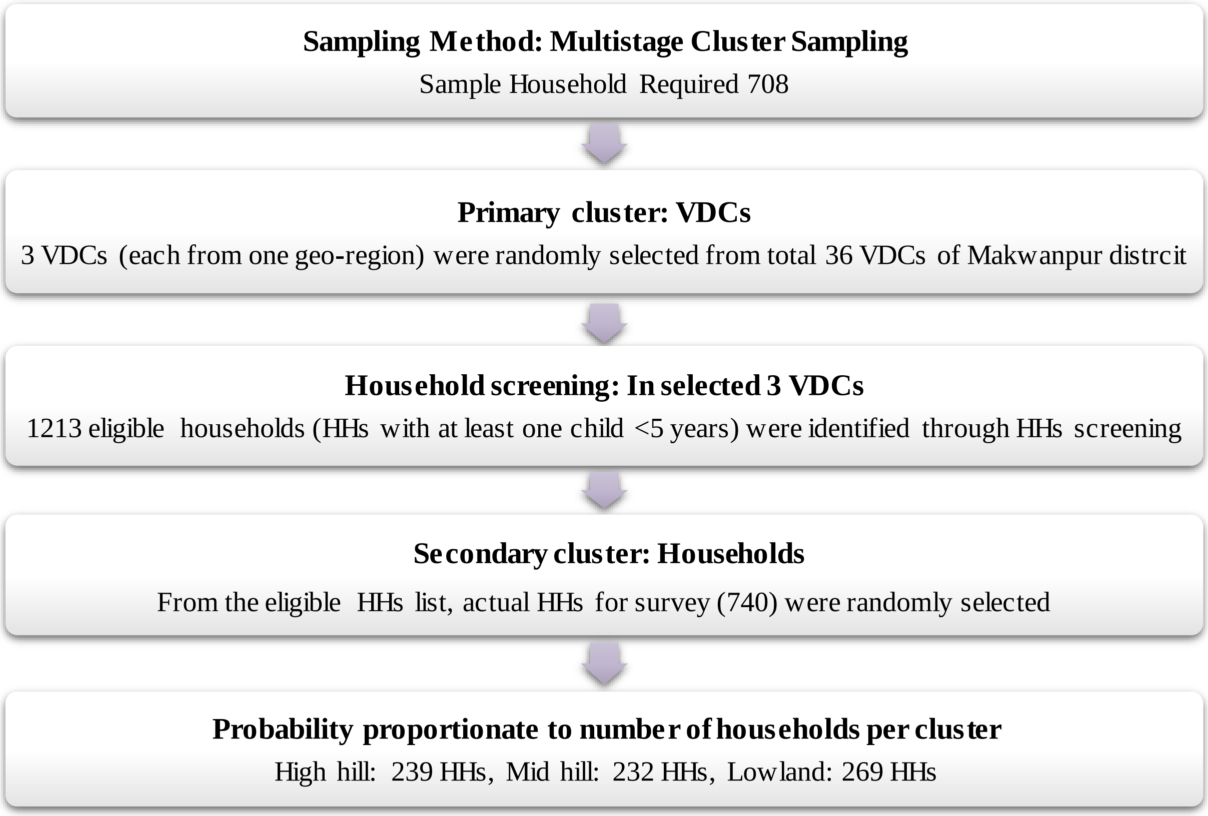
Similar studies have been done in other countries. Khan et al. (2013), showed that 72% households in Pakistan have 6 or more hazards. Another study conducted in New Zealand (Keall et al., 2008) found that the number of injuries increases as the number of hazards rises, from 6 or more. Therefore, in this study, the percentage of households with 6 or more hazards (r) was the variable used as the key indicator (r). The proportion of the population aged 0-59 months (p) and the average household size (ň) was ascertained from the National Population and Housing Census (2011) of Nepal (Central Bureau of Statistics, 2012). The sample design effect (deff) was assumed to be 2.0 to enable calculation of the required sample size for a cluster sample.

The anticipated non-response rate in this study was 10% because it was used in a previous study conducted in Nepal (Pant et al., 2015a) and is described in the World Health Organisation (WHO) guidelines for conducting community-based surveys on injury and violence (Sethi et al., 2004). Any household that declined participation was replaced with their nearest neighbouring household to maintain the calculated sampled size.

5.3.4 Selection of survey households and sampling method

The geographical terrain of Makwanpur district is varied. It was hypothesised that there would be differences in the lifestyles and risk factors for childhood injury according to geographical terrain. To make the study manageable as well as representative, sampled households were selected from three VDCs, each from different geographical regions of Makwanpur district. Multi-stage cluster sampling with probability proportional to size (PPS) methodology (Figure 5.1) was applied to select the survey units (i.e. individual households for data collection) according to the guidelines provided in the UN guideline for conducting household surveys in developing countries (United Nations, 2008).

Figure 5.1 Sampling method: Multistage cluster sampling. (HH= households)



5.3.4.1 First stage

All the existing 36 VDCs of Makwanpur district were categorised into three main geographical regions (strata): high hill (14 VDCs), mid hill (17 VDCs) and lowlands (5 VDCs). One VDC was selected randomly using simple random sampling from each region. Each selected VDC was the primary cluster. The total number of households (HHs) across the three VDCs were 3476; 983 were in high hill regions, 1403 in mid hill regions and 1090 in lowland regions. After identifying the total number of households in each VDC, household screening was undertaken.

5.3.4.2 Intermediate stage: Household screening

Household screening in all three VDCs, provided an up-to-date list of households with at least one child aged <5 years, making it an eligible household for the survey. Eligible households were identified by social mapping (i.e. visual method to identify relative location of households) and door-to-door visits by data collectors. A pre-designed household screening form was used to record a unique household identification number, the name and surname of the head of the household or parents, the number of children aged <5 years present in the household and the village or street name (Appendix 5.1). A six-digit unique identifier was created for each household using a combination of the VDC code, ward number and serial number (VVWHHH). 'VV' was used to record the VDC code, i.e. 21 for Gogane VDC, 02 for Ambhanjyang VDC and 24 for Dhiyal VDC. Each VDC has a total of nine (1-9) wards (W). As 740 households needed to be surveyed, three digits 'HHH' were used to record the household serial number. This unique identifier was used in the main survey to identify and visit the sampled households. The result of household screening found that 392 households had at least one child in high hill regions, 380 in mid hill regions and 441 in lowland areas. The household screening in all three VDCs began on 08 February 2015 and was completed by 17 February 2015.

5.3.4.3 Second stage

From the eligible households of all three VDCs, the required number of survey households in each VDC was calculated according to the probability proportionate to the number of households per VDC. Therefore, the larger the unit (number of eligible households per VDC), the greater its likelihood of being selected. It is logical that the larger first stage units should contribute more to the sample, as they contribute more to the reference population (McGee et al., 2004). Consequently, 239 households were surveyed in the high hill, 232 in the mid hill and 269 in the lowland regions. Microsoft Excel (MS-Excel) generated random numbers that were used to select the households to be surveyed in each VDC. These households were listed and those corresponding to the random numbers were selected for data collection. Therefore, these households were selected by simple random sampling.

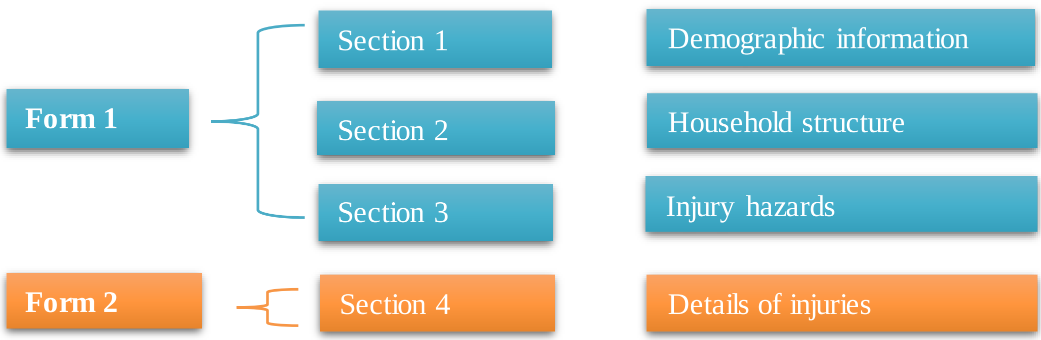
5.3.5 Data collection tools and variable definitions

A structured questionnaire and checklist adapted from a pilot study conducted in Pakistan (Khan et al., 2013) and quasi-experimental community trial in Bangladesh (Towner et al., 2010), were developed as data collection tools. Adapting an existing questionnaire has advantages over developing a new one because it is cheaper, easier, quicker and most importantly it facilitates comparison of data across studies (Boynton and Greenhalgh, 2004). However, gaining consent from the authors of the original studies and evaluating it is necessary and it must be adapted for the present study. Consent was gained from the authors of both studies as well as their recommendations for adapting the questionnaires to fit this study. These researchers were then reassured that their work would be acknowledged in any publications of the current study where appropriate.

The questionnaires were adapted to match the objectives of the current study and to consider the population and setting of this study and then pre-tested before being used in data collection in the field. This is because it was important to evaluate the reliability (consistent), validity (whether the questionnaire measured what it claimed to) and sensitivity (responsiveness to changes in circumstances/outcome) of the adapted questionnaire (Willis, 2004, Gillham, 2008).

Questionnaires and checklists were initially prepared in English and translated into Nepali. Validation of the translation was done by back-translation into English to ensure that the essence of the questions was not lost. The survey tool comprised two forms with four sections in total (Figure 5.2). The content of the questionnaires and checklist is summarised below (Full questionnaire including checklist in Appendix 5.2).

Figure 5.2 Summary of contents of the questionnaire and checklist



Form 1 was used for all sampled households and Form 2 only in the households where at least one child had sustained an injury (as defined in this survey) in the preceding 3 months. Form 1 has 3 sections. The questionnaires were designed to collect information for section 1 and 2 and a checklist was used for section 3.

Section 1: This section was designed to collect the household socio-economic and demographic information, such as caregiver's age, sex, education, occupation and ethnicity. This section also contains demographic information of any children aged <5 years.

Section 2: This section was designed to collect information on housing structure such as type and layout of house, number of rooms in the house and house ownership status.

Section 3: This section was designed to measure the number of potential home injury hazards. For this, a checklist was developed to identify and quantify existing potential hazards present in and around the home environment. Home hazards list were classified according to the risk of injuries that can be sustained and grouped them into 9 groups. Potential hazards were recorded according to place where they had been stored/kept or whether potential hazards were presence or absence during household observation. The place is categorised into different options: (1) on the floor, (2) <1-meter height, (3) >1-meter height, (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) Not Applicable. The options for potential hazards presence or absence included (1) Yes (2) No (3) Not Applicable. These options were used to determine whether potential hazards were within the reach or out of the reach of child. An example is given in table 5.2 for fire, burn or scald-related hazards.

Table 5.2 Potential hazards associated with fire, burn or scald injury

Fire, burn or scald			
Cooking stoves are kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) NA			
All flammable items such as matches/lighter/fuels (i.e. paraffin or kerosene) kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA			
Hot iron or other appliances (e.g. hair straighteners) after use are kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) NA			
Kerosene lamps or candles while used are kept (observe the place where these lighters are kept at night): (1) on floor (2) <1m ht. (3) >1m ht. (4) NA			
Sleeping area and cooking area are separated with a door or any other barrier.	Yes	No	NA

Section 4: This section was designed to record the injury events (reported by parents/caregiver) of the previous 3 months (between 18 November 2014 and 17 February 2015) that occurred in and around the home environment. A three months recall period was applied to achieve detail information about non-fatal injuries and to minimise recall bias (Harel et al., 1994). Variables in this section included the mechanism of injury,

substances/objects resulting in injuries, the outcome of the injuries, location of injury occurrence and whether the child was supervised at the time of injury.

5.3.6 Preparatory arrangements for data collection

5.3.6.1 Pilot testing of the questionnaire and checklist

The questionnaires and check-list were piloted in the study area before their use in the main survey. Households for pilot testing were purposefully selected in a VDC not included in the sample. The purpose of the pilot was to test for ease of use, relevance and understanding of both the questionnaires and the checklist by both responders and testers. The piloting also helped identify and eliminate potential problems and difficulties prior to use in the main survey. The VDC used in the pilot was selected through discussion with MIRA colleagues to ensure their similarity with the sample study VDC and households. In two days, 10 households were visited during the pilot test by a researcher (SB) and 2 members of staff (DA and PT) from the MIRA project.

Because of the pilot test there were some modifications to the questionnaire and checklist. The sequence of questions in the questionnaire in each section and instructions regarding skipping to relevant questions were adapted. Some questions of the hazard checklist were rearranged to observe injury hazard in single visit of a particular area of home. Also, duplicate questions in the hazard checklist were deleted.

5.3.6.2 Preparation of data collection manual

The data collector's manual was developed in English first and translated into Nepali to provide the data collectors with a uniform understanding of the survey questions. The manual had all the essential information and guidelines that data collectors would need to understand to collect the good quality data. Information such as the importance of the study, the objectives of the survey, and definitions of injury, home hazards, and the home environment used in this survey were clearly explained in the manual. All questions and instructions in the questionnaires were explained to ensure consistency and therefore validity of data. The manual also contained the household screening form and instructions for conducting household screening. The manual in Nepali was printed and distributed during the data collectors' training

5.3.6.3 Selection of the data collectors

MIRA recruited the data collectors as they currently have several trained data collectors who work in their local VDCs. In total, six data collectors were recruited from this group of trained local personnel to conduct the household survey in the three sampled VDCs. Thus, two data collectors worked in each of the three VDCs so that data collection work was distributed amongst more personnel, making it easier and more effective because they were already familiar with the people, households and area of their communities.

5.3.6.4 Orientation training of data collectors

Orientation training was important to provide a good understanding of the questionnaires and the method of data collection. Therefore, a three-days training session (04-06 Feb 2015) was conducted in the MIRA office by the researcher, assisted by two MIRA personnel (DA and PT) (Appendix 5.3). These MIRA employees were also involved in finalising the survey questionnaire, the development of the data collector's manual and the pilot test. All six data collectors had experience of conducting household surveys because they had worked as data collectors for several years with MIRA. Therefore, the training sessions were focused on the research objectives, content of the questionnaires and the process of household screening for eligibility. The first two-days of training were held in the MIRA office, the third day was in the field for a practical session about conducting household screening and a household survey. To check for inter-rater reliability, household screening form and data collection questionnaires were used twice in the same household by two data collectors at separate times. Difficulties related to completing the screening form or survey questionnaires were addressed during the field test and discussed as a group at the end of the course.

5.3.7 Data collection procedure

Finally, on 19 February 2015 it was possible to conduct the household survey in all three sampled VDCs of the Makwanpur district (Figure 5.3). It was completed in 40 days by 30 April 2015.

Figure 5.3 Makwanpur district map showing 3 surveyed VDCs

21 = Gogane VDC (high hill)
2 = Ambhanjyang VDC (mid hill)
24 = Dhiyal VDC (lowland)

(Used with permission of the author)

A door-to-door survey was conducted by six trained data collectors (MIRA staff) and by a researcher with the 740 randomly selected households. As mentioned earlier, all the data collectors were residents of the sampled VDCs and data collection was carried out in their own VDC. Two were from Gogane (high hill), two from Ambhanjyang (mid hill) and two from Dhiyal (lowland). During the first week of data collection, researcher and the two MIRA staff members (DA and PT) were also involved in the data collection work with 1 in each VDC.

Where possible, information was collected from the main caregiver of the child. In the absence of a main caregiver, another member of the household responsible for the child/children provided information. Some households were visited twice if no adult members were at home during the first visit. If none were at home for the second visit, an alternative household was selected for the survey and a similar household near to the sampled household was used as an alternative household. Before data collection began, collectors were informed as to the objective of survey and assured of the confidentiality of their information. Verbal consent was obtained to proceed the interview in each surveyed household (Appendix 5.4).

If there was more than one injured child aged <5 years in one household, a separate Form 2 was completed for them. If a child had sustained more than one injury in the last three months, the respondent was asked to provide information on the one injury that they considered to be the most severe.

Information was collected either by interview or by observation. With permission of the parent/carer, data collectors observed each area of the house with household's member or with their permission to document the potential hazards for injury. The areas in the checklist included the kitchen, bathroom, bedroom or sleeping area, the courtyard, the rooftop and the immediate vicinity of the house. Unused areas of the house that remained locked continuously for more than six months or places designated for worship were not observed. Each household survey took approximately 45-60 minutes to complete.

5.3.8 Monitoring and supervision of field activities

The researcher was responsible for the supervision of survey aspects such as providing training to the data collectors, verifying the survey questionnaires, providing feedback to data collectors and providing field support. In addition, a member of the MIRA project team was nominated as a field co-ordinator for communication between the researcher and the data collectors. The researcher also had direct communication with all the data collectors throughout the data collection period. After being involved in the data collection during the first week, the researcher and field co-ordinator were entirely engaged in facilitating, supervising and monitoring the VDC level activities and in verifying the data collection. The researcher and field coordinators were also responsible for collecting all the completed questionnaires from survey VDCs and bringing them to the Hetauda office. While collecting the completed questionnaires record keeping sheet were used to ensure sampled households were surveyed. A sample of record keeping sheet for completed questionnaires is presented in Appendix 5.5. In Hetauda office, completed questionnaires were thoroughly checked and verified by the quality control officer (PT) of MIRA and the researcher. Once questionnaires were checked and verified, data entry began.

5.3.9 Anonymity and confidentiality

Anonymity of survey participants and confidentiality of the information provided by them were maintained from the point of data collection. The questionnaires were developed in such a way that they did not include any personal identifiers, such as name and caste.

However, surveyed households were identifiable using the household identifier number (pseudo-anonymization).

The completed questionnaires were collected from the field and kept securely in the MIRA office. Hard copies were only accessed by the MIRA Hetauda Manager, the data entry clerk and the researcher. In order to maintain confidentiality of the data source, after data entry all survey questionnaires were locked in a drawer and kept securely in the MIRA office in a password-protected computer until the end of the survey (Now this are with researcher in UK).

5.3.10 Missing data

There was no missing data in this study. When collecting the completed questionnaires, either the researcher or field coordinators were responsible for checking missing data in the field. If missing data was found, responsible data collector were asked for clarification, or to revisit the household if needed.

5.3.11 Data management for analysis

A study database was developed in Microsoft (MS) Access by a member of the IT staff (DKS) of MIRA. MIRA has been using a similar database for their own research purposes and this was adapted for this study. The database was designed in such a way as to minimise data entry errors. For example, each field was limited for the appropriate entry. Any abnormal characters or digits were disallowed, and the system did not allow further data to be entered.

One employee (ST) of MIRA was responsible for the data entry in the same office. The researcher was responsible for data processing i.e. coding, editing, checking, and updates/corrections and verifying the data entry. All these steps were carried out manually, and a cleaned database file (MS-Access) was established. The completed database file was then transferred to a software IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp, 2013) for further data analysis.

Data analysis was performed by the researcher at the Centre for Child and Adolescent Health, UWE. The data cleaning was done at the time the forms were collected and entered into the MS-Access database. Therefore, a clean dataset was available for analysis by the time the researcher returned to the UK. Data analysis was performed in two stages; first descriptive and then multivariable analysis.

5.3.12 Descriptive analysis method

The descriptive analysis was performed in a software IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp, 2013). Descriptive data were presented in tables and/or graphs to describe the characteristics of households, caregivers, and children by geographical region. For continuous measures, the mean, median and standard deviation were calculated. Categorical variables were described using frequencies, percentages and rates as appropriate (based on the non-missing sample size).

While analysing the home hazards data, options like on the floor, <1-meter height, unlocked cabinet/drawer were categorised as presence of hazard and >1-meter height, locked cabinet/drawer or store-room were categorised as absence of hazard. Thus, the home injury hazard data were categorized into 3 groups: "Not Applicable", "Hazard", and "Safe". The proportion of households was calculated with exclusion of cases that were not applicable to the study. All the hazards data were classified into 8 groups according to the risk of injury that can be sustained from those hazards. These hazards data were then presented in tables: first table to describe the proportion of households with a potential hazard and second table to describe proportion of households where a potential hazard was hazardous.

5.3.13 Regression analysis method

The risk of injury in the home environment is likely to be due to a contribution of several risk factors. For designing and implementing injury prevention intervention, the individual risk factors for injury need to be identified. This section describes home hazards as an independent risk factor for unintentional child injury in the home environment. The main objective of this analysis is to investigate the relationship between the number of home hazards and number of children with injury by performing primary and secondary analysis.

Primary analysis: To analyse the association between the number of home hazards and number of children with any injury. Home hazards refer to falls, fire/burns/scalds, cuts/crushing injuries and animal-related hazards as exposure measures and children with an injury (fall, fire/burn/scald, cut/crush or animal-related) as an outcome measure.

Secondary analysis: To analyse the association between numbers of home hazards related to a specific injury mechanism and the number of children with that specific injury, as presented here:

- Injury hazards related to falls as an exposure and children falling as an outcome.
- Injury hazards related to fire/burns/scalds as an exposure and children with fire/burn/scald injuries as an outcome.
- Injury hazards related to cuts/crushing as an exposure and children with cuts/crush injuries as an outcome.

5.3.13.1 Exposure and outcome measures

Out of the 1042 children living in 740 households, 242 (23.2%) children had suffered an injury during the three-months recall period. In 242 injury cases, 89 (37%) were due to a fall, 67 (27%) were due to fire/burns/scalds, 53 (22%) were due to cuts/crush injuries and 24 (10%) were animal-related. There were 9 (4%) other injuries caused by blunt objects (n=5, 2.1%), near-drowning (n=1, 0.4%), machines/tools (n=1, 0.4%), suffocation or choking (n=1, 0.4%), and road/transport-related incidents (n=1, 0.4%). This 4%, categorised as 'other injury', is not included in the analysis due to the small numbers for the regression analysis. Therefore, only the main 4 injury mechanisms are considered in the analysis and they are referred to as 'injury' or 'any injury' unless specified during the analysis. To clarify, this analysis included 233 injuries and 800 non-injury cases, making a total of 1033. Injury hazards were identified by the data collector using different options and classified into three groups; 'yes' (hazard present), 'no' (hazard not present) and 'not applicable' (if it was not possible to determine whether there was a hazard present or not). The 'not applicable' cases have been excluded from the analyses. Therefore, the denominators used to analyse the home hazards differ between variables.

5.3.13.2 Statistical analysis

The distribution of all variables of interest and potential confounding variables were assessed by univariable and multivariable methods. Univariable analysis was used to identify which variables were associated with child injury. This analysis of the association between each independent variable and the dependent variables was undertaken using binary logistic regression. The independent variables were split into three groups: child, family and home. Independent variables were used as categorical, ordinal or continuous as appropriate. The frequency of injury (number and percentage) was reported for each independent variable. Wald test (X^2), p values (P) and odds ratios (OR) with 95% confidence intervals (CI) were calculated using binary logistic regression. The OR provides an estimate of the risk of child injury associated with each category compared to the reference category of each independent variable.

Multivariable-regression analyses were undertaken to understand the specific association between home hazards and child injury by controlling for the effect of the other variables (Katz, 2011). The regression analysis technique was considered for this study because it investigates the separate or joint effects of multiple risk factors on the outcome variable with greater accuracy (McNamee, 2005, Katz, 2011). Analyses were conducted by using a software IBM SPSS Statistics for windows, Version 22.0 (IBM Corp, 2013), for the initial setup of data and they were then converted to a STATA file. Univariable and multivariable analyses were undertaken using a Stata Statistical Software: Released 14 (StataCorp, 2015).

5.3.13.3 Adjustment for clustered data

The data for this study were collected by household survey using a multistage clustered sampling method. The primary cluster was the geographical region based around the three village development committees (VDCs) and the secondary cluster was at the household level (740 households). Total of 1042 children were living in the 740 households surveyed. This study assumes that children within a household may be exposed to similar injury hazards and so exhibit similar injuries, in comparison to children in different households. Hazards in the same VDC areas are also likely to be more similar than those in different VDC areas. Therefore, the data collected for this study are correlated (clustered) at both a household and geographical level.

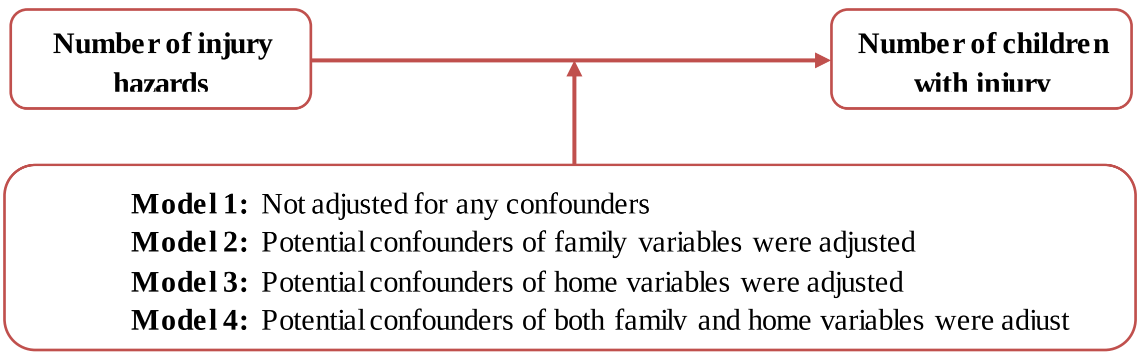
This multivariable regression analysis did not adjust for geographical regions as a cluster because no data describing differences between the VDC areas were collected at this level, other than categorising each household into one of three VDC areas. The geographical regions were considered as predictors and then controlled for during multivariable analysis. All variables used in regression analysis related directly to the household. Therefore, to avoid a Type I error (false positive result), clustering at household level was accounted for in the regression analysis. The clustering of data should be taken into account in the regression analysis otherwise it leads to small standard errors, a narrow confidence interval and a small p value of the estimated parameter (Kirkwood and Sterne, 2003b).

There are different ways to analyse clustered data. Common methods of analysing clustered data include using a survey set with a primary sampling unit, summary measures for each cluster, robust standard errors, generalized estimating equations (GEE) and random effect (multilevel) models. However, choosing the appropriate method depends upon the nature of the data and the purpose of the analysis. Using robust standard errors in clustering data was considered as an appropriate method to use in this analysis. It does not affect the parameter estimated, but it corrects standard errors, the confidence interval and the p value (Kirkwood and Sterne, 2003b).

5.3.13.4 Adjustment for confounding variables

Univariable analysis was used to identify potential confounding variables that needed to be included in the regression model. Confounding variables were the extraneous variables that correlated with both the independent and dependent variables (for this analysis, p value <0.1), whose presence affected the true relationship of the independent and dependant variables under study (Kirkwood and Sterne, 2003a, McNamee, 2005). Potential confounders should be adjusted whilst investigating the association between exposure and outcome variables otherwise it can produce an overestimate or underestimate of the true association (Kirkwood and Sterne, 2003a, McNamee, 2005, Katz, 2011). Before running the regression model, potential confounders in each group (child, family and home) were identified from the literature as well as from the data (detail is presented in results section). After this, multivariable regression analyses were undertaken to calculate the adjusted OR (AOR) of the relationship between home hazards and child injury, whilst controlling for the identified confounding variables.

Figure 5.4 A model framework for analysis home hazard for child injury



A total of four models were developed that considered the potential confounding variables (Figure 5.4). Model 1 explored the association between home hazards and child injury without adjusting for any confounding variables. Model 2 explored the association between home hazards and child injury whilst adjusting for the confounding variables affecting measured family variables. Model 3 explored the association between home hazards and child injury whilst adjusting for the confounding of home variables. Model 4 explored the association between home hazards and child injury whilst adjusting for the confounding variables of both the family and home variables. The AOR with 95% CI and p values were derived from each model and used to compare the independent effect of home hazards on child injury over and above that of family and home variables.

5.4 RESULTS OF DESCRIPTIVE ANALYSIS

This section of results describes the prevalence of unintentional home injury and home hazards by presenting in four main sections: a general description of surveyed area, description of surveyed households, description of childhood home injury and a description of potential home injury hazards. All descriptive data are presented both as a whole and also by the 3 different geographical regions (i.e. high hill, mid hill and lowland) in order to compare the data across different regions.

5.4.1 Description of surveyed area

Table 5.3 shows the households and population size identified in the surveyed VDCs across the three different geographical regions. All three VDCs are in rural areas of the Makwanpur district. Gogane VDC is in the high hill, Ambhanjyang in mid hill and Dhiyal in lowland. In total, there were 3476 households in the 3 VDCs of the Makwanpur district. Out of these households, 983 were in Gogane, 1403 in Ambhanjyang and 1090 in Dhiyal. In all three surveyed VDCs, 35% (n=1,213) of the total households (n=3,476) had at least one child aged <5 years (eligible households). In Gogane, 39.9% (n=292) of the total households (n=983) had children aged <5 years. In Ambhanjyang, 27.1% (n=380) of the total households (n=1,403) had children aged <5 years. In Dhiyal, 40.5% (n=441) of the total households (n=1,090) had children aged <5 years. About 9% (n=1,653) of the total population (n=18,196) were children aged <5 years across the three VDCs.

Table 5.3 Distribution of the surveyed households (HHs) and population by geographical region

Surveyed VDCs and geographical regions		Total HHs across the surveyed VDCs	HHs with children aged <5 yrs. (eligible HHs) (%)	Total population across all surveyed VDCs	Population of children aged <5 yrs. in eligible HHs (%)
Gogane	High hill	983	392 (39.9)	5,345	532 (10.0)
Ambhanjyang	Mid hill	1,403	380 (27.1)	6,906	494 (7.2)
Dhiyal	Lowland	1,090	441 (40.5)	5,945	627 (10.5)
Overall		3,476	1,213 (34.9)	18,196	1,653 (9.1)

Table 5.4 shows the number of households and children aged <5 years across three VDCs. In each VDC, about 61% of households were surveyed which identified 1042 children aged <5 years in total. The total population identified in all surveyed households was 4967.

Table 5.4 No. of children per household (HH) in surveyed VDCs by geographical region

Surveyed VDCs	**Screening result**		**Surveyed**		
	HHs with children aged <5 yrs.	Number of children aged <5 yrs.	HHs with children aged <5 yrs. (%)	Number of children aged <5 yrs.	Total population
Gogane	392	532	239 (61.0)	331	1,671
Ambhanjyang	380	494	232 (61.1)	311	1,375
Dhiyal	441	627	269 (61.0)	400	1,921
Overall	1,213	1,653	740 (61.00)	1042	4,967

5.4.2 Characteristic of the surveyed households

5.4.2.1 Household population

Overall, the total number of people of all ages living in the surveyed households was 4967 in which almost half (n=2469, 49.7%) were male. The mean number of household members living in a house was 6.71 (SD=2.622). The percentage of the males was slightly higher than females in the mid hill (50.5% vs 49.5%) and lowland regions (50.5% vs 49.5%). However, in the high hill region, the percentage of the population that was female was higher than those that were male (51.8% vs 48.2%) (Table 4.5).

5.4.2.2 Household size

Overall, the majority (n=440, 59.5%) of surveyed households had a medium-sized family (5-8 persons). About 21% (n=155) of the surveyed households had more than 9 persons living together and about 20% (n=145) of the surveyed households had 4 or fewer persons living together. By regions also, the proportion of households with 5-8 persons was highest across all regions (Table 4.5).

5.4.2.3 Household ethnicity in surveyed VDCs

The Health Management Information System section of the Department of Health Services of Nepal has classified ethnicity into six categories: Dalit, disadvantaged Janajatis (indigenous people), relatively advantaged Janajatis, disadvantaged non-Dalit Terai caste group, religious minorities, relatively advantaged Janajatis and upper caste group**.** According to this classification there were only four ethnic groups in all surveyed households.

Overall, most households belonged to disadvantaged Janajatis (n=534, 72.2%) followed by upper caste groups (n=198, 22.7%). The proportion of households belonging to disadvantaged Janajatis was highest in high hill (n=194, 81.2%) and lowland (n=344, 90.7%). The proportion of households belonging to the upper caste group was highest in mid hill (n=125, 53.9%) (Table 5.5).

5.4.2.4 Household income and expenditure

Overall, the median monthly income and monthly expenditure of surveyed households was Nepalese Rupees (NRs) 14, 000 and NRs 3,500 respectively. Monthly household income was highest in the lowland (NRs 19,000) followed by mid hill (NRs 10,000) and then high hill regions (NRs 7,000). Monthly household expenditure was highest in the mid hill (NRs 5,875) followed by high hill (NRs 4,000) and lowland regions (NRs 3,000) (Table 5.5).

5.4.2.5 Number of children aged < 18 years

Overall, the proportion of surveyed households with 1-2 and 3-4 children was 40.3% (n=298) and 41.5% (n=307) respectively. Only 18.2% (n=135) of households had more than 4 children. The proportion of households with 3-4 children was highest in high hill (n=115, 48.1%) and lowland regions (n=120, 44.6%). The proportion of households with 1-2 children was highest in mid hill (n=146, 62.9%) (Table 5.5).

Table 5.5 Characteristics of household/family by geographical region

Characteristics of household/family		Geographical regions			
		Overall n **= 740 (%)**	**High hill** n **= 239 (%)**	**Mid hill** n **= 232 (%)**	**Lowland** n **= 269 (%)**
Surveyed population *(*number of females per 100 males)*					
Total population		4967	1671	1375	1921
Male n (%)		2469 (49.7)	805 (48.2)	694 (50.5)	970 (50.5)
Female n (%)		2498 (50.3)	866 (51.8)	681 (49.5)	951 (49.5)
Sex ratio*		101.17	107.57	98.12	98.04
HH members (Mean, SD)		6.71 (2.622)	6.99 (2.557)	5.93 (2.311)	7.14 (2.786)
Household size					
Small size (≤ 4 people)		145 (19.6)	34 (14.2)	73 (31.5)	38 (14.1)
Medium size (5-8 people)		440 (59.5)	150 (62.8)	127 (54.7)	163 (60.6)
Large size (> 8 people)		155 (20.9)	55 (23.0)	32 (13.8)	68 (25.3)
Household ethnicity					
Dalit		23 (3.1)	12 (5.0)	9 (3.9)	2 (0.7)
Disadvantaged Janajatis		534 (72.2)	194 (81.2)	96 (41.4)	244 (90.7)
Relatively advant. Janajatis		5 (0.7)	3 (1.3)	2 (0.9)	0 (0.0)
Upper caste groups		168 (22.7)	24 (10.0)	125 (53.9)	19 (7.1)
Others		10 (1.4)	6 (2.5)	0 (0.0)	4 (1.5)
Household monthly expenditure and income (NRs) *Note: (US$ 1 = NRs 104).*					
Income	Median (IQR)	14000	7000	10000	19000
	Range (Min-Max)	1000-140000	1500-45000	1000-100000	1200-140000
Expenditure	Median (IQR)	3500	4000	5875	3000
	Range (Min-Max)	500-55000	1300-55000	1000-30000	500-30000
Number of children < 18 years					
1-2 children at home		298 (40.3)	77 (32.2)	146 (62.9)	75 (27.9)
3-4 children at home		307 (41.5)	115 (48.1)	72 (31.0)	120 (44.6)
> 4 children at home		135 (18.2)	47 (19.7)	14 (6.0)	74 (27.5)

5.4.3 Characteristics of caregivers

5.4.3.1 Main caregiver in the household

Overall, mothers were the main caregiver of children in the majority (n=474, 64.1%) of surveyed households followed by grandparents (n=246, 33.2%). This trend was similar across all regions. The mothers were the main caregivers in 70.7% (n=164) of households in the mid hill region, 66.9% (n=160) of households in the high hill region and 55.8% (n=150) of households in the lowland region (Table 5.6).

5.4.3.2 Age group of caregivers

Overall, caregivers in 37.8% (n=280) households were 20-29 years old followed by 50 years or above in 24.3% (n=180) households. There were only 5.5% (n=41) households with caregivers aged <20 years old. The proportion of households with 20-29-year-old caregivers was highest across all regions (Table 5.6).

5.4.3.3 Sex of the caregivers

The caregivers in most households were female across all regions (91.4% - 97.4%) (Table 5.6).

5.4.3.4 Major occupation of the caregivers

Across all regions, agriculture was the main occupation of most caregivers (n=561, 75.8%). About 81% (n=189) of caregivers in the mid hill region, 80.3% (n=216) in the lowland region and 65.3% (n=156) in the high hill region were engaged in agricultural work. About 33.9% (n=81) caregivers were unemployed in the high hill region, 11.9% (n=32) in the lowland region and 6.9% (n=16) in the mid hill region. The proportion of caregivers engaged in regular cash earning employment such as service, business or labour work was found to be very small across all VDCs (Table 5.6).

5.4.3.5 Education of the caregivers

Overall, caregivers in 53% (n=392) of households were able to read and write and 47% (n=348) could not. The proportion of caregivers able to read and write was higher in the mid hill regions (n=154, 66.4%) followed by high hill (n=125, 52.3%) and lowland (n=113, 42%) (Table 5.6).

5.4.3.6 Educational level of the caregivers

Overall, 33.3% of 392 caregivers had no formal education but could simply read and write. About 56% (n=221) of caregivers had completed either primary or secondary school education. Only 6.6% (n=26) of caregivers had completed Intermediate School (level 11 - 12) or higher. Proportionally, there were more caregivers in the high hill region (n=54, 43.2%) and lowland region (n=47, 41.6%) who had no formal education but could simply read and write. In the mid hill region, only 24% (n=37) of caregivers had completed primary school (level 1- 5) education (Table 5.7).

Table 5.6 Characteristics of caregivers by geographical regions

Characteristics of caregivers	Geographical regions			
	Overall *n* = 740 (%)	**High hill** *n* = 239 (%)	**Mid hill** *n* = 232 (%)	**Lowland** *n* = 269 (%)
Main caregiver in a household				
Mother	474 (64.1)	160 (66.9)	164 (70.7)	150 (55.8)
Father	7 (0.9)	2 (0.8)	0 (0.0)	5 (1.9)
Grandparents	246 (33.2)	69 (28.9)	65 (28.0)	112 (41.6)
Aunt/Uncle/other adult relative(s)	5 (0.7)	1 (0.4)	2 (0.9)	2 (0.7)
Older siblings/brother(s)/sister(s)	8 (1.1)	7 (2.9)	1 (0.4)	0 (0.0)
Age of the caregivers				
<20 years	41 (5.5)	22 (9.2)	11 (4.7)	8 (3.0)
20-29 years	280 (37.8)	78 (32.6)	112 (48.3)	90 (33.5)
30-39 years	143 (19.3)	59 (24.7)	37 (15.9)	47 (17.5)
40-49 years	96 (13.0)	27 (11.3)	22 (9.5)	47 (17.5)
50 years and above	180 (24.3)	53 (22.2)	50 (21.6)	77 (28.6)
Sex of the caregivers				
Male	42 (5.7)	13 (5.4)	6 (2.6)	23 (8.6)
Female	698 (94.3)	226 (94.6)	226 (97.4)	246 (91.4)
Major occupation of the caregivers				
Agriculture	561 (75.8)	156 (65.3)	189 (81.5)	216 (80.3)
Salary job/business	22 (3.0)	1 (0.4)	16 (6.9)	5 (1.9)
Skilled/wage labour	6 (0.8)	1 (0.4)	4 (1.7)	1 (0.4)
unemployed	129 (17.4)	81 (33.9)	16 (6.9)	32 (11.9)
Unable to work/elderly	22 (3.0)	0 (0.0)	7 (3.0)	15 (5.6)
Education of the caregivers				
Not able to read and write	348 (47.0)	114 (47.7)	78 (33.6)	156 (58.0)
Able to read and write	392 (53.0)	125 (52.3)	154 (66.4)	113 (42.0)

Table 5.7 Educational level of the caregiver by gender and geographical regions

Education level (completed)	Geographical regions			
	Overall *n* **= 392 (%)**	**High hill** *n* **= 125 (%)**	**Mid hill** *n* **= 154 (%)**	**Lowland** *n* **= 113 (%)**
Non-formal education	132 (33.7)	54 (43.2)	31 (20.1)	47 (41.6)
Primary School (level 1- 5)	128 (32.7)	44 (35.2)	37 (24.0)	47 (41.6)
Lower secondary (level 6 - 8)	55 (14.0)	19 (15.2)	22 (14.3)	14 (12.4)
Secondary (level 9 - 10)	38 (9.7)	6 (4.8)	28 (18.2)	4 (3.5)
S L C	13 (3.3)	0 (0.0)	13 (8.4)	0 (0.0)
Intermediate School (level 11 - 12) or higher	26 (6.6)	2 (1.6)	23 (14.9)	1 (0.9)

5.4.4 Characteristics of children aged <5 years

5.4.4.1 Population of the children

In total, 1042 children aged <5 years of age were living in the 740 surveyed households, of whom, 31.8% (n=331) were living in 239 households in the high hill region, 29.8% (n=311) were living in 232 households in the mid hill region and 38.4% (n=400) were living in 269 households in the lowlands. The average number of children per survey household was 1.40. The number of children per household was highest in the lowland region (1.49) followed by high hill (1.38) and mid hill regions (1.34) (Table 5.8).

5.4.4.2 Sex of the children

Overall, the proportion of male children (n=542, 52%) was higher than female children (n=500, 48%). By region, the proportion of male children was higher than female children in the mid hill (52.1% male) and lowland areas (53.8% male). In the high hill region, the proportion of male and female children was almost the same (50.2% male; 49.9% female) (Table 5.8).

5.4.4.3 Age group of the children

Overall, the largest proportion (n=248, 23.8%) of children in surveyed households were aged 48 to 59 months followed by 12 to 23 months (n=227, 21.8%), and 36 to 47 months (n=218, 20.9%). Only 15.5% (n=162) of children were aged <12 months. The largest proportion of children were aged 48 to 50 months in the high hill (n=82, 24.8%) and lowland regions (n=98, 24.5%), while in the mid hill region, the largest proportion of children (n=73, 23.5%) were aged 12 to 23 months (Table 5.8).

Table 5.8 Profile of surveyed households (HHs) with children aged <5 years age

Characteristics of children	Geographical regions			
	Overall (%)	High hill (%)	Mid hill (%)	Lowland (%)
Population of children				
Number of HHs	740	239 (32.2)	232 (31.4)	269 (36.4)
Number of children	1042	331 (31.8)	311 (29.8)	400 (38.4)
Children per household	1.40	1.38	1.34	1.49
Sex of the children				
Male children	542 (52.0)	165 (49.9)	162 (52.1)	215 (53.8)
Female children	500 (48.0)	166 (50.2)	149 (47.9)	185 (46.3)
Age group of the children				
<12 months	162 (15.5)	52 (15.7)	49 (15.8)	61 (15.3)
12-23 months	227 (21.8)	69 (20.8)	73 (23.5)	85 (21.3)
24-35 months	187 (17.9)	66 (19.9)	52 (16.7)	69 (17.3)
36-47 months	218 (20.9)	62 (18.7)	69 (22.2)	87 (21.8)
48-59 months	248 (23.8)	82 (24.8)	68 (21.9)	98 (24.5)

5.4.5 Description of childhood home injury

This section describes the injury events reported by parents/caregivers that occurred in children aged <5 years of age, living in surveyed households. The injury cases that are presented in this section are unintentional and sustained in the home environment. The recall period for the injury to be included were those that took place in the 3 months prior to the date of the first survey. These injury events are presented in the following section including details about the number and rate of overall injury mechanisms, number and rate of specific injury mechanisms, further description of the injury mechanisms, injury events by location and types of injury (Outcome) sustained.

5.4.5.1 Number and rate of overall injury mechanisms

In this section, the number and rate of overall injury mechanisms are described. The proportion of households reporting injury, is presented first. After this, the number and rate of overall injury mechanisms are presented by region, age group, age group and sex and by ethnicity.

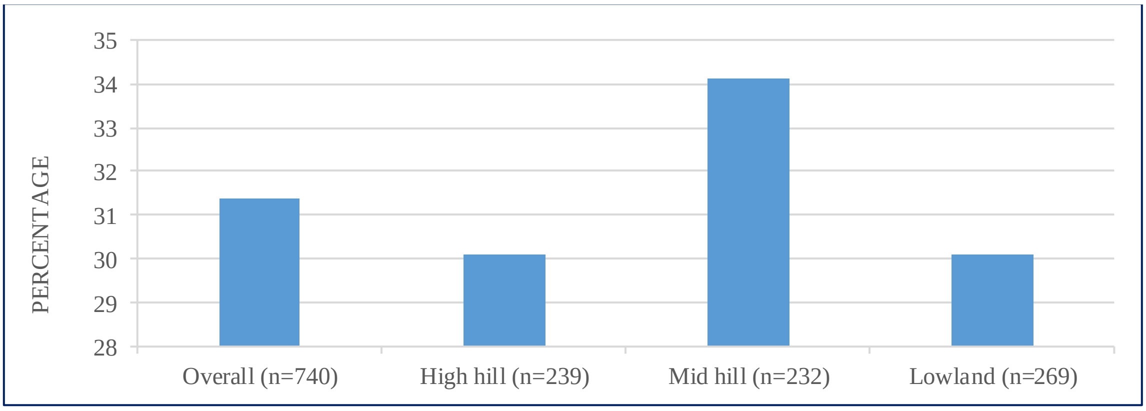
5.4.5.1.1 Proportion of households reporting injury

Overall, 31.4% (n=232/740) of households reported at least one child injury event. The proportion of households reporting injury were higher (n=79/232, 34.1%) in the mid hill region compared to the other two regions (n=72/239, 30.1% in the high hill; n=81/269, 30.1% in the lowland regions) (Table 5.9, Figure 5.5).

Table 5.9 Proportion of households (HHs) with injury status by geographical region

Geo-regions	Injury reported HHs (%)	No injury reported HHs (%)
High hill (n=239)	72 (30.1)	167 (69.9)
Mid hill (n=232)	79 (34.1)	153 (65.9)
Lowland (n=269)	81 (30.1)	188 (69.9)
Overall (n=740)	232 (31.4)	508 (68.6)

Figure 5.5 Proportion of households reporting injury by geographical region



5.4.5.1.2 Number and rate of injury mechanism by geographical region

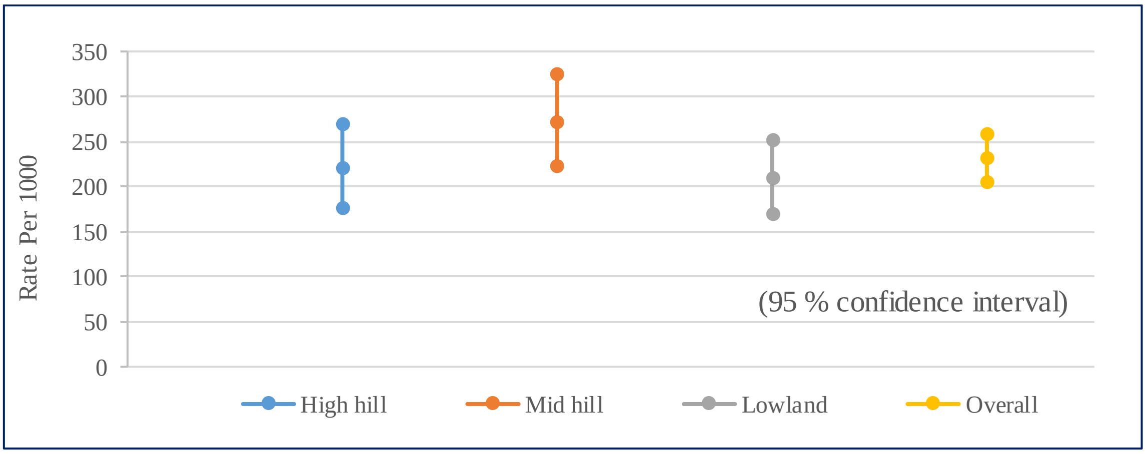
Amongst all the children (n=1042) of surveyed households, 23.2% (n=242) were reported to have sustained an unintentional injury during the recall period. The overall injury rate amongst children aged <5 years was 232.2 per 1000 children (95%CI: 206.9 - 259.1). The injury rate amongst children in the mid hill (273.3 per 1000 children; 95%CI: 224.5 - 326.5) was higher than that in the high hill (220.5/1000 children; 95%CI: 117.0 - 269.1) and the lowland (210/1000 children; 95%CI: 171.1 - 253.2). The difference in injury rate between regions is insignificant as it could have occurred by chance, as demonstrated by the overlapping confidence intervals (Table 5.10, Figure 5.6).

Table 5.10 Number and rate of injury mechanisms by geographical region

Geo-Regions	Number of children		Injury rate/1000	95% CI
	Injured children	Total children		
High hill	73	331	220.5	117.0 - 269.1
Mid hill	85	311	273.3	224.5 - 326.5
Lowland	84	400	210.0	171.1 - 253.2
Overall	242	1042	232.2	206.9 - 259.1

Note: the confidence intervals were calculated with Minitab 16 (using Basic stat. 1 Proportion)

Figure 5.6 Rate of injury mechanisms by geographical region (per 1000 children)



Note: the confidence intervals were calculated with Minitab 16 (using Basic stat. 1 Proportion)

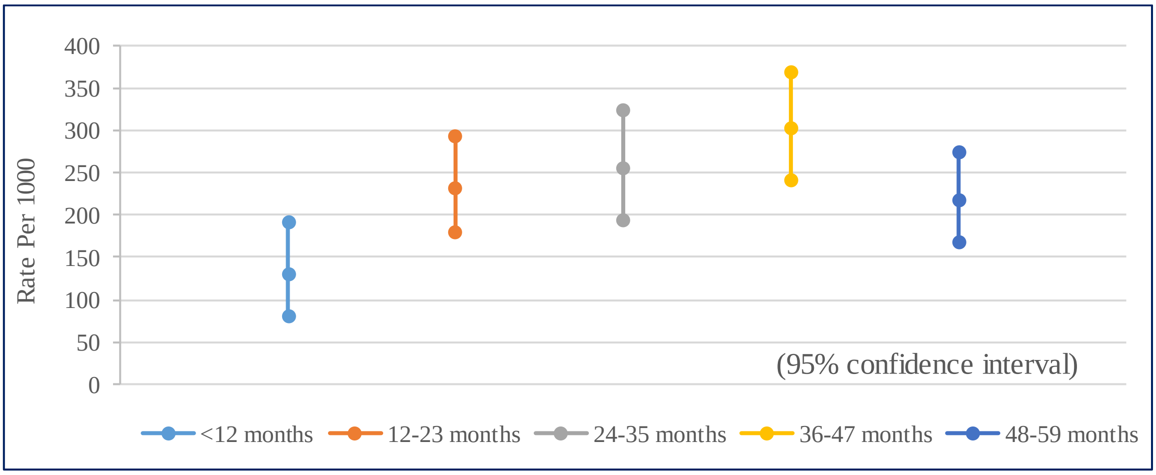
5.4.5.1.3 Number and rate of injury mechanisms by age group

Injury rates were highest among children aged 36-47 months at 302.8 per 1000 (95%CI: 242.5 - 368.4) and lowest in children aged <12 months at 129.6 per 1000 (95%CI: 82.1 - 191.3). Injury rate increased as age increased up to 47 months and fell thereafter at 48-59 months. The 95% confidence interval for injury rate in children aged 36-47 months does not overlap with that for children aged <12 months, suggesting a significant difference. However, there is overlap with the other categories (Table 5.11, Figure 4.7).

Table 5.11 Number and rate of injury mechanisms by age group

Age group	Number of children		Injury rate/1000	95% CI
	Injured children	Total children		
<12 months	21	162	129.6	82.1 - 191.3
12-23 months	53	227	233.5	180.0 - 294.0
24-35 months	48	187	256.7	195.7 - 325.5
36-47 months	66	218	302.8	242.5 - 368.4
48-59 months	54	248	217.7	168.0 - 274.4

Figure 5.7 Rate of injury mechanisms by age group (per 1000 children)



Note: the confidence intervals were calculated with Minitab 16 (using Basic stat. 1 Proportion)

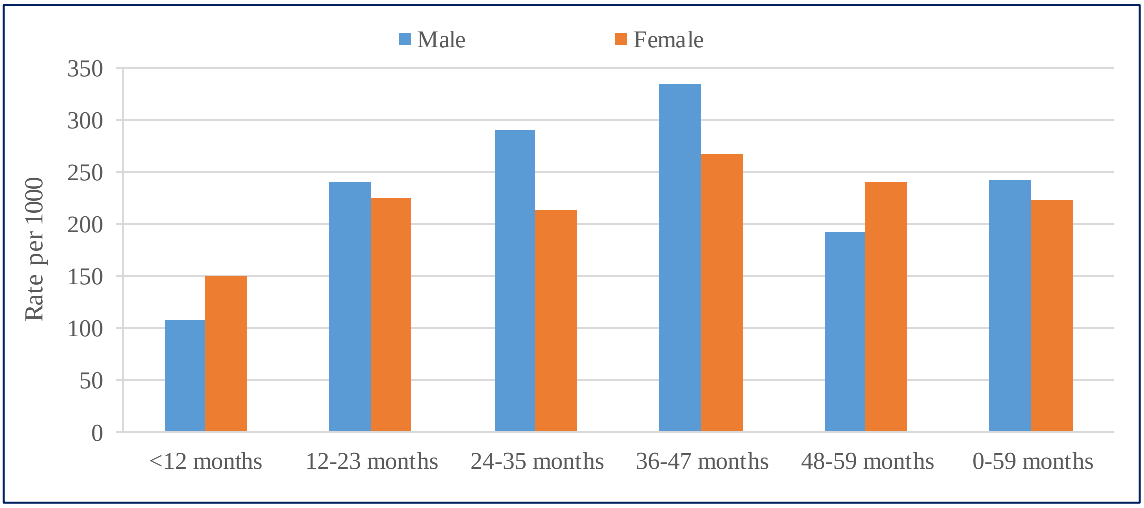
5.4.5.1.4 Number and rate of injury mechanisms by age group and sex

Overall, injury rate in male children was marginally higher than in female children (241.6 vs 222.2/1000). However, the difference in injury rate between male and female children is insignificant so could have occurred by chance as the confidence intervals overlapped. By age group, injury rate in both males (333.3/1000) and females (267.3/1000) was highest between the aged 36-47 months. However, injury rate was higher amongst male children aged 12-47 months, whilst injury rate was higher in female children <12 months and between 48-59 months (Table 5.12, Figure 5.8).

Table 5.12 Number and rate of injury mechanisms by age group (months) and sex

Age groups	Sex	Injured (n = 242)	Total (n = 1042)	Injury rate	95% CI
<12	Male	8	75	106.7	47.2 - 199.4
	Female	13	87	149.4	82.0 - 242.0
12-23	Male	31	129	240.3	169.5 - 323.4
	Female	22	98	224.5	146.4 - 319.9
24-35	Male	31	107	289.7	206.1 - 385.4
	Female	17	80	212.5	128.9 - 318.3
36-47	Male	39	117	333.3	248.9 - 426.4
	Female	27	101	267.3	184.1 - 364.6
48-59	Male	21	110	190.9	122.2 - 276.9
	Female	33	138	239.1	170.7 - 319.1
0-59	Male	130	538	241.6	206.0 - 280.1
	Female	112	504	222.2	186.7 - 261.1

Figure 5.8 Rate of injury mechanisms by age group and sex (per 1000 children)



5.4.5.1.5 Number and rate of injury mechanism by ethnicity

The number and rate of injury varied by ethnic group. The rate of injury amongst the relatively advantaged Janajatis children was highest (375 per 1000; 95%CI: 85.2 - 755.1). The upper caste group children had the second highest injury rate (290.6/1000; 95%CI: 233.3 - 353.3). However, due to the small number of children in some ethnic groups, the results might be incorrectly interpreted. (Table 5.13).

Table 5.13 Number and rate of injury mechanisms by ethnic group (per 1000 children)

Ethnic group	Injured children	Total children	Rate/1000	95% CI
Dalit	5	36	138.9	46.7 - 295.0
Disadvantaged Janajatis	163	751	217.0	188.0 - 248.3
Relatively advantaged Janajatis	3	8	375.0	85.2 - 755.1
Upper caste groups	68	234	290.6	233.3 - 353.3
Others	3	13	230.8	50.0 - 538.1

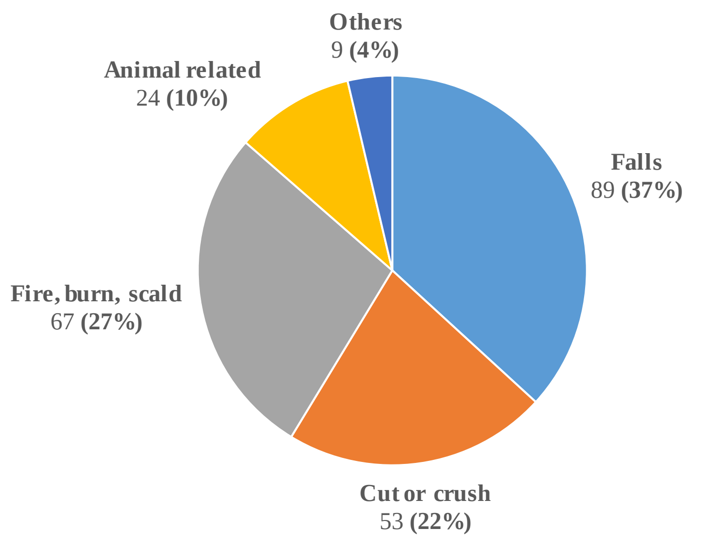
5.4.5.2 Number and rate of specific injury mechanisms

This section describes the proportion of injury mechanisms including the number and rates of specific injury mechanisms. These are presented by overall region, different region, age group, sex, and ethnicity.

5.4.5.2.1 Proportion of injury mechanisms

The largest percentage of injury events occurred due to a fall (n=89, 37%), followed by fire, burns, scalds (n=67, 27%), cuts or crushes (n=53, 22%) and then animal-related (n=24, 10%) injury. 4% (n=9) of other injury events were caused by blunt objects (n=5, 2.1%), near-drowning (n=1, 0.4%), machines or tools (n=1, 0.4%), suffocation or choking (n=1, 0.4%) and road or transport injury (n=1, 0.4%). Road or transport injury were defined in this study as those occurring on roads in close proximity to the home. No injury events were reported due to poisoning in this survey (Figure 5.9).

Figure 5.9 Proportion of child injuries by mechanism of injury (n = 242)



5.4.5.2.2 Number and rate of injury mechanism (Overall region)

Fall rate was highest amongst children aged <5 years (85.4 per 1000 children; 95%CI: 69.9-104). The rate of fire-related injury, burns or scalds was the second leading cause of injury amongst children (64.3/1000; 95%CI: 50.2 - 80.9) followed by cuts or crush injuries (50.9/1000; 95%CI: 38.3 - 66.0) and animal-related injury (23/1000; 95%CI: 14.8 - 34.1) (Table 5.14).

Table 5.14 Number and rate of injury by injury mechanism (Overall region)

Injury mechanism	**Number of total children = 1042**		
	Injured	Injury rate/1000	95%CI
Falls	89	85.4	69.9 - 104.0
Fire, burn, scald	67	64.3	50.2 - 80.9
Cut or crush	53	50.9	38.3 - 66.0
Animal-related	24	23.0	14.8 - 34.1
Others	9	8.6	4.0 - 16.3
All injuries	**242**	**232.2**	**206.9 - 259.1**

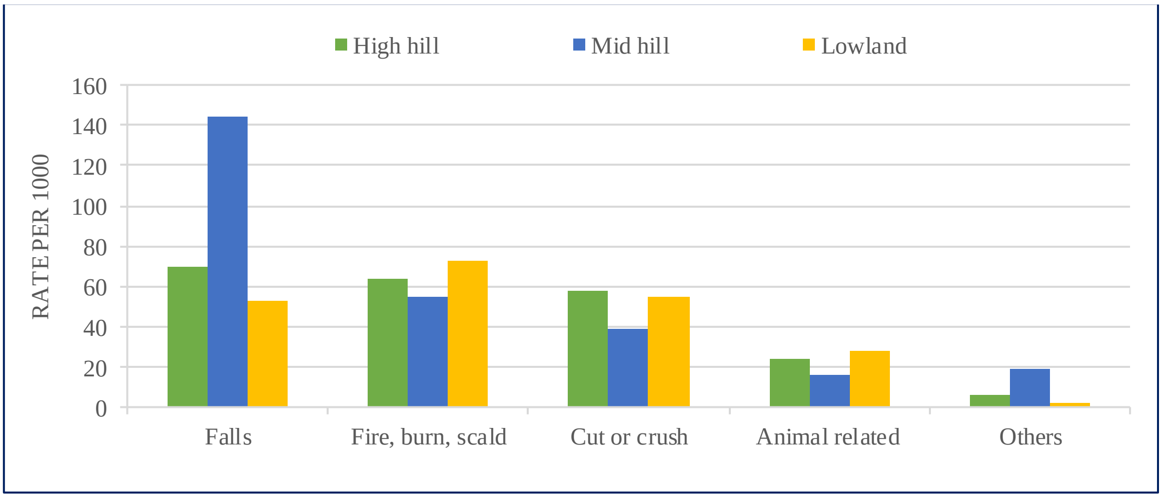
5.4.5.2.3 Number and rate of injury mechanism by differing region

The mechanism of injury varied according to the geographical location of the surveyed household. The highest rate of fall was observed in the mid hill region (144.7/1000). Rates of cut or crush injuries were highest in the high hill region (57.4/1000), whilst fires, burns, or scalds (72.5/1000) and animal related injuries (27.5/1000) were highest in the lowland region. (Table 5.15, Figure 5.10).

Table 5.15 Number and rate of injury by injury mechanism and geographical region

Injury mechanism	Geographical region					
	High hill (n = 331)		**Mid hill (n = 311)**		**Lowland (n = 400)**	
	Injured	Rate/1000	Injured	Rate/1000	Injured	Rate/1000
Falls	23	69.5	45	144.7	21	52.5
Fire, burn, scald	21	63.4	17	54.7	29	72.5
Cut or crush	19	57.4	12	38.6	22	55.0
Animal-related	8	24.2	5	16.0	11	27.5
Others	2	6.0	6	19.3	1	2.5
All injuries	**73**	**220.5**	**85**	**273.31**	**84**	**210.0**

Figure 5.10 Injury rate by injury mechanism and geographical region (per 1000 children)



5.4.5.2.4 Number and rate of injury mechanism by age group

The rates of injury amongst children was also analysed by mechanism of injury and the associated rate in each age group. Table 5.16 and Figure 5.11 show that the rate of falls gradually increased from young age to 47 months and sharply decreased from age 48-59 months. The rates of falls were highest amongst children aged 36-47 months (169.7/1000) and lowest in children <12 months (30.9/1000).

The rate of cuts or crush injury was 6.2/1000 in children aged <12 months and continuously increased with age. The rate of cuts or crush injury was highest amongst children aged 48-59 months (76.6/1000).

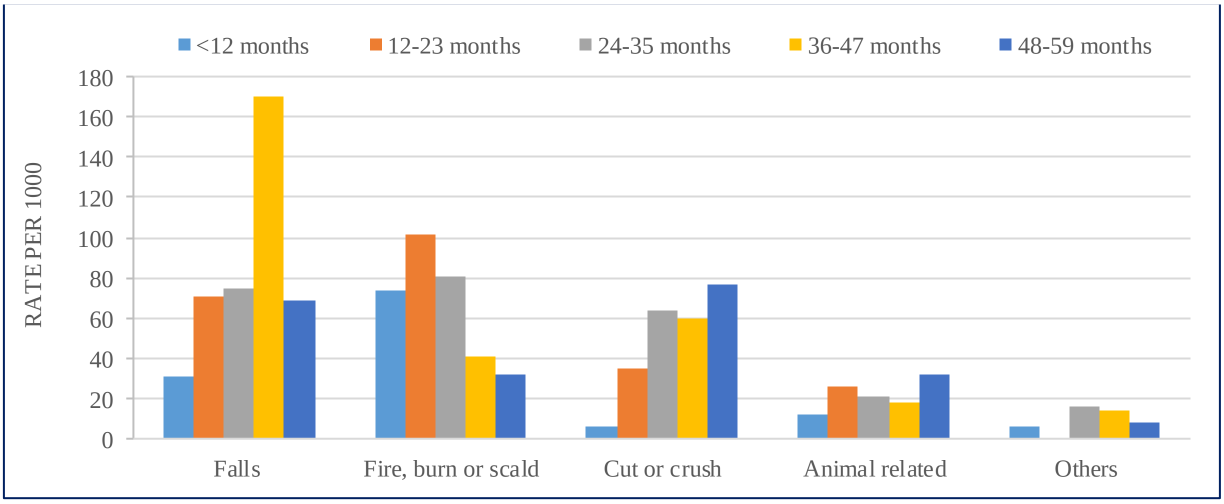
The rates of fire-related injuries, burns or scalds were highest amongst children aged 0-23 months, but the incidence gradually decreased amongst children aged 24-59 months. Fire, burn or scald injury rates were highest amongst children aged 12-23 months (101.3/1000) and lowest in children aged 48-59 months (32.3/1000).

Animal-related injury rates were relatively consistent across all age groups except in children aged <12 months where rates were lower (12.3/1000) than in other age groups.

Table 5.16 Number and rate of injury by injury mechanism and age group (per 1000 children)

Injury mechanism	<12 months		12-23 months		24-35 months		36-47 months		48-59 months	
	n =162		n = 227		n = 187		n = 218		n = 248	
	Inj.	Rate	Inj.	Rate	Inj.	Rate	Inj.	Rate	Inj.	Rate
Falls	5	30.9	16	70.5	14	74.9	37	169.7	17	68.5
Fire, burn or scald	12	74.1	23	101.3	15	80.2	9	41.3	8	32.3
Cut or crush	1	6.2	8	35.2	12	64.2	13	59.6	19	76.6
Animal-related	2	12.3	6	26.4	4	21.4	4	18.3	8	32.3
Others	1	6.12	0	0.0	3	16.0	3	13.8	2	8.1

Figure 5.11 Injury rate by injury mechanism and age group (per 1000 children)



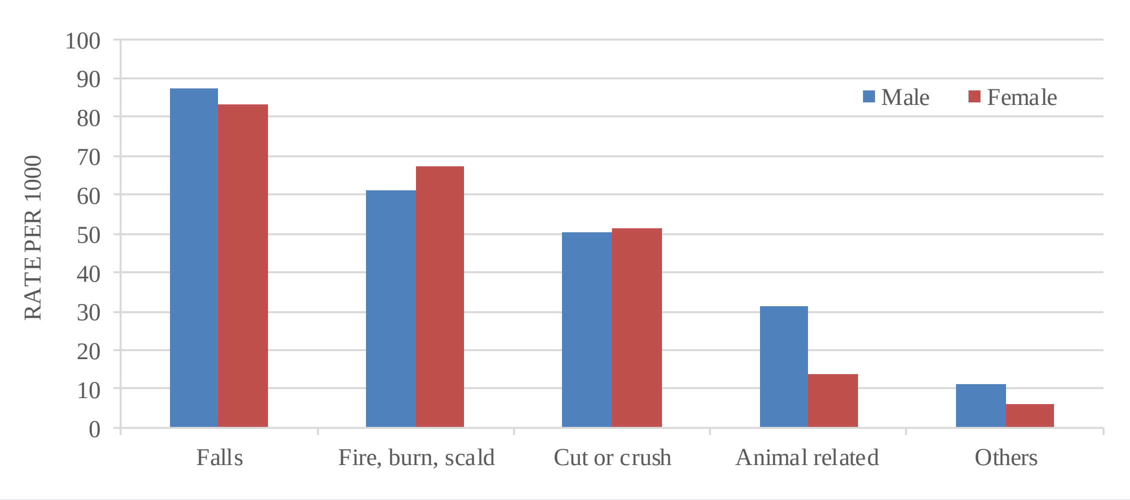
5.4.5.2.5 Number and rate of injury mechanism by sex

Whilst analysing injury rate according to the mechanism of injury by sex, it was found that the rate of falls (87.4/1000) and animal-related injuries (31.5/1000) was higher in male children than in females. However, fire-related injury, burns or scalds (67.5/1000) and cuts or crush injuries (51.6/1000) were highest in female children (Table 5.17, Figure 5.12).

Table 5.17 Number and rate of injury by injury mechanism and sex

Injury mechanism	Male (n = 538)		Female (n = 504)	
	Injured	Rate/1000	Injured	Rate/1000
Falls	47	87.4	42	83.3
Fire, burn or scald	33	61.3	34	67.5
Cut or crush	27	50.2	26	51.6
Animal-related	17	31.5	7	13.9
Others	6	11.2	3	6.0

Figure 5.12 Injury rate by injury mechanism and sex (per 1000 children)



5.4.5.2.6 Number injured by injury mechanism and ethnic group

The mechanism of injury also varied between ethnic groups in the surveyed households (Table 5.18). However, due to the small number of children with specific injury mechanisms in some ethnic groups, injury rates were not calculated.

Table 5.18 Number injured by injury mechanism and ethnicity

Injury mechanisms	Dalit (n = 36)	Disadvantaged Janajatis (n = 751)	Relatively adv. Janajatis (n = 8)	Upper caste groups (n = 234)	Others (n = 13)
Falls (n=89)	1	53	1	33	1
Fire, burn or scald (n=67)	4	47	0	15	1
Cut or crush (n=53)	0	40	2	10	1
Animal-related (n=24)	0	22	0	2	0
Others (n=9)	0	1	0	8	0

5.4.5.3 Further description of the mechanism of injury

5.4.5.3.1 Fall

In total, 37% (n=89/242) children were injured due to falls. Of the 89 falls, 25.8% (n=23) occurred in children living in the high hill, 50.6% (n=45) were in mid hill, and 23.6% (n=21) in the lowland region. Overall, more than half falls (n=47, 52.8%) were from a different level, the rest were from the same level. The proportion of falls from these two levels varied across all regions. Falls from the same level were more common in the mid hill region (n=25, 55.6%), whilst falls from a different level were more common in the high hill (n=13, 56.5%) and lowland regions (n=14, 66.7%) (Table 5.19).

Table 5.19 Description of the fall by geographical region

Injury event by fall	Geographical region			
	Overall (%)	**High hill (%)**	**Mid hill (%)**	**Lowland (%)**
Same level	42 (47.2)	10 (43.5)	25 (55.6)	7 (33.3)
Different level	47 (52.8)	13 (56.5)	20 (44.4)	14 (66.7)
Total	89 (100)	23 (100)	45 (100)	21 (100)

5.4.5.3.2 Fire-related, burn or scald injuries

In total, 27 % (n=67/242) children sustained fire, burns or scalds injury. Of the 67 children with fire, burns or scalds injuries, 31.3 (n=21) were living in high hill, 25.4% (n=17) in mid hill and 43.3% (n=29) in lowland areas. Overall, 55.2% (n=37) were injuries resulting from hot flames, 19.4 % (n=13) were hot liquid or steam injuries and 25.4 % (n=17) were due to contact with a hot object (Table 5.20).

Of the 37 hot flame injuries, 21.6% (n=8) occurred in the children living in high hill, 21.6% (n=8) were in mid hill and 56.8% (n=21) in lowland areas. Overall, the common source of the hot flame was a cooking fire (n=26, 70.3%), followed by heating fire (n=4, 10.8%), residential or house fire (n=3, 8.1%), workplace fire (n=2, 5.4%) and finally, candles/lamp/lights (n=2, 5.4%) (Table 5.20).

Of the 13-hot liquid/steam injuries, 61.5% (n=8) occurred in children living in the high hill, 23.1% (n=3) were in mid hill and 15.4% (n=21) in the lowland area. Overall, cooking water and steam (n=4, 30.8%) as well as hot tea, coffee or milk (n=4, 30.8%) were the most common types of hot liquid or steam causing burn or scald injuries amongst children (Table 5.20).

Of the 17 hot object injuries, 29.4% (n=5) occurred in children living in high hill, 35.3% (n=6) in mid hill and 35.3% (n=6) in the lowland area. Overall, hot iron and other metals (n=7, 41.2%) and cooking or heating utensils (n=6, 35.3%) were the most common types of objects causing burn or scald injuries amongst children (Table 5.20).

Table 5.20 Cause of fire, burn or scald injury by geographical region

Injury events caused by fire, burns or scalds	Geographical region			
	Overall (%)	High hill (%)	Mid hill (%)	Lowland (%)
Cause of burns or scalds				
Flame	37 (55.2)	8 (38.1)	8 (47.1)	21 (72.4)
Hot liquid or steam	13 (19.4)	8 (38.1)	3 (17.6)	2 (6.9)
Hot object	17 (25.4)	5 (23.8)	6 (35.3)	6 (20.7)
Total	67 (100)	21 (100)	17 (100)	29 (100)
Source of flame				
Cooking fire	26 (70.3)	4 (50.0)	6 (75.0)	16 (76.2)
Heating fire	4 (10.8)	1 (12.5)	0 (0.0)	3 (14.3)
Workplace fire at home	2 (5.4)	2 (25.0)	0 (0.0)	0 (0.0)
Residential or house fire	3 (8.1)	1 (12.5)	0 (0.0)	2 (9.5)
Candles, lamps or lights	2 (5.4)	0 (0.0)	2 (25.0)	0 (0.0)
Total	37 (100)	8 (100)	8 (100)	21 (100)
Types of liquid/steam				
Cooking water or steam	4 (30.8)	3 (37.5)	1 (33.3)	0 (0.0)
Bathing water	2 (15.4)	1 (12.5)	1 (33.3)	0 (0.0)
Cooking oil	1 (7.7)	0 (0.0)	1 (33.3)	0 (0.0)
Tea, Coffee or Milk	4 (30.8)	2 (25.0)	0 (0.0)	2 (100)
Pressure cooker steam	2 (15.4)	2 (25.0)	0 (0.0)	0 (0.0)
Total	13 (100)	8 (100)	3 (100)	2 (100)
Types of hot object				
Cooking or heating utensils	6 (35.3)	2 (40.0)	2 (33.3)	2 (33.3)
Coal	3 (17.6)	0 (0.0)	3 (50.0)	0 (0.0)
Iron and other metals	7 (41.2)	3 (60.0)	0 (0.0)	4 (66.7)
Hot ashes	1 (5.9)	0 (0.0)	1 (16.7)	0 (0.0)
Total	17 (100)	5 (100)	6 (100)	6 (100)

5.4.5.3.3 Cuts or crush injuries

In total, 22% (53/242) children were injured due to cuts or crush injuries. Of this 53, 35.8% (n=19) occurred in children living in high hill, 22.7% (n=12) in mid hill and 41.5% (n=22) in lowland areas. Overall, 60.4% (n=32) cuts or crush injuries were due to knives or sickles, 17% (n=9) due to sharp wood or bamboo and 13.2% (n=7) were due to contact with broken glass. The proportion of cuts or crush injuries caused by blades, wires or fences (n=2, 3.8%), axe (n=1, 1.9%), spades or hoes (n=1, 1.9%) and straw or grass cutters and ploughs (n=1, 1.9%) was small. Overall, in most households (n=28, 52.8%), sharp objects were kept or stored outside the home (Table 5.21).

Table 5.21 Causes of cuts or crush injuries by geographical region

Injury event caused by cut or crush	**Geographical region**			
	Overall (%)	**High hill (%)**	**Mid hill (%)**	**Lowland (%)**
Categories of sharp objects				
Knife/Sickle	32 (60.4)	11 (57.9)	7 (58.3)	14 (63.6)
Axe	1 (1.9)	0 (0.0)	0 (0.0)	1 (4.5)
Spade or Hoes	1 (1.9)	1 (5.3)	0 (0.0)	0 (0.0)
Broken glass	7 (13.2)	1 (5.3)	2 (16.7)	4 (18.2)
Straw and grass cutter or plough	1 (1.9)	0 (0.0)	1 (8.3)	0 (0.0)
Blades, wires, fences or nails	2 (3.8)	2 (10.5)	0 (0.0)	0 (0.0)
Sharp wood or bamboo	9 (17.0)	4 (21.1)	2 (16.7)	3 (13.6)
Total	53 (100)	19 (100)	12 (100)	22 (100)
Locations that sharp objects were kept or stored				
Kitchen	4 (7.5)	0 (0.0)	3 (25.0)	1 (4.5)
Dining area	1 (1.9)	1 (5.3)	0 (0.0)	0 (0.0)
Bathroom or toilet	2 (3.8)	0 (0.0)	1 (8.3)	1 (4.5)
Storage room	1 (1.9)	0 (0.0)	0 (0.0)	1 (4.5)
Cattle shed	4 (7.5)	0 (0.0)	3 (25.0)	1 (4.5)
Outdoors	28 (52.8)	8 (42.1)	5 (41.7)	15 (68.2)
Single room dwelling	13 (24.5)	10 (52.6)	0 (0.0)	3 (13.6)
Total	53 (100)	19 (100)	12 (100)	22 (100)

5.4.5.3.4 Animal-related injuries

In total, 10% (n=24/242) of household injury was related to animals or insects in children aged <5 years. Of this 24, 33.4% (n=8) occurred in children living in the high hill, 20.8% (n=5) in mid hill and 45.8% (n=11) in lowland regions. Overall, 45.8% (n=11) injuries caused by animals were due to hornets, wasps or bees, 29.2% (n=7) were due to pet or stray dogs or cats, 12.5% (n=3) were from snakes and 12.5% (n=3) were from cattle or buffalo. Overall, bites (n=14, 58.3%) were the most common type of injury caused by animals, followed by stings (n=7, 29.2%) and horns, kicks, butting or impaling (n=3, 12.5%) (Table 5.22).

Table 5.22 Description of animal or insect-related injury events by geographical region

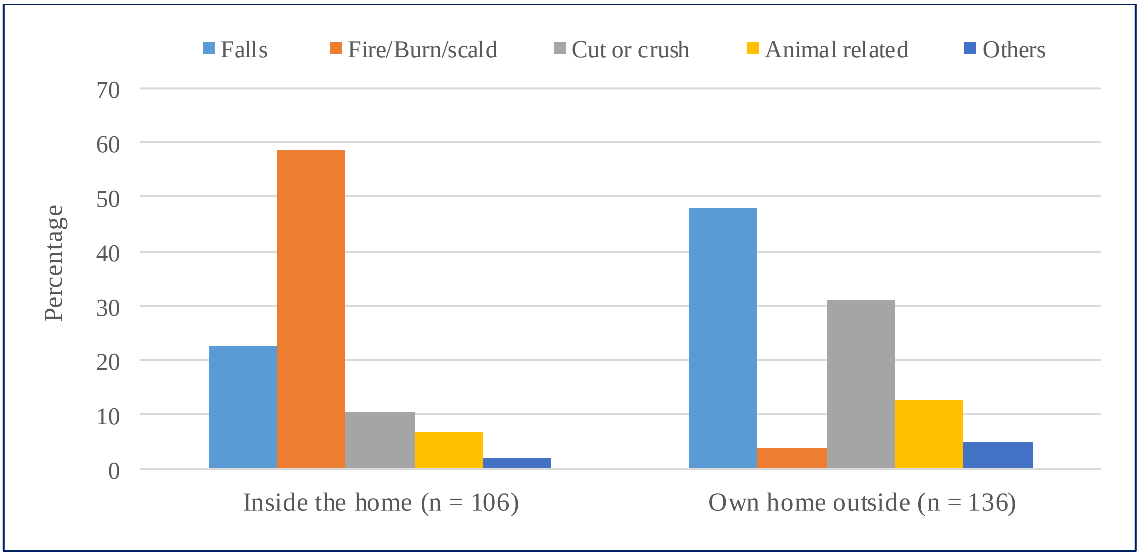
Injury events by animal or insect	Geographical region			
	Overall (%)	High hill (%)	Mid hill (%)	Lowland (%)
Type of animal or insect				
Pet or Stray dog or cat	7 (29.2)	1 (12.5)	2 (40.0)	4 (36.4)
Snake	3 (12.5)	0 (0.0)	0 (0.0)	3 (27.3)
Cattle or Buffalo	3 (12.5)	1 (12.5)	0 (0.0)	2 (18.2)
Hornet, Wasp or Bee	11 (45.8)	6 (75.0)	3 (60.0)	2 (18.2)
Total	24 (100)	8 (100)	5 (100)	11 (100)
Types of injuries caused by animals/insects				
Bite	14 (58.3)	4 (50.0)	2 (40.0)	8 (72.7)
Sting	7 (29.2)	3 (37.5)	3 (60.0)	1 (9.1)
Horn, kick, butting or impaling	3 (12.5)	1 (12.5)	0 (0.0)	2 (18.2)
Total	24 (100)	8 (100)	5 (100)	11 (100)

5.4.5.4 Injury events by location

5.4.5.4.1 Location where injury event occurred in home environment

Of the total injury events, 44% (n=106/242) occurred inside the home and 56% (n=136) occurred outdoors but within the home environment. Fires, burns or scalds were found to be the most common injury event occurred inside the home (n=62/106, 58%). Falls were found to be the most common injury event occurred outside the home environment (n=65/136, 47.8%) (Figure 5.13).

Figure 5.13 Location of injury event occurred in home environment (n = 242)



5.4.5.4.2 Location of injury events occurred inside the home

Inside the home, falls most commonly occurred in the living or sleeping areas (n=11/24, 45.8%). Fire-related injury, burns or scalds were most common in the kitchen (n=41/62, 66.1%), cuts or crush injuries (n=8/11, 72.7%) and animal-related injuries (n=4/7, 57.1%) most commonly occurred in single room dwellings. Overall, large proportion of injuries occurred in the kitchen (n=48/106, 48%) (Table 5.23).

Table 5.23 Location of injury events occurred inside the home

Injury mechanism	Kitchen (%)	Stairs within home (%)	Living/ Sleeping area (%)	Corridor/ Passage way (%)	Lobby/ porch/ Entrance (%)	Single room dwelling (%)
Falls (n=24)	4 (16.7)	2 (8.3)	11 (45.8)	0 (0.0)	4 (16.7)	3 (12.5)
Fire, Burns or scalds (n=62)	41 (66.1)	0 (0.0)	0 (0.0)	1 (1.6)	0 (0.0)	20 (32.3)
Cuts or crush injuries (n=11)	3 (27.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (72.7)
Animal-related (n=7)	0 (0.0)	3 (42.9)	0 (0.0)	0 (0.0)	0 (0.0)	4 (57.1)
Other (n=2)	0 (0.0)	1 (50.0)	0 (0.0)	1 (50.0)	0 (0.0)	0 (0.0)
All injuries (n=106)	48 (45.3)	6 (5.7)	11 (10.4)	2 (1.9)	4 (3.8)	35 (33.0)

5.4.5.4.3 Location of injury event occurred outdoors but within the home environment

Outside the home environment, most injury events occurred in the courtyard area (Table 5.24).

Table 5.24 Location of injury events occurring outdoors but within home environment

Injury mechanism	Balcony (%)	Stairs outside home (%)	Courtyard (%)	Kitchen garden (%)	Others (%)
Falls (n=65)	2 (3.1)	6 (9.2)	36 (55.4)	18 (27.7)	3 (4.6)
Fire, Burns or scalds (n=5)	0 (0.0)	0 (0.0)	4 (80.0)	1 (20.0)	0 (0.0)
Cuts or crush injuries (n=42)	1 (2.4)	0 (0.0)	24 (57.1)	13 (31.0)	4 (9.5)
Animal-related (n=17)	2 (11.8)	0 (0.0)	11 (64.7)	3 (17.6)	1 (5.9)
Others (n=7)	1 (14.3)	0 (0.0)	2 (28.6)	1 (14.3)	3 (42.9)
All injuries (n=136)	6 (4.4)	6 (4.4)	77 (56.6)	36 (26.5)	11 (8.1)

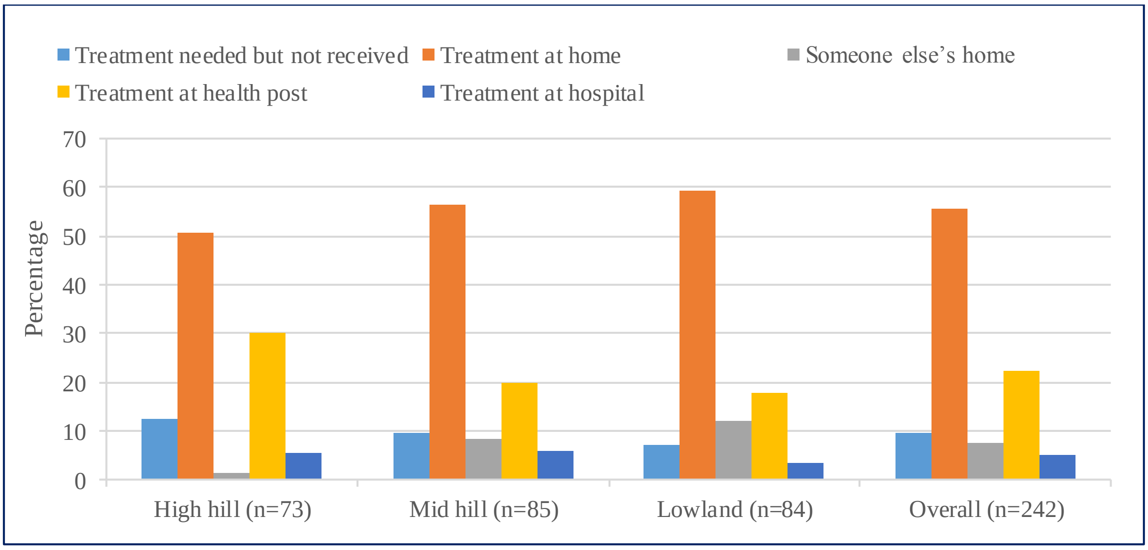
5.4.5.4.4 Location where the child was treated

More than 50% (n=135) of injured children received treatment in their own homes and 22.3% (n=54) at a health post. This trend was similar across all geographical regions. Caregivers/parents reported that it was normal practice to provide basic treatment at home if the child had a minor injury. Children were taken to a health post or hospital only in the case of a major injury (Table 5.25, Figure 5.14).

Table 5.25 Location of treatment for injured children by geographical region

Location of treatment	Geographical region			
	Overall n=242 (%)	**High hill n=73 (%)**	**Mid hill n=85 (%)**	**Lowland n=84 (%)**
Treatment needed but not received	23 (9.5)	9 (12.3)	8 (9.4)	6 (7.1)
Treatment at home	135 (55.8)	37 (50.7)	48 (56.5)	50 (59.5)
Another home	18 (7.4)	1 (1.4)	7 (8.2)	10 (11.9)
Treatment at health post	54 (22.3)	22 (30.1)	17 (20.0)	15 (17.9)
Treatment at hospital	12 (5.0)	4 (5.5)	5 (5.9)	3 (3.6)

Figure 5.14 Location of treatment for injured children by geographical region



5.4.5.4.5 Application for safety measures

Out of 242 injury events, safety measures (improving home environment) were applied for 7.4% (n=18) cases to prevent the reoccurrence of such injuries in future. Safety measures were more likely to be applied in the mid hill region (n=13, 15.3%) than in the high hill (n=4, 5.5%) and lowland areas (n=1, 1.2%) (Table 5.26).

Table 5.26 Application of safety measures after an injury event by geographical region

Safety measures applied	Geographical region			
	Overall n=242 (%)	**High hill n=73 (%)**	**Mid hill n=85 (%)**	**Lowland n=84 (%)**
No	224 (92.6)	69 (94.5)	72 (84.7)	83 (98.8)
Yes	18 (7.4)	4 (5.5)	13 (15.3)	1 (1.2)
Total	242 (100)	73 (100)	85 (100)	84 (100)

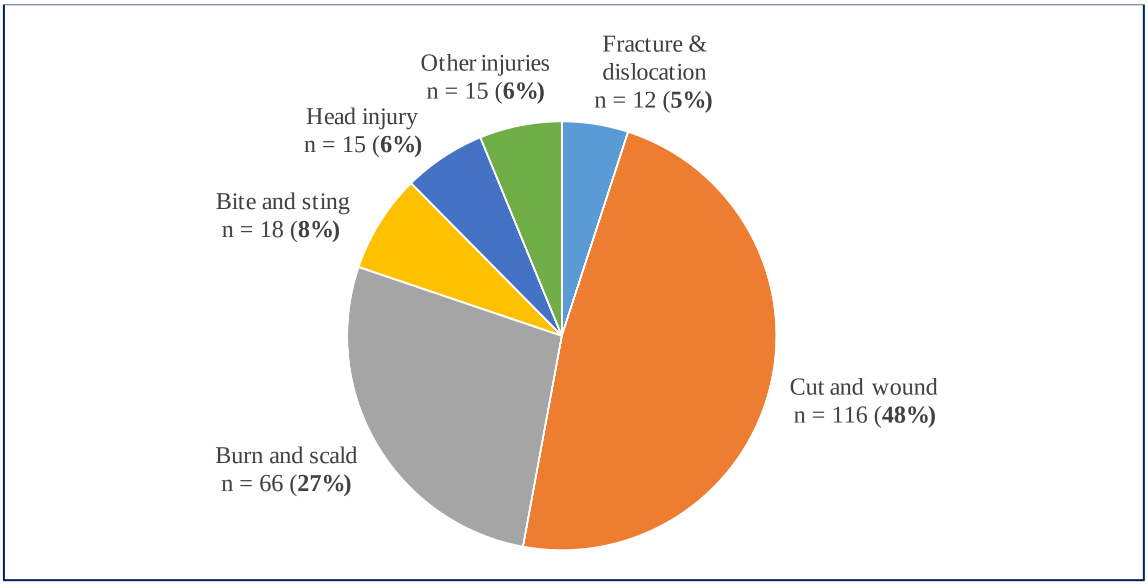
5.4.5.5 Number and rate of injury sustained (Outcome)

This section describes the proportion of injuries sustained by children and the number and rate of specific injury types. Rate and number of different types of injuries are presented overall, by each region, by age group, by sex and by ethnicity. 1 child death was reported as a result of an insect bite (scorpion) within the recall period of this study but there were no other deaths due to unintentional injury in the home.

5.4.5.5.1 Proportions of injury sustained

The most common type of injury reported were cuts and wounds (n=116, 48%), which accounted for almost half of the total reported injuries. The second most common type of injury were burns and scalds (n=66, 27%) that accounted for more than a quarter of the total injuries (Figure 5.15). 6% (n=15) of other injuries sustained by children were eye injuries (n=3, 1.2%), near-drowning (n=1, 0.4%), bruising and swelling (n=3, 1.2%), a foreign body in an orifice (n=1, 0.4%) and the rest had no visible injury (n=7, 2.9%).

Figure 5.15 Proportions of different types of injury sustained by children (n = 242)



5.4.5.5.2 Number and rate of injury types (Over all regions)

The number and rates varied according to the type of injury. The rates of cuts and wounds were highest amongst children aged <5 years (111.3 per 1000; 95%CI: 92.9-132). The rate of burns and scalds had the second highest incidence, followed by bites and stings, head injuries and then other injuries. The rate of fracture and dislocation was the least common (Table 5.27).

Table 5.27 Number and rate of injury by injury type (Over all regions)

Injury types	Total children (n = 1042)		
	Injured (n = 242)	**Injury rate/1000**	**95% CI**
Cuts and wounds	116	111.3	92.9 - 132.0
Burns and scalds	66	63.3	49.3 - 79.9
Bites and stings	18	17.3	10.3 - 27.2
Head injury	15	14.4	8.0 - 23.6
Fracture and dislocation	12	11.5	6.0 - 20.0
Other injuries	15	14.4	8.0 - 23.6

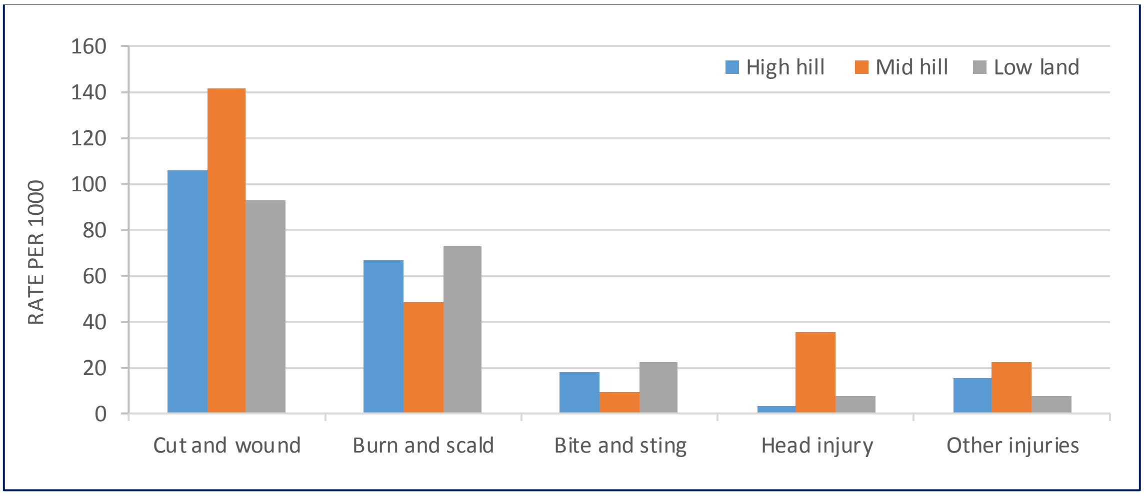
5.4.5.5.3 Number and rate of injury type by different region

The highest rates of cut and wound injuries (141.5/1000), fractures and dislocations (16.1/1000), head injuries (35.4/1000) and other injuries (22.5/1000) were observed in the mid hill region. The rates of burn and scald injuries (72.5/1000) and bites and stings (22.5/1000) were highest in the lowland area (Table 4=5.28, Figure 5.16).

Table 5.28 Number and rate of injury by injury type and geographical region

Injury type	Geographical region					
	High hill (n = 331)		**Mid hill (n = 311)**		**Lowland (n = 400)**	
	Injured	Rate/1000	Injured	Rate/1000	Injured	Rate/1000
Cuts and wounds	35	105.7	44	141.5	37	92.5
Burns and scalds	22	66.5	15	48.2	29	72.5
Bites and stings	6	18.1	3	9.6	9	22.5
Head injury	1	3.0	11	35.4	3	7.5
Fracture and dislocation	4	12.1	5	16.1	3	7.5
Other injuries	5	15.1	7	22.5	3	7.5

Figure 5.16 Rate of injury by injury type and geographical region (per 1000 children)



5.4.5.5.4 Number and rate of injury type by age group

Table 5.29 and figure 5.17 show the number and rate of different injuries sustained by children at different ages.

The rate of cut and wound injuries gradually increased from young age to 47 months and fell for 48-59 months. The rate of cut and wound injuries was highest (169.7/1000) amongst children aged 36-47 months and lowest (30.9/1000) in those aged <12 months.

The rate of burn and scald injuries were 74.1 per 1000 among the children aged <12 months and reached their peak (101.3/1000) amongst children aged 12-23 months. The rate of burn and scald injuries decreased (74.9/1000) for children aged 24-35 months and sharply decreased for children aged 36-59 months (36/1000).

The rate of bite and sting injuries were relatively constant across all age groups except in children aged <12 months, where the rate of bite and sting injuries was very low (6.2/1000).

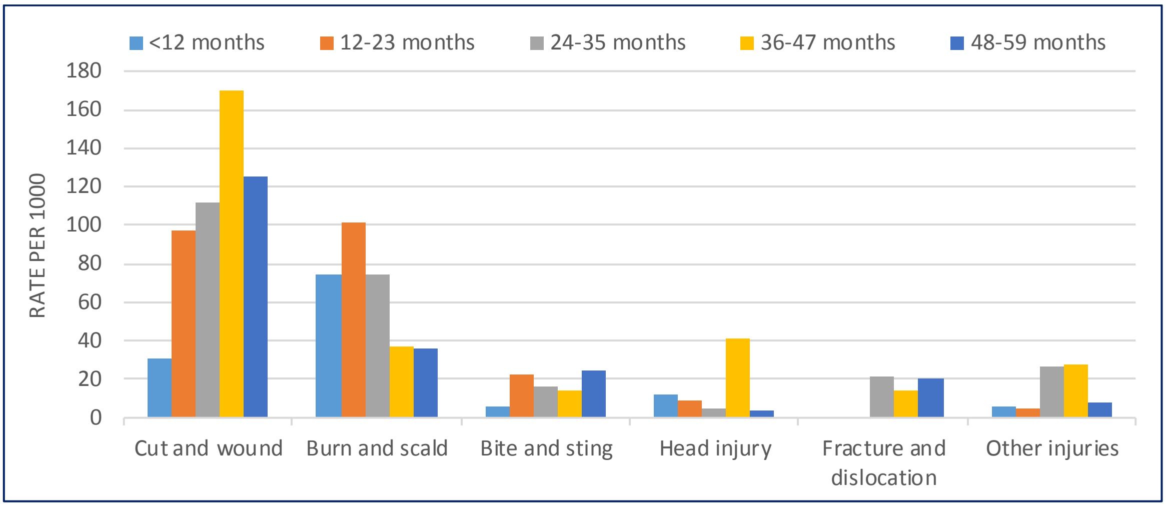
Head injury rate was observed to be highest amongst children aged 36-47 months. The rate in other age groups was relatively constant and low.

There were no fracture and dislocation injuries in very young children (0-23 months). The rate of fracture and dislocation injury was marginally higher amongst children aged 24-35 months (21.4/1000) than in those aged 48-59 months (20.2/1000).

Table 5.29 Number and rate of injury by injury type and age group (per 1000 children)

Injury type	<12 months (n = 162)		12-23 months (n = 227)		24-35 months (n = 187)		36-47 months (n = 218)		48-59 months (n = 248)	
	Inj.	Rate	Inj.	Rate	Inj.	Rate	Inj.	Rate	Inj.	Rate
Cuts and wounds	5	30.9	22	96.9	21	112.3	37	169.7	31	125.0
Burns and scalds	12	74.1	23	101.3	14	74.9	8	36.7	9	36.3
Bites and stings	1	6.2	5	22.0	3	16.0	3	13.8	6	24.2
Head injury	2	12.3	2	8.8	1	5.3	9	41.3	1	4.0
Fracture or dislocation	0	0.0	0	0.0	4	21.4	3	13.8	5	20.2
Other injuries	1	6.2	1	4.4	5	26.7	6	27.5	2	8.1

Figure 5.17 Rates of injury by injury type and age group (per 1000 children)



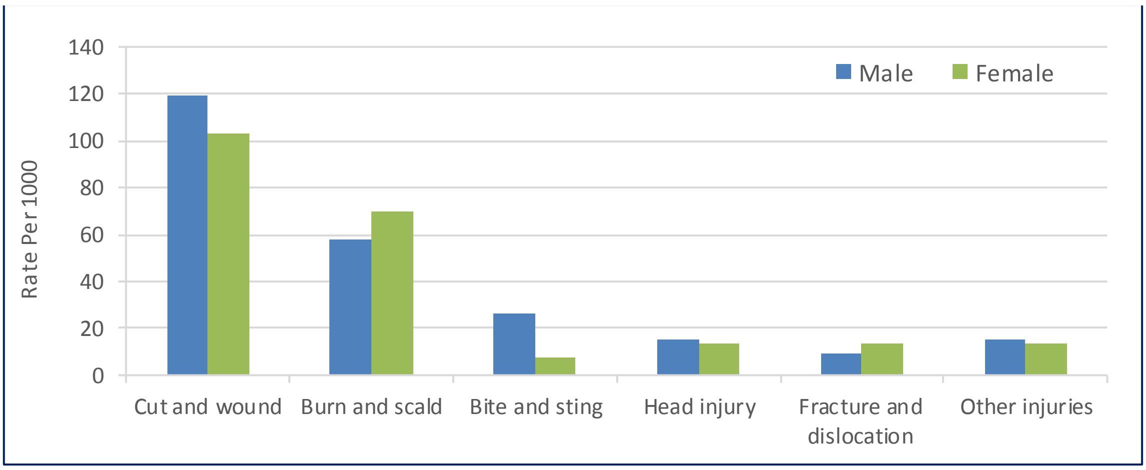
5.4.5.5.5 Number and rate of injury type by sex

The rates of cut and wound injuries, bite and sting injuries and head injuries were higher in male children, whilst burn and scald injuries and fracture and dislocation injury were more common in female children (Table 5.30, Figure 5.18).

Table 5.30 Number and rate of injury by injury type and sex

Injury type	Male (n = 538)		Female (n = 504)	
	Injured	Rate/1000	Injured	Rate/1000
Cuts and wounds	64	119.0	52	103.2
Burns and scalds	31	57.6	35	69.4
Bites and stings	14	26.0	4	7.9
Head injury	8	14.9	7	13.9
Fracture and dislocation	5	9.3	7	13.9
Other injuries	8	14.9	7	13.9

Figure 5.18 Rate of injury by injury type and sex (per 1000 children)



5.4.5.5.6 Number injured by injury type and ethnic group

The types of injury sustained by children also varied by ethnic group in the surveyed households. However, due to the small number of children in each injury type category in some ethnic groups, injury rates were not calculated (Table 5.31).

Table 5.31 Number injured by injury type and ethnicity

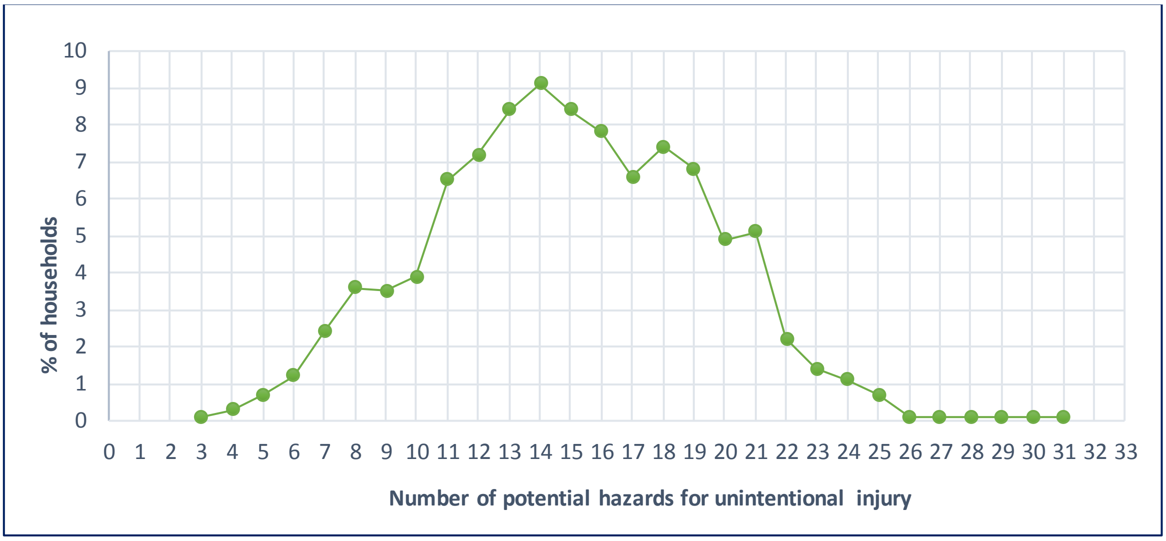
Injury types	**Dalit** (n = 36)	**Disadvantaged Janajatis** (n = 751)	**Relatively adv. Janajatis** (n = 8)	**Upper caste groups** (n = 234)	**Others** (n = 13)
Cuts & wounds (n=116)	2	82	2	28	2
Burns & scalds (n=66)	3	47	0	15	1
Bites & stings (n=18)	0	16	0	2	0
Head injury (n=15)	0	5	0	10	0
Fracture & dislocation (n=12)	0	7	0	5	0
Other injuries (n=15)	0	6	1	8	0

5.4.6 Description of home injury hazards

5.4.6.1 Households with hazards (Overall region)

In total, the mean number of injury hazards was 14.98 (SD = 4.48) in all surveyed households (n=740) with a range of 3-31 (Figure 5.19).

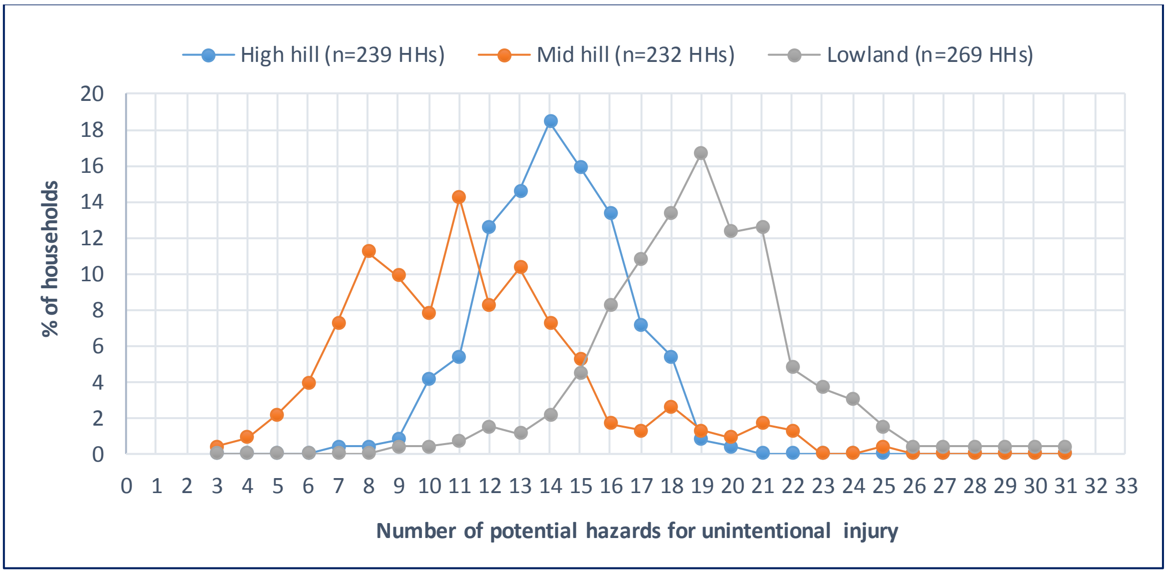
Figure 5.19 Distribution of households (HHs) with number of hazards (Overall region, n=740 HHs)



5.4.6.2 Household hazards in different regions

The number of injury hazards was highest in the lowland region (mean 18.93, SD = 3.15, range 9-31) followed by high hill (mean 14.1, SD 2.22, range 7-20) and mid hill areas (mean 11.29, SD 3.86, range 3-25) (Figure 5.20).

Figure 5.20 Distribution of households with number of hazards by geographical region



5.4.6.3 Prevalence of home injury hazards for unintentional childhood injury

This section describes childhood home injury risk identified from the household observation. The data are presented in tables to summarise the number and proportion of household with hazards for each injury mechanism. Percentages calculated only for applicable case (Yes + No) and only numbers are presented for not applicable (NA) cases. (Please also see a Table 5.40 that clarifies how a hazard is defined)

5.4.6.3.1 Home hazards for falls

Overall, the absence of protective railings on stairs or ladders, the absence of guards or rails in windows and the absence of bars or railings on balconies were identified as the most common hazards for falls. It was observed that 1.8% (n=13/740) of households did not had stairs or ladders. Of those households with stairs and ladders, 98.1% (n=713/727) did not have protective handrails along both sides. The window was not protected by guards or rails in 83.6% (n=552/660) of households. About 62.7% (n=464/740) households did not have a balcony and of those that had balcony, it was not protected by a railing in 50% (n=138/276) of households. Stairs or ladders without protective handrails and windows without protective guard's rails were consistently identified as the most common hazards for falls across all regions.

The proportion of households that had a baby walker accessible to children aged <18 months was highest in the high hill region. In the high hill region, baby walkers were accessible to children aged <18 months in 79% (n=23/29) of the households. However, in the mid hill area, baby walkers were only accessible to children in 4.7% (n=10/212) of the households. Baby walkers were not accessible to children aged <18 months in any households in the lowland.

The proportion of households with a balcony and without a protective bar or railing was higher in the mid hill region than the other two regions. In the mid hill area, the balcony was not protected by a bar or railing in 60.7% (n=88/145) of the households (Table 5.32).

Table 5.32 Proportion of households (HHs) with hazards for falls

Identified hazards for fall	Overall ($N^{\#}$=740 HHs)			High hill ($N^{\#}$=239 HHS)			Mid hill ($N^{\#}$=232 HHs)			Lowland ($N^{\#}$=269 HHs)		
	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**
	n (%)	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)
Protective handrails absent along both sides of stairs or ladder	13	713 (98.1)	14 (1.9)	2	231 (97.5)	6 (2.5)	10	217 (97.7)	5 (2.3)	1	265 (98.9)	3 (1.1)
Window without protective guards or rails	80	552 (83.6)	108 (16.4)	1	203 (85.3)	35 (14.7)	0	185 (79.7)	47 (20.3)	79	164 (86.3)	26 (13.7)
Balcony without protective bars or railings	464	138 (50.0)	138 (50.0)	186	12 (22.6)	41 (77.4)	87	88 (60.7)	57 (39.3)	191	38 (48.7)	40 (51.3)
Large objects like book shelves, TVs, entertainment units, furniture etc. are unstable on their own or unsecured to the walls	159	135 (23.2)	446 (76.8)	156	13 (15.7)	70 (84.3)	2	11 (4.8)	219 (95.2)	1	111 (41.4)	157 (58.6)
Furniture (table, stools, chairs etc.) close to window, ceiling fans, balcony or rooftop's railing	202	108 (20.1)	430 (79.9)	122	15 (12.5)	102 (87.5)	5	14 (6.2)	213 (93.8)	75	79 (40.7)	115 (59.3)
Shower or bathing area with slippery surface	1	99 (13.4)	640 (86.6)	0	27 (11.3)	212 (88.7)	0	54 (23.3)	178 (76.7)	1	18 (6.7)	250 (93.3)
Walking area with cluttering items, telephone or electrical cords and other obstacles	87	53 (8.1)	600 (91.9)	41	6 (3.0)	192 (97.0)	5	9 (4.0)	218 (96.0)	41	38 (16.7)	190 (83.3)
Baby walkers accessible to child aged <18 months	303	33 (7.6)	404 (92.4)	210	23 (79.3)	6 (20.7)	20	10 (4.7)	202 (95.3)	73	0 (0.0)	196 (100)
Indoor walking areas not adequately lit	9	24 (3.3)	707 (96.7)	1	18 (7.6)	220 (92.4)	4	3 (1.3)	225 (98.7)	4	3 (1.1)	262 (98.9)
Stairs, balconies, porches or patios with slippery surface or liquid, grease or water on the floor	18	19 (2.6)	703 (97.4)	7	5 (2.2)	227 (97.8)	10	4 (1.8)	218 (98.2)	1	10 (3.7)	258 (96.3)

Notes: *NA = Not Applicable;*
$N^{\#}$ = (NA + Yes + No); Percentages calculated only from applicable cases (Yes + No) =100;
Yes = Hazard because of absence of protective measures for corresponding household structures/items;*
*No** = Safe because of presence of protective measures for corresponding household structures/items.*

5.4.6.3.2 Home hazards for fire-related, burn or scald injuries

Overall, cooking stoves were within the reach of young children, there was a lack of barrier or door between the sleeping and cooking areas and flammable items left within the reach of children were identified as the most common hazards for fire-related injury, burns or scalds. Cooking stoves were often within the reach of the child in 98.4% (n=728/740) of the households. In less than 2% (n=12/740) households, cooking stoves were kept in safe place. All the households in study area had cooking stoves. Many households with both sleeping and cooking areas (n=736/740, 99.5%) did not have any barrier or door between them (n=315/736, 42.8%). Flammable items such as matches/, lighters or fuels (e.g. paraffin or kerosene) were within the reach of the child in 42.1% (n=310/736) of the households and in 57.8% (n=426/736) of households these flammable items were kept safe.

Having a cooking stove within reach of the child was also identified as the most common hazard for burns and scalds across all regions. All the households in the high hill (n=239/239, 100%) and lowland (269/269, 100%) regions had cooking stoves that were within reach of the child. About 95 % (n=220/232) households in the mid hill region had cooking stoves that were within reach of the child. In the high hill area, hot iron or other hot appliances (e.g. hair straighteners) were within the reach of the child in 77.8% (n=14/18) of households that had hot irons or other hot appliances. The proportion of households that had kerosene lamps or candles were within the reach of the child when used was highest in the lowlands. In this region, kerosene lamps or candles were within the reach of the child in 90.9% (n=30/33) of the households that had kerosene lamps or candles (Table 5.33).

Table 5.33 Proportion of households (HHs) with hazards for fire-related injury, burns or scalds

Identified hazards for fire-related injury, burns or scalds	Overall ($N^{\#}$=740 HHs)			High hill ($N^{\#}$=239 HHS)			Mid hill ($N^{\#}$=232 HHs)			Lowland ($N^{\#}$=269 HHs)		
	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**
	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)
Cooking stoves within reach of the child	0	728 (98.4)	12 (1.6)	0	239 (100)	0 (0.0)	0	220 (94.8)	12 (5.2)	0	269 (100)	0 (0.0)
Lack of barrier or door between sleeping and cooking areas	4	315 (42.8)	421 (57.2)	0	95 (39.7)	144 (60.3)	3	51 (22.3)	178 (77.7)	1	169 (63.1)	99 (36.9)
Flammable items such as matches, lighters and fuels (e.g. paraffin or kerosene) within reach of the child	4	310 (42.1)	426 (57.9)	0	74 (31.0)	165 (69.0)	2	101 (43.9)	129 (56.1)	2	135 (50.6)	132 (49.4)
Kerosene lamps or candles within reach of the child when in use	421	111 (34.8)	208 (65.2)	87	22 (14.5)	130 (85.5)	98	59 (44.0)	75 (56.0)	236	30 (90.9)	3 (9.1)
Hot irons or other appliances (e.g. hair straighteners) within reach of the child	633	21 (19.6)	86 (80.4)	221	14 (77.8)	4 (22.2)	148	5 (6.0)	79 (94.0)	264	2 (40.0)	3 (60.0)

Notes: *NA = Not Applicable;*
$N^{\#}$ = (NA + Yes + No); Percentages calculated only from applicable cases (Yes + No) =100;
Yes = Hazard because of absence of protective measures for corresponding household structures/items;*
*No** = Safe because of presence of protective measures for corresponding household structures/items.*

5.4.6.3.3 Home hazards for cuts or crush injuries

Overall, sharp or hard protruding components and breakable objects within reach of young children were identified as the most common hazards for cut injuries. Sharp or hard protruding components like big stones, pieces of wood, woodpiles, old machinery etc. were often within the reach of children in 82.9% (n=609/735) of the households that had these objects (n=735/740, 99.3%). Breakable objects like bottles or dishes made by glass or mud were often within the reach of young children in 79.4% (n=545/686) of the households and these breakable objects were kept safe only in 20.6% (n=141/686) of households.

It was observed that the proportion of households that had sharp or hard protruding components within reach of the child was greatest in the high hill region where sharp or hard protruding components were within reach of children in 97.5% (n=232/238) of the households. Only in 2.5%

(n=6/238) of households these objects were out of child reach. The proportion of households that had breakable objects, sharp equipment designed for agricultural purposes and sharp items such as knives, scissors, razors etc. within reach of children was greatest in the lowlands in comparison to the other two regions (Table 5.34).

Table 5.34 Proportion of households (HHs) with hazards for cuts or crush injuries

Identified hazards for cuts or crush injuries	Overall ($N^{\#}$=740 HHs)			High hill ($N^{\#}$=239 HHS)			Mid hill ($N^{\#}$=232 HHs)			Lowland ($N^{\#}$=269 HHs)		
	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**
	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)
Sharp or hard protruding components (e.g. big stones or pieces of wood, woodpiles, old machinery etc.) within reach of the child	5	609 (82.9)	126 (17.1)	1	232 (97.5)	6 (2.5)	2	131 (57.0)	99 (43.0)	2	246 (92.1)	21 (7.9)
Breakable objects (e.g. bottles or any dishes made by glass or mud etc.) within reach of the child	54	545 (79.4)	141 (20.6)	24	176 (81.9)	39 (18.1)	30	109 (54.0)	93 (46.0)	0	260 (96.7)	9 (3.3)
Sharp equipment designed for agriculture purpose (e.g. axe, sickle, spade etc.) within reach of the child	2	458 (62.1)	280 (37.9)	1	76 (31.9)	162 (68.1)	1	119 (51.5)	112 (48.5)	0	263 (97.8)	6 (2.2)
Sharp items such as knives, scissors, razors etc. within reach of the child	0	413 (55.8)	327 (44.2)	0	52 (21.8)	187 (78.2)	0	106 (45.7)	126 (54.3)	0	255 (94.8)	14 (5.2)

Notes: *NA = Not Applicable;*
$N^{\#}$ = (NA + Yes + No); Percentages calculated only from applicable cases (Yes + No) =100;
Yes = Hazard because of absence of protective measures for corresponding household structures/items;*
*No** = Safe because of presence of protective measures for corresponding household structures/items.*

5.4.6.3.4 Home hazards for animal related injury

It was observed that cattle sheds were not protected by a proper fence in 90.6% (n=646/713) of the households that had cattle shed (n=713/740, 96.4%). That means, only 10% (n=67/713) households had cattle sheds with adequate fencing. The proportion of households without protective fences around the cattle sheds were 80.5% (n=190/236) in high hill and 90.1% (n=191/212) in mid hill regions. No households in the lowlands had adequate fences around the cattle shed (n=265/265, 100%) (Table 5.35).

Table 5.35 Proportion of households (HHs) with a hazard for animal related injury

Identified hazards for animal injury	Overall ($N^{\#}$=740 HHs)			High hill ($N^{\#}$=239 HHS)			Mid hill ($N^{\#}$=232 HHs)			Lowland ($N^{\#}$=269 HHs)		
	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**
	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)
Cattle sheds without adequate fencing	27	646 (90.6)	67 (9.4)	3	190 (80.5)	46 (19.5)	20	191 (90.1)	21 (9.9)	4	265 (100)	0 (0.0)

Notes: *NA = Not Applicable;*
$N^{\#}$ = (NA + Yes + No); Percentages calculated only from applicable cases (Yes + No) =100;
Yes = Hazard because of absence of protective measures for corresponding household structures/items;*
*No** = Safe because of presence of protective measures for corresponding household structures/items.*

5.4.6.3.5 Home hazards for drowning

It was observed that bodies of water like ponds, lakes and streams were not protected in 95.9% (n=307/320) households that had a body of water in the home environment. About 57% (n=420/740) households did not have bodies of water around the home environment. Open holds or vats designed to feed the cattle were commonly within the reach of the child in 87.1% (n=606/696) households that had open holds or vat. Open containers of water or other liquids were within the reach of child in 83.6% (n=613/733) of the households. Ditches and pools of water around houses were accessible to children in 52.1% (n=198/380) of households.

The proportion of households with drowning hazards was higher in the lowland region in comparison to others. However, open holds or vats designed to feed the cattle being within reach of children was observed as the most common hazard for drowning in the high hill region. Open holds or vats were within reach of the child in 97.7% (n=216/221) of households. Unprotected water bodies near the house was identified as the most common hazard for drowning in the mid hill region. Unprotected water bodies were within the reach of the child in 96.2% (n=127/132) of the households (Table 5.36).

Table 5.36 Proportion of households (HHs) with hazards for drowning

Identified hazards for drowning	Overall (N#=740 HHs)			High hill (N#=239 HHS)			Mid hill (N#=232 HHs)			Lowland (N#=269 HHs)		
	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**
	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)
Unprotected bodies of water (pond, lake, stream etc.) near the house (within 100 meters)	420	307 (95.9)	13 (4.1)	189	44 (88.0)	6	100	127 (96.2)	5 (3.8)	131	136 (98.6)	2 (1.4)
Open holds or vats designed to feed cattle within reach of the child	44	606 (87.1)	90 (12.9)	18	216 (97.7)	5	24	128 (61.5)	80 (38.5)	2	262 (98.1)	5 (1.9)
Open container of water or other liquids within reach of the child	7	613 (83.6)	120 (16.4)	1	171 (71.8)	67	5	177 (78.0)	50 (22.0)	1	265 (98.9)	3 (1.1)
Ditches or pool of water around the house within reach of the child	360	198 (52.1)	182 (47.9)	91	52 (35.1)	96	48	101 (54.9)	83 (45.1)	221	45 (93.8)	3 (6.2)

Notes: *NA = Not Applicable;*
$N^{\#}$ = (NA + Yes + No); Percentages calculated only from applicable cases (Yes + No) =100;
Yes = Hazard because of absence of protective measures for corresponding household structures/items;*
*No** = Safe because of presence of protective measures for corresponding household structures/items.*

5.4.6.3.6 Home hazards for poisoning

Overall, alcoholic beverages, agricultural chemicals or fertilizers, tobacco products and candles or fuels left within reach of the child were identified as the most common hazards for poisoning. Alcoholic beverages were within the reach of the child in 91.5% (n=465/508) of the households that alcoholic beverages. Similarly, agricultural chemicals or fertilizers were within the reach of the child in 61.5% (n=338/550) of the households. Tobacco products were within the reach of the child in 45.3% (n=223/492) of the households. Candles or fuels (e.g. kerosene, cooking oil, petrol, diesel, gas etc.) were within the reach of the child in 44.4% (n=325/732) of the households that had candles or fuels.

The proportion of households that had alcoholic beverages, agricultural chemicals or fertilizers and tobacco products within reach of young children was greatest in the high hill region. The proportion of households that had candles or fuels and poisonous plants within reach of the child was greatest in the lowland region. In the lowlands, candles or fuels were within the reach of child in 76% (n=199/262) of the households and poisonous plants were within the reach of the child in 93.3% (n=14/15) of the households (Table 5.37).

Table 5.37 Proportion of households (HHs) with hazards for poisoning

Identified hazards for poisoning	Overall ($N^{\#}$=740 HHs)			High hill ($N^{\#}$=239 HHS)			Mid hill ($N^{\#}$=232 HHs)			Lowland ($N^{\#}$=269 HHs)		
	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**
	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)
Alcoholic beverages within reach of the child	232	465 (91.5)	43 (8.5)	28	205 (97.2)	6 (2.8)	154	62 (79.5)	16 (20.5)	50	198 (90.4)	21 (9.6)
Agricultural chemicals or fertilizers within reach of the child	190	338 (61.5)	212 (38.5)	2	195 (82.3)	42 (17.7)	77	22 (14.2)	133 (85.8)	111	121 (76.6)	37 (23.4)
Tobacco products within reach of the child	248	223 (45.3)	269 (54.7)	64	123 (70.3)	52 (29.7)	99	10 (7.5)	123 (92.5)	85	90 (48.9)	94 (51.1)
Candles or fuels (e.g. kerosene, cooking oil, petrol, diesel, gas etc.) within reach of the child	8	325 (44.4)	407 (55.6)	0	80 (33.5)	159 (66.5)	1	46 (19.9)	185 (80.1)	7	199 (76.0)	63 (24.0)
Cosmetics (e.g. lipsticks, cream, nail polish etc.) within reach of the child	24	201 (28.1)	515 (71.9)	11	79 (34.6)	149 (65.4)	1	22 (9.5)	209 (90.5)	12	100 (38.9)	157 (61.1)
Cleaning products, chemicals, bleaches, acids and detergents within reach of the child	150	159 (26.9)	431 (73.1)	148	33 (36.3)	58 (63.7)	1	40 (17.3)	191 (82.7)	1	86 (32.1)	182 (67.9)
Toiletries such as shampoos, soaps, toothpastes within reach of the child	0	158 (21.4)	582 (78.6)	0	28 (11.7)	211 (88.3)	0	41 (17.7)	191 (82.3)	0	89 (33.1)	180 (66.9)
Poisonous plants within reach of the child	477	48 (18.3)	215 (81.7)	217	15 (68.2)	7 (31.8)	6	19 (8.4)	207 (91.6)	254	14 (93.3)	1 (6.7)
Medicines and vitamins within reach of the child	261	74 (15.4)	405 (84.6)	75	27 (16.5)	137 (83.5)	2	20 (8.7)	210 (91.3)	184	27 (31.8)	58 (68.2)

Notes: *NA = Not Applicable;*
$N^{\#}$ = (NA + Yes + No); Percentages calculated only from applicable cases (Yes + No) =100;
Yes = Hazard because of absence of protective measures for corresponding household structures/items;*
*No** = Safe because of presence of protective measures for corresponding household structures/items.*

5.4.6.3.7 Home hazards for electric shock

Overall, electrical cables within the reach of young children were identified as the most common hazard relating to electric shocks, followed by electrical switches or plug points and unsafe electric wiring. Electrical cables were within reach of the child in 12.6% (n=77/611) of the households that had electrical cables (n=611/740, 82.6%). That means only in 17.4% (n=129/740) households did not have electric cables. Of the households that had electrical switches or plug points, these were within the reach of the child in 8% (n=49/610). It was also observed that electric wiring was not safe in 5.6% (n=34/607) of the households. About 18% (n=133/740) did not have electric wiring.

Keeping electrical cables within reach of the child was the predominant hazard for electric shocks in the lowland region. In this region, electrical cables were within the reach of the child in 31.3% (n=70/224) of the households. The proportion of households with hazards related to electric shocks were highest in the lowland region (Table 5.38).

Table 5.38 Proportion of households (HHs) with hazards for electric shock

Identified hazards for electric shock	Overall ($N^{\#}$=740 HHs)			High hill ($N^{\#}$=239 HHS)			Mid hill ($N^{\#}$=232 HHs)			Lowland ($N^{\#}$=269 HHs)		
	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**
	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)
Electrical cables within reach of the child	129	77 (12.6)	534 (87.4)	77	2 (1.2)	160 (98.8)	7	5 (2.2)	220 (97.8)	45	70 (31.3)	154 (68.7)
Electrical switches or plug points within reach of the child	130	49 (8.0)	561 (92.0)	77	6 (3.7)	156 (96.3)	9	4 (1.8)	219 (98.2)	44	39 (17.3)	186 (82.7)
Unsafe electric wiring	133	34 (5.6)	573 (94.4)	77	4 (2.5)	158 (97.5)	11	6 (2.7)	215 (97.3)	45	24 (10.7)	200 (89.3)

Notes: *NA = Not Applicable;*
$N^{\#}$ = (NA + Yes + No); Percentages calculated only from applicable cases (Yes + No) =100;
Yes = Hazard because of absence of protective measures for corresponding household structures/items;*
*No** = Safe because of presence of protective measures for corresponding household structures/items.*

5.4.6.3.8 Home hazards for suffocation/choking

Overall, plastic bags within reach of the child were identified as the most common hazard for suffocation or choking followed by small food and small objects that left within reach of the child. Plastic bags were within the reach of the child in 52.2% (n=344/659) of the households. No plastic bags were found stored or kept in 10.9% (n=81/740) of households. Similarly, small food items such as peanuts, beans, seeds or grains were within the reach of the child in 49.8% (324/651) of the households that had food items. Small objects such as marbles, coins, buttons, toys and loose or spare batteries were within the reach of the child in 39.5% (n=272/688) of the households that had these small objects.

Small food items being left within reach of the child was observed as the most common hazard for suffocation or choking in the high hill region. In the high hill, small food items were within the reach of the child in 84.8% (n=201/237) of the households. Compared to other two regions, in lowland, storing plastic bags and small objects within reach of young children was the predominant hazard for suffocation or choking. Where, 92.5% (n=247/267) and 62.3% (n=154/247) households had plastic bags and small objects within child's reach respectively (Table 5.39).

Table 5.39 Proportion of households (HHs) with hazards for suffocation or choking

Identified hazards for suffocation or choking	Overall ($N^{\#}$=740 HHs)			High hill ($N^{\#}$=239 HHS)			Mid hill ($N^{\#}$=232 HHs)			Lowland ($N^{\#}$=269 HHs)		
	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**	NA	Yes*	No**
	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)	n	n (%)	n (%)
Plastic bags within reach of the child	81	344 (52.2)	315 (47.8)	69	47 (27.6)	123 (72.4)	10	50 (22.5)	172 (77.5)	2	247 (92.5)	20 (7.5)
Small food items such as peanuts, beans, seeds or grains etc. within reach of the child	89	324 (49.8)	327 (50.2)	2	201 (84.8)	36 (15.2)	1	25 (10.8)	206 (89.2)	86	98 (53.6)	85 (46.4)
Small objects such as marbles, coins, buttons, toys, small loose and spare batteries within reach of the child	52	272 (39.5)	416 (60.5)	21	102 (46.8)	116 (53.2)	9	16 (7.2)	207 (92.8)	22	154 (62.3)	93 (37.7)

Notes: *NA = Not Applicable;*
$N^{\#}$ = (NA + Yes + No); Percentages calculated only from applicable cases (Yes + No) =100;
Yes = Hazard because of absence of protective measures for corresponding household structures/items;*
*No** = Safe because of presence of protective measures for corresponding household structures/items.*

5.5 RESULTS OF REGRESSION ANALYSIS

5.5.1 Univariable analysis

There were 10 hazards potentially associated with injury from falls, five hazards with fire-related, burn or scald injuries and four hazards due to cuts or crushing injuries (identified from the literature). In total, 19 hazards were related to any type of injury (fall, burn and cut injury) and these are listed in table 5.40. Primary and secondary analyses were conducted to investigate the correlation between the number of home hazards (any hazards or specific injury-related hazards) and number of injuries (any injury or specific injury).

Table 5.40 Home hazards potentially associated with fall, fire or burns or scalds and cut or crush injury

Home hazards potentially associated with falls
1. Protective handrails absent along both sides of stairs or ladder
2. Windows without protective guards or rails
3. Balcony without protective bars or railings
4. Large objects like book shelves, TVs, entertainment units, furniture etc. unstable on their own or unsecured to the walls
5. Furniture (table, stools, chairs etc.) close to window, ceiling fans, balcony or rooftop's railing
6. Shower or bathing area with slippery surface
7. Walking area with clutters, telephone or electrical cords and other obstacles
8. Baby walkers accessible to child aged <18 months
9. Indoor walking areas inadequately lit
10. Stairs, balconies, porches and patios with slippery surface or liquid, grease or water on the floor
Home hazards potentially associated with fire/burns/scalds injury
1. Cooking stoves within reach of the child
2. Lack of barrier or door between sleeping and cooking areas
3. Flammable items such as matches, lighter or fuels (i.e. paraffin or kerosene) within reach of the child
4. Kerosene lamps or candles (while in use) within reach of the child when in use
5. Hot irons or other appliances (e.g. hair straighteners) within reach of the child
Home hazards potentially associated with cut/crush injury
1. Sharp or hard protruding components (e.g. big stones, pieces of wood, woodpiles, old machinery etc.) within reach of the child
2. Breakable objects (e.g. bottles or any dishes made from glass or mud etc.) within reach of the child
3. Sharp equipment designed for agriculture purpose (e.g. axe, sickle, spade etc.) within reach of the child
4. Sharp items such as knives, scissors, razors etc. within reach of the child

5.5.1.1 Primary exposure and outcome

There was positive correlation between number of identified home hazards and proportion of children with injury. Compared to children living in households with 1 to 7 hazards, there was a 2-fold increased risk of injury to children living in households with 8-9 hazards (OR 2.00; 95%CI: 1.37, 2.93) and more than a 2-fold increased risk of injury to children living in households with 10 to 15 hazards (OR 2.58; 95%CI: 1.78, 3.75). Using the number of home hazards as a continuous variable, logistic regression analysis showed that there was an estimated increase of 21% in the odds of injury occurrence associated with each additional injury hazard found in the home (95%CI: 13% to 29%) (Table 5.41).

Table 5.41 Univariable logistic-regression results for the association between home hazards and any injury ***(N = 1033)***

Number of home hazards	No injury (N = 800) n (%)	Any injury (N = 233) n (%)	Odds ratio (95% CI)	P-value
Hazards in tertiles				
Quantile 1 (1-7 hazards)	303 (86.1)	49 (13.9)	Reference	N/A
Quantile 2 (8-9 hazards)	253 (75.5)	82 (24.5)	2.00 (1.37, 2.93)	<0.001
Quantile 3 (10-15 hazards)	244 (70.5)	102 (29.5)	2.58 (1.78, 3.75)	<0.001
Hazards in continuous scale				
1-15 hazards			1.21 (1.13, 1.29)	<0.001

Adjustment for clustering effect at household level was achieved using cluster standard error

5.5.1.2 Secondary exposure and outcome

There was positive correlation between number of identified fall hazards and proportion of children with fall injury (Table 5.42). In comparison to children living in households with 0 to 2 hazards, there was more than a four-fold increased risk of fall injury in children living in households with 3 to 9 hazards (OR 4.40; 95%CI: 2.62, 7.41). With the number of fall hazards as a continuous variable, logistic regression analysis demonstrated that the odds of an injury as a result of a fall, increases by 2.03 times with each additional fall hazard found in the home (OR 2.03, 95%CI: 1.67, 2.45).

Table 5.42 Univariable logistic-regression results for the association between fall-related hazards and fall injury (N = 1033)

Number of fall hazards	No fall (N = 944) n (%)	Fall (N = 89) n (%)	Odds ratio (95% CI)	P-value
Hazards in 2-quantiles				
Quantile 1 (0-2 hazards)	514 (96.4)	19 (3.6)	Reference	N/A
Quantile 2 (3-9 hazards)	430 (86.0)	70 (14.0)	4.40 (2.62, 7.41)	<0.001
Hazards in continuous scale				
0-9 hazards			2.03 (1.67, 2.45)	<0.001

Adjustment for clustering effect at household level was achieved using cluster standard error

There was positive correlation between number of identified fire/burn/scald hazards and proportion of children with fire, burn or scald-related injury (Table 5.43). In comparison to children living in households with 0 to 2 hazards, there was more than a 7-fold increased risk of fire, burn or scald-related injury to children living in households with 3 to 5 hazards (OR 7.73; 95%CI: 4.32, 13.84). Using the number of fire/burn/scald hazards as a continuous variable, logistic regression analysis showed that the odds of obtaining a fire/burn/scald injury increases by 2.41 times with each additional fire/burn/scald hazard found in the home (OR 2.41; 95%CI: 1.72, 3.38).

Table 5.43 Univariable logistic-regression results for the association between fire/burn/scald hazards and fire/burn/scald-related injury (N = 1033)

Number of burn hazards	No burn (N = 966) n (%)	Burn (N = 67) n (%)	Odds ratio (95% CI)	P-value
Hazards in 2-quantiles				
Quantile 1 (0-2 hazards)	667 (97.8)	15 (2.2)	Reference	N/A
Quantile 2 (3-5 hazards)	299 (85.2)	52 (14.8)	7.73 (4.32, 13.84)	<0.001
Hazards in continuous scale				
0-5 hazards			2.41 (1.72, 3.38)	<0.001

Adjustment for clustering effect at household level was achieved using cluster Standard Error

There was positive correlation between numbers of identified cut or crush hazards and proportion of children with cut/crush-related injury (Table 5.44). In comparison to children living in households with 0 to 3 identified hazards, there was more than a 4-fold increased risk of cut/crush- related injury to children living in households with 4 hazards (OR 4.31; 95%CI: 2.32, 7.99). Using the number of cut/crush hazards as a continuous variable, logistic regression analysis demonstrated that the odds of obtaining a cut/crush-related injury increases by 2.48 times with each additional cut/crush hazard found in the home (OR 2.03, 95%CI: 1.67, 2.45).

Table 5.44 Univariable logistic-regression results for the association between cut/crush hazards and cut/crush-related injury *(N = 1033)*

Number of cut hazards	No cut (N = 980) n (%)	Cut (N = 53) n (%)	Odds ratio (95% CI)	P-value
Hazards in 2-quantiles				
Quantile 1 (0-3 hazards)	595 (97.7)	14 (2.3)	Reference	N/A
Quantile 2 (4 hazards)	385 (90.8)	39 (9.2)	4.31 (2.32, 7.99)	<0.001
Hazards in continuous scale				
0-4 hazards			2.48 (1.72, 3.57)	<0.001

Adjustment for clustering effect at household level was achieved using cluster standard error

5.5.2 Potential confounding variables

The univariable analysis results identified potential confounding variables which were then considered using a Directed Acyclic Graph (DAG) (Pearl, 2009). Some of the variables that were not affecting both exposure and outcome (i.e. not potential confounders) were excluded for further analysis. Only those variables affecting both exposure and outcome (i.e. potential confounders) were included to measure their level of association (p value) with outcome of interest. For this analysis, p value <0.1 is used as a marker of association (significant level) between potential confounding variables and outcome of interest. Potential confounders associated with the outcome measure with p value <1.0 were only included in the regression models (Table 5.45). [Note: Confidence interval may cross 1 when using marker of association <0.1]

Table 5.45 Potential confounding variables identified from DAG and their level of association with outcome measures

Groups	Independent variables	Variables associated with outcome with P value (Wald test)				
		Potential Confounders	Any injury	Fall only	Fire, burn or scald only	Cut or crush only
Child	Child gender	No	-	-	-	-
	Child age	No	-	-	-	-
Family	Siblings under 18 years	Yes	0.713	0.950	0.988	0.440
	Main caregiver	No	-	-	-	-
	Gender of caregiver	No	-	-	-	-
	Caregiver's age (years)	Yes	0.265	0.343	0.323	0.910
	Caregiver's education level	Yes	0.007	0.590	0.147	0.022
	Caregiver's occupation	Yes	0.577	0.013	0.466	0.063
	Family size	Yes	0.368	0.076	0.587	0.504
	Family member >18 yrs.	Yes	0.027	0.216	0.059	0.576
	Ethnic groups	Yes	0.076	0.001	0.957	0.998
	HH income	Yes	0.678	0.148	0.118	0.497
Home	Floors in the house	Yes	0.214	0.026	0.949	0.547
	House ownership	Yes	0.013	<0.001	1.000	1.000
	House age	Yes	0.504	0.855	0.773	0.761
	Number of rooms	Yes	0.447	0.006	0.653	0.247
	Foundation materials	No	-	-	-	-
	Roof material	No	-	-	-	-
	Geographical regions	Yes	✓	✓	✓	✓

Note: P values were estimated by adjusting clustering effect at household level. Geographical region was treated as a predictor and therefore included in the 2nd, 3rd & 4th models (Table 5.46, 5.47, 5.48 and 5.49)

5.5.2.1 Confounding variables affecting primary exposure and outcome measures

Confounding variables affecting exposure and outcome included the caregiver's education level, whether there was a family member over 18 years living in the home, ethnic group and house ownership status were found to be associated with any type of injury. In comparison to children whose caregivers were not literate, there was 6% reduced risk of any type of injury to children whose caregiver were able to read and write (OR 0.94; 95%CI: 0.64, 1.13) and a reduced risk of 42% of any type of injury to children whose caregivers had received school education (OR 0.58; 95%CI: 0.41, 0.82).

There was a reduced risk of 28% of any type of injury to children living in households with more than two members over 18 years of age (OR 0.72; 95%CI: 0.54, 0.96) in comparison to children living in households with two or fewer members over 18 years of age. There was a 36% increased risk of any type of injury to children belonging to privileged ethnic group (OR 1.36; 95%CI: 0.97, 1.92) in comparison to children in families belonging to an underprivileged ethnic group. Furthermore, in comparison to children living in owner-occupied houses, there was more than a 2-fold increased risk of any injury to children living in a rented home (OR 2.15; 95%CI: 1.17, 3.64) (Appendix 5.6).

5.5.2.2 Confounding variables affecting secondary exposure and outcome measures

Confounding variables associated with fall-related injury included, the caregivers' occupation, family size, ethnic group, number of floors in the house, house ownership status and the number of rooms in the home. There was a 57% reduced risk of fall-related injury in children whose caregivers were unemployed or unable to work (OR 0.43; 95%CI: 0.22, 0.83) in comparison to children whose caregivers were employed or able to work. In comparison to children living in households with 4 or fewer members, there was a 26% reduced risk of fall-related injury to children living in households with 5 to 8 members (OR 0.74; 95%CI: 0.42, 1.28). There was a 2.3-fold increased risk of fall-related injury to children belonging to privileged families (OR 2.30; 95%CI: 1.43, 3.69) when compared to children belonging to underprivileged families. Children living in 1 to 2 floors houses, there was a 66% increased risk of fall-related injury in children living in 3 storey houses (OR 1.66; 95%CI: 1.06, 2.60). As compared to children living in owner-occupied houses, there was more than a 3-fold increased risk of fall-related injury to children living in rented houses (OR 3.46; 95%CI: 1.73, 6.91). There was also an 89% increased risk of fall-related injury in children living within households with 4-10 rooms (OR 1.89; 95%CI: 1.19, 2.98) when compared to children living in households with 1-3 rooms (Appendix 5.7).

Only one variable, having a family member over 18 years living in the home, was associated with fire, burn, or scald injury. There was a 38% reduced risk of fire, burn or scald injury to children living in households with more than 2 members over 18 years of age (OR 0.62; 95%CI: 0.38, 1.02) when compared to children living in households with 2 or fewer members over 18 years old (Appendix 5.8).

Cut or crush-related injury was affected by two confounding variables, the caregiver's education level and their occupation. In comparison to children whose caregivers were not literate, there was a 4% increased risk of cut/crush-related injury to children whose caregiver(s) were able to read and write (OR 1.04; 95%CI: 0.56, 1.94), but this result was not statistically significant. However, there was a 65% reduced risk of cut/crush-related injury to children whose caregivers had received school education (OR 0.35; 95%CI: 0.16, 0.77). There was a 74% increased risk of cut/crush-related injury to children whose caregivers were unemployed or unable to work (OR 1.74; 95%CI: 0.97, 3.13) as compared to children whose caregivers were employed or able to work (Appendix 5.9).

5.5.3 Multivariable analysis

5.5.3.1 Primary exposure and outcome

The independent relationship between the number of home hazards and number of child injury was assessed through several multivariable models (Table 5.46). The final model (Model 4) was adjusted for geographical region, family and home variables showing that as the number of identified home hazards increases, the proportion of children having related injury also increases. Compared to children living in households with 1 to 7 hazards, there was a 2.39-fold increased risk of injury to children living in households with 8-9 hazards (AOR 2.39; 95%CI: 1.60, 3.56) and almost a fourfold increased risk of injury to children living in households with 10 to 15 hazards (AOR 3.94; 95%CI: 2.52, 6.16). Using the number of home hazards as a continuous variable, multivariable regression analyses showed that there was an estimated increase of 31% in the odds of injury occurrence associated with each additional injury hazard found in the home (95%CI: 20% to 42%).

5.5.3.2 Secondary exposure and outcome

The independent relationship between the number of fall hazards and number of children with fall injury was assessed through several multivariable models (Table 5.47). The final model (Model 4) was adjusted for geographical region, family and home variables showing that as the number of identified fall hazards increased, the proportion of children having fall-related injury also increased. Compared to children living in households with 0 to 2 hazards, there was a 4-fold increase in risk of fall-related injury to children living in households with 3 to 9 hazards (AOR 4.00; 95%CI: 2.34, 6.86). Using the number of fall hazards as a continuous variable, multivariable regression analysis showed that the odds of sustaining fall related injury increases by 2.19 times with each additional fall hazard found in the home (AOR 2.19; 95%CI: 1.77, 2.70).

The independent relationship between the number of fire/burn/scald hazards and number of children with fire/burn/scald injury was assessed through a multivariable model (Table 5.48). No potential home-related confounding variables were associated with the outcome (p value < 0.1) so model 2 was used. Model 2 where family variables were adjusted, showing that as the number of identified fire/burn/scald hazards increases, the proportion of children having fire-related/burn/scald injury also increases. Compared to children living in households with 0 to 2 hazards, there was an ~8-fold increased risk of fire-related/burn/scald injury to children living in households with 3 to 5 hazards (AOR 8.12; 95%CI: 4.39, 15.00). Using the number of fire/burn/scald hazards as a continuous variable, multivariable regression analysis showed that the odds of sustaining a fire-related/burn/scald injury increases by 2.45 times with each additional fire/burn/scald hazard found in the home (AOR 2.45; 95%CI: 1.72, 3.49).

The independent relationship between the number of cut/crush hazards and number of children with cut/crush-related injury was assessed through a multivariable model (Table 5.49). No home-related potential confounding variables were associated with an outcome that had a p value <0.1. Therefore, model 2 was used to adjust for the family variables, showing that as the number of identified cut/crush hazards increases, the proportion of children having cut/crush-related injuries also increases. Compared to children living in households with 0 to 3 hazards, there was ~13-fold increased risk of cut/crush-related injury to children living in households with 4 hazards (AOR 13.60; 95%CI: 5.04, 36.69). Using the number of cut/crush hazards as a continuous variable, multivariable regression analysis showed that the odds of having a cut/crush-related injury increased 4.72 times with each additional cut/crush hazard found in the home (AOR 4.72; 95%CI: 2.44, 9.13).

Table 5.46 Multivariable logistic-regression results for the association between home hazards and any injury (N = 1033)

Variables	Model-1		Model-2		Model-3		Model-4	
	Unadjusted		Geo. regions & family variables adjusted		Geo. regions & home variables adjusted		Geo. regions family & home variables adjusted	
	OR (95%CI)	P-value	AOR (95%CI)	P-value	AOR (95%CI)	P-value	AOR (95%CI) *	P-value
Hazards in tertiles								
Q 1 (1-7 hazards)	Referent		Referent		Referent		Referent	
Q 2 (8-9 hazards)	2.00 (1.37, 2.93)	<0.001	2.39 (1.61, 3.56)	<0.001	2.52 (1.69, 3.76)	<0.001	2.39 (1.60, 3.56)	<0.001
Q 3 (10-15 hazards)	2.58 (1.78, 3.75)	<0.001	3.98 (2.55, 6.21)	<0.001	4.17 (2.65, 6.56)	<0.001	3.94 (2.52, 6.16)	<0.001
Hazards in a continuous scale								
1-15 hazards	1.21 (1.13, 1.29)	<0.001	1.31 (1.21, 1.43)	<0.001	1.32 (1.21, 1.44)	<0.001	1.31 (1.20, 1.42)	<0.001

*Regression analyses were adjusted for geographical (geo.) region, caregiver's education level, family member over 18 years of age, ethnic group and house ownership status. AOR = Adjusted odds ratio. CI= Confidence Interval.

Table 5.47 Multivariable logistic-regression results for the association between fall hazards and fall-related injury *(N = 1033)*

Variables	Model-1		Model-2		Model-3		Model-4	
	Unadjusted		Geo. regions & family variables adjusted		Geo. regions & home variables adjusted		Geo. regions family & home variables adjusted	
	OR (95%CI)	P-value	AOR (95%CI)	P-value	AOR (95%CI)	P-value	AOR (95%CI) *	P-value
Hazards in 2 quantiles								
Q 1 (0-2 hazards)	Referent		Referent		Referent		Referent	
Q 2 (3-9 hazards)	4.40 (2.62, 7.41)	<0.001	4.15 (2.42, 7.10)	<0.001	4.03 (2.39, 6.78)	<0.001	4.00 (2.34, 6.86)	<0.001
Hazards in continuous scale								
0-9 hazards	2.03 (1.67, 2.45)	<0.001	2.21 (1.80, 2.74)	<0.001	2.22 (1.80, 2.73)	<0.001	2.19 (1.77, 2.70)	<0.001

*Regression analyses were adjusted for geographical (geo.) region, caregiver's occupation, family size, ethnic group, no. of storeys in the house, house ownership status and number of rooms. AOR = Adjusted odds ratio. CI= Confidence Interval.

Table 5.48 Multivariable logistic-regression results for the association between fire/burn/scald hazards and fire/burn/scald injury *(N = 1033)*

Variables	Model-1		Model-2		Model-3		Model-4	
	Unadjusted		Geo. regions & family variables adjusted		Geo. regions & home variables adjusted		Geo. regions family & home variables adjusted	
	OR (95%CI)	P-value	AOR (95%CI) *	P-value	AOR (95%CI)	P-value	AOR (95%CI)	P-value
Hazards in 2 quantiles								
Q 1 (0-2 hazards)	Referent		Referent		N/A	N/A	N/A	N/A
Q 2 (3-5 hazards)	7.73 (4.32, 13.84)	<0.001	8.12 (4.39, 15.00)	<0.001	N/A	N/A	N/A	N/A
Hazards in continuous scale								
0-5 hazards	2.41 (1.72, 3.38)	<0.001	2.45 (1.72, 3.49)	<0.001	N/A	N/A	N/A	N/A

*Regression analyses were adjusted for geographical region and family member over 18 years. AOR = Adjusted odds ratio. CI= Confidence Interval.

Table 5.49 Multivariable logistic-regression results for the association between cut/crush hazards and cut/crush-related injury *(N = 1033)*

Variables	Model-1		Model-2		Model-3		Model-4	
	Unadjusted		Geo. regions & family variables adjusted		Geo. regions & home variables adjusted		Geo. regions family & home variables adjusted	
	OR (95%CI)	P-value	AOR (95%CI) *	P-value	AOR (95%CI)	P-value	AOR (95%CI)	P-value
Hazards in 2 quantiles								
Q 1 (0-3 hazards)	Referent		Referent		N/A	N/A	N/A	N/A
Q 2 (4 hazards)	4.31 (2.32, 7.99)	<0.001	13.60 (5.04, 36.69)	<0.001	N/A	N/A	N/A	N/A
Hazards in continuous scale								
0-4 hazards	2.48 (1.72, 3.57)	<0.001	4.72 (2.44, 9.13)	<0.001	N/A	N/A	N/A	N/A

*Regression analyses were adjusted for geographical (geo.) regions, caregiver's education level and caregiver's occupation. AOR = Adjusted odds ratio. CI= Confidence Interval.

5.5.4 Summary

Multivariable logistic regression analysis (adjusted for clustering effect and potential confounding variables) was used to measure the association between number of injury hazards and number of related injuries. The results of both primary and secondary analyses found positive correlation between number of identified home hazards and proportion of children with injury. Primary analysis showed that there was more than a 2-fold increased risk of injury to children living in households with 8-9 hazards (AOR 2.39; 95%CI: 1.60, 3.56) and almost a 4-fold increased risk of injury to children living in households with 10 to 15 hazards (AOR 3.94; 95%CI: 2.52, 6.16) when compared to children living in households with 1 to 7 hazards. There was an estimated increase of 31% in the odds of injury occurrence associated with each additional injury hazard found in the home (95%CI: 20% to 42%).

Secondary analyses found that there was a 4-fold increased risk of fall to children living in households with 3 to 9 hazards (AOR 4.00; 95%CI: 2.34, 6.86) when compared to children living in households with 0 to 2 hazards. The odds of having a fall injury increases by 2.19 times with each additional fall hazard found in the home (AOR 2.19; 95%CI: 1.77, 2.70). There was a ~8-fold increased risk of fire/burn/scald injury to children living in households with 3 to 5 hazards (AOR 8.12; 95%CI: 4.39, 15.00) when compared to children living in households with 0 to 2 hazards. The odds of experiencing a fire/burn/scald injury increases by 2.45 times with each additional fire/burn/scald hazard present in the home (AOR 2.45; 95%CI: 1.72, 3.49). There was a about 13-fold increased risk of cut or crush injury to children living in households with 4 hazards (AOR 13.60; 95%CI: 5.04, 36.69) compared to children living in households with 0 to 3 hazards. The odds of having a cut or crush injury increases by 4.72 times with each additional cut/crush hazard present in the home (AOR 4.72; 95%CI: 2.44, 9.13).

CHAPTER 6: A QUALITATIVE STUDY (FOCUS GROUP)

6.1 INTRODUCTION

This chapter describes the objectives of the qualitative study, the method used for data collection and the findings of the study.

6.2 OBJECTIVES

The objective of this study was to explore the potential for environmental change in the home at a community level to prevent children from unintentional injury in their home environment, and identify the barriers and facilitators of such change.

6.3 METHOD

6.3.1 Focus Groups

Qualitative research describes naturally occurring data by studying people in their natural settings (Bowling, 2014). Qualitative methods employ subjective information and observation of participants within their own social setting to gain a deeper understanding of experiences that cannot be collected through quantitative methods. Qualitative methods are useful for exploring complex issues that are difficult to explore by numbers alone as well as topics that may be sensitive or where there is little pre-exiting knowledge (Bowling, 2014). This is an exploratory study complemented the quantitative data collection in order to provide a detailed picture of home injury hazards (Creswell, 2013).

There were two main options for collecting a qualitative: individual interviews or FGs. Individual interviews allow the interviewer to explore individual differences in experience, whereas, FGs are useful to understand the social context of an issue rather than individual context. FGs are a discussion-based interview with multiple respondents to get closer to participant understandings of and perspectives on certain issues (Onwuegbuzie et al., 2009, Krueger and Casey, 2014). This study required the consensus or debate and the solution from participant's interaction by sharing their ideas, common trends and situation. Therefore, FGs were used for qualitative data collection concurrent to the household survey.

6.3.2 Data collection tools

A semi-structured checklist (topic guide) was prepared to discuss the main aim of the qualitative study. A FG discussion is usually structured through the use of a topic guide that introduces the various topics of interest and promotes group discussion (Braun and Clarke, 2006). The guiding questions in the topic guide were formulated based on available literature and consulting with the supervisory team. The topic guide was designed to explore people's knowledge and beliefs about child injury, home injury hazards, potential home environmental change interventions and the barriers and facilitators of such an intervention. To organize the group discussion, it was divided into 4 major parts.

Part 1. <u>Injuries and perceived hazards</u> in the home environment.

Part 2. <u>Possible changes</u> that could be undertaken within their homes to improve the home safety.

Part 3. <u>Potential barriers</u> to each possible change to improve the safety of home environment.

Part 4. <u>Potential facilitators</u> for each possible change to improve the safety of home environment.

These four major parts of the discussion were carried out with the help of further guiding questions. Each section was planned to be completed within 10 minutes making each group last about 40 minutes plus 10 minutes for introduction and wrap-up (Appendix 6.1).

6.3.3 Pilot testing

One pilot FG was conducted with mothers in Harnamadi VDC before conducting the main FGs. The main objective of the pilot FG was to derive clues about the appropriateness of the FG method. This pilot FG was useful to find out how easily and openly a topic would be discussed, whether the discussion would be completed within the designated time (45-60 minutes), and whether guiding topics needed to be rearranged to make the discussion more logical and understandable. Pilot FG helped to rearrange topic guide to make the flow of discussion smooth and logical. It also helped to complete main FGs within allocated time.

6.3.4 Sampling and recruitment of participants

Qualitative research does not use probability sampling like quantitative research. Therefore, the individuals or groups for this study were selected on the basis of specific criteria and convenience in order to increase the insight into social phenomena rather than to produce generalizable findings (Davies and Hughes, 2014). Supervisory team and

MIRA staffs were consulted to decide the number of FGs and to select participants of those groups. Nature of study (exploratory) and time limitation were also considered while deciding. Finally, 47 participants in 5 distinct groups that representing the society were recruited: Mothers, Female Community Health Volunteers (FCHVs), Early Childhood Education and Development (ECED) teachers, fathers, and school students. These five FGs were selected by consulting with supervisory team and MIRA staffs in order to achieve the objectives of study.

6.3.5 Location and setting

All the FGs were conducted within the surveyed area of the quantitative study but in a variety of locations. The purpose of having FG discussions in variety of locations was to understand the views and opinions of people with different socio-cultural backgrounds. Three out of the five FGs were conducted in the mid hill region (students, FCHVs, and ECED teachers); one in the high hill region (mothers) and one in the low land (fathers).

The FG discussion with school students consisted of a group of grades nine students. It was conducted in a Higher Secondary School of Ambhanjyang VDC. The principal of the school helped to arrange the venue (school library) and selection of the students (voluntarily) for group discussion.

The FG discussion with FCHVs was conducted in the Health Post of Ambhanjyang VDC. It was the usual meeting rooms of the Health Post. The recruitment of FVHVs and venue were arranged by an officer of the Health Post. The invitations to participate in the FG discussion were issued verbally by officer of the Health Post.

The FG discussion with mothers was held in an open place designated for mothers' monthly meetings in Gogane VDC. Recruitment and venue were arranged by a data collectors (SA) of a household survey. This data collector was a local resident of Gogane and has worked for MIRA for years. The data collector arranged this meeting on the same day as the mothers' group monthly meeting for convenience.

The FG discussion with the ECED teachers was held in a community meeting centre, Ambhanjyang VDC. Recruitment and venue were arranged by an officer of PLAN international Nepal (an INGO). The invitations to participate in the FG discussion were issued verbally by an officer of PLAN international Nepal.

The FG discussion with fathers was held in a meeting room of Lower Secondary school of Dhiyal VDC (low land region). Recruitment and venue were arranged by another data collector (BMB) of household survey. He was a local resident of Dhiyal and has been working for MIRA for years. The invitations to participate in the FG discussion were issued verbally by the same data collector (BMB).

(Please note: SB is a main researcher, SA and BMB are MIRA staffs)

6.3.6 Ethical approval and consent

At the start of each FG discussion, the researcher (SB) explained the objectives and process of the research to the all participants. Participants were told how long to expect the discussion to last. They were told that participation was purely voluntary, and they could withdraw from the discussion at any time and for any reason if they want. The researcher guaranteed confidentiality of the information and anonymity of the participants and obtained written consent (thumb print if they were unable to sign) from everyone to record the discussion. Ethical approval for conducting these studies was obtained from the Nepal Health Research Council and Faculty Research Ethics Committees (FRECs), UWE.

6.3.7 Procedure

All the FG discussions were conducted by a researcher (SB) and two trained MIRA staffs (MM and RS). Face-to-face interaction with all the participants in a group was performed. The discussion was divided into four main section as mentioned earlier. The discussion was started by informing participants to think about children under 5 years and any injury occurring in the home environment. Participants were also clearly informed that injury or injury hazards in other environments such as roads, schools, and playgrounds would not be part of the discussion.

Participants were encouraged to present their views clearly, one person at a time and with examples wherever possible. Participants were encouraged to provide their opinions and ideas without being afraid of being right or wrong. Participants were informed that they could agree or disagree with each other to get an insight into how a group thinks about the issue, about the range of opinions and ideas, and of the variation that exists in a particular community in terms of beliefs, experiences and practices.

FG discussions were recorded with the use of two digital recorders that were later used for transcription. Notes were also taken to identify the participants and to record their body language. The researcher (SB) acted as a moderator and concentrated on facilitating the discussion process. Two other members of MIRA staff, experienced in conducting and facilitating FGs assisted with note taking during each session. Immediately following each FG, the notes were discussed between the researcher and note taker to identify agreement on key issues.

6.3.8 Theoretical framework and analysis

A thematic approach was used to analyse the qualitative data collected through FG discussion. Thematic analysis is a widely used approach of qualitative data analysis. It provides important information in terms of themes that are developed from groups of similar codes that repeatedly emerge from data (Braun and Clarke, 2006). The main purpose of using thematic analysis (TA) was to identify, analyse and report patterns within the data. Thematic analysis is mainly done in two ways; either with inductive TA (theoretical), generating themes according to the pre-existing theory using a top-down approach or deductive TA, which involves generating themes from the data using a bottom-up approach (Braun and Clarke, 2013). The study used inductive TA as it allows reporting of themes in the data driven by the overall aim, but still allowing for the exploration of themes which may not have been previously considered.

All FG discussions recorded in Nepali language were transcribed verbatim in Nepalese by the researcher (SB) and MIRA staffs (MM and RS). The Nepalese transcription was then translated into the English language, with an attempt to retain the original meaning of the statements. The translation of all the five transcripts was done by a MIRA staff and those translations were again cross-checked by a researcher to assure the quality of work. (For a sample of transcripts, please see Appendix 6.2). TA was performed according to the guidelines provided by (Braun and Clarke, 2006) (Table 6.1). Initial data coding was performed using the NVivo Qualitative Data Analysis Software, Version 10 (NVivo, 2012). This software was used to systematically arrange the codes and collate the data relevant to each code. Once coding was complete, the remaining analysis was conducted manually.

Table 6.1 Phases of thematic analysis

Phase	Description of the process
1. Familiarizing with data	Transcribing data (if necessary), reading and rereading the data, noting down initial ideas.
2. Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes:	Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes:	Checking that the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
5. 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.
6. Producing the 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 scholarly report of the analysis.

Source: Copied from Qualitative Research in Psychology by Braun and Clarke (2006).

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At the first stage of TA, it was important to become familiar with the data. Therefore, the researcher (SB) read and re-read all transcripts several times and made initial notes to summarize the data. In the second stage, the whole dataset was broken down into meaningful segments and then coded using a word or short phrase. When making the initial notes and codes, all features of the data were used, not just the area of interest. After coding all transcripts, the individual codes were reviewed and placed into clusters based on their similarities. Overall 16 clusters were created.

At the third stage, the clusters were reviewed against the study aims. The clusters that were irrelevant to the study aims were not considered for further analysis. For example, clusters relating to injury hazard but in other environment than home such as school or forest. The final clusters were organised into candidate themes and subthemes. Extracted coded data were placed within relevant themes. At the fourth stage, candidate themes and subthemes were reviewed and refined to form a coherent pattern. Finally, each theme and subtheme were given an appropriate name to identify it (Appendix 6.3). Supervisory team also read two different transcripts independently to assure the accurate representation of themes, sub-themes and codes applied to text data. Any conflicting results with respect to any themes, sub-themes and codes were added or removed by agreement.

6.4 RESULT

The findings of the qualitative studies are presented mainly in two sections: the characteristics of FG participants and the themes generated from the inductive TA. The themes and subthemes are presented with the statements of the participants from the FG along with the researcher's (SB) own observations in the field. Each statement presented in the results is linked to the participants' identification number and the group that they represented (for example: *Mother #3 is Participant number 3 of mother's group*).

6.4.1 Participants

Overall 47 participants were in total of five FGs and discussion was conducted in three different geographical regions. Participants in individual groups were from similar backgrounds but participants between the groups were different from each other. The FG discussion with mothers was conducted in Gogane VDC (high hill), the student, health volunteer, and teacher groups in Ambhanjyang VDC (mid hill), and the fathers in Dhiyal VDC (low land). The discussion sessions lasted from 40 to 78 minutes.

In the student group, there were nine participants, four boys and five girls. The students were aged 13 to16 years and were all studying in Grade 9 of Saraswati Shree Sharada Higher Secondary School located in Ambhanjyang VDC.

The health volunteers were all female, aged 21 to 52 years. Among them, two were quite young, 21 and 22 years whereas all other volunteers were older than 30 years. Three participants had received lower secondary school education, one higher secondary and four only primary school educations. All health volunteers had been working in different wards of Ambhanjyang VDC. There was normally one volunteer or in some cases two per ward, if it was bigger in terms of area or population. The role of the health volunteers was to support local groups and assist with the government's health awareness programme in local communities. The programme conducts health promotion activities in the community, including child and maternal care, family planning and child immunisation with the help of government bodies.

There were nine participants in the mother group of age 24 to 40 years. Among them, four were aged between 24 to 30 years and five were aged between 31 to 40 years. All participants were women local to Gogane VDC and had at least one child. Their main occupation was agriculture. Only two participants had primary school education, another two could read and write without having had formal education and five were illiterate.

The teacher group consisted of nine local women aged 20 to 38 years, of which five were aged between 20 to 30 years and five were aged between 31 to 35 years. Most teachers had higher secondary school education but 1 had lower secondary school education. They were working in the early childhood education and development (ECED) centre in the different wards of Ambhanjyang VDCs. There were one or two ECED centres in most VDCs of the Makwanpur district. The teachers were employed by an organisation called PLAN International that promotes early education and development for preschool children in rural communities.

In the group of fathers there were a total of 12 participants that resided in Dhiyal VDC. They were aged 27 to 40 years with at least each child. Among them, three were of age less than 31 years, seven were aged between 31 to 40 years and two were aged between 40 to 45 years. Amongst them, only one participant had lower secondary school education; most of them had only primary school education. Agriculture was their main occupation, but one worked as local leader of his community and one was a business man. Full participant demographics are shown in table 6.2.

Table 6.2 Characteristics of the focus group participants

Groups	Participants	Age (Years)	Number of Participants	Ethnicities of participants	VDC/regions	Length of session
Trial FG	Mothers	24-40	11 females	Brahmin, Chhetri	Harnamadi (Low land)	73 min
FG1	Students of grade 9	13-16	9 (4 boys and 5 girls)	Brahmin, Chhetri, Tamang	Ambhanjyang (Mid hill)	40 min
FG2	Health volunteers	21-52	8 females	Brahmin, Chhetri, Tamang	Ambhanjyang (Mid hill)	72 min
FG3	Mothers	24-40	9 females	Brahmin, Tamang, Chhetri, Dalit	Gogane (High hill)	70 min
FG5	ECED Teachers	20-38	9 females	Brahmin, Chhetri, Tamang,	Ambhanjyang (Mid hill)	78 min
FG5	Fathers	27-45	12 males	Brahmin, Chhetri, Tamang, Magar, Dalit	Dhiyal (Low land)	75 min

6.4.2 Themes

Overall four main themes and 13 subthemes were identified; Home injury and associated hazards, Potential environmental change or modification in the home to improve home safety, Barriers to environmental change or modification and Facilitators of environmental change or modification. The first theme explores the community's perception and knowledge about injury in the home and associated hazards. The second theme focuses on the possibility of changing the home structure to improve safety. The third and fourth themes discuss the potential barriers to and facilitators of environmental change respectively. A full summary is presented in table 6.3.

Table 6.3 Schematic presentation of the major themes and subthemes

Themes	Subthemes
1. Home injury and associated hazards	General perception of unintentional home injury
	Incidence of unintentional home injury
	Knowledge about home injury hazards
2. Potential environmental change or modification in the home	Adapting the home and use of safety equipment/devices
	Removing potential hazards
	Behaviour change
3. Barriers to environmental change or modification	Lack of awareness of injury risk and their management
	Poor financial situation and lack of resources
	Geographical constraints and poor housing types
	Lifestyle/culture
4. Facilitators of environmental change or modification	Provision of an awareness programme
	Resources and financial support
	Involvement of family and community

6.4.2.1 Home injury and associated hazards

This theme mainly concerned with acknowledging people's understanding and perception about home injury during childhood, whether they thought homes in their community were safe for children and what they knew about potential hazards associated with child injury.

6.4.2.1.1 General perception of unintentional home injury

The participants between groups had different perceptions about home injury and this may be because they had different background and experiences. However, most mentioned that injury in childhood is a normal phenomenon, a part of child development. In the community, minor injury was not considered a child issue so remained ignored by parents and caregivers. Only the injuries with a severe outcome received attention.

A participant in the teacher group stated that no parent wanted their children to be sick or to suffer from any kind of accident. Carelessness was not intentional. However, unintentional accidents occurred regardless. She also stated that whilst attempting to prevent injury to their children, it still happened. Other teachers agreed by saying that preventing injury in young children was a challenging task because they are unpredictable.

> *"It is very difficult [preventing injury] with children up to 5 years of age. When they will cross five years it will be easier." (Teacher #1)*

> *"After reaching 5 years their understanding develops. They know whilst doing something that there is certain damage to them. When we say something to them they know what will happen… There is an understanding of something [risk factors]. The children under that age think if we can do this or that."* (*Teacher* #9)

A similar view was expressed by the group of fathers in a slightly different way. They were more concerned about the children aged 2-5 years. They thought there was a higher risk of injury when children could walk and run.

> *"It is like this… People usually like to carry the children below 5 years of age, who are 2 years, 3 years, 3 and half years with them. Everyone loves them, and they grow in everyone's lap. When the children start walking step by step, the parents want some free time away from them [for work]. When that happens, they start doing their work whenever the children start playing. They start working in one place and in the other place child falls." (Father #8)*

Participants in the health volunteers' group mentioned that most injury events in children <5 years occurred in the home environment. They provided many examples of injuries they had seen in the community during their frequent field visits. The most common injuries they noticed were falls, cuts, burns or scalds, animal-related injuries and unintentional poisonings.

Most student participants believed that minor injury happened more frequently in younger children in comparison to severe injury. They stated that minor injuries from falling out of a tree, being burnt by fire or falling from a balcony were common occurrences in their community. In discussion with the mothers' group, it was noticed that most of them struggled to provide their opinion and examples of different types of injury at the beginning of the discussion. They emphasised fractures as a common injury in their community and ignored other injuries like cuts and bites.

> *"They cut their hands with sickle because they see big people [parents or grown-up people] using them. Only small injuries happen, there are no big injuries. They play, they cut, what can we do?" (Mother #3)*
>
> *"I don't think we have heard of many getting bitten by the snakes, insects or crabs. In our no.1 [ward], there have been incidents of children falling over. This year everyone had a broken hand by falling over." (Mothers #1, #9)*

Many examples of injury events emerged from the mothers' group as the discussion progressed, which they had not mentioned previously. This might have been because mothers did not want to talk about incidents which had occurred to their own children or did not want to recall events that could make them sad. The most salient and clear message throughout all group discussions was that child injury in rural communities is a common problem. Injury is considered so normal that it is just a part of daily life and the potential to do something to avoid it is not realised.

6.4.2.1.2 Incidence of unintentional home injury

According to members of the different FGs, many children had suffered both fatal and non-fatal injuries in their home environment. Tables 6.4 and 6.5 show examples of injury incidents mentioned by these participants.

Table 6.4 Quotes regarding non-fatal injury incidents. X is used to denote a person's name whilst keeping them anonymous

Injury incident	Quote
Fall	*… So many things happened to my son. Once he fell from the top window and another time downhill. The next time he fell from the drum [water container]. 3 times my son has been through incidents such as these. (Health Volunteer #2)*
	Yes, it happened in my neighbourhood. When a child was left at home and they [parents] went to cut the grass, he fell off the balcony (Student #8)
	Once, a mother took her daughter to the tap. She kept her daughter on one side and was busy talking on the other. The child fell on the tap and broke 2 of her teeth. (Health Volunteer #2)

Near-drowning	*If there is an irrigation channel in front of the house, then children could be washed away with it. It happened a few days ago in our village, Simaltaar. There is a house with an irrigation channel close by. When a child was left at home and the mother went down the hill the child fell into the water and was washed away to the end of the channel. (Health Volunteer #3)*
Sharp Equipment	*I have a granddaughter who plays with weapons. Once she cut her finger with a knife. Her finger still doesn't function properly. (Health Volunteer #2)*
	... (Showing a small child's hand) He has wounds on every finger (laughs) because of the sickle. (Mother #5)
	We must keep water in big drums (shows by moving the hands) and even if the child drowned, we would not have found them. My son nearly fell into the drum, but a neighbour found him and helped him out. However, he still got cut by the sharp border of the drum. There are still scars on my child's body. (Health Volunteer #2)
Fire, Burns and Scalds	*Some children have burned their hand when their parents were cooking food. In my village, whist a mother boiled water to make porridge from maize flour, she got distracted talking. A child attempted to put the flour in the water, but it fell over him. Even my child has fallen in food prepared for the cows and cattle. He was playing and suddenly climbed into it from behind. My youngest son's back is burnt (points to the back). (Health Volunteer #1)*
	When he threw the acid, it fell onto a sari, so it was damaged. Some acid also dripped onto the child's hand resulting in an acid burn (she shrugs her hands). (Health Volunteer #3)
	A man used to keep acid in a bottle in the toilet in order to clean. Another volunteer from the health post (indicating with hands) has a daughter who went with her to this house. When the child went to the toilet she used it to wash thinking it was water. She was badly burnt. (Health Volunteer #6)
Poisoning	*Don't you know what happened in Simaltaar? The family had kept poison meant for houseflies in the house and it was eaten by their child who was rushed to Bharatpur [hospital for treatment]. Didn't you know?? (Asking volunteer #6). (Health Volunteer #1)*
	People keep everything inside trunks.... An older member one family had kept items safely in it. They also kept Metacid [pesticide] and beaten rice in it [trunk]. The Metacid leaked into the beaten rice and all of them ate the rice for lunch [without knowing it was poisoned] ... the younger girl suffered severely. (Health Volunteer #6)
	... A young child took the bottle of Metacid in his hand. He could have been 5 years old or may have been younger. He opened the bottle using his mouth and whilst opening it, the poison touched his tongue. Metacid tastes sour. If it had been sweet, he would had drunk it all and certainly died. However, because it was sour, he instead poured it over his head and spread it all over his body (Father #8)
	A mother went to market and called her child to her, but the child went home. The father was spraying insecticides to kill the flies in the field. The child ate some of the insecticide and then started crying. The insecticide was kept on two plates and one

	plate was empty, so they knew that was what the child had eaten. They took her to Bharatpur Hospital and she was kept in the intensive care unit (ICU) for 72 hours. It has only been 5-7 days that she has been well enough to be back home (Teacher #5)
	My husband had stored the Foret [fertilizer] somewhere safe but it fell down. Our young son found it and ate it with the meat that had been brought to the house. Since it was eaten with the meat, we did not know… After looking carefully, I found something in his mouth…Then I told his father about it and he told me it was Foret. Therefore, his grandfather went to the house and mixed curd, cow dung and soap together and we fed him that. He vomited 7 seeds of Foret. After that we took him to Dandabas Hospital where he was given some medicine. That medicine has made my son very thin. (Mother #2)
Choking	*My eldest daughter is now 14 years old. At 5 months old during her rice-feeding ceremony she had to wear rubber bangles. I left her on the mat and went to cook food while she was playing. She took the bangle off by herself and put it in her mouth. I don't know when she took it off and ate it. Later, I realized she had been quiet for a long time. I looked at her. Her eyes were almost closed, and she had difficulty in breathing because the bangle was stuck in her throat. I remembered that when someone is choking we should hit them here [back of neck], and when I did it came out from her throat. It had already softened. Thank God it was only rubber bangles. Had they been made from glass, she would have died. (Mother #6)*
	My sister-in-law had to remove the lid of a Coca-Cola bottle from her child's throat. (Mother #5)
	Once a child came in with corn inside his nose... I pushed here like this (catches the nose and shows) to get it out. If I hadn't pushed, it would have gone further inside. (Health Volunteer #6)
Animals and Insects	*It is not only that. We saw a grown-up boy without one eye. When we asked his mother what had happened, she said it had been pecked by a hen. When he was young he was left in the sun after an oil massage …. She made him sleep in the sun just like that and the hen came and pecked at him [an eye] and now he only has 1 eye. (Health Volunteer #6)*

Table 6.5 Quotes regarding incidents leading to fatal injury. X is used to denote a person's name whilst keeping them anonymous

Injury incident	Quote
Fall	*There was one lady in our village who left her 5 months old daughter sleeping on a balcony that was not barred. The child fell from the balcony and died. (Health Volunteer #8)*
Drowning	*In the pond, above the hill, water is stored in a reservoir in a drum and children go there to fetch water. One child got inside the big drum saying he would swim and drowned. (Teacher #3)*

	Don't you remember X's daughter? While the mother was washing clothes, and fetching water from the well, the daughter climbed into the bucket and died. (Health Volunteer #6)
	We have heard that children fall into the drum filled with water and die. We have heard this. It has happened in the west. Usually, they keep water in huge jars. It is very hot there ... In one incident, I don't know whether the lid of the jar was left open or something, but the kid drowned in the water. This was also in the news. (Father #8)
Fire and Burns	*A child also died once. The clothes did not dry in the monsoon, so they kept them near the fire to dry. They also left the child by the fire to warm him up. The mother went to cut the grass after covering the child with a blanket. They do not even know when the fire caught. After she had returned from cutting the grass, the child was already dead. (Health Volunteer #3)*
Poisoning	*One or two years ago, a child died by taking pesticide…They [parents] were in the field putting pesticide amongst the corn. She [mother] had left the rest of the pesticide near her son. The son thought it was sugar and ate it. (Mother #7, #8)*
	There was one incident when two children ate pesticide that was kept below the bedding after being used on the rice farm. They [children] saw it and ate it. When their father asked what they had eaten, they said they had eaten sugar which was stored below the bed. They died within two hours and before reaching the hospital …. One died immediately and one an hour later. They were brother and sister from the same family. (Teachers #3, #4)
Animals and Insects	*Yes, they died. They died because a killer bee stung them. X's sister died due to bee stings at home. (Health Volunteer #3)*
	Once, a child was crying whilst the mother was trying to make him sleep. She was very tired so let the child sleep in the cradle and she slept on the bed beside it. The cat came and sat over the child and the child died …The cat came in search of warmth and it was warm in the cradle, so the cat sat on the child's face. He died of asphyxiation. (Health Volunteer #6)
Suffocation	*Also, whilst breast-feeding the child, its mother fell asleep and the child died because her breasts pressed over the child's face. (Health Volunteer #2)*
	In our village, also whilst breast-feeding at night, the mothers' weight on her daughter [after falling asleep] suffocated the child who then died. (Health Volunteer #8)
	It occurs when mothers breastfeed their children... My own nephew died. My nephew latched on to breastfeed and my sister-in-law fell asleep … he died as the breast suffocated him. (Teacher #7)

The participants reported that both fatal and non-fatal child injuries in the home environment were well known within the communities. Participants mentioned that fall, near-drowning, sharp equipment, fire, burns or scalds, poisoning, choking, as well as animals and insects were frequently reported causes of non-fatal injuries. Likewise, falls, drowning, fire or burns, poisoning, animals, insects and suffocation were also well-known causes of fatal injuries in their communities.

6.4.2.1.3 Knowledge about home injury hazards

It was crucial to know the level of understanding about home hazards resulting in injury. When asked about potential hazards, most participants provided many examples that they had seen in their homes and community. One participants in the teachers' group stated that people within the community might know about some home injury hazards but that they needed reminding.

> *"... Sir the thing is, we have information about many things but feel as if we don't know and when others tell us we then realize we did know it. The same thing happened to their guardians. They know this might happen to their children but their actions it demonstrates otherwise." (Teacher #1)*

Other teachers provided some examples of common injury type caused by home hazards, including suffocation, electric shock, drowning and poisoning.

> *"In our home there are plastic bags, children use those plastic bag as hats and whilst doing so there is a possibility of suffocation that they are unaware of. Electrical sockets fitted near the floor are also dangerous and there is more danger from water drums when they are uncovered." (Teacher #1)*

> *"Yes ... we keep medicine for housefly [to kill]. We sometimes keep medicine for cockroach. They [children] copy sometimes by putting a pipe in a bottle containing water and spraying. When we put poisonous insecticides in places where they can reach then it is dangerous." (Teacher #9)*

During discussion with the health volunteers, one participant mentioned that the parents' activities in the home are also responsible for creating a risky environment for their children. Not storing hazardous items in a safe place after being used, could lead to injury. She also mentioned stairs and balconies without protective railings were more likely to cause injury to children.

> *"... Parents leave knives in the chopping block by mistake whilst cutting straw litter into small pieces. The children attempt to copy their parents and then cut their hands. Fire can be left in the stove just like that and the parents go to work. Small children play with it and end up burning their hand. Children also fall downstairs or off the balcony. Those*

who have houses on the side of the road, may get hit by the motorbikes." (Health Volunteer #6)

The students' opinions were similar to the health volunteers'. They mentioned that if the hazardous objects like weapons and broken glass were not kept out of reach by parents or guardians, children might get hold of them, possibly leading to injuries like a cut.

"When weapons are used in the house and are not stored in their proper place, the children may get hold of them and this can result in injury. If broken glass is thrown carelessly, toddlers may try and play with it and sustain an injury." (Students #4, #5)

Both the mother and volunteer groups discussed animal-related injury saying that children might get injured by cows in a cowshed. Cows and buffaloes can even kill a child by hitting them. Sometimes when parents are absent, a child may go to the shed to feed the animals. Most cattle sheds in the community are near the house and unfenced; this type of unprotected shed is a risk factor for child injury.

Apart from the hazardous home environment, they also talked about the nature of young children saying that they are curious and impatient and like to explore their surrounding environment. Young children are more vulnerable of getting injury as they do not know what is and what is not hazardous to them.

"Young children are very impatient. More than being impatient, when we say don't do that then they will go there and put hand to see what will happen. Also, in my own house, I had boiled water and I said to my son not to put his hand in hot water otherwise it will scald his hand. It is possible he didn't know what this meant so he put his whole hand inside the water and scalded his hand." (Teacher #1)

"… Small children do not have the ability to understand the things that can kill them." (Health Volunteer #4)

It was understandable that participants were concerned about both the hazardous environment as well as nature and ability of young children. They provided many examples of potential home injury hazards. They also mentioned that any potential hazard could be hazardous to the child if it is within reach of the child. These examples and views indicate the level of knowledge in the community about home injury hazards.

However, during the discussion they did not provide any strong opinion on whether people in the community had tried to manage these hazards. Their knowledge about hazards in the home was from experience not because they had done a risk assessment.

Out of all participants, mothers were the least aware of hazards that could result in injury. One mother expressed her view regarding knowledge of hazards like this:

> *"Yes. We do not know many things. We are always busy collecting fodder in the morning. We do not know about other things. Now you are asking us questions and we are answering by looking around our own house and surroundings. Apart from that we have no other source of knowledge and we do not know many things." (Mother #1)*

The common home hazards resulting in injury discussed by the participants are summarized in table 6.6.

Table 6.6 Common home hazards causing different injuries in children

Injury mechanisms	Common hazards described by participants
Fall	Stairs/ladders and balconies without protective railings; Narrow and slippery stairs; Windows without bars; High porch or entrance area; Moss on the floor of water tap; Falls from cradle (cot).
Drowning	Water containers like a bucket, gar or drum; Water ponds and water wells in the home environment; Irrigation channel by the home; Stored water in compost holes.
Cut and/or crush	Sharp equipment such as sickle, scissor, knife, axe and other agricultural equipment within child's reach; Broken glass within child's reach;
Burn and/or scald	Open fire, matchsticks, lighters within child's reach; Boiled water for domestic use; Hot liquid food; Acid kept for cleaning purposes.
Poisoning	Fertilizers, pesticides, insecticides and other household chemicals within a child's reach; Medicine for the family or cattle within child's reach.
Electric shock	Water pump; Switches and plugs installed near the floor on walls.
Suffocation	Covering of the child's face with cloth to protect them from houseflies; Plastic bags within children reach.
Chocking	Small food items like corns and beans; Coins and marbles within child's reach.
Animal related	Sting from honey bee; Hitting or bites from domestic animals like cows, buffaloes, goats etc.

6.4.2.2 Potential environmental change or modification in the home

The theme of potential environmental change or modification focuses on what participants thought would be a potential solution to improve safety in their home by using local resources or carrying out minimal changes. It became clear that participants had some common views that they thought would work to reduce the risk of unintentional injury at home in their community. The main changes discussed by participants included installation of safety equipment/devices, removing potential injury hazards, and changing behaviour to improve safety.

6.4.2.2.1 Adapting the home and using safety equipment/devices

Participants expressed their view on how they could improve home safety by changing their house structure. In this regard, all groups had common opinions. They believed that if they installed railings on the balcony, grills on the window and fences around the house, it could protect their children from common types of injury like falls and drowning. They also described how they could make grills, bars and fences from locally available materials like wood and bamboo instead of buying from the market as most households could not afford them.

> *"If there is a slope in the courtyard, then it should be barred so that the children won't fall. If the house is fenced, there is a hope that the children will not break their hands or legs and they won't fall. If there is water drainage near the house and it is fenced off with wood or bamboo, then the children will not fall there." (Volunteer #3 and #4)*

> *"The rich people keep grills on the doors and windows. Those who cannot afford to do that can use bamboo and cover the area to keep the children safe. The same can be done to the cowshed." (Health Volunteer #6)*

In almost all FG discussions, participants talked about stairs and ladders as a common cause of fall whilst children climbed up or down. Stairs and ladders in rural communities are made from slanted wood without protective railings and are narrow. Some stairs are made from stones and mud so are slippery, especially during the rainy season as they are located outdoors. The health volunteer group suggested that parents could use locally available resources like ghopte (a stair gate made with bamboo) at both the bottom and top of the stairs to stop the child climbing up or down the stairs.

> *"If the stairs and ladders are to be kept safe, then a ghopte should be made at the bottom of the stairs. Then the child cannot go upstairs. We can open it when we want to go. We do the same. That is how to make things safe. That is all. There is nothing else. The child cannot push it away and cannot climb over it. That is the solution." (Health Volunteer #2)*

Also, both the volunteer and mother groups talked about the area near the water tap as high risk for falls, mainly because moss growing there, making it slippery. According to them, the water taps were near the house, so children could go and play with the water any time. It was not possible to stop children going to the tap every time. Therefore, they thought it should be a parent's responsibility to clean the surface around the tap on a regular basis.

"… If the tap is nearby, then they may slip and break their head. The tap area should be cleaned and scrubbed with a brush then they are less likely to fall. Even adults can fall over. Let's not only say children under 5 years. When they go to the toilet, they slip, and their leg gets stuck there and they can break it. We should clean it ourselves." (Health Volunteer #6)

"That happened [fall injury] because it [moss around tap] was not clean. That green moss should be cleaned. The taps should be cleaned from time to time." (Mothers #1 and #8)

Participants from the health volunteer group also mentioned the possibility of making a small wooden plank box where they can keep hazardous stuffs like weapons, fertilizers or chemicals safely. They also talked about cattle sheds which are often near the house. Some families live on the upper floor converting the lower floor into cattle shed. Most cattle sheds are unprotected, so children are frequently sustaining animal-related injuries in their community. They suggested that this could be prevented by tying the animals in a designated area where children are unable to go or by fencing the sheds with wood or bamboo if it was near the house.

"We should not buy a cupboard costing 10 or 12 thousand (Nepalese Rupees) to keep the weapons. We can bring one small plank of wood and keep them. It is something that can be done. The cattle should also be tied up properly in the shed or the shed should be fenced, which does not cost much. A hen has pecked an eye of the child. A small place should be built for the hens, or bamboos can be cut and used to cover them up." (Health Volunteer #6)

One mother also raised the issue of house structures like porches and the railings. She said: "*Houses that have already been built should be improved and the houses that are yet to be built should be with fewer hazards. The porches of the houses that are already there are high. Their height can be reduced and the bars on the balcony are low and can be made higher." (Mothers #6).*

Throughout the discussion, participants provided examples of ways to improve safety that they or those in their community could do. Most examples seemed to be related to installation of safety devices and changing the home structure affordably in terms of both cost and resources. However, it was clear from the discussion that people in the community had not actually carried out these changes in their home.

6.4.2.2.2 Removing potential hazards

As well as installation of safety devices in the home, most participants talked about keeping hazardous items out of reach and/or sight of the child to prevent unintentional injury. They provided many examples from their homes and community including sharp weapons, open fires, lighters or matches and poisonous chemicals like fertilizers, pesticides, and medicines were the most prominent causes of child injury in the home. Participants also mentioned that most houses in their community had no proper storage for these hazardous things. Most were built to have few rooms, and some were single room dwellings. Many houses had no separate kitchen or sleeping area. The health volunteers mentioned that in many houses, hazardous objects were within the child's reach.

> *"In most of the places we have seen, the electric plugs are on a low surface where children can reach it and even poke it." (Health Volunteer #6)*

The Fathers' group also stated that hazardous items within the child's reach could cause injury.

> *"When children play in the place where weapons are kept and when things like lighters and matchsticks are kept within the reach of children, they don't know what can happen ...." (Father #1)*

Apart from removing hazards, some participants also suggested that proper supervision was needed to prevent the child exposing themselves to hazards. Other participants focused more on moving the hazardous objects out of their reach. Supervision for preventing the injury was out of the scope of this discussion so we focussed on how to keep a barrier between the potential hazards and children.

Many participants thought of keeping the hazardous things like weapons, poisons and chemicals out of the child's reach as a potential solution for injury prevention.

> *"We should keep the weapons in the place where they cannot find them. Things made up of glass or things that cut should be kept out of reach." (Health Volunteer #5)*

When asked about what they meant by "out of the child's reach" and where or what this place may be, nearly all participants suggested high places, a locked box or cupboard, behind khopas (small partitions made to keep items) or in a separate room where children could not go.

"The place where they cannot reach means places like Khopas or on hooks. The main thing is that the child should not be able to find them. After cutting logs, they leave the axe just like that. The children try to copy what their parents do. They also go and start hitting the logs but hit somewhere else. Those things should be kept safe." (Health Volunteer #6)

"If we want to hang the sickle, scissors, axe or any other things we can easily get bamboos in the village. The child will find it when it is within reach. If they are kept in the windows or are hung up like this (shows using the hand as hook), then we can take it out when we need it. When we do not need it then we keep it there." (Health Volunteer #2)

Some participants from the teachers' group felt that it was safer to keep hazardous things out of a child's sight rather than just out of their reach. They thought that if children could see something they wanted but could not reach then they would try climbing on chairs or up the window which could lead to another accident. Other participants of teachers' group agreed on this.

"A place where children cannot see, or a high place is better. If things are stored in a high place and children have seen them then they may try to reach it anyway. We have to keep hazardous objects out of sight." (Teacher #3)

The volunteers were also concerned about injury that could happen due to electric shock. They had noticed that in some houses, electrical switches, sockets and plugs are fitted on the lower portion of the wall which children could reach easily. Therefore, they suggested that electrical switches, sockets and plugs should not be within the reach of child as they may play with them and get an electric shock.

"Another thing is, the wiring should not be done too low where the children could reach. It should be done higher on the walls." (Health Volunteer #6)

The participants in the fathers' group suggested some preventive measures to be taken by all family members including locking the hazardous items in a cupboard, drawer or trunk depending on the parents- financial situation, and only open it when they needed something from there, otherwise children could use them. They also indicated the importance of having a separate room for the kitchen to prevent children exposing themselves to hazardous things.

"We do not want children to go to the kitchen where there are many weapons and instruments. Anything from racks to chairs could result in the children getting injured.

They could also catch fire in the kitchen as it is dangerous when attaching the cooking gas. As far as possible, we should make the kitchen a separate room." (Father #11)

6.4.2.2.3 Behaviour change

Apart from the installation of safety devices or changing the home structure and keeping the hazardous things out of child reach/sight, participants talked about other behaviour change and adapting safety practice. Although the predominant message from participants referred to the proper supervision of children, there were some who felt that changing behaviour to improve environmental safety would also be effective in preventing child injury in the home. Some health volunteers had an idea about how to prevent falls, electric shocks, fires, burns, scalds, poisoning and other injuries.

They suggested that locking the toilets and turning off the electrical supply when not in use could prevent some injuries in the home.

> *"The toilets should be locked as far as possible. I also have a toilet. Whenever my son gets a chance he goes to the toilet and plays with the water that is in the bucket." (Health Volunteer #5)*

> *"If a place is dangerous and you have a child, then you should turn off the meter and do your work. If the meter is turned off, then nothing will happen even if the child touches it." (Health Volunteer #3)*

In these communities in Nepal, mothers are mainly responsible for preparing food in the home. As previously discussed many fire and burn injuries happened in the cooking area. Most households in rural areas use an open fire for cooking food and the majority of these stoves are on the floor. When the mother FG was asked about how they could prevent such fire-related injury in the home, one mother said – *"We should put the fire out immediately after food is cooked or whilst out of the home." (Mother #6)*

Similarly, the student participants suggested some preventive measures to be taken by parents and other family members. They were - parents should teach their children from the very beginning that few things should not be done, water should not be spilt on the floor, children's faces should not be covered when sleeping because they may suffocate, and they should not be allowed to watch the hazardous things on the television, as they might be influenced by it and imitate them as they tend to do what they see.

6.4.2.3 Barriers to environmental change or modification

This theme encompasses the potential barriers to improve home safety by removing physical hazards or changing the structure in the home. When discussing this topic, some subthemes emerged. These were lack of awareness of risk, a poor financial situation, geographical difficulties, poor housing quality and lifestyle and the culture of those living in the rural areas.

6.4.2.3.1 Lack of awareness of injury risk and their management

One of the most significant barriers discussed by all participants was the lack of awareness amongst those living in rural areas. The volunteers, teachers and mothers raised lack of awareness as a main hindering factor in making homes safer for children. They believed that most parents and guardians in their communities were uneducated and lacked information or skill for risk prediction and management. There was an argument between the participants of the volunteers' group. For some, awareness was the major barrier to improving home safety and for others it was the financial situation. One of the health volunteers highlighted that without education, parents may be unaware of how to prevent injury and make their homes safe for their children, as they would not have the knowledge.

> *"It's really difficult when the parents are uneducated. They really do not understand. They only think of one way and do not care about what might happen next." (Health Volunteer #2)*

As opposed to the financial problem as a barrier, volunteer #6 focused on lack of awareness as a main barrier. According to her, most parents in rural communities did not have the proper knowledge and skill to reduce risk of injury. They did not know whether the risk could be predicted, or incidents reduced by changing the home structure. If parents knew, then they could have made changes in their homes.

> *"...it is the parents' fault because of the lack of awareness. They [parents] do not know and do not understand. If they knew such things would happen then they might be cautious but because they do not know, there should be some awareness programs ... All this happens because parents do not have the understanding." (Health Volunteer #6)*

> *"They buy the sickle and cut the grass. They can afford that. But throwing the sickle or axe outside is not due to a financial problem. I disagree on that." (Health Volunteer #6)*

The same participant mentioned an example of an awareness programme provided by a non-governmental organisation (NGO) called Mother and Infant Research Activities (MIRA). She said that women of her community were influenced by MIRA, so they went to a check-up during pregnancy. This suggested that their reason for not using preventative measures to reduce risk of injury to their children was not because they did not love their children, it was because they did not have the knowledge.

> *"… I have to say, before MIRA came here, there were no tests during pregnancy. They did not go for check-ups. It was because of their lack of awareness. If they had known, it could be dangerous for them and their children's' life then they would have gone before. MIRA set up the groups. At the beginning, it was difficult to run the groups but later they started realizing it was beneficial. The pregnant women now come either to the health post here, or go to Hetauda, or Bharatpur. If educating them in preventing injury in the home with an awareness programme, then people will be aware and there will be fewer accidents."* (Health Volunteer #6)

The opinions voiced by the teachers were very similar as they also talked about how lack of knowledge to predict injury risk and their management is the main barrier to prevent children from sustaining injuries in the home. They did say that some parents are negligent as they know how to improve safety in their houses. They also mentioned that parents only realize something is hazardous to their children once incidents have occurred, either in their family or in another family within their community.

> *"We do lack knowledge to predict potential injury and accidents…. We have less understanding to help us predict that children may fall, or get injured due to hazards in the home. Beside this, there is also negligence." (Teacher #8)*

> *"Until and unless an accident occurs, there is no awareness amongst them. When something happens in one family, it is a lesson to whole local community." (Teachers #)*

During this discussion, there were many pauses and silences amongst the mothers. They also highlighted lack of awareness as a barrier but did not provide much information about it. One participant felt that she knew little about injury risk so did not know what changes in the home could prevent injury.

> *"In some houses, even the mother does not know that if they keep certain things in one place then the children will play with them and there could be accidents. Some just leave the fire burning inside and the child goes and plays with it. When the child plays with it,*

the house could catch fire and the child may even lose their life. Therefore, there is lack of awareness." (Mother #6)

The mothers repeatedly talked about supervision, teaching the children, making them careful around hazards or even scolding them if they did something that might hurt them, as methods to manage injury risk at home. However, they rarely talked about changing the home environment. They were also unable to provide examples of how their home environment could be changed or what sort of change they could do themselves. Most only talked about keeping the hazardous things out of the child's reach. This showed that mothers were aware of child injury because they had seen it happening to their children, but they were unaware of what they could do to improve home safety.

6.4.2.3.2 Poor financial situation and lack of resources

Poor financial situations and lack of resources emerged as an important barrier to environmental change or modification in the rural communities. The main source of income in these rural communities was agriculture. Even those that had small businesses still had difficulty in earning enough to cover their household expenses. In Nepal, fathers are the main bread winner in most communities and they are the main person responsible for looking after their family.

When asked, the father and volunteer groups talked about poor financial situation as a barrier to environmental change. They also stressed lack of resources as another barrier. They needed money to buy resources and pay for the cost of labour. In some cases, the parents' livelihood made them incapable of improving home safety.

> *"Actually, this can also happen... there are some people who have to work from morning until night. There are some poor people who must earn in the afternoon and eat at night with what they earned that day. Consequently, I think they cannot do it [change home environment]." (Father #10)*

> *"Some people do not have the money and the child is already born. It is difficult to make bars around there. The people of the house have to go to work." (Health Volunteer #3)*

Another father agreed that people wanted to make the house safe for their children, but they could not afford it due to their low economic status. He also said there were many things in the house that needed to be maintained or installed to improve home safety and that needed either money, resources or both which was difficult for many to afford.

"We should protect children from danger. I have it in my mind to build a house like that … but economically I am poor." (Father #8)

"We make a house, but we do not have a window. At one place, there is no door. Somehow, we make the door but again there is no window. We make both windows and doors but again the stairs are not good. We somehow make the stairs again there are no gates. The children are always running from here and there. If they go out of the gate, anything can happen. We should be prepared for all things but for all things, we need it [money]." (Father #8)

Most people in the rural communities work hard to earn enough for food and living but even working in agriculture they struggled to achieve what they needed. They spent most of their time working to survive so food and living costs predominated over their priority to improve home safety, which they believed needed both money and time that was better spent elsewhere.

"We work hard all day, normally 12 hours every day but there is no achievement. Some people do agricultural work from 5 am to 7 pm … they spend most of the time on the farming land but still don't get enough money to cover the family expenses." (Teacher #1)

6.4.2.3.3 Geographical constraints and poor housing types

Most households in the Makwanpur district are in a hilly area where houses are built in a small space due to topography. They are often built on a slope and made with a combination of wood, mud and galvanized sheet metal. Many of the houses in this area are of a poor quality with regard to safety due to the lack of grills in the windows and railings on the balcony amongst other things. Many participants mentioned that their houses were not child-friendly, and their children were living in poor quality housing.

"Almost all the houses are made of mud. Most of the houses in our community are built on sloped land and in a small area. Therefore, ladders are built straight and most are made from wood or mud, so they are slippery. Ladders do not have protective bars and some ladders have empty spaces underneath. There is chance of a fall specifically for small children. Some houses have stones near the end of ladder so there is a risk of injury if children fall down and hit the stones. It is not safe at all." (Teacher #1)

Some teachers stated that making a house that is safe in the hilly areas is a difficult task because it takes time and money to flatten the land. Most of the people in their community were unable to afford the associated cost for it. Therefore, they had to build their house in a small area of land. Some built a house with few rooms, without a separate kitchen or living room and others a single room dwelling, which make children more vulnerable to injury.

"The sloped land on the hill area makes it difficult. It involves huge labour costs and time to flatten the land which we can't afford." (Teacher #3)

"In my case, I wish I could make a separate kitchen in my home. I am unable to do that because the area is too small .... On one side, there is a cliff and on the other, there is a risk that stones will fall down the hill towards the house." (Teacher #5)

The fathers were more concerned about their inability to maintain the houses regularly. One father provided a practical example of why most houses in rural areas are poor quality and why it is difficult to make them safe.

"Our houses are not safe because when making the windows and doors (pointing at the doors and windows), we use nails that are 1 inch, 1.5 inch or sometimes 3 inches. After one year or so such nails rust but we do not notice. We think it is fine. We don't know how it holds the window. After 2 or 3 years, it becomes so weak that it can fall just like that. It is difficult to maintain or change poorly built houses as they need more money and effort." (Father #8)

6.4.2.3.4 Lifestyle/culture

The lack of common responsibility amongst those in the community and of understanding from family members are examples of common barriers to environmental change in the community. Proper supervision of children emerged as a common strategy to prevent chid injury in almost all groups. It was mentioned that some parents had to tie their children up to do the house work if there was no one to look after them. This is more common in a nuclear family where both parents need to work.

"Let's not hide things. Why do we need to hide the things that we have done? To save the children from dying and not let anything happen to them, we have tied them. We should say what we have done. We even tie them up now." (Health Volunteer #3)

"When we go to work there is no one to look after our children and they themselves give their legs to be tied. This has become their habit (Everyone laughed). We have seen that in our village." (Teacher #3)

The above statement says so much that the parents do recognise their children are at risk, yet they have so few alternatives when they have to get on with work.

According to the health volunteers and teachers, home safety is less of a priority than other health-related issues in the rural communities. All FGs mentioned that they were talking about home safety issue for the first time. There had been no discussion regarding this topic throughout their life.

> *"We are quite careless also Sir ... we know that we can do that but also don't make it a priority. We think it is a small thing and may be not important than other things we do." (Teachers #3, #9)*

> *"We also hadn't brought this topic up during our mothers' group meeting. It was not necessary, so we did not do it." (Health Volunteer #6)*

Members of the health volunteer group said that the inability to share responsibility amongst people in the community was a barrier for local change. They used an example of an area around a water tap which was built in the community for common use. As previously stated, this area with a slippery surface is a hazardous place that could result in a fall causing injury to children. They mentioned that cleaning the tap area should be a common responsibility amongst those who use it, but none took the responsibility to clean it.

> *"Yes ... When it is dirty, anyone can clean it. They [neighbours] fetch water but they do not even clean the dirt that their slippers carry. They leave it just like that. I wash it with water myself and clean it. I used brush to clean it [scrubs the mosses]. I feel very awkward. People go there and see that a volunteer's tap is so dirty. Many people know me. The tap is shared amongst 3-4 households, but no one scrubs it. I just do it without saying anything." (Health Volunteer #3)*

The teachers raised another issue as a barrier for changing the home environment. According to some participants their own family members create difficulties when they want to do something good for their children. They think those of the new generation are more educated and know more than the elderly members of their family. However, the older people in the family, for example, the father or mother in-law may have different opinions to their daughter in-law. In most Nepalese families, the older generation are the main decision makers. The teachers believed that older people should have an understanding of the importance of home safety, otherwise they would not support any changes in the homes.

".... In old people, there is the thinking that if our mother in law treated us this way, we should treat our daughter-in-law in a similar manner. It runs in families because they had no understanding. We cannot avoid that, can we (Everyone laughed)? However, using information, we are moving forward but the older people in our houses provide difficulties in that." (Teacher #5)

"When there is no change in their [senior members of family] thinking, nothing can be done. If there is change in their thinking, only then it works." (Teacher #1)

6.4.2.4 Facilitators of environmental change or modification

The theme of facilitators of environmental change or modification focuses on what participants thought would be the potential facilitators that would help communities to improve home safety. It became clear that participants had different opinions regarding facilitators of environmental change. However, provision of an awareness programme, resources and financial support as well as family and community involvement emerged as the main facilitators from the discussion.

6.4.2.4.1 Provision of awareness programme

Many participants talked about the provision of an awareness programme for the community and that it would be the best facilitator to improve home safety. They believed that without awareness amongst the mothers, main caregivers and the older members of the families, changing the home structure for safety reasons is not possible. They felt that awareness would be an effective prompt to make people realize that they have the responsibility to change their home environment to save their children from injury. If they were not aware, then no one would do it for them.

"If there is no awareness, then there is no one who does things for you. Others are not going to make a hen enclosure for you or to keep your weapons in the right place. You are not going to do that for other people. It is not going to happen at all. The main thing is awareness." (Health Volunteer #6)

The same participant also used an example to prove the effectiveness of awareness in the community by the following statement.

"... previously we did very few tests during pregnancy. Few women came [to the health post] to give birth because of lack of awareness. MIRA brought an awareness program. Now the pregnant women come for a check-up, form groups and things are good. Now

people come with enthusiasm. We cannot forget that. This thing will also change. This thing will change even sooner." (Health Volunteer #6)

The fathers' group felt that many people in the community still did not know about the injury risk within the home. However, this was not the case as knowledge about injuries and injury risk was the same then as it was before. They believed that if the community had an awareness programme regarding home safety, then the information would have disseminated throughout the whole communities.

"Tomorrow the mother could fall in the place where the children fall. If it is not managed properly then accidents can happen. I have said this before. No matter how we talk or what we talk about we do not know how to change our thinking." (Father #8)

"If one friend learns 2-3 things then he will tell it to the other. He will teach some technique. Technique is the most important thing. If advice comes from the upper level telling them to do certain things in certain ways, it would be safer. Technique is a necessity actually." (Father #12)

When asked about who should provide an awareness programme, nearly all participants talked about organisations that had been working in their communities like MIRA and PLAN International. It was observed that people in the community believed in the organisations and felt that one like MIRA or PLAN could also help them on this issue.

"It is impossible to think that the organisations will give us money and we will make it (laughing). If the organisations come and give us awareness and counsel us, then based on that we hope we can do such things." (Mother #1)

"Students like us can tell the parents ... the railings should be kept on the balcony of the house, but they may not believe what we say. If people from an organisation say so they will believe such things." (Student #8)

FGs discussed which member of the family should be educated so that it would be more effective in improving home safety. Different views emerged from the discussion in this regard.

Some teachers felt that parents should go on an awareness programme because they are the main person looking after their children. Parents have a better understanding of where and how most injuries occur and the type of change in their home that would be effective in preventing injury to their children.

"Sir, at first we have to educate guardians [parents]. If we do not educate guardians, then there is no use any effort. This might take only 4 hours. When staying there they can see who (sir/madam) is conducting the research. Children are with their parents for 20-24 hours so if we are not able make parents aware, then these types of injury and accident will continue." (Teacher #5)

The students and teachers had similar views that parents should go on an awareness programme.

"Their parents should be informed about such scenarios; they should be taught how to keep children safe." (Student #5)

Most participants felt that of the parents, it would be a priority to train mothers as they spent more time with their children than the fathers. Fathers spent the majority of their time working in either agriculture or business. They were away from home throughout the day so were less aware of their children's safety.

Some other participants believed that the head of the household should go on an awareness programme. In most Nepalese households, grandparents are head of the household and are responsible for making decisions for their family. A teacher stated that if they were aware of the importance of home safety, then it was more likely to improve.

"Awareness should be provided to the household head ... who is responsible for managing most of the household activities." (Teacher #1)

According to both the fathers' and mothers' groups, awareness should have been given to all members of the family. They believed that the head of the household, parents and other members were all responsible for maintaining or improving home safety. Unless all members were aware, then only it is more likely to improve home safety.

"I think the awareness should be provided to the parents and guardians of the child and general awareness should be provided to all the all members of family." (Father #11)

"Everyone should know that they [hazardous things] should be kept safe. Everyone in the house should be aware." (Mothers #1, #6)

It was interesting to note that only one participant from the student group mentioned the importance of conducting a risk assessment. He mentioned that parents should know firstly, what the potential hazards are and secondly how they are associated with child injury; only then would they think about how hazards could be reduced or eliminated.

> *"First of all, find the cause behind the accident and all the causes of such accidents should be properly analysed and managed." (Student #5)*

Some participants from the teacher and volunteer FGs talked about how people in the community could be trained to improve the home safety through environmental change. They felt that a door-to-door awareness programme or training session showing pictures and videos could raise awareness but believed that these visual aids would be more effective than oral advice.

> *"Instead of just saying, pictures and films would be more effective to inform people and make them understand injury hazards. When we say anything then they will only hear, if something is shown then they will realize. I myself analysed this." (Teacher #8)*

> *"Are there any videos about injury prevention? If such videos could be used, then they will remember." (Health Volunteer #2)*

6.4.2.4.2 Resources and financial support

As discussed in the earlier sub-theme of 'provision of an awareness programme' some participants thought that providing awareness to the community people would be the most effective factor for environmental change. However, other participants suggested that the need for resources and financial support was another important factor for change in the home environment. They described that due to low income, they were unable to afford both the labour and resources. Therefore, they felt that if an organisation or committee provided these people with money or resources then they would be able to change their home environment.

> *"Not everyone in society is rich. There are some poor people with bad financial situations. They have a smaller area of land and there is not even enough for them to eat. There might be 2 children who need to be fed and given clothes to wear…They might have it in their mind that if someone helped them with money or wood, they would install a railing on the balcony... Although they consider these things, they cannot just go and ask." (Health Volunteer #3)*

> *"Along with awareness if they were given something [resources or money] then they would be empowered to do things because someone has helped." (Health Volunteer #1)*

Similarly, the fathers' group emphasized that poorer people should be recognized in the community and helped financially or given the resources to change their home structure. They also mentioned that some people in the community, although aware of injury risk, were unable to manage it due to their economic status. In that situation those people would need to be helped by provision of resources or money.

> *"Organisations should consider the status of the household and analyse whether it is appropriate to help financially. If they are not safe, is it because they do not have money, or it is because they do not have awareness? Therefore, they should be given suggestions about safety to improve their awareness. If they cannot do it because they do not have money, then they should be provided with financial support." (Father # 11)*

Participants shared an idea that community forest user group could help them by providing wood or bamboo to build railings or bars in their houses. They believed that getting financial help from an organisation or wood and bamboo from the community forest would help them to change their home structure.

> *"Apart from financial support, they provide wood for building houses… the community forest user group can also help by providing the resources." (Mothers #1, #6)*

> *"… If my house is in the state of falling, we cannot ask the forest committee to make my house exactly like it was before. By looking at the physical condition of the house, we cannot ask for cement from them. But we can ask them for wood for reconstruction." (Father # 6)*

6.4.2.4.3 Involvement of family and the community

For some participants, particularly the volunteer's group, it was necessary to involve all family members to make the home environment safe. They described that women in the family do most household activities and look after their children but that women should not bear the full responsibility for child safety. They felt that men should be equally responsible in making the home environment safe for children.

> *"The women cannot do everything. They [men] have to cut a bamboo and bring it home to create a bar around the balcony. The men should help. It is impossible if only the women do it. If there is a stream near the courtyard of the house, then a man should put something over it." (Health Volunteer #6)*

Participants also believe that changing the home environment for child safety should not only be the responsibility of some families, but it should be taken as a responsibility of whole community. Children do not stay purely within their home, they would go to the neighbour's home and play with other children. If someone made their home safe in order to prevent their children from injury the children might have still been injured when playing in the home of a neighbour. The participants' views about community involvement in changing the home environment was reflected through a father and a mother's voice.

> *"… Not only one person's house should be safe, others should also be informed about how to keep the place safe for children. We should tell others how to manage and tell our neighbours to take care of things. We should not only be making our houses safe because the children can go to other houses as well. This is about our whole village... Every neighbourhood in the village should do it. We should tell our neighbours to pay attention to such things." (Father #1)*

> *"If we talk to the family members, they should all understand how to keep children safe from danger. Also, in the neighbourhood, if anyone sees hazards then they should tell others that it should not be done, and the children should be kept safe." (Mother #1)*

The health volunteers showed their commitment saying that they could help their community by informing people about home safety. They believed that the community could be made aware about by discussing it with other groups, like mothers and informing people by going door-to-door.

> *"Just like we are discussing things here, if we could have such discussions in the village, it would help the community to improve their home safety…We can go to their houses and, tell them not to do that because the children might get hurt…We can go to the mothers' group and say such things." (Health Volunteers #1, #4, #6)*

The fathers' group also expressed a hope that children could be prevented from sustaining injuries if all parents came and discussed ways to improve home safety.

> *"Whatever has happened until now has already happened. We have grown up like that. We should think together how to make our children safe through this fathers' group and the mothers' group. Many accidents might have happened because we had not given much thought to it. We should all sit together and discuss what to do and learn things we do not know." (Father #7)*

Similarly, the teachers believed that if one community could develop as an example demonstrating injury prevention by making the home environment safe, then other communities might be influenced to do the same.

> *"…if one community could develop as exemplary then other communities could follow that." (Teacher #3)*

6.5 SUMMARY OF THE CHAPTER

Unintentional injury in the home is an important cause of death and disability among young children in Nepal. Reducing home injury hazards by changing the home environment has the potential to prevent home injuries. The aim of this study was to explore the potential for environmental change at a community level to prevent children from unintentional injury in their home environment, and identify the barriers and facilitators of such change.

Focus group discussions (FGDs) were conducted with mothers, fathers, teachers, school students and community health volunteers from three different rural areas of the Makwanpur district in Nepal. All the FGDs were conducted in Nepali languages. The discussions were recorded, transcribed, translated into English and a thematic analysis was carried out.

Five FGDs, with a total of 47 participants, were undertaken. Four major themes with multiple sub-themes were identified. Participants mentioned different home injury hazards that they were aware of in their home and community, but did not voice any strong opinions on whether people in the community had tried to manage these. Strategies suggested by participants for environmental change included adapting the home and installing safety equipment, removing hazardous objects or restricting the child's access to those hazards and changing behaviours to improve safety in the home. Barriers to environmental change included lack of awareness in the community about injury risk and risk management, and a poor financial situation. Geographical constraints, poor quality houses and lack of common responsibility amongst family and community were also key barriers. Things that would facilitate environmental change included provision of an awareness programme for the community, requiring resources and financial support and involvement of family members including community.

The participants suggested a range of potential environmental change interventions, including the barriers to and facilitators of such change. Addressing the environmental factors identified will be useful in developing an effective and cost-effective intervention for preventing home injury in young children.

CHAPTER 7: DISCUSSION

7.1 INTRODUCTION TO THE CHAPTER

This chapter summarises the key findings from the different studies of this thesis, compares them with the existing literature, and presents an overview by integrating the findings from the different studies. It also describes the strengths and limitations of each of the studies (systematic review, quantitative survey and qualitative study) and then describes the overall strengths and limitations of the thesis.

7.2 SYSTEMATIC REVIEW

This review aimed to evaluate the effectiveness of home environmental change interventions in preventing unintentional injury in children in LMICs. Out of four studies included in the review, only one Control Before and After (CBA) study (Krug, 1994), reported data on injuries. This CBA study evaluated the effects of safety education and child resistant container (CRC) distribution on the incidence of paraffin ingestion (Krug, 1994). The other three studies were RCTs which reported data on household hazards (Swart, 2008; Odendaal, 2009; Rehmani, 2010). Two of these RCTs (Swart, 2008; Odendaal, 2009) used similar interventions (home inspection, safety education and safety devices) to measure the similar outcomes (household hazards associated with burns, poisonings and fall injuries), therefore included in a meta-analysis. The other RCT looked at the effects of home inspection and safety education on household hazards associated with ingestions (poisonings and chokings) and fall injuries (Rehmani, 2010).

7.2.1 Summary of findings of systematic review

7.2.1.1 Summary of results

It is surprising that only one study was found that met the primary outcome of this review (Krug, 1994). In this CBA study, specifically designed child-resistant containers were distributed with health education about paraffin poisoning prevention to reduce the incidence of paraffin ingestion. This study reported a significant reduction of the incidence of paraffin ingestion in the study area during the intervention period. This study also reported that the incidence rates in the study area were less than half of those in the control area after the intervention. Thus, this study provided good evidence that distribution of child tamper-proof paraffin containers in South Africa can reduce the incidence of poisoning. This intervention can be adapted in other LMICs where paraffin poisoning is an issue for child injury. However, this result should be interpreted with caution as the analysis was based on non-randomized participants.

The pooled effect size from the two RCTs included in the meta-analysis (Swart, 2008; Odendaal, 2009) found a significant difference in post-intervention mean scores for poisoning hazards (Mean Difference (MD) -0.77; 95%CI -1.36, -0.19) and burn related unsafe practices ((MD -0.37; 95%CI -0.66, -0.09), but not for fall hazards, electrical burn hazards, paraffin burn hazards or total household hazards. In contrast, the study by Rehmani (2010) showed significant difference in post-intervention mean scores for fall related hazards (MD -0.5; 95%CI -0.66, -0.33, P<0.001), but not for ingestion hazard (poisoning and choking).

Reasons for the differences between the meta-analysis and the Rehmani study might include the methodological difference. The post intervention follow-up period in Rehmani study was longer (6 months) than that Swart (4 months) and Odendaal (3 months). Therefore, it can be hypothesised that structural changes were not practical within a short period. Another reason might be the difference in the socio-economic condition of households between the studies included in meta-analysis (South African low-income setting) and Rehmani (urban neighbourhood in Karachi, Pakistan). It is more likely that the households in urban area had better socio-economic condition and were able to afford safety appliances as compared to the households in low income settings.

Overall, the conclusions of this systematic review and meta-analysis were that multifactorial interventions such as home inspection, education and safety devices were only found to be effective in reducing burn related unsafe practices and poisoning hazards (from meta-analysis) and fall hazards (from a single RCT). However, recognizing that a "one size fits all" approach to interventions does not work (Hayes et al., 2014a), it is important to consider the different aspects of these interventions with further evaluation to assess the full utility of home visit programmes in low income communities in LMICs such as South Africa and Pakistan.

7.2.1.2 Summary of risk of bias

The CBA study was considered to have a high risk of performance bias, detection bias and attrition bias due to the lack of blinding of participants, personnel, and outcome assessors and incomplete outcome data. The two RCTs included in the meta-analysis were found to be of robust quality except that blinding of participants or personnel were not clearly reported in either study, and outcome assessors were not blinded in the third RCT (Rehmani, 2010), therefore it was judged to have had a high risk of detection bias. Overall, none of the studies included in the review were assessed to be at low risk in any of the domains of the assessment for risk of bias.

7.2.2 Strengths and limitations of systematic review

This is the first systematic review and meta-analysis of experimental studies to determine the efficacy of environmental change interventions to reduce home hazard or childhood home injury in LMICs. This review used a comprehensive search strategy, and robust methods for study selection and data extraction. Further, it had no language restrictions, assessed risk of bias in the included studies and, where possible, meta-analysis was carried out for a more precise estimation of the true intervention effects. The internal validity of the review was assured with two reviewers checking the consistency and accuracy of data extraction and the appraised quality of the included studies.

There are several limitations however. This review was only able to utilize data which were available in published studies. Negative or neutral effect studies are known to be less likely to be published, so analysing the results only from published data may lead to a false positive effect (Bartolucci and Hillegass, 2010). To counter this, efforts to find unpublished work by directly contacting authors were made but only one out of four authors responded. So perhaps having more time to seek further unpublished data could have strengthened this review.

Heterogeneity is important to consider for any meta-analysis and it is equally important to explore the reasons for it (Higgins and Thompson, 2002). Despite combining two sufficiently homogeneous studies, I^2 statistic indicated substantial heterogeneity (I^2 >50%) in some of their results. Statistical heterogeneity in their results might be due to the limited number of trials, different in small sample size, or may be due to the low quality and potential bias of the trials included in meta-analysis. Only two studies were included in the meta-analysis, therefore, sensitivity analysis was not performed to find out the actual reason of heterogeneity shown in the results.

7.2.3 Implications of the systematic review for this PhD

This review had direct influence on the PhD project plan and in shaping recommendations for further work. The review revealed the small number of existing experimental studies evaluating home environmental change interventions for child injury prevention in LMICs. This showed there is a lack of relevant studies in this area and justified progression to undertake a survey and qualitative study to inform potential future interventions in Nepal.

The review also highlighted the most common hazards and the key variables used in household surveys. These were used to formulate research questions for the qualitative study (Focus Group). Some observational studies conducted in LMICs (Chandran et al., 2013, Khan et al., 2013, Qiu et al., 2014) and in HICs (Jordaan et al., 2005, Keall et al., 2008, Phelan et al., 2009) found in the review's search and were adapted and used to develop the injury hazard checklist to assess household risk. Similarly, some key variables selected, such as socioeconomic (e.g. education, occupation, ethnicity, income etc.) and demographic (age, sex etc.) variables were also determined from these studies.

7.3 HOUSEHOLD SURVEY

The community based survey explored home environmental risks for injury among 1042 children <5 years old, living in 740 households in three rural areas of Makwanpur district.

7.3.1 Summary of descriptive analysis results

Injury incidence

A total of 242/1042 (23.2%) children <5y were reported to have sustained an injury in the previous three months, severe enough to require treatment or be unable to take part in usual activities for at least one day. The commonest mechanism of injury was falls, followed by burns/scalds and cuts/crushes and then animal related injuries. Most injury events (56%) occurred in the area immediately outside the home, and in this location falls were the commonest type of injury. Inside the home burns/scalds were the commonest type of injury. Only 18/242 (7.4%) of injury events resulted in action being taken by the family to alter the home environment to reduce the likelihood of the injury occurring again.

Home injury hazards

In total, the mean number of injury hazards was 14.98 (SD = 4.48) in the 740 surveyed households with a range of 3 - 31. Overall, the absence of protective railings on stairs or ladders, and the absence of guards or railings for windows and balconies were identified as the most common hazards for falls. Cooking stoves within the reach of young children, lack of a barrier or door between the sleeping and cooking areas and flammable items within the reach of children were identified as the most common hazards for fire-related injury, burns or scalds. Sharp or hard protruding components and breakable objects within the reach of young children were identified as the most common hazards for cut and crush injuries. Common poisoning hazards included access to alcoholic beverages, agricultural chemicals or fertilizers, tobacco products and candles or fuels. Accessible electrical cables and switches /plug points together with unsafe wiring were electrical injury hazards, and plastic bags, small objects and food were identified as choking hazards.

Outside the home, it was observed that cattle were rarely fenced, and common drowning risks included accessible ponds, lakes and streams and ditches, open holds or vats designed to feed the cattle, and open containers of water or other liquids.

7.3.2 Comparison of findings of descriptive results with other studies

7.3.2.1 Comparison of home injury results

Injury incidence

The incidence of injuries among children <5 years in this study was 23.2%, which is much higher than found by a study conducted in the same district in Nepal, four years earlier, where the incidence of injuries in children <5 was 3% during the previous 12 months (Pant et al., 2015a). The main reason for the difference in incidence was that this earlier study only recorded more severe injuries (which resulted in the child being unable to participate in usual activities for three or more days), and used a recall period of 12 months which may have meant that some families had forgotten injury events by the time the survey was conducted.

The incidence of injury in children <5 years reported in the current study is similar to some studies conducted in other LMICs (Alptekin et al., 2008, Bashour and Kharouf, 2008, Kamal, 2013, Aloufi, 2017). Compared with the current study, some studies conducted in LMICs had reported a higher incidence rate of injury in children (Abd El-Aty et al., 2005, Erkal and Safak, 2006, Eldosoky, 2012, Shriyan et al., 2014a, Banerjee et al., 2016, Nouhjah et al., 2017). As compared to the current study, injury incidence was considerably less in other studies conducted in LMICs (Khan et al., 2013, Xu et al., 2014, Ahmed et al., 2015, Rezapur-Shahkolai et al., 2016).

The difference between these studies and the current study may be due to the difference in the age of the studied children, differing methodologies used, varied recall periods, study areas and socio-economic conditions of households (Appendix 7.1). If a study has a longer recall period, injury incidence rate appears to be lower. Where recall periods are similar to the current study, rates are more similar. This consistency of rates across different settings and populations despite some variation in study methods, reassure that the findings of current study are valid. The longer recall period is likely to be associated with some injury events being forgotten and therefore not reported, leading to an underestimation of the true rate.

Gender (overall injury)

There is a consistently higher incidence of boys experiencing injuries than girls (Hyder et al., 2009, Balan and Lingam, 2012). This is because male children are known to take more risks and are more impulsive in nature than girls. Traditionally, boys were also exposed to more hazardous environments than girls (Towner et al., 2005) and were given greater freedom to explore their environment (Peden et al., 2008). In the current study, injury incidence in male children (24.1%) was only marginally higher than in female children (22.2%), which is similar to findings from Iran (Poorolajal et al., 2013, Rezapur-Shahkolai et al., 2016), Egypt (Kamal, 2013), Turkey (Erkal, 2010, Öztürk et al., 2010). In contrast, a community based study conducted in Nepal found that the rate of non-fatal injury among children aged 1-4 years was significantly higher amongst male than female (p=0.002) (Pant et al., 2015a). Similarly, a number of studies in other LMICs have demonstrated differences by gender greater than could have occurred by chance. For instance, significant gender difference was found in study conducted in India (Nath and Naik, 2009, Mahalakshmy et al., 2011, Shriyan et al., 2014a), in Egypt (Eldosoky, 2012), and in Pakistan (Lasi et al., 2010).

Age groups (overall injury)

In the present study, the injury incidence was highest among children aged 36-47 months (30.3%) and lowest in children aged <12 months (13%). Overall, children with 36-47 months age group are consistently most at risk of being injured and this might be related with their developmental stage, their natural curiosity and lack of fear of harm. The cognitive and physical abilities of children of this age are rapidly changing and thus they are involved in more risky activities (Poorolajal et al., 2013). In addition, the likelihood of child injury and accidents is also determined by changing levels of supervision in accordance with age (Towner et al., 2005). This pattern is consistent across injury studies in different populations and settings. For example, a study from Turkey (Erkal and Safak, 2006) and Iran (Rezapur-Shahkolai et al., 2016) reported that the majority of injured children were aged 36-47 months. In the current study, injury rate rose sharply as age increased to 47 months of age and then gradually decreased. This finding is consistent with the findings of other studies conducted in Egypt (Kamal, 2013), in Turkey (Erkal, 2010) and in Iran (Mohammadi et al., 2005)

Consistent with the findings of the current study, falls and burns were reported as the most frequent injury mechanisms in other studies conducted in Iran (Rezapur-Shahkolai et al., 2016), Turkey (Erkal, 2010), India (Shriyan et al., 2014a), Ghana (Gyedu et al., 2014), Pakistan (Lasi et al., 2010, Khan et al., 2013), Egypt (Kamal, 2013) and Sudan (Ahmed et al., 2015).

The current study highlighted that overall male children had a higher injury risk than female children and fall and burns were most frequent injuries. This was not the case when looking at the specific injury mechanism by sex. In the current study, the incidence of falls and animal-related injuries was higher in male children. However, fire-related injuries, burns or scalds and cuts or crush injuries were higher in female children. In most LMICs, girls had a higher incidence of fire-related injuries (Bartlett, 2002, Fatmi et al., 2007, Mashreky et al., 2008) due to exposure to unsafe cooking practices at home whilst helping their mothers (Peden et al., 2008).

7.3.2.2 Comparison of home hazards results

The current study found the presence of substantial hazards in most of the surveyed households. Similar to the findings of current study, a community based study in China investigating home injury hazards amongst toddlers (24-47 months) reported that the mean home hazards was 12.29 (SD = 6.39) with a range of 0-36 hazards (Qiu et al., 2014). However, the percentage of households with hazards was higher in the current study (90%) than in the Chinese study (74.3%) (Qiu et al., 2014). It would be more likely that the difference in prevalence of home hazards was due to lifestyle/ cultural difference between Nepal and China.

Fall hazards

The current study observed that the majority (98%) of households had stairs or ladders but nearly all of them (98%) did not have protective handrails along both sides. Similar findings were reported by Parmeswaran from India (Parmeswaran et al., 2016) but in other studies, the proportion of households with either unsafe or no railings was much lower, between 23-25% (Abd El-Aty et al., 2005, Banerjee et al., 2016). Although, fall related hazards like unprotected stairs or ladders were common in LMICs, these studies suggest that the number of households without protective handrails on stairs or ladders is much higher in Nepal.

In the current study, windows were not protected by guards or rails in 84% of households and there was no protective railing in balcony in 50% households. Similar findings were reported by Khan from Karachi, Pakistan, (Khan et al., 2013) where balconies were unprotected in 42% of households. In contrast, smaller proportion of households in Egypt, lacked window shields (8%) and only 6% households had an unsafe railing on the balcony (Abd El-Aty et al., 2005). This suggest that the households in Nepal have higher risk of fall from unprotected balcony or window as compare to Egypt but similar to Pakistan. This might be the difference in housing structure between the countries since. Pakistan are more likely to have similar structure to that of Nepal whereas Egypt is likely to be different.

Munro et al. (2006) reported that the physical home environment, such as slippery surfaces, are also associated with the risk of falling in childhood. The situation in relation to injuries and slippery surfaces is quite mixed and likely to be very dependent on the household structure and method of reporting hazards. In the current study, a slippery surfaced shower or bathing area was found in smaller proportion (13%) of households as compared to other studies. In Turkish study, 71% of households had slippery floors in the bathroom (Erkal and Safak, 2006), and in Egyptian study, 24% of households had slippery floor (Helmy et al., 2002). This indicates that slippery surface is not particularly common in Nepal, so childhood fall due to slippery surface is less likely to occur as compared to other fall related hazards. However, this does not mean that slippery surface in the households should be ignored.

Fire, burn or scald hazards

In the current study, all households with children under 5 had cooking stoves and of these the majority (98%) were within the reach of the child. Most cooking stoves in rural areas of Nepal use fire wood that have open fires. Almost all households with both sleeping and cooking areas did not have any barrier or door between the two areas. This differs to most other studies, (Egypt, Pakistan, two in India) where only about half, or less, of the households had open fires that children could reach (Helmy et al., 2002, Khan et al., 2013, Banerjee et al., 2016, Parmeswaran et al., 2016). This shows that the occurrence of cooking stoves that are accessible to children is much higher in Nepal than in many other LMICs that have reported such hazards. A recent systematic review investigating epidemiology of burn injuries in Nepal also highlighted that the use of open fire for cooking was the most common hazard of burn injuries in the Nepalese population (Tripathee and Basnet, 2017).

Flammable items such as matches/ lighters or fuels (e.g. paraffin or kerosene) are widely used within the home in LMICs. In the current study, these flammable items were within the reach of the child in 42% of the households. Similar findings were reported by Khan from Pakistan (Khan et al., 2013) but in Indian studies, flammable items were within the reach of child in 29% households (Banerjee et al., 2016) and 35% households (Mirkazemi and Kar, 2009). A qualitative study from two low-income settings in South Africa highlighted similar hazards that increase the risk of burns in children (Munro et al., 2006).

Cut or crush hazards

Almost all households (99%) in the current study had sharp or hard protruding components like big stones, pieces of wood, wood piles, old machinery etc. in their home environment and these within the reach of children in majority of households (83%). These objects were not reported as potential hazards for cut or crush injury in any study from LMICs even in the study from India or Pakistan, where rural households are very much similar. However, this study would like to highlight these objects as important hazard for cut or crush injury for children living in rural area of Nepal.

The current study observed that the 56% of households had sharp items (such as knives, scissors and razors) within the reach of children. Compared to current study, the proportion of households that had knives or other sharp objects within the reach of children was found higher (66%) in Indian study (Banerjee et al., 2016) but lower (37%) in Pakistani study (Khan et al., 2013). Similarly, a Turkish study noticed that, in 73% of houses cutting tools were within the reach of the child in kitchen and in 43% of houses needles were stored/kept within the reach of the child in living, dining and bedrooms (Erkal and Safak, 2006).

In the current study, sharp equipment designed for agricultural purposes (e.g. axe, sickle, spade etc.) were within the reach of the child in 62% of households but in the Indian study, only 26% households had agricultural equipment like spade within reach of the child (Banerjee et al., 2016). Similarly, in the current study, breakable objects like bottles or dishes (made of glass or clay) were within the reach of children in 80% of the households. Whilst, only 32% of households had glass material (cup, mirror etc.) within the reach of the child in India (Banerjee et al., 2016).

Drowning hazards

In the current study, 51% of households had ditches and pools of water around houses and were accessible to children in more than 50% of these households. In addition, 43% of households had bodies of water, including ponds, lakes and streams in their home environment and were not protected in more than 95% of these households. In an Indian study by Mirkazemi and Kar (2009), the presence of unprotected bodies of water near to houses were noticed in 32.5% of households. Another Indian study also reported that 36.2% of households had unprotected ponds in their immediate vicinity, and 4.9% of households had an uncovered well inside the house (Banerjee et al., 2016). This shows that accessible water bodies to the children present in the home environment or nearby home are much higher in Nepal as compared to the neighbour country like India.

Small buckets of water or a bath tub of water are risk factors for the drowning of children <3 years old (Jumbelic and Chambliss, 1990). Storing water in a bucket for domestic purposes is normal practice in most LMICs. Pertaining to this, household survey of current study identified that open containers of water (or other liquids) were within the reach of a child in 84% of households. In contrast, smaller proportion of households in Pakistan, had open buckets of water within the reach of children in their courtyards (18%)

and 48% had open buckets of water in their bathrooms (Khan et al., 2013). Furthermore, the current study found that open holds or vats designed to feed the cattle were commonly within the reach of a child (87%) in households that possessed these features (94%). These findings show similar results to those of Hyder et al. (2008a), which show that water kept for livestock around the house, and drinking water stored in kitchen were common risk factors for drowning in Bangladesh.

Poisoning hazards

The current study found that alcoholic beverages (92%) and tobacco product (45%) were within the reach of children in majority of households. Surprisingly, these products were not reported in any other studies from LMICs, probably because they underestimated the associated risk, or these products were not kept/stored in the households.

The main risk factors for childhood poisoning in developing countries are storage of poisonous chemicals, and fertilizers at ground level or in unsafe containers (World Health Organization, 2002). In the current study, agricultural chemicals or fertilizers, and cleaning products were within the reach of the child in 62% households. This is most likely due to the lack of lockable cupboards for storage. Other studies in LMICs also found that many households lacked lockable cupboard for storage of poisonous chemical. For example, 79-91% of households in Indian studies (Mirkazemi and Kar, 2009, Parmeswaran et al., 2016) and 56% of households in Pakistani study (Khan et al., 2013) did not have lockable cupboard for storage of poisonous chemicals.

The current study observed that cleaning products, chemicals, bleaches, acids and detergents within child's reach in 27% of households. In Indian study, 18% of households had Phenyl cleaners, or acid used in the bathroom (Banerjee et al., 2016) and in Egyptian study, 8% of households had cleaning agents stored in an unsafe manner (Abd El-Aty et al., 2005). A South African study also reported that chemicals were stored in unsafe or non-standard containers, which misled children and increased the likelihood of poisoning. Easy chemical accessibility for children contributed to the risk of poisoning even if it was stored in its original container (Munro et al., 2006).

In the current study, 44% of households had candles/fuels (e.g. kerosene, cooking oil, petrol, diesel, gas etc.) within child's reach. Whereas, 35% of households in Indian study had unsafe containers for the storage of kerosene. In African countries like Malawi, Jordan and Kenya, most childhood poisonings occurred due to paraffin ingestion

(Chibwana et al., 2001, Shotar, 2005, Lang et al., 2008). Other studies in South Africa have demonstrated that paraffin poisoning was related to the physical accessibility of paraffin to children (Ellis et al., 1994, Krug et al., 1994, Reed and Conradie, 1997). This pattern was also seen in a hospital-based descriptive study conducted in Pakistan (Manzar et al., 2010), which found that kerosene was the most common household agent; it caused about 50% of childhood poisoning.

In the currents study, 15% of the households had medicines and vitamins within child's reach. This was consistent with the findings of Pakistani study (Khan et al., 2013), where medicines were within the child's reach in 15% of households. In contrast, the proportion of households that had medicines within the child's reach was much lower in Indian study (Banerjee et al., 2016), but higher in Turkish and Egyptian studies, between 53-67% (Abd El-Aty et al., 2005, Erkal and Safak, 2006).

Suffocation or choking hazards

Suffocation or choking are leading causes of unintentional injury or even death in infants and toddlers. However, it is relatively difficult to determine exact types of hazards that could contribute these incidences. There are several items in the home that present a choking or suffocation risk to infants and young children. This might be the reason, types of suffocation and choking hazards that have been reported in different studies are different.

The current study observed that about 90% of households had plastic bags and these were within the reach of the child in more than half of those households (52%). Addition to this, small objects such as marbles, coins, buttons, toys and loose or spare batteries were within the reach of the child in 40% of the households that had these small objects (93% households). A similar study in China reported that 74% of households had plastic bags, 69% of households had coins or buttons and 67% of households had toys with small components (Qiu et al., 2014). However, it is unclear from the study that whether these objects were within the reach of child or just presence in the households.

In an Indian study by Banerjee et al. (2016), coins were within the reach of the child in 14% of households and cosmetics, safety pins or other choking hazards were within the reach of the child in 8%. A study by Khan also reported that about 15% of households had toys that were pointed and sharp, and 19% had other small choking hazards in accessible places (Khan et al., 2013). This suggests that the suffocation or choking hazards such as plastic bags, coins or buttons and toys with small parts were the most common hazards in the countries like Nepal, China, India and Pakistan.

Electric hazards

In the current study, electrical cables were within reach of the child in 13% of the households and electric wiring was unsafe in 6% of the households. Similar findings were reported by Banerjee et al. (2016) from India, where 14% of households had an uncovered wire within the reach of the child. In Egypt, Helmy et al. (2002) also found unsafe electrical cords in 16% of households in their studied population. The current study also observed that the electrical switches or plug points were within the reach of the child in 8% of the households. In contrast, 22% of households in Indian study had plug points or a switch board within the reach of the child (Banerjee et al., 2016). Furthermore, a study from China reported that 55% of households had low sockets and were uncovered in 53% of households (Qiu et al., 2014). Similarly, a Turkish study noticed that 63% of households had open electrical sockets in living rooms, dining rooms and bedrooms, 95% households had these in their kitchen, and 53% of households had these in their bathroom (Erkal and Safak, 2006). This data suggests that electricity related hazards are much lower in Nepalese households than in many other LMICs that have reported such hazards.

This section has summarised the findings of home hazards assessment of the current study and compared them with similar studies reported the home injury hazards in LMICs. This enabled to understand the most common household hazards in Nepal and in other LMICs. For example, open fire was found as most common hazards in Nepal and other LMICs for childhood burn. Similarly, stairs, balcony and windows without protective railing and lack of lockable cupboards was noticed as common hazards for fall and poisoning respectively. Some of hazards that were identified as most common hazards in the current study were not reported in other studies from LMICs. This is most likely due to the difference in household environment, where some hazards were more common than other, so only the common hazards were reported in those studies. Thus, the comparison also helped to validate the findings of current study, ultimately, highlights the need of home safety programme to eliminate or reduce these hazards.

7.3.3 Summary of regression analysis results

The main objective of the regression analysis was to investigate the relationship between the number of home hazards and number of children with (i) any injury (ii) specific types of injuries, adjusted for family and home variables.

The results of both primary and secondary analyses found a positive correlation between the number of identified home hazards and proportion of children with injury. Primary analysis showed more than a two-fold increased risk of injury to children living in households with 8-9 hazards (AOR 2.39; 95%CI: 1.60 - 3.56), and almost a four-fold increased risk of injury to children living in households with 10 to 15 hazards (AOR 3.94; 95%CI: 2.52 - 6.16) when compared to children living in households with 1 to 7 hazards. There was an estimated increase of 31% in the odds of injury occurrence associated with each additional injury hazard found in the home (AOR 1.31; 95%CI: 1.20 - 1.42).

The findings from the secondary analyses were broadly similar to that from the primary analyses in that the higher the number of hazards found in the home the greater the likelihood of an injury occurring. (Section 5.5.3)

7.3.4 Comparison of findings of regression results with other studies

Few studies are available with which to compare the findings of this analysis. The results found are similar to some previous studies (Keall et al., 2008, Banerjee et al., 2016) because a similar analytical approach was used. A study with 163 households in West Bengal, India found a significant association between the number of injury hazards in a household and either unintentional child injuries that required medical care, or cessation of regular activities for at least one day (Banerjee et al., 2016). This study revealed that the odds of having an injury increased by 55% with each additional injury hazard found in the home (AOR 1.55; 95%CI: 1.3 - 1.8), adjusted for confounding variables. The finding of this Indian study that found a similar pattern of association between home hazard and injury, suggests that the findings of current study are valid. Similarly, positive associations between increasing numbers of home hazards and increasing numbers of injuries have also been found in HICs such as New Zealand (Keall et al., 2008), and Canada (LeBlanc et al., 2006).

In contrast to studies reporting increasing injuries with increasing numbers of hazards, studies from Australia (Osborne et al., 2016) and from Egypt (Kamal, 2013) and the UK

(Pearce et al., 2012) did not show such relationships between numbers of hazards and numbers of injuries once home factors were adjusted for. Authors of these studies highlighted the importance of socioeconomic status as a cause of injury risk. The difference between the findings of current study and the studies from Australia, Egypt and UK might be related to the difference in socio-economic conditions. For example, children in Australia, UK and even Egypt may live in generally safer environments in which children grow up. In the HICs like UK and Australia, there are buildings regulations and there has been a greater emphasis on safety than in LMICs. These might be the reasons that the children in these countries are less likely to expose to hazards of injury or the potential impact of hazards in the home are moderated/ reduced somehow.

7.3.5 Strengths and limitations of household survey

7.3.5.1 Strengths

This household survey was conducted in the Makwanpur districts of Nepal to provide population-based injury incidence data and information about a representative sample of households (Rahman et al., 1999). Makwanpur district has a variety of geographical environments (high hill, mid hill and lowland) and represents the majority of Nepal. Conducting a household survey in this district provided the opportunity to explore injury hazards and home injury epidemiology of different geographical regions. Ultimately, it provided comparable survey data from three regions and enabled exploration of whether a difference in culture and socioeconomic conditions affected childhood home injury and prevalence of home hazards.

To plan the size of the survey sample, sample size guidelines for conducting household surveys in developing countries, recommended by the WHO were used (United Nations, 2008). Multi-stage cluster sampling with probability proportional to size (PPS) methodology was applied to select the surveyed units (i.e. individual households for data collection). Simple random sampling was then used to select the VDC and households. These methods ensured the study was representative of the population in these VDCs (Thoms and Ron, 2007). In general, household listing is not available in low-income countries, therefore, household screening in all three randomly selected VDCs was undertaken. This provided an up-to-date list of eligible households for the survey.

Local, experienced data collectors carried out the survey supervised and led by the author of this thesis with monitoring by two members of staff from MIRA, an established research-focused NGO. Data were collected from all the sampled households. A small number of households were replaced with similar households for data collection if the original household's member was not available after two visits. There are no missing data for any of the variables in the survey. When collecting the completed questionnaires, either the researcher or field coordinators were responsible for checking missing data in the field. If missing data were found, the responsible data collector was asked for clarification, and households revisited if needed.

Terms used in this survey such as injury, home environment and home hazards were clearly defined to maximise interrater reliability during data collection. To ensure that data collectors were well informed about all possible mechanisms of unintentional injuries to children and potential home injury hazards, three days of training were provided for data collectors, including a trial field visit. In addition, guideline manuals for data collection were developed and provided to data collectors. Additionally, no more than 5-7 households were visited in a day by a data collector. These factors helped in the collection of high quality data, and minimised bias arising from inter-rater differences in understanding of the questionnaires (Bowling, 2005).

Long recall periods are associated with underestimations of injury incidence, due to injury events being forgotten. For the reliable estimation of non-fatal injury rates, recall periods of 3 months or less is recommended (Harel et al., 1994, Mock et al., 1999, Moshiro et al., 2005). Therefore, the details of all injuries that occurred in the 3 months prior to the first survey (between 18 November 2014 and 17 February 2015) were asked for retrospectively. The short recall period helped responder to remember specific details of injuries (including minor injuries) and minimised the risk of under-reporting of injury events.

This is the first survey that has been conducted in Nepal to explore the home hazards and home injury in children <5 years. The home hazard assessment checklist included a detailed assessment of the presence of home injury hazards by data collectors through observation rather than reliance on a written or verbal report from household members. This study has not only identified and quantified potential home injury hazards, but also explored the association between the number of home hazards and number of child injuries. This study has also presented a detailed picture of child injury occurrence in and around the home. In addition, detailed demographic and socio-economic information of households helped to explain their relationship with child injury.

Studies in other LMICs that assessed the presence of home hazards for childhood injuries did not clearly define how they standardised the term "within reach of the child" (Khan et al., 2013, Parmeswaran et al., 2016). Rather than using the terms "within reach" or "out of reach", this study applied different methods to determine whether potential hazards were within reach of the child or not. For example, potential hazards were recorded according to the place where they had been stored/kept, or whether potential hazards were present or absent. Location of hazards were categorised into different options: (1) on the floor, (2) <1-meter height, (3) >1-meter height, (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) Not Applicable. The options for hazard presence or absence included (1) Yes, (2) No, (3) Not Applicable. These options were all used to determine whether potential hazards were within the reach of a child and consistent recording of hazards.

While analysing the home hazards data, the options ‘on the floor’, ‘<1-meter height’, and ‘unlocked cabinet/drawer’ were used to classify the presence of a hazard, and the options ‘>1-meter height’ and ‘locked cabinet/drawer or store-room’ were used to classify the absence of a hazard. Thus, home injury hazard data were categorized into 3 categories: hazard, no hazard and not applicable. The proportion of households possessing a given hazard were calculated with exclusion of cases that were not applicable to the study.

7.3.5.2 Limitations

Makwanpur district covers three different geographical settings, which are similar to other areas of Nepal. Whilst random sampling was used to select three of the 36 VDCs, three VDCs is a relatively small area of coverage for the whole district. Three were chosen because this was felt to be practical within the time frame and represent the main geographical areas in Nepal. High hill, mid hill and lowland areas were categorised according to their altitude. As such, the lowland of Makwanpur does not represent the geography of the plain areas in southern Nepal which are lower in altitude. Therefore, the results of household surveys may not be generalisable to all environments in Nepal.

Although injury and its mechanisms were clearly defined for the purposes of this survey, the accuracy of information regarding child injury depends on proxy responses. The quality of proxy respondent information on childhood injury is an important issue; proxy respondent data on childhood injury have been found to be reliable and valid if they are provided by parents (Macarthur et al., 1997). In this survey, the main caregivers of children were interviewed to obtain child injury information. In most surveyed households, mothers were the main caregivers, but in others the main caregivers were the grandparents, fathers or older siblings. There is a possibility of variation in responses provided by different respondents' due to the difference in their knowledge and awareness of child injury.

Three month recall periods are useful in the collection of detailed information regarding non-fatal injury but a longer recall period would have included the potential seasonal effects on injury incidence (Hang et al., 2004). For example, injury incidence in summer could have been compared to winter months (Zwerling et al., 1995). This study only found one case of fatal injury within the 12-month recall period; twelve months as a recall period is a relatively short period of time, or sample size of this study may not have been large enough to identify cases of death due to home hazards, relative to the population of Nepal.

In many studies, poisoning, drowning, suffocation and choking are frequently reported as causes of mortality and morbidity in preschool children. In the current study, no injury events were reported due to poisoning. There was a single event of near-drowning and one event of suffocation or choking. This finding may be valid and accurately estimate the incidence in this sample. Alternatively, there may have been under-reporting of these injury types, possibly by the parents not wanting to share information of these events as they felt guilty, or that the injuries did not leave visible marks as other do and were forgotten or ignored.

The hazard assessment was carried out at the time of household survey, so it is possible that the household could have contained a different number of hazards at the time the injury occurred. If this is the case, the quantity and type of identified home hazards may have differed over time.

This survey only covered the rural area of Makwanpur district, so child injury in these home environments, and the potential hazards in the households, doesn't necessarily reflect those of an urban area. Whilst the findings regarding home injury hazards may not be generalizable to urban communities, they would be relevant to similar rural communities.

Despite providing rigorous training and guidelines to the data collectors, there could have been a difference in perception of injury hazards, and variation in the hazard assessment process between data collectors. Due to the limited time and resources available, it was not possible to re-visit a surveyed household to check interrater reliability during data collection.

7.4 FOCUS GROUP DISCUSSION

The objective of the qualitative study was to explore the potential for home environmental change at a community level to prevent children from unintentional injury in their home environment, and to identify the barriers and facilitators of such change. This study complemented the quantitative data collection, and provided a greater understanding of home injury hazards.

7.4.1 Summary of findings of focus groups

Overall, 47 participants took part in five FGs in three different geographical regions. The FG discussion with mothers was conducted in Gogane VDC (high hill), the student, health volunteer, and teacher groups in Ambhanjyang VDC (mid hill), and the focus group with fathers took place in Dhiyal VDC (low land). Overall, four main themes were identified: knowledge of home injury and associated hazards, potential environmental changes or modifications to improve home safety, barriers to environmental change or modification, and facilitators of environmental change or modification.

Throughout the discussion, it became clear that childhood injuries were not considered a public health issue. Despite this, participants were able to describe a range of strategies for environmental change to make homes a safe place for children. Many participants thought that a lack of awareness about potential injury risks and how to manage those risks were the major barriers to making their homes safer for children. Some mentioned the poor financial situation of rural people, geographical constraints, poor housing conditions and lack of common responsibility amongst family and community as other barriers to environmental change. Most participants suggested that the best facilitator to improve home safety would be the provision of an awareness programme for the community. Some suggested that resources and financial support would be helpful, whilst others believed that changing the home environment for the safety of a child should be the responsibility of all family members, as well as the community.

7.4.2 Insight from the FG discussion

Qualitative studies on child injury prevention are important to explore a range of factors, including: perception of the causes of injuries and prevention measures (Butchart et al., 2000, Rahman et al., 2008, Mashreky et al., 2009, Chowdhury et al., 2013), parents' knowledge, attitude, and belief related to childhood injuries (Morrongiello and Dayler, 1996), mothers' belief about parenting and injury prevention (Laura and Bennet, 2001), and parents' perception, attitude and behaviours towards child safety (Vincenten et al., 2005). In Nepal, there is limited data available from qualitative studies to understand injuries occurring to children in the home, their causes and potential preventive measures.

Home injury and associated hazards

Injuries in children were considered as a normal part of child development, and most people in the community did not believe that injuries could be prevented. These perceptions of fatalism in relation to child injury were also heard from the participants of other studies conducted in LMICs (Butchart et al., 2000, Munro et al., 2006). This includes a previous study in Nepal that also found parents perceived injury to be a bad coincidence, bad luck, witchcraft or ill fate (Pant et al., 2014). Fatalism in relation to child injury were also present in HICs (Morrongiello and Dayler, 1996, Whitehead and Owens, 2012, Ablewhite et al., 2015a). Perceptions of injury risk and prevention measures have been found to vary between people, depending upon their professional, social and personal backgrounds (Rothe, 2000, Stone and Morris, 2010). Therefore, to develop and deliver the appropriate interventions, it is vital to understand the perceptions and values of those receiving interventions. In terms of home injury and hazards, participants talked about different injury hazards that they were aware of in their home and community that had resulted in both fatal and non-fatal injuries in children. For instance, sharp weapons, open fires, lighters or matches and poisonous chemicals like fertilizers, pesticides, and medicines were identified as more prominent causes of child injury in the home. Nepal is one of the poorest countries in the world (DAC List of ODA Recipients, 2016) and it is well known that low-income communities possess a higher burden of injury hazards (Peden et al., 2002, Peden et al., 2008).

Past research in HICs has shown that supervision (i.e. watching, proximity), teaching children (i.e. about safety behaviour) and modifying the local environment (i.e. reduce access to hazards) are the most common strategies for reducing the risk of injury in young children at home (Morrongiello et al., 2004). It was apparent from the FG discussions that providing supervision and teaching children about safety were common practices in the community to prevent child injury in the home. However, there has been insufficient evidence to suggest that supervision alone is effective to prevent child injury risk (Morrongiello, 2005, Morrongiello and Schell, 2010), and relatively little is known about parental teaching of young children about home safety (Morrongiello et al., 2014). Studies have shown that inadequate supervision predicts more frequent injuries (Morrongiello et al., 2004, Morrongiello et al., 2011) and the use of a teaching strategy with preschool children was not effective to reduce the frequency of injury without addressing home hazards (Morrongiello et al., 2004). This might be the reason that supervision and teaching strategies, without environmental modification, have not been effective in preventing child injury in Nepal. Although supervision might have prevented some injuries, not all the parents in rural communities in Nepal are able to provide consistent supervision to their children. In low income communities, economic activities of parents, such as work, limits the parents' ability to supervise their children (Munro et al., 2006). FG discussions revealed that some parents tie children's legs or leave them unsupervised at home when they have to go for work. This suggests the importance and need of a home safety and crèches programme in Nepal.

Potential environmental change or modification in the home

The current study gave insight into the community's understanding about environmental change to improve home safety. In this regard, some participants believed that removing hazardous objects from a home, or restricting the child's access to those hazards would have the potential to prevent injury, for example, installation of railings on a balcony, and grills on windows and fences around the house, would have the potential to protect their children from common types of injury such as falls and drowning. Safety education that could improve parental attitudes to their local environment was also highlighted in the FG discussions as an important method of injury prevention. The findings of the current study were consistent with a qualitative study, where culturally appropriate home visits and environmental modification interventions were suggested to prevent unintentional injury in young children in a Mexican population (Crosslin and Tsai, 2016). A qualitative study conducted in South Africa concluded that interventions including environmental changes involving less inputs and activities from the parents would be effective in a low income contexts (Munro et al., 2006). This is because low income communities would not be able to afford resource intensive interventions and would be unlikely to be sustainable over longer periods of time. This was confirmed by a study conducted in rural Bangladesh (Rahman et al., 2010), which found that interventions using low-cost, locally available resources which addressed the needs of the community were well-received by the community. Although participants were able to suggest a range of potential environmental change strategies, it was clear from the FG discussions that most of the people in the community had not actually carried out these changes in their home. This might be due to the prevailing culture/practice of accepting hazardous home environments in their community, or believing that parental supervision and teaching children about safety were the sole means of preventing child injury. Similar patterns were seen in rural Bangladesh, where people generally knew the causes of child drowning and its preventive measures, but rarely took preventive measures to protect their children from drowning (Rahman et al., 2008). A previous study in Nepal also reported that parents generally believed that warning or teaching children about the risk of injury was the main preventive measure to injury, and so put less efforts to improve hazardous environments (Pant et al., 2014).

Barriers to and facilitators of home environmental change or modification

Understanding the barriers to and facilitators for injury prevention is essential in the successful development and delivery of injury prevention interventions. Several studies in HICs have identified key barriers and facilitators to keep children safe from unintentional injury within the home environment (Smithson et al., 2011, Ingram et al., 2012, Ablewhite et al., 2015b). However, the findings from HICs cannot directly be compared to the findings from LMICs due to the difference in the socio-economic conditions, housing structures, types of home hazards and prevention measures. Some of the barriers and facilitators identified in the current study are also highlighted in the studies from HICs.

In the current study, lack of awareness about injury risk and risk management was found as the major barrier to making homes safer for children. Participants believed that most parents and guardians in the studied population were uneducated and therefore they did not have proper knowledge about injury risks or know how to manage those risks. Consistent with the current study, a lack of parental anticipation of injury-producing events and lack of knowledge about the consequences of injury were barriers to home safety (Ablewhite et al., 2015b). Similarly, lack of awareness or knowledge of injury risk was highlighted as a barrier to home safety intervention (Vincenten et al., 2005, Smithson et al., 2011). Other factors in the current study acting as barriers included geographical constraints and poor housing because most houses in their community were built within a small area (due to topography). The majority of people in this community were unable to afford the associated cost to improve the home structure, for example, the cost related to the installation of railings or safety equipment in the home. Consistent with this, a review by Smithson et al. (2011) reported that poor quality housing and the cost of installing safety devices were the main barriers to the success of interventions that aimed to reduce injury in the home. A review by Ingram et al. (2012) found low household income as an important barrier for home injury interventions. This is because the families living with economic constraints tend to prioritize the food and living costs over investing on home safety (Olsen et al., 2015).

The current study found that the best facilitator to improve home safety would be a provision of an awareness programme for the parents/carers to change their behaviour. Many participants believed that awareness raising would be an effective prompt to make people realize that they have the responsibility to change their own home environment. Consistent with the current study, enabling parents to predict injury risk has been found to help them to remove the hazard or restricting child exposure to those hazards (Ablewhite et al., 2015b). Similarly, providing culturally sensitive information and advice about the injury risk to the mothers would be successful factors for injury prevention (Smithson et al., 2011). However, other participants suggested that resources and financial support to those in the community would help them to build a safer house or maintain existing safety measures. With regard to 'resources and financial support', provision and free fitting of safety equipment, particularly for low-income families, was noticed to be an important factor for successful intervention (Ingram et al., 2012). In the current study, participants believed that changing the home environment for the safety of a child should be the responsibility of all family members, as well as of whole community. They also believed that if one community could develop as exemplar, then other communities could follow. In a study by Ingram et al. (2012), sensitizing the whole community to normalize safety practices by increasing the risk awareness was described as successful approaches for injury prevention intervention.

Here, it is important to note that although people thought that awareness raising was an effective way to change injury risks or outcomes, awareness program on its own is unlikely to be effective. This is because changing the individual behaviour is difficult. Therefore, intervention that focus on community development and consider passive methods to enable people to live safer lives, e.g. through legislation, product design or environmental change that is delivered by agencies (such as the local authority) is more likely to be effective for injury prevention.

Overall, this study reveals important insights into a community's knowledge and perception regarding home injury and home hazards, and their suggestions for effective environmental change intervention including barriers and facilitators. The finding of this study could be adapted to develop home injury prevention interventions in rural communities of Nepal, as well as in similar settings of rural low-income countries, ultimately reducing home injury incidence due to a hazardous home environment.

7.4.3 Strengths and limitations of focus groups

7.4.3.1 Strengths

The current qualitative study was exploratory and, intended to complement the quantitative data collection to provide a detailed picture of home injury hazards in Nepal (Creswell, 2013). This is the first study conducted in Nepal to explore community perception of childhood home injury, injury hazards and the possibility of environmental change in the home to combat these.

Diverse participants who represented different groups in the community were recruited, including: mothers, female community health volunteers (FCHVs), early childhood education and development (ECED) teachers, fathers, and school students. The FGs were conducted within the surveyed area of the quantitative study and at least one FG was held in each of the geographical regions. The purpose of having FG discussions in variety of locations was to understand the perspectives of people with different socio-cultural backgrounds. This helped to gather a broad range of information about childhood home injuries and their risk factors. The FG discussions were conducted alongside the household survey for additional insight and understanding of context and depth of household survey data. This ultimately helped to validate the finding the household survey.

The transparency and systematic nature at each stage of study (data collection, analysis and interpretation of results) has been maintained to improve the reproducibility and robustness of the findings (Meyrick, 2006, Tracy, 2010). To further improve the quality of findings, a supervisory team were also involved whilst developing the topic guide, making decisions about sample size and participants, choosing the appropriate analysis method and cross-checking the themes and subthemes by reviewing transcript copies (Noble and Smith, 2015).

7.4.3.2 Limitations

This study did not include interviews. The limit on the number of FGs and the lack of interviews was because of the limited time available for data collection.

Issues regarding the understanding of terms and definitions of injuries might also have influenced the discussion and, ultimately, the results of the FGs. Child injury was a new topic to discuss for most of the participants. Moderators had to remind participants several times about the types of unintentional injuries otherwise most participants only considering road traffic accidents as an injury. Discussion about home injury hazards specifically was also new for the participants. This is perhaps because they live with these hazards every day therefore do not perceive them as hazards. This could be a major challenge in establishing a home safety programme in Makwanpur.

Like all qualitative research, it is not possible to generalise these findings to the wider population. However, FGs with representative people of the community, and FGs in a variety of locations, helped to provide a broader representation of the views and experiences of the community. Therefore, findings from this qualitative study can be transferrable to communities of people living in similar situations.

7.5 OVERVIEW OF THESIS

An overview of thesis is presented below by integrating the findings of the three different studies.

7.5.1 Incidence of childhood home injury

Only one fatal-injury, due to an insect bite, was found in household survey. However, more fatal injuries emerged in the FG discussions that were occurred in children <5 years during the 12 months recall period. For example; one child died falling from balcony, three children died due to drowning, (of which two children in water drum and one in a water bucket), one child died due to fire and burns, two children died due to pesticide poisoning, three children died because of suffocation from their mother's breast and two children died due to animal/insect exposure. The small number of fatal-injuries reported in the household survey could have been due to several reasons. Most probably, household with fatal injury would not have been selected for survey because of random sample selection, or reluctance of the parent to disclose about their child death to the data collector if they thought that could lead to a controversy.

Non-fatal injuries among children <5 years are common in the home environment (Peden et al., 2008, Zia et al., 2012). This is most likely because young children spend most of their time in these settings. This has been well observed from a study of 16 European countries (Sengoelge et al., 2011), and in other HICs such as New Zealand (Gulliver et al., 2005), Canada (Flavin et al., 2006), New South Wales (Harris and Pointer, 2012), and The United States of America (Phelan et al., 2005). Similarly, home injuries in children <5 are commonly reported in studies from LMICs like India (Mohan et al., 2010, Mahalakshmy et al., 2011, Shriyan et al., 2014b), Bangladesh (Chowdhury et al., 2009), Pakistan (Fatmi et al., 2009), Ethiopia (Abebe et al., 2006), Egypt (Halawa et al., 2015), Iran (Mohammadi et al., 2006, Poorolajal et al., 2013), and South Asia (Hyder et al., 2008b). The household survey reported in this thesis revealed an incidence of injuries among children <5 years to be 23.2%, which is relatively high. This finding was supported by the FG discussions, where many participants mentioned that most of injury events in children <5 years occurred in their home and neighbouring environment. In the FG discussions, fall, fire, burn, or scalds and sharp equipment were frequently reported as a cause of non-fatal injuries. Overall, it was apparent from the findings of household survey and FG discussions that many children sustained unintentional injury in their own home due to hazardous living environment. Some children also had fatal injury, but these are more likely to be underreported.

Why do pre-school children experience an increased frequency of injuries in the home?

<u>Child development:</u> children are highly dependent on their carer in early childhood whilst they are developing both physically and cognitively. Furthermore, young children are vulnerable to injury because they are curious in nature, and like to explore the

environment around them before they develop the skills that they need to identify and respond to potential risks (Garzon, 2005). This was highlighted in the FG discussions as an important risk factor of childhood home injury.

Parental supervision: The likelihood of child injury is also determined by the changing level of supervision in accordance with age, the environment in which they live and the way they are nurtured (Towner et al., 2005). In most of the rural areas of Nepal, there is no provision of nursery classes, early childhood development centres or crèches. Most preschool aged children stay at home with their parents or other members of family. Parents understood that by leaving their child while they were at work their child would be at risk of injury. Therefore, they would tie their children - to try to keep them safe from harm.

Hazardous living environment: In addition to child behaviour and inadequate supervision, hazardous household environment and unsafe practices were important factors that contributed to injuries in children. Both household survey and FG discussion of current study provide evidence for this (detail in following section, 7.5.2).

7.5.2 Home injury hazards and unsafe practice

Published research has reported that low-income communities live in environments with greater numbers of hazards than high-income communities (Peden et al., 2002, Peden et al., 2008). Hazardous living environments such as poor housing infrastructure, lack of barriers to cooking or washing areas, inadequate recreational space, use of open fires and paraffin stoves, lack of safe storage for harmful substances, stairs and window without safety grills, unprotected balconies and open water reservoirs are among the major risk factors for child injury in low-income settings (Hyder et al., 2008b, Balan and Lingam, 2012). Some of the studies that assessed home hazards for childhood injury in LMICs confirm this finding (El-Aty et al., 2005, Erkal and Safak, 2006, Mirkazemi and Kar, 2009, Kamal, 2013, Khan et al., 2013, Banerjee et al., 2016, Parmeswaran et al., 2016). The current study found similar hazards in the surveyed households as those mentioned above. For example, the absence of protective railings on stairs or ladders and cooking stoves within the reach of young children.

Most of the hazards that were identified from household survey were also highlighted in the FG discussions. However, some hazards and unsafe practices that were not identified through the survey were noticed as important during the FG discussion. For example, narrow stairs, high porch or entrance area, and the quality of cradles (cot) were found as common hazards for fall injury in the FG discussion. Similarly, boiled water for domestic use and hot liquid food within child's reach were also mentioned frequently in the FG discussion as burn and scald hazards. It is particularly surprising to know that one child lost his eyes because of being pecked by a hen, and one baby died due to the asphyxiation as a cat had sat on his face. Practices such as a mother sleeping with her baby in the same bed, covering a baby's face with cloth to protect from houseflies, and allowing small children to wear rubber bangles (choking hazard) were discussed during focus groups and some of these were reported to have resulted in child deaths. Some of the cloths that they used to cover their baby's face were thick enough to make breathing difficulties. Similarly, rubber bangles were small in size and made of soft plastic that could easily lodged in the baby's throat if they put in mouth. This shows that although the household survey captured a large range of injuries and injury risks, there were other risks and injuries that were not listed in the household survey, and this demonstrates the value of using different methods to gain information on a subject.

Why do most households in rural Nepal live in hazardous environments?

<u>Lack of public awareness of risk</u>: The World Health Organisation report on child injury prevention showed that many LMICs lacked community awareness about child injury prevention (Peden et al., 2008). This was also apparent from the FG discussions in the current study, which revealed that most parents and guardians in their communities' lack awareness of injury risks or an understanding of what parents could do to keep their child safe from those risks.

<u>Relationship with poverty</u>: There is good evidence of the social gradient in both LMICs and HICs. The findings from both the household survey and FG discussions support the earlier literature, that injuries occurring to young children in the home could be associated with the poor economic condition of households. Low-income communities are known to have more hazards (Peden et al., 2002, Peden et al., 2008) and hazardous home environments are the major risk factor for child injury in low-income settings (Hyder et al., 2008b, Balan and Lingam, 2012). The findings of the household survey and FG discussions provide evidence that many households in the studied area were of low income and that most households live in hazardous environments. The FG discussions

also highlighted that parental work patterns, child supervision, and physical and structural safety of the home environment were severely affected by income.

<u>Lack of resources and skills</u>: Resources and the necessary skills are essential for improving the safety of a home environment. For example, installing a railing on a balcony, or placing safety locks on cupboards or drawers, all require resources and a set of skills to install them. It was apparent from the FG discussions that the community lacked both resources and skills, and were therefore unable to make their home safer for children. Additionally, it was noticed from the FG discussions that, most of the households in hilly area were built on small piece of land due to the topography. Therefore, many of these houses were either single room dwelling or without separate kitchen or living rooms. Changing the home structure in hilly area need to flatten the land to increase the area of land. And, most of the people in the community were unable to afford the associated cost of it.

<u>Lack of empowerment to act</u>: Fatalistic views about injury were well-recorded in the FG discussions. Most parents believed that child injury was an unavoidable event and therefore preventing injury was beyond their capacity. This might be the reason that people did not consider a preventative measure even after their child had sustained a severe injury. This can also be seen from the results of household survey. For example, a fall was reported as the most common cause of child injury, but a large proportion of households had unprotected balconies, windows and stairs. This fatalistic view is also present in other low-income societies in the world, and has a negative impact upon health-seeking behaviours including home safety. Ultimately, these people still believe that accidents and injuries are the results of ill fate or bad luck (World Health Organization, 2011c).

7.5.3 Relationship between home hazards and child injury

Studies conducted in Canada, New Zealand and India have shown that environmental hazards are significantly associated with child injury (LeBlanc et al., 2006, Keall et al., 2008, Banerjee et al., 2016) even after adjusting for confounding factors. Studies conducted in the UK, Egypt and Australia have shown that socioeconomic factors are associated with child injury independent of living in hazardous environments (Pearce et al., 2012, Kamal, 2013, Osborne et al., 2016). To develop a targeted injury prevention programme, it is important to understand the relationship between home hazards and child injury risk. In this study, after controlling for confounding factors, a positive relationship was found between both the number of home hazards and number of child injuries, and between the number of specific hazards (fall, fire, burn or scald and cut or crush) and the number of related injuries to these hazards (fall, fire, burn or scald and cut or crush). These findings suggest that children living in households with a higher number of environment hazards have higher chance of having injuries, independent of the socioeconomic situation of the household. The FG discussions also suggested that hazardous living environments were likely to contribute to child injury, particularly when children were not under the supervision of adults. For families living in rural Nepal, it is usually not possible to supervise children all the time because parents need to work and there is no childcare provision. However, there was an awareness in the FGs that injuries might not have happened in the community if a carer had been able to provide constant supervision.

7.5.4 Home environmental change and safety practice

Making an environment safe and using safety equipment are key aspects of home injury prevention in young children (Morrongiello et al., 2004). The presence of an environmental hazard does not necessarily mean that it will contribute to an injury; however, the exposure of children to those hazards is likely to increase the risk of injury. Environmental modification helps to limit a child's injury risk, either by eliminating the hazards or by using safety equipment (and practices) to restrict access to the hazards. Environmental modification may reduce both the likelihood and severity of injury.

The household survey found that, out of 242 injury events, safety measures to improve the home environment were applied in just 7.4% (n=18) cases (after injury events) to prevent the reoccurrence of such injuries. This number shows clearly that environmental modifications to improve home safety are uncommon in rural areas of Nepal. This was reaffirmed by the FG discussions, which revealed that most houses in their communities were not safe for young children. A lack of awareness about home safety in the community was highlighted as a major barrier to environmental change, although FG participants suggested that a range of culturally appropriate environmental change interventions could be effective in reducing the number of hazards found in household survey. As an example, the household survey found that most households that had a balcony did not have a protective railing, however the FG participants suggested independently that a railing should be installed on balconies to protect children from falling. In addition to environmental change, the FG participants also suggested the adoption of safety behaviours, such as putting a fire out after cooking food and locking toilets and kitchen door (if households have these) when not in use. For hazard reduction interventions to be effective, the identified barriers to environmental change need to be considered; this includes lack of awareness of risk, a poor financial situation, geographical difficulties, poor housing quality and the lifestyle and culture of those living in rural areas. At the same time, identified facilitators need to be enhanced, such as provision of an awareness programme, resources (locally available resource and required skills), financial support and family and community involvement.

The systematic review found limited evidence from LMICs to determine whether environmental change interventions reduced home hazards or child injury compared with no intervention. There was a paucity of high grade evidence to evaluate the interventions that changed/modified the home physical environment with the aim of reducing the number of injury cases or hazards., Nevertheless, the review found that a multifactorial intervention, such as home inspection/visit to identify potential hazards, home safety education to parents/caregivers together with installation of safety devices resulted in significantly reduced poisoning hazards and burn-related unsafe practices. Product modification, such as child resistant paraffin containers and safety education, were effective in reducing poisoning from paraffin ingestion. Although, this review provides insufficient details to help the development or implementation of environmental change interventions for Nepal, it does show that passive interventions, along with safety messages, have the potential to improve safety.

Integrating findings from all three studies (household survey, FG discussions and systematic review), this thesis can suggest culturally appropriate environmental change interventions and safety behaviours for preventing childhood home injury in rural Nepal. However, effectiveness of intervention dependence on feasibility, practicability and sustainability of the intervention in a specific population. As such, when deciding on what will be the most cost-effective intervention for a community, involvement of people from that community in the decision-making process is worthwhile. Thus, suggested environmental change interventions and safety behaviours in the table 7.1 need to be further developed with communities and evaluated to prove their effectiveness.

Table 7.1 Common hazards and potential strategies to address them, grouped by possible consequence of home hazards

Common home hazards and unsafe practices (Identified from home risk assessment and FG discussion)	**Potential home environmental change and safety practices** (Achievable after awareness raising activities as an input)
Falls	
Protective handrails absent along both sides of stairs or ladder	Install hand rails on both sides of stairs and ladders
Windows without protective guards or rails	Install protective guards or rails in windows
Balcony without protective bars or railings	Install protective bars or railings in balcony
Large objects like book shelves, TVs, entertainment units, furniture etc. are unstable on their own or unsecured to the walls	Make lager objects stable on their own or secured them to the walls
Furniture (table, stools, chairs etc.) close to window, ceiling fans, balcony or rooftop's railing	Avoid placing "step-stones" such as furniture close to window, balcony or rooftop's railing
Shower or bathing area with slippery surface	Make rough surface on shower or bathing area
Walking area with cluttering items, telephone or electrical cords and other obstacles	Keep walking area free of obstructions
Baby walkers accessible to child aged <18 months	Avoid access of baby walker to child <18 months when they are not supervised by adults
Indoor walking areas not adequately lit	Arrange enough lightening in indoor walking area
Stairs, balconies, porches or patios with slippery surface or liquid, grease or water on the floor	Keep all the surface dry as far as possible
Narrow stairs that were made from tree trunk	Make stairs wide where reasonably practicable
High porch or entrance area	Never leave babies unattended on raised surfaces
Falls from cradle (cot) that are mostly home made	Ensure bed-rail of the baby cot is tall enough and always raised when the baby is in the cot
Drowning	
Unprotected bodies of water (pond, lake, stream etc.) near the house	Install barriers to prevent children from accessing unprotected bodies of water
Open holds or vats designed to feed cattle within reach of the child	Keep these in high place or covered with their lid and keep children away from it
Open container of water or other liquids within reach of the child	Keep these covered with their lid or keep empty when not in use
Ditches or pool of water around the house within reach of the child	Install barriers to prevent children from accessing ditches or pool of water.

Cut and/or crush	
Sharp or hard protruding components (e.g. big stones or pieces of wood, woodpiles, old machinery etc.) within reach of the child	Keep sharp or hard protruding components out of reach of children
Breakable objects (e.g. bottles or any dishes made by glass or mud etc.) within reach of the child	Keep these objects out of reach of children, preferably in a locked cupboard/drawer or store room
Sharp equipment designed for agriculture purpose (e.g. axe, sickle, spade etc.) within reach of the child	Keep these equipment's designed for agriculture purpose out of reach of children, preferably in a locked store room
Sharp items such as knives, scissors, razors etc. within reach of the child (HS + FGD)	Keep these items out of reach of children, preferably in a locked cupboard/drawer
Burn and/or scald	
Cooking stoves within reach of the child	Install proper fence or door at the entrance of kitchen and these must be closed always
Lack of barrier or door between sleeping and cooking areas	Install proper fence or door between the sleeping and cooking areas
Flammable items such as matches, lighters and fuels (e.g. paraffin or kerosene) within reach of the child	Keep/store flammable items in locked cupboard/drawer or store room
Kerosene lamps or candles within reach of the child when in use	Keep kerosene lamps or candles where children cannot reach
Hot irons or other appliances (e.g. hair straighteners) within reach of the child	Keep hot irons or other appliances where children cannot reach
Boiled water for domestic use within child's reach	Boiled water must not be placed within reach of the child
Hot food within child's reach	Hot food must not be placed within reach of the child
Acid kept/stored for cleaning purposes within child's reach	Acid should be kept/stored where child cannot see or reach.
Poisoning	
Alcoholic beverages within reach of the child	Keep alcoholic beverage out of sight and reach of children, preferably in a locked cupboard/drawer or store room
Agricultural chemicals or fertilizers within reach of the child	Keep agricultural chemicals or fertilizers out of sight and reach of children, preferably in a locked cupboard/drawer or store room.
Tobacco products within reach of the child	Keep tobacco products out of sight and reach of children, preferably in a locked cupboard/drawer or store room
Candles or fuels (e.g. kerosene, cooking oil, petrol, diesel, gas etc.) within reach of the child	Keep Candles or fuels where children cannot reach
Cosmetics (e.g. lipsticks, cream, nail polish etc.) within reach of the child	Keep cosmetics out of sight and reach of children, preferably in a locked cupboard/drawer

Cleaning products, chemicals, bleaches, acids and detergents within reach of the child	Always store chemicals in their original containers with appropriate labels and keep out of reach of children, preferably in a locked cupboard/drawer or store room
Toiletries such as shampoos, soaps, toothpastes within reach of the child	Keep toiletries out of reach of children, preferably in a locked cupboard/drawer
Poisonous plants within reach of the child	Remove poisonous plants around the house
Medicines and vitamins within reach of the child	Keep medicines and vitamins out of sight and reach of children, preferably in a locked cupboard/drawer
Electric shock	
Electrical cables within reach of the child	Keep electrical cables out of reach of children
Electrical switches or plug points within reach of the child	Install proper cover to sockets or install >1 m height from floor
Unsafe electric wiring	Install safe electric wiring and check frequently for any malfunction
Water pump within child's reach	Keep fence or any barrier around the water pump
Suffocation or Choking	
Plastic bags within children reach	Plastic bags and strings should be kept out of reach of children
Small food items such as peanuts, beans, seeds or grains etc. within reach of the child	Ensure small food items are kept out of reach of children
Small objects such as marbles, coins, buttons, toys, small loose and spare batteries within reach of the child	Ensure small objects are kept out of reach of children. Choose toys appropriated to the age of children. Avoid toys with detachable small parts
Covering of the child's face with cloth to protect babies from houseflies	Do not use large and heavy cloths. Never let the cloths cover the face of children
Sleeping with mothers on the same bed	Avoid sleeping with baby on the same bed
Children (<2 years) using rubber bangles	Never let children wear rubber bangles
Animal related	
Cattle sheds without adequate fencing	Make proper fence around the cattle shed
Presence of domestic animals like cat, dogs, and hen	Avoid exposure of pets with children, most importantly with children <12 months

Note: Out of reach of child = kept/stored >1-m height, in locked cabinet/drawer or store-room;
Within reach of the child = kept/stored on the floor, <1-m height, or in unlocked cabinet/drawer or store-room

7.6 STRENGTHS AND LIMITATIONS OF OVERALL THESIS

7.6.1 Overall strength of the thesis

This thesis gathered comprehensive information on childhood home injury using a multi-method approach, consisting of a systematic review, household survey and focus group discussions. This multi-method research integrates quantitative and qualitative findings to generate deeper insights to child injuries in the home and associated hazards, greater than would have been possible if a single methodology had been used.

This is the first study in Nepal that used home hazard checklist to identify and quantify modifiable risk factors of child injury in the home environment. This hazard checklist could be adapted for use with other settings and for other age groups.

The data collected on home injury aetiology, potential hazards and the communities' perceptions about potential home environmental change interventions have completed the 1st and 2nd steps of a public health approach to injury prevention (Razzak et al., 2005). This information can be used to directly inform the development of an effective and cost-effective intervention to improve home safety in Nepal and other similar LMICs.

This programme of study also strengthened the collaboration between national and international organisations and health professionals, such as the University of the West of England (UWE) and Centre for Child and Adolescent Health (CCAH) in UK, Centre for Injury Prevention and Research Bangladesh (CIPRB) in Bangladesh, and Mother and Infant Research Activities (MIRA) in Nepal. In addition, a good working relationship was established with health professionals including female community health volunteers (FCHVs), health post staff, and VDC officials in the study area of Makwanpur district, Nepal.

7.6.2 Overall limitations of the thesis

Generalisability of the findings is the main limitation of this study. Although Makwanpur district has great variation in its social and physical environment, the district may not represent fully the country because Makwanpur does not contain the high mountains or the terai so there are topographies in Nepal not represented by the communities surveyed, difference in cultural practices, and its social structures in the community. As such, the findings from this district of Nepal may not translate to all other districts in Nepal.

Furthermore, the current study collected district-level information from the areas in which it was based and not the perspectives of national-level policy makers.

Comprehensive data were collected and analysed according to the aim and objectives of the study. However, from the existing datasets, it may be possible to carry out further analyses. For example, the relationship between an individual hazard and specific resultant injury could be further investigated; the current study only investigated the relationship between number of home injury hazards and number of children with injuries. This was not the target of current PhD and there were also time limitations.

CHAPTER 8: CONCLUSION AND RECOMMENDATIONS

This is the concluding chapter of the thesis, presenting four main sections: achievement of aims and objectives, contribution to research/knowledge, overall conclusions and recommendations for research, practice and policy.

8.1 ACHIEVEMENT OF AIMS AND OBJECTIVES

At the beginning of this thesis, an overview of the literature was performed to establish which home environmental risks for child injury have been previously identified (objective 1) and whether interventions have been shown to be effective in the prevention of child injury in LMICs (objective 2). Objective 3 has been achieved through coordination with the Centre for Injury Prevention Research Bangladesh (CIPRB). In the first year of this study, a visit was made to CIPRB at which the content of the household survey was developed and the process for conducting the survey was discussed; this built on their extensive experience of conducting surveys (Appendix 8.1). During the final year of this study, colleagues at the CIPRB were consulted again to receive feedback on the proposed final recommendations arising from the analysis of the data collected in these studies. By undertaking a household survey in Makwanpur, Nepal, data on home injury aetiology and the prevalence of home injury hazards were collected (objective 4). Together with descriptive epidemiological information about childhood injury, risk factors for injury were further investigated using regression analysis. In addition, the current study collected information about the community's perceptions of home injury, injury hazards, potential home environmental change interventions, and the barriers and facilitators of such intervention (objective 5). Thus, the current study has gathered detailed information that will prove useful when developing potential environmental change interventions against childhood home injuries in rural Nepal. In this chapter, data from different studies are used to recommend culturally appropriate interventions for environmental behaviour changes, and strategies for future development and evaluation (objective 6).

8.2 CONTRIBUTION TO RESEARCH/KNOWLEDGE

8.2.1 Contributions from the systematic review

Injuries sustained in the home are a significant contributor to the burden of death and disabilities among young children, especially those living in LMICs (Peden et al., 2008).

This is the first systematic review to explore home environmental change interventions and their effectiveness in reducing child injury or injury hazards in the home in LMICs. This review found only four studies which met the inclusion criteria, thus highlighting the dearth of experimental studies exploring the effectiveness of environmental change interventions in reducing childhood home injury or injury hazards in LMICs. This review summarizes the effectiveness of the interventions studied, provides information regarding what has been previously studied, and suggests what needs to be studied in more detail.

8.2.2 Contributions from the descriptive analyses of quantitative data

The findings of this study increase our understanding of home injury hazards in rural areas of Nepal by following a risk assessment process, and has been the first of its kind in Nepal. Home hazards were quantified, reported as the proportion of households with hazards, and categorized according to the mechanism of injury. The distribution of childhood home injuries by age, gender, location, mechanism, and outcome were also described in detail. Overall, these findings provide valuable information to inform the development of interventions to address the most common home injury hazards and/or injury mechanisms in Nepal.

8.2.3 Contributions from regression analyses of quantitative data

The multivariable logistic regression analysis used data from the hazard survey to describe the association between the number of injury hazards and number of related injuries. Findings indicated that, as the number of identified home hazards increased, the odds of children with injury also increased, even after adjustment for confounding factors. These findings suggest that addressing the quantity of injury hazards in rural Nepalese homes may be effective in reducing home injury. Additionally, the analyses investigating the association between specific hazards and specific injury types can be used to help prioritise areas for hazard reduction interventions.

8.2.4 Contributions from the thematic analysis of qualitative data

The qualitative study provides new knowledge in the field of childhood home injury prevention by collecting views and experiences of people living in rural communities in Nepal. The findings highlight the Makwanpur communities' perceived inevitability of child injury and their perceived lack of agency in being able to influence the occurrence or outcome of injury events. Nevertheless, in the focus groups, there were discussions on the topic and they enabled the communities to identify hazards and methods to reduce or remove those hazards. These findings provide a robust framework for designing an appropriate home environmental change intervention that are likely to be effective when addressing barriers and facilitators of such a change, to ultimately reduce childhood injury in the home.

8.3 CONCLUSIONS

Several studies in HICs have shown that effective injury prevention for young children depends not only on providing adequate supervision, but also on systematic identification and reduction or management of the home hazards to which children are exposed (King et al., 2001, Phelan et al., 2011, Kendrick et al., 2013a, Stewart et al., 2016). Interventions such as modifying the home environment are important public health approaches to protect children from different injuries (Turner et al., 2006). Environmental modification is a passive intervention and has the advantage of addressing injury risks for not only children but for all occupants of the household. In addition, passive interventions are long lasting compared to active approaches where ongoing behaviour change is necessary to prevent the injury occurrence. However, for the design and implementation of effective home environmental change interventions, accurate information on the burden of home injury and associated risk factors are essential.

In this study, the household survey and home hazard assessment revealed a significant burden of hazards for childhood injuries within the home environment. This study also found a positive relationship between the number of home hazards and number of childhood injuries. FG discussions explored the possible ways of improving home safety by changing the home environment, including specific barriers and facilitators of such change. In addition, the systematic review synthesised the evidence on the efficacy of environmental change interventions in reducing childhood injury and injury hazards in the home environment in LMICs. These findings provide a robust baseline from which it is possible to design a targeted and culturally relevant home environmental change intervention to reduce number of home hazards in Nepal, with the potential to be adapted for similar socio-cultural settings in other low-income countries.

8.4 RECOMMENDATIONS

8.4.1 Recommendations for future research

8.4.1.1 Evidence from systematic review

The systematic review highlighted the need for understanding the risk factors that contribute to a sequence of injury events in the home environment. All four included studies that used multifactorial interventions such as home inspection, education and/or safety devices, so it is difficult to say whether the intervention effect is due to a combined approach or whether one approach had more influence than another. More experimental research is needed to clarify the role of different interventions, such as home visits, education to parents/caregivers, and distribution of safety devices.

Future research could also evaluate whether interventions which target a single injury type are more effective than addressing multiple injury types together. The actual safety effect can be measured by using appropriate study designs such as controlled before and after studies or randomised controlled trials.

The measurement of injury hazards and injury outcomes should be standardised (e.g. using the same validated questionnaire or checklist for measuring injury cases or injury hazards). The use of consistent definitions and measurement tools would enable comparisons between studies in future research.

While it may seem logical that the reduction/modification of home hazards will reduce the occurrence of injuries, only one study in this review measured the effectiveness of hazard reduction interventions on injury rates. Therefore, more studies with rigorous experimental designs are needed to support or refute the effectiveness of an intervention to reduce hazards in the home environment in reducing injuries in LMICs.

8.4.1.2 Evidence from household surveys

The survey found a very small number of child injuries were caused by poisoning, drowning and suffocation or choking. However, these injuries are frequently reported causes of mortality and morbidity in preschool children in other studies and instances of fatal suffocation and drowning were recorded during the focus group discussions. This discrepancy between expected and observed findings might be because these injuries either contributed deaths and the parents did not want to share that information, or because these injuries do not leave visible marks (as other injuries do), so may have been more easily forgotten, or because the survey recipients did not recognise these outcomes as injuries. Further investigations are needed to explore the reason behind this discrepancy. This could be achieved by more qualitative work to understand how these injury types are perceived within the community. This will help to develop relevant questions and these questions could be used in a further survey.

Home hazard assessments were carried out at a single time point during the household survey. As such, there are possibilities that a household could have had a better or poorer environment at another given time point. This is a recognized limitation of cross sectional studies. Therefore, the ability to monitor ongoing trends in injury occurrence would be desirable. Establishing community-based injury surveillance systems to detect trends in injury occurrence would be ideal. If this is not possible then periodic surveys would provide data for comparisons over time. The challenge is that both options require funding and sustainability is an issue.

The survey was undertaken in rural areas of Makwanpur district. Therefore, child injuries and potential hazards could be different in urban communities. Further studies are needed to explore home injury hazards in urban areas to determine whether similar hazards exist or whether targeted interventions need to be developed for each setting.

This study and survey focused on children <5 years and the home since this is where children <5 years spend most of their time and therefore most likely to be injured. Future research could focus on older children and explore the occurrence of hazards outside the home, such as at schools, in play areas and the hazards associated with travel. In Nepal, there are no studies so far that have explored injury hazards for children in these settings.

Regression analysis showed that an increasing number of home hazards was associated with an increasing number of childhood injuries in the home. This suggests that reducing the number of hazards has the potential to reduce the number of home injuries. There is a need for further research to identify effective methods of increasing home safety, potentially by reparation or remediation of identified structural or physical injury hazards, and calculating their associated cost. Following this study, further research is needed to measure whether the repairing or remediation of structural or physical injury hazards could effectively increase safety.

8.4.1.3 Evidence from FG discussions

Communities need to be involved in the design of interventions to reduce home hazards and in the design of the study to test the interventions. However, a culture of fatalism regarding child injury emerged in the FG discussions. Therefore, there is a need for further qualitative research to understand better the culture of fatalism and why people feel disempowered to keep themselves and their children safe.

There is a need for a community-based intervention to be developed to raise awareness of home hazards and to reduce risks for childhood injury. This should be designed for parents, caregivers, early childhood education and development teachers, together with capacity building of village level health workers, such as female community health volunteers (FCHV).

8.4.2 Recommendations for prevention policy and practice

According to the findings of this thesis, adherence to culturally appropriate interventions for environmental behaviour change, and strategies for future development and evaluation are recommended. With the recent administrative transformation in Nepal which instated powerful village and municipal councils with elected representatives, most of the following recommendations can be directed to local government levels. This will ensure that local needs are addressed in policies and interventions. There are some recommendations also for central government and ministries.

1. Injury surveillance system

This study has demonstrated the value of injury data to inform prevention activities. There is a need for continued monitoring of the injury burden and investigation of risk factors. This could be achieved through the development of a sustainable approach to acquiring nationwide data on injuries, by developing an injury surveillance system at a hospital and community level i.e. at health posts and sub-health posts (by the Ministry of Health and population, and local councils).

2. Integration of injury prevention with other child focused programmes

Child injury prevention and control should be an integral part of national legislations and activities to promote child health, survival and wellbeing. This can be achieved through integration of child injury prevention programs with other child rights and child health development programmes, such as those preventing child maltreatment, controlling infectious diseases or promoting child rights. There is an advantage of doing this because it will save time and efforts of key stakeholders that they need for child injury prevention separately. Also, there is an advantage to thinking about the child holistically, so improving one aspect of their life may improve other areas of their life. Sometimes features are related, e.g. unintentional and intentional injuries can be considered as two ends of a spectrum along which lack of parental supervision merges into neglect. Therefore, promoting good parent/child interaction not only reduces the likelihood of maltreatment it may also improve supervision and thereby reduce injuries.

For example, injury prevention activities can be integrated into 'Golden 1000 Days Public Awareness Campaign' which is, since April 2016, currently being implemented with a commitment to reducing undernutrition among pregnant women, infant and young children in Nepal (Ministry of Health and Population, 2017) (by Ministry of Health and Population).

Similarly, Child Friendly Local Governance (CFLG) programme can be utilised as another platform to ensure the safety of all children at home. CFLG provides overall guidance to the government in realizing and mainstreaming the rights of children (Survival, Development, Protection and Participation) into the local government system, structure, policies and process (Goverment of Nepal, 2011). This CFLG strategy was adopted by the Government of Nepal in 2011 where the CFLG operational guideline was endorsed (by Ministry of Federal Affairs & Local Development).

Some activities can be integrated into child protection programmes which is monitored by Central Child Welfare Board (CCWB). This CCWB is statutory body aimed to protect the children's rights as per the Child Rights Convention (CRC) standard (Goverment of Nepal, 2017) (by Ministry of Women, Children and Social Welfare).

3. Home safety awareness programme

In Nepal, there are no general awareness activities within the community about the importance of home safety. Awareness programmes should be developed, implemented and evaluated in both rural and urban areas of Nepal to improve safety for people at home. This can be achieved by providing an appropriate home safety education to mothers' groups, fathers' groups, Early Childhood Education and Development teachers, and Female Community Health Volunteers (by Ministry of Local Development, Ministry of Education, Ministry of Health and Population and local councils).

4. Support for parents

This study revealed that many children under the age of five were regularly being left alone while their parents go to work or are busy completing household tasks. Therefore, there is a need for interventions that can support parents to help increase appropriate child supervision and keep their children safe during these vulnerable times of the day.

Provision of adequate supervision could be a possible intervention, and this can be achieved by developing and promoting the use of crèches (children's centres) or early childhood education and development centres (ECED) in rural Nepal. These have been used in other LMICs (Rahman et al., 2009); a feasibility study for a crèche has been undertaken in Nepal (Pant et al., 2016) but these options are seldom available in Nepal (by Ministry of Local Development, Ministry of Education, Ministry of Health and Population, and local councils).

5. Home environment change/modification

This study suggests there is a need for injury prevention interventions to reduce the number of potential hazards present in the home environment.

Local/provincial government can enforce housing and building code/standards (http://www.dudbc.gov.np/buildingcode) for any new building works. After the Earthquake, the construction codes have been enforced strictly (though only for Earthquake resistance). If the new codes have been recently revised to improve earthquake resistance, there is the potential for local and provincial government to consider safety from other injury risks in the home when preparing building codes/standards for any new building works (by Ministry of Local Development, Ministry of Health and Population, Ministry of Urban Development).

6. Environmental health approach

This study recommends adoption of the principles of the environmental health approach to reducing injuries e.g., responding to the most prevalent injuries and hazards, working with communities to understand the reasons behind the injuries and presence of the hazards, As Low as Reasonably Practicable (ALARP) interventions, considering transfer of risks, hierarchy of control of risks and the need to evaluate risk reduction interventions (HSE, 2014). (By Ministry of Local Development, Ministry of Health and Population, and local councils).

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APPENDICES

Appendix 3.1 Detail search strategy in Medline (Ovid)

The following search strategy was used for this review, using MeSH headings where applicable, and keywords searches.

1	(house* or housing or home or homes or abode* or residence* or residential or accommodation* or apartment* or flat* or maisonette* or condo or condominium* or menage* or dwelling* or domicil* or domestic*).tw.	409912
2	exp housing/	24728
3	exp public housing/	975
4	exp household products/	34904
5	or/1-4	454607
And		
6	(fall* or scald* or burn* or drown* or near drown* or poison* or chok* or asphyx* or suffocate* or injur* or accident*).tw.	784617
7	((chemical* or thermal or electri*) adj5 injur*).tw	8151
8	((unintentional or accident*) adj injur*).tw.	2781
9	((injur* or accident*) adj prevent*).tw.	4810
10	poisons/	1731
11	exp drowning/	3227
12	exp near drowning/	516
13	exp fires/	7022
14	exp burns/	47742
15	exp accidental falls/	14975
16	exp accidents/	137440
17	accidents, home/	3969
18	exp accident prevention/	58446
19	exp "wounds and injuries"/	691709
20	or/ 6-19	1288559
And		
21	developing countries.sh,kf.	71625
22	(africa or asia or caribbean or west indies or south america or latin america or central america).hw,kf,ti,ab,cp.	180097
23	(afghanistan or albania or algeria or angola or antigua or barbuda or argentina or armenia or armenian or aruba or azerbaijan or bahrain or bangladesh or barbados or benin or byelarus or byelorussian or belarus or belorussian or belorussia or belize or bhutan or bolivia or bosnia or herzegovina or hercegovina or botswana or brasil or brazil or bulgaria or burkina faso or burkina fasso or upper volta or burundi or urundi or cambodia or khmer republic or kampuchea or cameroon or cameroons or cameron or camerons or cape verde or central african republic or chad or chile or china or colombia or comoros or comoro islands or comores or mayotte or congo or zaire or costa rica or cote d'ivoire or ivory coast or croatia or cuba or cyprus or czechoslovakia or czech republic or slovakia or slovak republic or djibouti or french somaliland or dominica or dominican republic or east timor or east timur or timor leste or ecuador or egypt or united arab republic or el salvador or eritrea or estonia or ethiopia or fiji or gabon or gabonese republic or gambia or gaza or georgia republic or georgian republic or ghana or gold coast or greece or grenada or guatemala or guinea or guam or guiana or guyana or haiti or honduras or hungary or india or maldives or indonesia or iran or iraq or isle man or jamaica or jordan or kazakhstan or kazakh or kenya or kiribati or korea or kosovo or kyrgyzstan or kirghizia or kyrgyz republic or kirghiz or kirgizstan or lao pdr or laos or latvia or lebanon or lesotho or basutoland or liberia or libya or lithuania or macedonia or madagascar or malagasy republic or malaysia or malaya or malay or sabah or sarawak or malawi or nyasaland or mali or malta or marshall islands or mauritania or mauritius or agalega islands or mexico or micronesia or middle east or moldova or moldovia or moldovian or mongolia or montenegro or morocco or ifni or mozambique or myanmar or myanma or burma or namibia or nepal or netherlands antilles or new caledonia or nicaragua or niger or nigeria or northern mariana islands or oman or muscat or pakistan or palau or palestine or panama or paraguay or peru or philippines or philipines or phillipines or phillippines or poland or portugal or puerto rico or romania or rumania or roumania or russia or russian or rwanda or ruanda or saint kitts or st kitts or nevis or saint lucia or st lucia or saint vincent or st vincent or grenadines or samoa or samoan islands or navigator island or navigator islands or sao tome or saudi arabia or senegal or serbia or montenegro or seychelles or sierra leone or slovenia or sri lanka or ceylon or solomon islands or somalia or south africa or sudan or suriname or surinam or swaziland or	2674174

	syria or tajikistan or tadzhikistan or tadjikistan or tadzhik or tanzania or thailand or togo or togolese republic or tonga or trinidad or tobago or tunisia or turkey or turkmenistan or turkmen or uganda or ukraine or uruguay or ussr or soviet union or union soviet socialist republics or uzbekistan or uzbek or vanuatu or new hebrides or venezuela or vietnam or viet nam or west bank or yemen or yugoslavia or zambia or zimbabwe or rhodesia).hw,kf,ti,ab,cp.	
24	((developing or less* developed or under developed or underdeveloped or middle income or low* income or underserved or underserved or deprived or poor*) adj (countr* or nation? or population? or world)).ti,ab.	50420
25	((developing or less* developed or under developed or underdeveloped or middle income or low* income) adj (economy or economies)).ti,ab.	226
26	(low* adj (gdp or gnp or gross domestic or gross national)).ti,ab.	136
27	(low adj3 middle adj3 countr*).ti,ab.	2580
28	(lmic or lmics or third world or lami countr*).ti,ab.	2982
29	transitional countr*.ti,ab.	93
30	or/ 21-29	2771398
And		
31	exp child/	1522112
32	exp infant/	923728
33	exp infant, newborn/	490308
34	exp adolescent/	1583881
35	exp minors/	2170
36	exp child, preschool/	740360
37	(child* or adolesc* or infan* or young* or minor* or toddl* or baby or babies or new born or youth* or pre-school* or preschool* or teenager* or neonat* or paediatric* or pediatric* or boy* or girl*).tw.	1986900
38	or/31-37	3505443
39	5 and 20 and 30 and 38	3272

Appendix 3.2 An example of email to corresponding authors of an included study

-----Original Message-----
From: Santosh Bhatta [mailto:Santosh2.Bhatta@live.uwe.ac.uk]
Sent: 07 December 2014 10:59 PM
To: Willem Odendaal
Subject: A humble request for additional data for review
Importance: High

Dear Dr Odendaal,

I am a PhD student (Public health), currently studying at University of the West of England, based in Centre for Child and Adolescent Health (CCAH), Bristol. As part of my research, I am conducting a systematic review. The objective of this review is to evaluate the effectiveness of environmental change interventions in and around the home to prevent child injury in Low and Middle Income Countries (LMICs).

I read your RCT study (Odendaal *et al* 2009), which meets all of the inclusion criteria for my review. I note that in your study you published results based on the number of injury hazards. I would like to synthesise studies reporting the number of injury hazards and injury incidences. Therefore, I am contacting you to ask whether you collected data on the number of injuries as well and if so, whether you would be prepared to share this data for inclusion in my review.

Importantly, I would like to assure you that any information given by you or your organization would be kept securely and be used only for this purpose. Your provision of additional data would be fully acknowledged in my PhD and any subsequent publications.

If you are interested in the result of this review or have any questions, comments, or suggestions, please send me an email. Alternatively, you are most welcome to contact my supervisory team (Dr Toity Deave at Toity.deave@uwe.ac.uk<mailto:Toity.deave@uwe.ac.uk> or Dr Julie Mytton at Julie.mytton@uwe.ac.uk).

Thank you very much on this regard. Your time and cooperation will be much appreciated.

Sincerely,

Santosh Bhatta
PhD Student
University of the West of England (UWE), Bristol
Centre for Child and Adolescent Health
Oakfield House, Oakfield Grove, Bristol BS8 2BN
Tel: (+44) 0117 373 8766
Mobile: (+44) 07411189730
Email: santosh2.bhatta@live.uwe.ac.uk

Appendix 3.3 Study eligibility form

Title of study				
Author and year of publication				
Study Characteristics	Eligibility criteria	Yes	No	Unsure
Type of study	Any experimental design (any trials study) at this stage	☐	☐	☐
Participants	The recipients (and or delivery) of interventions who are in LMICs (For example any people who received environmental change interventions living in LMICs. Recipients would be either community people or the people being trained to deliver intervention to the community people. (Seeing the list of LMICs countries used in search strategy)	☐	☐	☐
Types of intervention	Any environmental change interventions designed/intended to reduce the physical hazards at home or within the home boundary or Making the home environment safe to reduce the injury occurrence. It would be either by physical modification or supply/installation of safety equipment or providing education or recommendation or mixed of any that aimed to improve the safety at home or within the home boundary.	☐	☐	☐
Comparison	Who doesn't received environmental change interventions [i.e. Comparing intervention group who is getting environmental change interventions with control group who is getting any other interventions (education, training etc.) or a bit of intervention or not getting any intervention/placebo at all]	☐	☐	☐
Types of outcome measures	Any reported physical injuries in children less than 18 years in study areas or any household hazards associated with child injury.	☐	☐	☐
IN ☐ **OUT** ☐ **POSSIBLE** ☐				
Reason for IN or OUT or POSSIBLE	If study definitely meeting all of the above characteristics [**IN**] If study definitely not meeting any of the above characteristics [**OUT**] If study definitely meeting at least two of the above characteristic [**POSSIBLE**]			
If excluded, reasons for it				
Notes				

Appendix 3.4 Data extraction form

	Description
Characteristics of study	
Title of study	
Author(s), year of publication	
Full reference	
Date of data extraction	
Aim of study	
Study setting including country	Setting: Country:
Notes	
Participants characteristics	
Age (mean, median, range)	
Sex (number, %)	
Inclusion criteria	
Exclusion criteria	
Sample size calculation	
No. of approached participants	
No. of eligible participants	
No. of randomized participants	
Notes	
Method	
Study design (E.g. parallel, crossover, cluster, CBA etc.)	
Unit of allocation	
Number of units (E.g. total no. of HHs, people, village etc.)	Intervention group: Control group:
Intervention/Control (Describe here what intervention & its procedure)	Intervention group: Control group:
Length of follow-up/interval	
Lost to follow-up	Intervention group: Control group:
Notes	
Outcome measures relevant to the review	
(E.g. change in injury rate or risk, change in prevalence of safety features, change in prevalence of hazards etc.)	Primary outcome: Secondary outcome:
Time point measured/reported	
Any other results reported	
Study limitation:	
Other relevant information:	
Key conclusion (s) of the study:	
Notes:	

Appendix 3.5 Characteristics of excluded studies (ordered by study ID)

SN	Study ID	Reasons for exclusion
1	(Mashreky et al., 2011)	Pilot study, No experimental or CBA. No intervention that met inclusion criteria. No outcome that met inclusion criteria.
2	(Sinha et al., 2011)	Before and after study without control group. No intervention that met inclusion criteria. No outcome that met inclusion criteria.
3	(Callaghan et al., 2010)	Community based pilot study/observational study. No comparison group. No outcome that met inclusion criteria.
4	(Wang and Zhu, 2009)	No intervention that met inclusion criteria.
5	(Kumar et al., 2013)	No intervention that met inclusion criteria. No control group.
6	(Konradsen et al., 2007)	Before and after without control group, single group study. Not unintentional injury study. No outcome that met inclusion criteria.
7	(Weerasinghe et al., 2008)	Qualitative study.
8	(Hawton et al., 2009)	Qualitative study.
9	(Jordaan et al., 2005)	Before and after study without control group. No intervention that met inclusion criteria. No outcome that met inclusion criteria.
10	(Hyder et al., 2012)	Community based pilot study/observational study. No comparison group.
11	(Jetten et al., 2011)	Pre-test-post-test study design without control group.
12	(Altundağ and Oztürk, 2007)	Pre-test-post-test study design without control group.
13	(Turan et al., 2010)	Pre-test-post-test study design without control group. No outcome that met inclusion criteria.
14	(Chandran et al., 2013)	Pre-test-post-test study design without control group.
15	(Gimeniz-Paschoal et al., 2009)	No outcome that met inclusion criteria.

Appendix 3.6 Risk of bias, EPOC tool

Risk of bias, EPOC* Tool (for CBA) *Krug, 1994*		
Domain	Authors' judgement (Yes, No, Unclear)	Support for judgement
Random sequence generation (selection bias) (Biased allocation to interventions) due to inadequate generation of a randomised sequence.	High risk	Generation of randomized sequence is not a part of CBA study.
Allocation concealment (selection bias) (Biased allocation to interventions) due to inadequate concealment of allocations prior to assignment.	High risk	No allocation concealment in CBA study.
Baseline outcome measurements similar? (selection bias) Were baseline outcome measurements similar?	Low risk	"During the pre-intervention period the incidence rate in study area were not statistically significantly different from those in the control area: mean 8.63 (SD 4.87) Vs 7.94 (SD 4.26) for the control area." Comments: No important differences were present across study groups for outcome measurements.
Baseline characteristics similar (Confounding bias) Were baseline characteristics similar?	Unclear	"The population estimates may be inaccurate but the two populations are similar in demographic structure and were considered comparable." Comments: Author has mentioned above statement but data available are not enough to judge similarities between the intervention and control groups.
Blinding of participants and personnel (performance bias) Performance bias due to knowledge of the allocated interventions by participants and personnel during the study.	High risk	Not blinded.
Free of contamination (performance bias) Was the study adequately protected against contamination	Unclear	Comment: it is possible that communication between intervention and control could have occurred but not reported in detail to make a judgement.
Blinding of outcome assessment *(detection bias)* Detection bias due to knowledge of the allocated interventions by outcome assessors.	High risk	Not blinded.

Incomplete outcome data (attrition bias) Attrition bias due to amount, nature or handling of incomplete outcome data.	High risk	Comment: Data presented are incomplete and some data are reported that were not pre-specified. Population for intervention and control group is not clear.
Selective reporting (reporting bias) Reporting bias due to selective outcome reporting	Unclear	Comment: Study protocol not available to confirm all outcomes reported.

Appendix 3.7 Risk of Bias Table (adapted from Cochrane Risk of Bias tool)

Risk of Bias Table (adapted from Cochrane Risk of Bias tool) **Odendaal, 2009**		
Domain	Authors' judgement (Yes, No, Unclear)	Support for judgement
Random sequence generation (selection bias) (Biased allocation to interventions) due to inadequate generation of a randomised sequence.	Unclar	Quote: "Randomization of households to intervention and control group was performed after the baseline assessment" Comment: No further information regarding sequence generation provided.
Allocation concealment (selection bias) (Biased allocation to interventions) due to inadequate concealment of allocations prior to assignment.	Low risk	"Each data collector, randomly allocated to an area, had to recruit 25-30 Household demarcated on the map." Comment: Data collectors collected the baseline data from the allocated area. Randomization of households to intervention and control group was performed after the baseline assessment. Home visitor conducted intervention after randomization.
Blinding of participants and personnel *(performance bias)* Performance bias due to knowledge of the allocated interventions by participants and personnel during the study.	Unclear	Comment: Insufficient information to permit judgement. Method of blinding is not described.
Blinding of outcome assessment *(detection bias)* Detection bias due to knowledge of the allocated interventions by outcome assessors.	Low risk	"Data collectors were not informed to the intervention or control status of households at post intervention assessment, though it was possible that they might have been alerted to the status of household by the caregiver themselves or by observing the safety devices in the intervention household." Comment: Because of the objective outcome of study (injury hazards), knowledge of intervention households by data collectors could not influence the outcome as they used structured checklist to identify and quantify the hazards.
Incomplete outcome data (attrition bias) Attrition bias due to amount, nature or handling of incomplete outcome data.	Low risk	"Across the control and intervention group, 19 household (9%) were lost to the post intervention assessment." "An intention-to-treat analysis was conducted to calculate the outcomes of the intervention." Comment: Loss to follow-up for intervention (11HHs) and control group (8HHs) is balanced and reported similar reasons for both group.
Selective reporting (reporting bias) Reporting bias due to selective outcome reporting	Low risk	"Research protocols were reviewed and approved by the South African National Research Foundation." Comment: All possible outcomes stated in the methods section reported in the results section.

Risk of Bias Table (adapted from Cochrane Risk of Bias tool) **Rehmani, 2009**		
Domain	Authors' judgement (Yes, No, Unclear)	Support for judgement
Random sequence generation (selection bias) (Biased allocation to interventions) due to inadequate generation of a randomised sequence.	Low risk	Quote: "Simple randomization was done using a random number generator."
Allocation concealment (selection bias) (Biased allocation to interventions) due to inadequate concealment of allocations prior to assignment.	Unclear	"Parents of children up to 3 years who agreed to participate in the trial were randomly allocated to either group 1 (falls) or group 2 (ingestions: poisoning and choking)." Comment: Insufficient information to conclude that investigators or participants cannot foresee assignment.
Blinding of participants and personnel *(performance bias)* Performance bias due to knowledge of the allocated interventions by participants and personnel during the study.	High risk	"This was a non-blinded randomized controlled trial design …" Comment: Lack of blinding is more likely to influence the measurement of subjective outcome (injury hazards).
Blinding of outcome assessment *(detection bias)* Detection bias due to knowledge of the allocated interventions by outcome assessors.	High risk	"This was a non-blinded randomized controlled trial design …" Comment: Lack of blinding is more likely to influence the measurement of subjective outcome (injury hazards).
Incomplete outcome data (attrition bias) Attrition bias due to amount, nature or handling of incomplete outcome data.	Low risk	"Across the control and intervention group, 36 households (10%) were lost to the post intervention assessment." "… and analysed data on an intention-to-treat basis." Comment: Loss to follow-up for fall intervention group (19HHs) and control group (17HHs) is balanced. Reasons to loss of follow-up is not reported but is unlikely to affect true outcomes.
Selective reporting (reporting bias) Reporting bias due to selective outcome reporting	Unclear	Comment: Study protocol not available to confirm all outcomes reported.

Risk of Bias Table (adapted from Cochrane Risk of Bias tool) **Swart, 2008**		
Domain	Authors' judgement (Yes, No, Unclear)	Support for judgement
Random sequence generation (selection bias) (Biased allocation to interventions) due to inadequate generation of a randomised sequence.	Low risk	Quote: "Data collectors were given computer generated lists of all house numbers in each block, sorted in random order, and instructed to select houses from the top down until the required total of eligible households." Comment: No further information regarding sequence generation provided.

Allocation concealment (selection bias) (Biased allocation to interventions) due to inadequate concealment of allocations prior to assignment.	Low risk	"Data collectors were allocated at random to the blocks, but not to a block where they resided. After obtaining informed written consent from participating homes, data collectors implemented the baseline injury risk assessment. Thereafter, eligible blocks were randomly allocated to the intervention and control groups." "….While data collectors were masked to group assignment at baseline, they …" Comment: data collectors were blinded during recruitment and baseline assignment.
Blinding of participants and personnel *(performance bias)* Performance bias due to knowledge of the allocated interventions by participants and personnel during the study.	Unclear	Comment: Insufficient information to permit judgement. Method of blinding is not described.
Blinding of outcome assessment *(detection bias)* Detection bias due to knowledge of the allocated interventions by outcome assessors.	Low risk	"While data collectors were masked to group assignment at baseline, they might have been alerted to the intervention houses at post-intervention." Comment: Because of the objective outcome of study (injury hazards), knowledge of intervention households by data collectors couldn't influence the outcome as they use structured checklist to identify and quantify the hazards.
Incomplete outcome data (attrition bias) Attrition bias due to amount, nature or handling of incomplete outcome data.	Low risk	"Across the control and intervention group, 33 households (8%) were lost to the post intervention assessment." "A mixed-model analysis of variance, with random effects to reflect the correlation of observations among households in the same block, was conducted to assess whether the intervention effect was significantly different from zero, with 95% CIs." Comment: Loss to follow-up for intervention (19HHs) and control group (14HHs) is balanced. Reasons for lost to follow-up is not reported but is unlikely to affect true outcomes.
Selective reporting (reporting bias) Reporting bias due to selective outcome reporting	Low risk	Comment: Although study protocol is not available to confirm all outcomes reported but all possible outcomes stated in the methods section reported in the results section

Appendix 3.8 Numerical data of 3 RCTS as presented in original studies

Swart, 2008:	Baseline (n=410)				Post-intervention (n=377) 4 months' follow-up						
	Control (n=202)		Intervention (n=208)		Control (n=188)		Intervention (n=189)			*Intervention effect:* Post intervention mean scores for the intervention HHs minus those obtained for the control HHs.	
	Mean (SD)	Range	Mean (SD)	Range	Mean	SE	Mean	SE	Mean diff./IE	Effect (95% CI)	P Value
Total scores (90)	16.5 (5.8)	4–34	16.0 (5.0)	6–30	14.2	0.54	13.9	0.53	−0.31	−1.8 to 1.2	0.680
Burns, electrical (20)	1.9 (2.5)	0–10	2.0 (2.5)	0–9	1.3	0.14	1.1	0.14	−0.19	−0.54 to 0.16	0.294
Burns, paraffin (20)	3.9 (2.7)	0–13	4.0 (2.4)	0–14	3.2	0.21	3.2	0.21	−0.03	−0.64 to −0.57	0.911
Burns, safety practices (13)	3.3 (1.5)	0–8	3.4 (1.5)	0–8	2.9	0.12	2.5	0.12	−0.41	−0.76 to −0.07	0.021
Poison (19)	3.0 (2.1)	0–9	2.7 (1.8)	0–10	2.4	0.20	1.9	0.20	−0.45	−1.01 to 0.11	0.110
Falls (15)	4.5 (2.5)	0–13	3.9 (2.2)	0–12	3.6	0.24	3.7	0.24	0.09	−0.60 to 0.78	0.785
Odendaal, 2009	**Baseline (n=211)**				**Post-intervention (n=192) 3 months' follow-up**						
	Control (n=99)		Intervention (n=112)		Control (n=91)		Intervention (n=101)			*Intervention effect:* Post intervention mean scores for the intervention HHs minus those obtained for the control HHs.	
Total scores (88)	27.7 (7.84)	39 (7–46)	26.2 (7.96)	48 (5–53)	23.9	0.92	20.3	0.89	-3.6	-6.16 to -1.12	0.005
Burns electrical (20)	5.7 (3.08)	12 (0–12)	5.0 (2.82)	12 (0–12)	3.9	0.29	3.0	0.27	-0.9	-1.70 to -0.15	0.024
Burns paraffin (18)	4.0 (2.46)	10 (0–10)	3.8 (2.50)	10 (0–10)	3.3	0.23	2.6	0.24	-0.7	-1.37 to -0.04	0.037
Burns safety practices (14)	7.2 (2.37)	11 (3–14)	7.0 (2.03)	11 (3–14)	7.1	0.21	6.8	0.19	-0.3	-0.80 to 0.31	0.289
Total burns (52)	17.0 (4.99)	24 (5–29)	15.8 (5.15)	32 (4–36)	14.3	0.57	12.4	0.53	-1.9	-3.41 to -0.35	0.015
Poison (18)	4.3 (2.39)	10 (0–10)	4.0 (2.66)	12 (0–12)	4.0	0.25	2.9	0.23	-1.1	-1.77 to -0.44	0.001
Falls (18)	6.5 (2.55)	15 (0–15)	6.4 (2.45)	14 (0–14)	5.6	0.30	5.0	0.29	-0.6	-1.47 to 0.16	0.152

Rehmani, 2010	**Baseline (n=340)**				**Post-intervention (n=304) 6 months' follow-up**						
Fall group	Control (n=170)		Intervention (n=170)		Control (n=151)		Intervention (n=153)			*Intervention effect:* Post intervention mean scores for the intervention HHs minus those obtained for the control HHs.	
	3.0 (0.7)	NR	3.1 (0.7)	NR	2.9	0.7 SD	2.4	0.8 SD	- 0.5	-0.66 to -0.33	<0.001
Ingestion group	Control (n=170)		Intervention (n=170)		Control (n=153)			Intervention (n=151)		Intervention effect	
	1.9 (1.1)		2.3 (1.2)		2.0	1.0 SD	1.9	1.3 SD	- 0.1	-0.36 to 0.16	0.453

Intervention Homes	Impact of fall intervention on homes with at least one fall hazard at baseline and safe when no hazards at follow-up					Impact of ingestion intervention on homes with at least one ingestion hazard at baseline and safe when no hazards at follow-up				
	Inter N	%	Cont. N	%	RR (95% CI)	Inter N	%	Cont. N	%	RR (95% CI)
Safe at T2 (after intervention)	19	13.5	5	3.5	13.5/3.5 = 3.8 (1.5, 10.0)	24	18.8	3	2.4	18.8/2.4 = 7.8 (2.4, 25.3)
Unsafe at T2 (after intervention)	122	86.5	137	96.5		104	81.2	122	97.6	
Unsafe at T1 (baseline)	141	100	142	100		128	100	125	100	

NR = Not Reported; n = number of households; yellow shaded colour represents the recalculated value from original data

Appendix 4.1 Name of the staffs involved in overall field activities including their role

SN.	Name of the staffs	Position/role
1	Mr Shambhu Aryal (Gogane VDC)	Interviewer/HHs screening and survey
2	Mr Thakur Singh Moktan (Gogane VDC)	Interviewer/HHs screening and survey
3	Mr Ram Bahadur Synginan (Ambhanjyang VDC)	Interviewer/HHs screening and survey
4	Mrs Narayani Pudasaini (Ambhanjyang VDC)	Interviewer/HHs screening and survey
5	Mr Buddha Man Bal (Dhiyal VDC)	Interviewer/HHs screening and survey
6	Ms Karuna Thing (Dhiyal VDC)	Interviewer/HHs screening and survey
7	Ms Mangala Manandhar	Facilitator/Focus group
8	Mrs Rita Shrestha	Facilitator/Focus group
9	Mr Dej Krishna Shrestha	Officer/developed database in MS Access
10	Mr Dhurba Adhikari	Officer/overall management and supervision
11	Mr Pramod Thapa	Officer/quality control and field support
12	Mr Sagar Thapa	Officer/data entry and quality control
13	Mr Santosh Bhatta	Principal Investigator/overall activities

Appendix 4.2 Ethical clearance letter from NHRC

Nepal Health Research Council
Estd. 1991

Ref. No.: 964

04 January 2015

Mr. Santosh Bhatta
Principal Investigator
University of the west England (UWE)
Bristol, UK

Ref: **Approval of Research Proposal** entitled **An exploration of the environmental risks associated with unintentional injuries among children in Makwanpur district of Nepal and the potential for environmental change**

Dear Mr. Bhatta,

It is my pleasure to inform you that the above-mentioned proposal submitted on 02 December 2014 (**Reg. no. 273/2014** please use this Reg. No. during further correspondence) has been approved by NHRC Ethical Review Board on 02 January 2015 (2071- 9-18).

As per NHRC rules and regulations, the investigator has to strictly follow the protocol stipulated in the proposal. Any change in objective(s), problem statement, research question or hypothesis, methodology, implementation procedure, data management and budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. Thus, it is compulsory to submit the detail of such changes intended or desired with justification prior to actual change in the protocol.

If the researcher requires transfer of the bio samples to other countries, the investigator should apply to the NHRC for the permission.

Further, the researchers are directed to strictly abide by the National Ethical Guidelines published by NHRC during the implementation of their research proposal and submit progress report and full or summary report upon completion.

As per your research proposal, the total research amount is **USD 7,300 .00** and accordingly the processing fee amounts to **US$. 100.00**. It is acknowledged that the above-mentioned processing fee has been received at NHRC.

If you have any questions, please contact the Ethical Review M & E section of NHRC.

Thanking you.

....
Dr. Khem Bahadur Karki
Member-Secretary

Appendix 4.3 Approval letters from all three surveyed VDCs

गाउँ विकास समितिको कार्यालय
गोगने, मकवानपुर
Office of the Village Development Committee
Gogane, Makawanpur
(NEPAL)

प. सं. :- ०६९।०७०
च. न.(Ref. No.) :- ११०

मिति (Date) २०६९।११।१४

विषय (Sub.) :- अनुमति सम्बन्धमा ।

श्री मिरा मकवानपुर
हेटौंडा,

प्रस्तुत विषयमा यस गा.वि.स. मा "ग्रामिण समुदायमा आधारित बालबालिकामा हुने घरायसी चोट पटक सम्बन्धी जोखिम" सम्बन्धमा त्यस संस्थाको संलग्नतामा सन्तोष श्रेष्ठ मार्फत अध्ययन गर्न लागेकोले सो कार्यमा गा.वि.स. को कुनै पनि भौतिक तथा सामाजिक प्रभावमा असर नपर्ने गरी अध्ययन गर्नको लागि अनुमति प्रदान गरिएको व्यहोरा जानकारी गराइन्छ ।

०६९।११।१४

गाउँ विकास समितिको कार्यालय

धिँयाल, मकवानपुर

Office of the Village Development Committee

Dhinyal, Makawanpur (NEPAL)

प. सं. :- ०६९।०६२

च. नं.(Ref. No.) :- १२०४.

मिति (Date) २०६९।११।१२

श्री मिरा (MIRA) मकवानपुर, हेटौंडा।

विषय :- अनुमति प्रदान गरिएको बारे।

उपरोक्त सम्बन्धमा ताहाँको कार्यालयको च.नं. ६२।०६९।६२ मिति २०६९।११।११ को ~~श्र~~ पत्र प्राप्त भई व्यहोरा अवगत भयो। उक्त सम्बन्धमा "नेपालको ग्रामीण समुदायमा आधारित बालबालिकामा हुने चोटपटकको जोखिम" विषयको अध्ययन/शोधकार्य बाट यस गा.वि.स.लाई समेत फाइदा पुग्ने भएको हुँदा श्री सन्तोष भट्टलाई यस गा.वि.स.मा शोधकार्य गर्न अनुमति प्रदान गरिएको व्यहोरा जानकारीको लागि अनुरोध गरिन्छ।

०६९।११।१२.

गा.वि.स. सचिव

अनुसूची ३०

कार्यविधिको दफा ५८ को उपदफा (१) सँग सम्बन्धित

(गै.स.स.लाई कार्यक्रम सञ्चालनका लागि प्रदान गरिने समझदारी पत्र)

इ.प. काठमाडौं गा.वि.स.(...)......कार्यालय र मिरा काठमाडौं गै.स.स.बीच भएको प्रारम्भिक सहमति:

१. गै.स.स. को नाम, ठेगाना :- MIRA (Mother and Infant Research Activities.
२. कार्यक्रम सञ्चालन गर्न सहयोग गर्ने अ.गै.स.संस्था (यदि भए)
३. परियोजनाको नाम :- नेपालको ग्रामीण समुदायमा आधारित बालबालिकामा हुने पुरानो चौरपरकको जोखिम अनुसन्धान
४. परियोजनाको लागि सम्पर्क व्यक्ति :-
५. परियोजनाको अवधि :- २०६९ फागुन र चैत्र
   शुरू हुने मिति :- २०६९ फागुन
   सम्पन्न हुने मिति :- २०६९ चैत्र मसान्त
६. कार्यक्रम सञ्चालन हुने न.पा./गा.वि.स. :-
७. कार्यक्रमका मुख्य मुख्य उद्देश्यहरू :- ५ वर्ष मुनीका बालबालिकामा हुने जोखिम पत्ता लगाउने
८. सञ्चालन गरिने मुख्य मुख्य क्रियाकलापहरू :- घर-घरमा गई सोधपुछ तथा नमूना संकलन
९. लाभान्वित हुने मोटामोटी कुल जनसंख्या :- ३०० घर धुरी लक्ष्य
१०. लाभान्वित हुने मोटामोटी कुल जनसंख्या मध्ये नियमित रोजगारी पाउने जनसंख्या :- २
११. संस्थामा रोजगारी पाउने नेपाली जनशक्ति :- २ जना
१२. संस्थामा रोजगारी पाउने विदेशी जनशक्ति :- X
१३. गैसस मार्फत प्राप्त हुन सक्ने (सम्भाव्य मोटामोटी) रकम :-
१४. कार्यक्रम सञ्चालनका लागि सम्बन्ध राख्ने मुख्य प्रमुख साझेदार संस्थाहरू :- आ.प. काठमाडौं इ. पी. तथा निर्माण ...

जि.वि.स.को संयोजकत्वमा नियमित अनुगमन तथा समन्वयात्मक कार्य सञ्चालन तथा आवश्यक कार्यक्रमहरू जि.वि.स.को वार्षिक योजनामा समाविष्ट गर्ने गरी ....जि.वि.स. र .... गै.स.स. बीच यो प्रारम्भिक सहमति भएको छ।

..................गै.स.स.को तर्फबाट
हस्ताक्षर
नाम :- ध्रुव प्रसाद अधिकारी
पद :- अनुसन्धान अधिकृत
मिति :- २०६९/११/१५

आ.प. काठमाडौं, गा.वि.स.को तर्फबाट
हस्ताक्षर
नाम :- भुवन ... पौडेल
पद :- अध्यक्ष
मिति :- ०६९/११/१...

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Appendix 4.4 Ethical clearance letter from FRDCs, UWE

University of the West of England
BRISTOL

Faculty of Health & Applied Sciences
Glenside Campus

Blackberry Hill
Stapleton
Bristol BS16 1DD
Tel: 0117 328 1170

Our ref: JW/lt
14th January 2015

Santosh Bhatta
Centre for Child & Adolescent Health
School for Social and Community Medicine
University of Bristol, Oakfield House, Bristol BS8 2BN

Dear Santosh

Application number: HAS/15/01/88

Application title: An exploration of the environmental risks associated with unintentional injuries amongst children in Makwanpur district of Nepal and the potential for environmental change

Your Ethics application and approval conditions have been considered by the Faculty Research Ethics Committee on behalf of the University. It has been given ethical approval to proceed with the following conditions:

- You comply with the conditions of the Nepal Health Research Council Ethical Review Board's approval.
- You notify the Faculty Research Ethics Committee of any further correspondence with the Nepal Health Research Council.
- You must notify the Faculty Research Ethics Committee in advance if you wish to make any significant amendments to the original application.
- If you have to terminate your research before completion, please inform the Faculty Research Ethics Committee within 14 days, indicating the reasons.
- Please notify the Faculty Research Ethics Committee if there are any serious events or developments in the research that have an ethical dimension.
- Any changes to the study protocol, which have an ethical dimension, will need to be approved by the Faculty Research Ethics Committee. You should send details of any such amendments to the committee with an explanation of the reason for the proposed changes. Any changes approved by an external research ethics committee must also be communicated to the relevant UWE committee.
- Please note that any information sheets and consent forms should have the UWE logo. Further guidance is available on the web: http://www1.uwe.ac.uk/aboutus/departmentsandservices/professionalservices/marketingandcommunications/resources.aspx
- Please note that the University Research Ethics Committee (UREC) is required to monitor and audit the ethical conduct of research involving human participants, data and tissue conducted by academic staff, students and researchers. Your project may be selected for audit from the research projects submitted to and approved by the UREC and its committees.

We wish you well with your research.
Yours sincerely

Julie S Woodley

Dr Julie Woodley
Chair
Faculty Research Ethics Committee

Appendix 5.1 Household screening form

Makwanpur

Household Screening Form

(Make sure child/children is living in this house from at least last 3 months)

VDC: ……………………………………

Ward Number: [ ]

New No.	HH. S. No.	Name and Surname of			No. of children <5 years	Village/Street
		HH Head	Father	Mother		

[Note: Please fill up the form 1 & 2 if you find any case of child death in home environment due to unintentionally injury is last one year.]

Appendix 5.2 Household survey questionnaires including hazard checklist

<u>Form 01</u>

Household survey questionnaire on
Community-Based Home Injury Risk Assessment in Rural Nepal
(PhD Research, the University of the West of England, Bristol)

Interview date:	d	d	m	m	y	y	y	y

SECTION 1: Household demographic information

District: Makwanpur	VDC:			Ward:		Household N.			

HH ID number:							Village/Tole: ………………………

[Note: This form should be used for all households where at least one child aged between birth and their 5th birthday (that is, up to 59 months) is routinely living]. Please interview the main caregiver of the child. In the absence of main caretaker, interview other member of household responsible for child/children.

<u>Please take permission for interview</u>

Q1.0 Interview completed or not? *(Please circle one option)*
1. Interview completed
2. Refused to give interview

Q1.1 During the day, who is the main caregiver for your child/children at home? *(Please circle one option)*
1. Mother 3. Grandparents 5. Older siblings/brother(s)/sister(s)
2. Father 4. Aunt/Uncle/other adult relative(s) 98. Others (Specify _____________)

Q1.2 Relationship of respondent to that child? *(Please circle one option)*
1. Mother 3. Grandparents 5. Older siblings/brother(s)/sister(s)
2. Father 4. Aunt/Uncle/other adult relative(s) 98. Others (Specify _____________)

Q1.3 Gender of caregiver (*Please circle one option)*
1. Male
2. Female

Q1.4 Ethnicity of caregiver *(Please circle one option)*
1. Tamang 4. Newar 7. Dharti 10. Pariyar 13. Danuwar/Rai 16. Pahari
2. Brahman 5. Magar 8. Majhi 11. Sarki 14. Gurung 17. Bankariya
3. Chhetree 6. Praja 9. Biswakarma 12. Sanyasi 15. Thakuri 98. Others

Q1.5 Age of the caregiver ________ Years *(completed years)*

Q1.6 Is caregiver able to read and write? *(Please circle one option)*
1. Yes *(if yes go to Q1.7)*
2. No *(if no go to Q1.8)*

Q1.7 What education caregiver has completed? *(Please circle one option)*
1. No formal education but can read and write 5. S L C pass
2. Primary School (through 5) 6. Intermediate School (grades 11 - 12)
3. Middle School (grades 6 - 8) 7. Undergraduate or higher (e.g. Master, PhD etc.)
4. High School (grades 9 - 10)

Q1.8 What is the major occupation of caregiver of the child/children? *(Please circle one option)*
1. Agriculture 4. Skilled labor 7. Student 10. Unable to work/elderly
2. Salary job 5. Wage labor 8. Volunteer 98. Other (Specify _____________)
3. Business 6. Household work 9. Work abroad

Q1.9 How many people live in this home? (*Please write the number of person*) _________ Total members

Q1.9.1	_____ Children (under 5 years of age);	_____ male	_____ female
Q1.9.2	_____ Children (5 to 10 years of age);	_____ male	_____ female
Q1.9.3	_____ Children (11 to 17 years of age);	_____ male	_____ female
Q1.9.4	_____ Adults (over 18 years of age);	_____ male	_____ female

Q1.10 Children in the household under 5 years *(Please complete the table below)*

Q.N.	Child ID N.	Age (completed months)	Sex		Is this child got injured in last 3 months at home environment?
			M	F	
Q1.10.1	Child 1 (C1)				Yes [ ] No [ ] *(if yes, fill a new form 2 also for this child)*
Q1.10.2	Child 2 (C2)				Yes [ ] No [ ] *(if yes, fill a new form 2 also for this child)*
Q1.10.3	Child 3 (C3)				Yes [ ] No [ ] *(if yes, fill a new form 2 also for this child)*
Q1.10.4	Child 4 (C4)				Yes [ ] No [ ] *(if yes, fill a new form 2 also for this child)*
Q1.10.5	Child 4 (C5)				Yes [ ] No [ ] *(if yes, fill a new form 2 also for this child)*
Q1.10.6	Child 4 (C6)				Yes [ ] No [ ] *(if yes, fill a new form 2 also for this child)*

Q1.11 Is there any child/children under 5 years died in last one-year due to injury?
1. Yes *(If yes, fill up the table below)*
2. No *(If not, go to Section 2)*

Q.N.	Child ID N.	Age (completed months)	Sex		Are there any child/children under 5 years died in last one-year due to injury (only due to injury at home environment)
			M	F	
Q1.11.1	Child 1 (C1)				Yes [ ] No [ ] *(if yes, fill a new form 2 also for this child)*
Q1.11.2	Child 2 (C2)				Yes [ ] No [ ] *(if yes, fill a new form 2 also for this child)*

Definition: An unintentional injury is one without any intent of harm by others, self-harm, homicide, or suicide.
An injury in this study is defined as physical damage caused by transport (e.g. road traffic collision, bicycle injury, injury as a pedestrian whilst on the road), falls, falling object, cut/ wounds, burn or scald, drowning, suffocation, accidental poisoning, electric shock, animals (bites, stings, crush), sprain or strain that required medical attention or at least 1 day's loss of usual activities or absence from school. (Please apply this definition for injury events that occurred only at home environment to complete Q1.10 and Q1.11)

[Note: The sections 2 and 3 are to be completed by the interviewer based on observation of the home, and in discussion with the respondent where required.]

SECTION 2: House description

	Yes	No
Q2.1 Is there an enclosed courtyard/patio?	[ ]	[ ]
Q2.2 Is there a separate room for the kitchen?	[ ]	[ ]
Q2.3 Is there a bathroom within the house/courtyard?	[ ]	[ ]
Q2.4 Is there a toilet within the house/courtyard?	[ ]	[ ]
Q2.5 Is there any balcony in the house?	[ ]	[ ]
Q2.6 Are there any stairs in the house?	[ ]	[ ]

Q2.7 How many stories (floors) has this house? *(Please circle one option)*
1. Only ground floor 2. Two floors 3. Three floors 4. Four floors

Q2.8 What kind of fuel is most often used by your household for cooking? *(Please circle one option)*
1. Firewood 3. Leaves/Straw/Thatch 5. Kerosene 98. Other
2. Dung 4. Bio-Gas 6. LPG (Cylinder Gas) specify___________)

Q2.9 Is this your own or rented house? *(Please circle one option)*
1. Own house 2. Rented house

Q2.10 How old is this house? *(Please circle one option)*
1. <5 years 2. 5-10 years 3. 11-20 years 4. 20 years 99. Don't know

Q2.11 Number of separate rooms as part of this property including kitchen room? (_____) Total

Q2.12 Main construction material used to build-up the house *(Please circle one option)*

Q2.12.1. Outside walls (ground floor)
1. Cement/bricks/stones
2. Mud/bricks/stones
3. Timber
4. Iron/zinc sheets
5. Mud/bamboo/wood/straw
98. Other: (Specify__________)

Q2.12.2. Foundation (ground floor)
1. Brick/stone/concrete/cement
2. Bamboo/timber
3. Mud
98. Other: (Specify_____________)

Q2.12.3. Roof (top floor)
1. Brick/concrete/cement
2. Iron/zinc/galvanized sheets
3. Tiles/Slate
4. Bamboo/wood/straw
98. Other: Specify______)

Q2.13 Gross monthly income and expenditures of this household *(Please write on numbers) [note: this information will only be used for research purpose and will not be disclosed anywhere.]*

1. Monthly expenses NRs. ________________
2. Monthly income NRs. ________________

Q2.14 Are there any first aid materials in this household (such as bandages, disinfectants etc.)? *(Please circle one option)*

1. Yes *If yes, go to Q 2.15*
2. No *If no, go to Section 3*

Q2.15 If yes, what you have? *(Please circle one option)*

1. Handiplast only
2. Betadine/Betnovate (Skin Cream)
3. Skin Cream and Thermometer
4. Skin Cream and Bandages
5. Skin Cream, Bandages and Thermometer
6. Skin Cream, Bandages, Adhesive tape and Scissor
7. Skin Cream, Bandages, Adhesive tape, Scissor and Thermometer
8. FA box with all materials

SECTION 3: Home injury hazards checklist

(Applicable for children < 5 years)

Please put [✓] for at appropriate place for YES, No or Not Applicable; Circle one option 1/2/3/4/5/6 as appropriate.

	Injury hazards	Y	N	NA
Q3.1	**Drowning**			
1	Open container of water/liquids such as bucket, drum etc. are kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) locked store-room (5) NA			
2	Holders/vats for feeding cattle covered or placed high up (>1m) while not in use.	Yes	No	NA
3	All ditches/pool of water around the house are filled up or covered.	Yes	No	NA
4	Water bodies near the house (within 100 meters) i.e. pond, lake, stream protected with fenced to make inaccessible to the child.	Yes	No	NA
Q3.2	**Fall injury**			
1	Bathing area is free of slippery surface (have rough surface).	Yes	No	NA
2	All windows are secured with window guards/rails to keep a child from falling out.	Yes	No	NA
3	All walking areas are clear of clutter, telephone or electrical cords and other obstacles.	Yes	No	NA
4	All large objects like bookshelves, TVs, entertainment units, furniture etc. are stable on their own or secured to the walls.	Yes	No	NA
5	Surfaces of stairs, balconies, porches and patios have non-slip surfaces or free from any liquid, grease or water on the floor.	Yes	No	NA
6	Protective handrails are installed along both sides of stairs/ladder.	Yes	No	NA
7	Protective bars or railing are installed on the balcony.	Yes	No	NA
8	Arranged enough lighting in indoor walking areas (such as rooms, stairs, balconies etc.)	Yes	No	NA
9	No baby walkers at home or not accessible to child under 18 months			
10	All the furniture (table, stools, chairs etc.) are located safely (e.g. away from window, ceiling fans, balcony/rooftop railings).	Yes	No	NA
Q3.3	**Burn/scald**			
1	Cooking stoves are kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) NA			
2	All flammable items such as matches/lighter/fuels (i.e. paraffin or kerosene) kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA			
3	Hot iron or other appliances (e.g. hair straighteners), after use are kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) NA			
4	Kerosene lamps or candles while used are kept (observe the place where these lighters are kept at night): (1) on floor (2) <1m ht. (3) >1m ht. (4) NA			
5	Sleeping area and cooking area are separated with a door or any other barrier.	Yes	No	NA

Q3.4	**Cut injury**	
1	Any sharp items used in house, such as knives, scissors, razors etc. are kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
2	Any sharp equipment designed for agricultural purpose (e.g. axe, sickle, spade etc.) are kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
3	All breakable objects (e.g. bottles or any dishes made by glass or mud etc.) are kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
4	All sharp/hard protruding components (e.g. big stones, big piece of wood, woodpiles, old machinery etc.) are kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) NA	
Q3.5	**Poisoning**	
1	All plants around the home are identified and poisonous plants have been removed.	Yes No NA
2	Any candles or fuels (e.g. kerosene, cooking oil, petrol, diesel, gas etc.) are kept/ stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
3	All medicines and vitamins are kept/ stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
4	All cleaning products, chemicals, bleaches, acids and detergents are kept/ stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
5	All toiletries such as shampoos, soaps, toothpastes etc. are kept/ stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) NA	
6	All cosmetics (e.g. lipsticks, cream, nail polish etc.) are kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) NA	
7	Any alcoholic beverages are kept/ stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
8	Any tobacco products (e.g. cigarettes) are kept/ stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
9	Any agricultural chemicals or fertilizers are kept/ stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
Q3.6	**Electric shock**	
1	Electrical switches and plug points are/installed: (1) on floor (2) <1m ht. (3) >1m ht. (4) NA	
2	All electrical cords are: (1) on floor (2) <1m ht. (3) >1m ht. (4) NA	
3	All electric appliances, plugs and wiring are in good condition (no frayed cords or damaged plugs).	Yes No NA
Q3.7	**Suffocation/chocking**	
1	Any small objects such as marbles, coins, buttons, toys, small loose and spare batteries are kept/ stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
2	Any plastic bag kept/stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
3	Any small food items such as peanuts, beans, seeds or grains etc. kept/ stored: (1) on floor (2) <1m ht. (3) >1m ht. (4) unlocked cabinet/drawer (5) locked cabinet/drawer or store-room (6) NA	
Q3.8	**Animal related injury**	
1	All cattle sheds are properly fenced.	Yes No NA

Note: Please check Q1.10 and Q1.11. If there are no unintentional injuries or related deaths among any member of the household aged below 5 years, thank the person and stop the interview here and move to the next household. If there was any child injured in last 3 months due to the unintentional injury, please complete the FORM 02 also for each injured or death child. **End of the form 01**

Form 02

Household survey questionnaire on

Community-Based Home Injury Risk Assessment in Rural Nepal

(PhD Research, the University of the West of England, Bristol)

Injury Morbidity/Mortality Questionnaire

To be filled out ONLY when there is at least one child aged under 5 years found to be injured UNINTENTIONALLY during the last three months or death during the last 1-year due to injury at home before the survey date (______ 2014 to ______ 2014).

If there are more than one injured child aged <5 years living in the household, a separate Form 2 should be completed for each child. If a child has had more than one injury in the last three months, the respondent should be asked to provide information on the one injury that they consider to be the most serious.

This questionnaire was administered to a proxy (i.e. to parents or career)

SECTION 4: Recent Injury History occurred at home environment

District: Makwanpur VDC: Ward: HH N. Child identification N.

HH ID number: V V W H H H C Village/Tole: ………………………

Q4.1 Child identification Number: [ ] (*Please write here child ID number according to Q 1.10 if injured or according to Q1.11 if death*)

Q4.2 Situation of the child now *(please circle one option)*

1. Live *(If live go to Q 4.3)* ***2. Death*** *(If death go to the Q 4.4)*

Q4.3 How many times has this child had any injury in last 3 months? ……………….. Times

Q4.4 Date of most serious injury occurred ________________ (mm/yyyy)

Q4.5 Time of injury ___________ [ ] am [ ] pm

Q4.6 What was the mechanism of the injury? *(Please circle one option as appropriate)*

1. Fall injury (go to part 1)
2. Sharp Objects (go to part 2)
3. Fire/burn/scald (go to part 3)
4. Drowning (go to part 4)
5. Poisoning (go to part 5)
6. Electric shock (go to part 6)
7. Blunt object (go to part 7)
8. Suffocation/chocking (go to part 8)
9. Animal related injury (go to part 9)
10. Machine/tool injury (go to part 10)
11. Road/Transport injury (go to part 11)

Note: If more than one injury results from the injury event, select the mechanism that resulted in the most severe injury.

Part 01-Fall injury

Q4.7 Type of fall *(Please circle one option)*

01. Same Level 02. Different level

(Please go to Q4.34)

Part 02-Contact with Sharp Objects

Q4.10 What was the sharp object? *(Please circle one option)*

01. Knife/Sickle
02. Axe
03. Spade/Hoes
04. Scissors (domestic use)
05. Broken glass
06. Straw or grass cutter/plough
07. Bladed wire/fence/nails
08. Sharp wood/bamboo
98. Other (specify _______)

Q4.11 Where was the sharp object *(Please circle one option)*

01. Kitchen
02. Bed room
03. Dining area
04. Living area
05. Bathroom/toilet
06. Storage room
07. Cattle shed
08. Outside
09. Single room dwelling
10. Porch
98. Other (specify _______)

(Please go to Q4.34)

Part 03-Fire/burns/scalds

Q4.12 Cause of burn *(Please circle one option)*

01. Flame (go to Q4.13)	03. Hot object (go to Q4.15)	05. Chemical (go to Q4.17)
02. Hot liquid (go to Q4.14)	04. Explosive (go to Q4.16)	99. Don't know (go to Q 4.34)

Q4.13 If flame: What was source of flame *(Please circle one option)*

01. Cooking fire	04. Residential or house fire	06. Electrical short circuit
02. Heating fire	04. Kerosene/oil lamp	07. Candle lamp/lights
03. Work place fire at home	05. Matches	98. Other (specify _______)

Q4.14 If hot liquid: What was the liquid or steam? *(Please circle one option)*

01. Cooking water/steam	04. Cooking oil	98. Other (specify _______)
02. Bathing water	05. Tea/Coffee/milk	
03. Washing water	06. Pressure cooker steam	

Q4.15 If hot object: What was the object? *(Please circle one option)*

01. Cooking/heating utensils	04. Muffler/engine part	07. Hot ashes
02. Coal/fuel	05. Heater	98. Other (specify _______)
03. Iron/metal	06. Oven/Kiln	

Q4.16 If explosive: Why was it? *(Please circle one option)*

01. Fireworks/crackers	03. LPG cylinder	98. Other (specify _______)
02. Gun power/Gun	04. Pressure cooker	

Q4.17 Chemical burn *(Please circle one option)*

01. Acid	03. Antiseptic/ Dettol	98. Other (specify _______)
02. Lime		

(Please go to Q4.34)

Part 04-Drowning/Near Drowning

Q4.18 What was the water source? *(Please circle one option)*

01. Pond/Lake	04. Canal	07. Storage drum
02. Ditch	05. River/stream close to house	08. Tub
03. Well	06. Bucket	98. Other (specify _______)

Q4.19 What was the approximate distance of the water source from home? *(Please circle one option)*

01. Inside home	04. 11 – 20 meters	07. 100 + meters
02. 1 – 5 meters	05. 21– 50 meters	
03. 6 – 10 meters	06. 51 – 100 meters	

(Please go to Q4.34)

Part 05-Accidental Poisoning

Q4.20 What was the category of the poisoning substance? *(Please circle one option)*

01. Pesticides/Insecticides	04. Kerosene/petroleum	07. Wild poisonous plants
02. Any medicines	05. Antiseptic/Dettol	99. Don't know
03. Soap/detergents	06. Paints/dyes/solvents	98. Others (specify _______)

Q4.21 Type of container *(Please circle one option)*

01. Bottle without lid	04. Closed mouth container (non-bottle)	06. Strips
02. Bottle with lid		07. Spraying tank
03. Open container (non-bottle)	05. Packets	98. Others (specify _______)

Q4.22 Nature of container *(Please circle one option)*

01. Original (go to Q4.24) 02. Not original container (go to Q4.23)

Q4.23 If the poison was not kept in the original container *(Please circle one)*

01. Was container labelled outside 02. Container was not labelled outside

Q4.24 Place where container was kept? *(Please circle one option)*

01. Floor	04. Inside a locked box/cupboard	07. On a Shelf (< 1m)
02. Under the bed/mattress	05. Inside an unlocked box/cupboard	98. Others (specify _______)
03. Hanging from ceiling	06. On a shelf (> 1m)	

(Please go to Q4.34)

Part 06-Electric shock

Q4.25 What was the source of electric shock**?** *(Please circle one option)*

01. Lightning
02. Electric switches/plugs/cords
03. Generator/motor
04. Battery/Solar
98. Other (specify _______)

(Please go to Q4.34)

Part 07-Injury by blunt object

Q4.26 What was the blunt object? *(Please circle one option)*

01. Moving object specify________)
02. Fixed object (specify_______)
98. Other (specify________)

(Please go to Q4.34)

Part 08-Suffocation/chocking

Q4.27 What was the suffocation/chocking agent? *(Please circle one option)*

01. Carbon monoxide
02. Liquid
03. Food items
04. Small objects (e.g. Coins)
05. Clothes/plastic
06. Covered by adult body
99. Don't know
98. Other (specify_________)

(Please go to Q4.34)

Part 09-Animal injury/insect bite/sting

Q4.28 Name of animal *(Please circle one option)*

01. Pet/Stray dog
02. Pet/Stray cat
03. Snake
04. Fox/Jackle
05. Cattle/Buffalo
06. Hornet/Wasp/Bee
98. Other (specify__________)

Q4.29 Type of injury *(Please circle one option)*

01. Bite
02. Sting
03. Kick
04. Step on
05. Horn/other butting/impale
98. Other (specify__________)

(Please go to Q4.34)

Part 10-Contact with machine/tool injury

Q4.30 What type of machine? *(Please circle one)*

01. Agriculture (Go to Q4.31)
02. Domestic (Go toQ4.32)
03. Industrial equipment (Go to Q4.34)
04. Construction equipment (Go to Q4.34)
05. Furniture (Go to Q4.34)
98. Other (Specify __________) (Go to Q4.34)

Q4.31 Machine used in agriculture *(Please circle one option)*

1. Water pump engine
2. Tractor
3. Rice/wheat thrasher
4. Ploughing equipment
5. Blowing fan
6. Generator
98. Other (Specify ________) (Go to Q4.34)

Q4.32 Domestic equipment: *(Please circle one option)*

01. Sewing machine
02. Grinder/mixer
03. Generator/motor
98. Others (Specify ________)

(Please go to Q4.34)

Part 11-Transport injury (occurred on road next by home)

Q4.33 Counterpart: With what did the injured person (or his vehicle) hit by? *(Please circle one option)*

01. Bicycle/Rickshaw
02. Motorcycle
03. Car/Tampo/Jeep/Auto rickshaw
04. Truck/bus/tractor/trailer
05. Bullock/push cart
06. Stationary vehicles
99. Don't know
98. Other (specify _______)

Q4.34 What actually happened? Please describe shortly ____

Note: Please ask the following questions to all participants regardless of injury mechanisms

Q4.35 What was the result of the injury to the injured person's body? *(Please circle one option)*

01. Fracture
02. Dislocation of a joint
03. Cut, laceration, gash, graze, wound, 'scrage'
04. Burn, scald or blister
09. Ingestion of foreign body/substance
10. Head injury
11. Eye injury
12. Dental injury

05. Sting or bite	13. No visible injury
06. Bruising, swelling, or mark on skin	14. Near drowning
07. Over exertion /over stretching injury	99. Not known/not specified
08. Foreign body in orifice	98. Other injury

Q4.36 What was the place of injury occurrence? *(Please circle one option)*
1. Inside the home *(go to the Q4.37)*
2. Own home outside *(go to the Q4.38)*

Q4.37 Where did it occur, if inside the home? *(Please circle one option)*

1. Kitchen	3. Stairs inside home	5. Corridor/passage way	7. Single room dwelling
2. Bathroom/toilet	4. Living/sleeping area	6. Lobby/porch/entrance way	98. Other (specify place: _______)

(Please go to Q4.39)

Q4.38 Where did it occur, if outside the home but within home environment? *(Please circle one option)*

1. Balcony	3. Rooftop	5. Kitchen garden
2. Stairs outside home	4. Courtyard	98. Other (specify place: ________)

Q4.39 Who was with the child at the time of injury? *(Please circle one option)*

1. Father	4. Grandparent (s)	7. Out of site
2. Mother	5. Older siblings/brother/sister(s)	99. Don't know
3. Aunt/Uncle/other adult relative (s)	6. Friends	98. Others (Specify ______)

Q4.40 Where did the child get treatment? *(Please circle one option)*

1. Treatment needed but not received	4. Treatment at health post	99. Don't know
2. Treatment at home	5. Treatment at hospital	
3. Someone else's home	6. Death	

Q4.41 Were any changes/modifications to the house as a result of this injury and to prevent children from the similar injury events happening in the future? *(Please circle one option)*
1. Yes *(If so, describe briefly)* ____
2. No *(If not, go to Q4.42)*

Q4.42 Is there another injured child or child death in this household? *(Please circle one option)*
1. Yes *If yes, please fill up another form 2 for that child.*
2. No *If not, thanks the respondent/parents/career and move to the next sampled household.*

End of the form 02

Appendix 5.3 Orientation of the data collectors

TIME	ACTIVITIES	BY
SCHEDULE: DAY 1 [04-02-2015]		
10:00	Registration	PT
10:30	Introduction of participants and the orientation programme	DA & Interviewers
11:00	Introduction to the child injury survey	DA
11:10	Introduction and objectives of the survey	SB
11:30	Tea Break	
11:45	Objectives of the survey and methodology	SB
12:15	Role and responsibilities of interviewers	DA
12:45	Break	
1:00	Interviewer's manual and survey questionnaires	SB & DA
2:00	Lunch break	
3:00	Itemised discussion on Form 1 (section 1)	SB
4:00	Itemised discussion on Form 1 (section 2)	SB
5:00	Departure	All
SCHEDULE: DAY 2 [05-02-2015]		
10:00	Revision of Day 1	SB & DA
11:00	Itemised discussion on Form 1 (section 3)	SB
12:30	Tea Break	
12:45	Discussion on household screening method	DA & SB
2:00	Lunch Break	
3:00	Discussion on screening & developing lists of HHs	SB
4:00	Discussion and practical session	DA, PT, SB & Interviewers
5:00	Mock interview in pair	Interviewers
6:00	Departure	All
SCHEDULE: DAY 3 [06-02-2015]		
10:00	Revision of Day 1	
10:45	3 groups division (3 in each including trainer)	SB & DA
11:00	Tea Break	
11:15	Departure for field (Laljhari village)	All
11.45	Arrival in field	All
12:00	Practice on doing household screening	3 groups separately
1:30	Lunch Break	
2:00	Practice on taking interviews and observation	3 groups separately
4:30	Departure from field	All
5:00	Arrived office	All
5:15	Discussion & sharing field experiences	Interviewers
6:00	Departure	All

Note: SB=Santosh Bhatta, DA=Dhurba Adhikari, PT=Pramod Thapa, Interviews= Data Collectors

Appendix 5.4 Informed Consent letter

Informed Consent

Namaste!

My name is .... and I am here for a research study of "community based household risk assessment for child injury." The study is being conducted by faculty of Health and Life Sciences of University of the West of England, Bristol, United Kingdom as a part of doctoral study of Mr Santosh Bhatta. This household has been selected as a sample of the study therefore you are invited to participate.

The purpose of this research study is to explore the environmental risks associated with unintentional injuries among children aged 01-59 months in a rural district of Nepal. This will also include the potential for the home environment modifications at a community level to prevent injury occurrence.

This study is designed to understand the risk factors associated with child injury at home environment and also to know the facilitator and barrier of local change intervention in community level. We are conducting this study to learn more about this important public health issue as it has not been studied in Nepal so far. To get this information, both household survey and focus group will be used in this study. Participation in the study involves completion of a survey questions about demographic information and the child injury history of last 3 months. House environment will also be assessed to identify and quantify potential hazards for injury. This survey will last for approximately 60-90 minutes.

There are no risks or discomforts that are anticipated from your participation in the study. Potential risks or discomforts include possible emotions of sadness when asked questions during the interview. The anticipated benefit of participation is the opportunity to discuss feelings, perceptions, and concerns related to the child injury.

The information gathered during this study will remain. Only the researchers will have access to the study data and information. There will not be any identifying names on the collected data. All the information will be coded with the purpose of analysis. Your names and any other identifying details will never be revealed in any publication of the results of this study without your consent. The results of the research will be published in the form of a research paper and may be published in a professional journal or presented at professional meetings. The knowledge obtained from this study will be of great value in guiding professionals to be more effective in developing child injury intervention in future.

Participation in this study is voluntary; refusal to participate will involve no penalty. You are free to withdraw consent and discontinue participation in this project at any time without prejudice or penalty. You are also free to refuse to answer any question we might ask you.

You are welcome to ask the researcher any questions that occur to you during the survey. If you have further questions after the survey, you are encouraged to contact the principal researcher at ……………………………………………….

I, ____ (name; please print clearly), have read the above information. I freely agree to participate in this study. I understand that I am free to refuse to answer any question and to withdraw from the study at any time. I understand that my responses will be kept anonymous.

________________________ ______________________

Participant Signature Date

Appendix 5.5 Record keeping sheet for completed questionnaires

Makwanpur District

(Community Based Home Injury Risk Assessment in Rural Nepal)

Record keeping sheet for completed questionnaires

Name of interviewer:						Name of V.D.C.:	
S.N.	Ward N.	Household N.			Form N. 1	Form N. 2	Remarks
Sign of giver:						Sign of receiver:	
Date:						Date:	

Appendix 5.6 Univariable logistic-regression results for the association between any injury and potential confounding variables

Potential confounding variables	No injury N = 800 n (%)	Any injury N = 233 n (%)	Adjusted for clustering at household level		
			Odds ratio (95% CI)	P-value	Wald test P value
Siblings under 18 years					
0 siblings	88 (79.3)	23 (20.7)	…	…	0.713
1-4 siblings	635 (77.5)	184 (22.5)	1.11 (0.68, 1.80)	0.678	
> 4 siblings	77 (74.8)	26 (25.2)	1.29 (0.69, 2.42)	0.424	
Caregiver's age (years)					
≤ 30	376 (76.0)	119 (24.0)	…	…	0.265
> 30	424 (78.8)	114 (21.2)	0.85 (0.64, 1.13)	0.265	
Caregiver's education level					
Not literate	334 (74.1)	117 (25.9)	…	…	0.007
Reading & writing ability	181 (75.7)	58 (24.3)	0.94 (0.64, 1.31)	0.626	
School education	285 (83.1)	58 (16.9)	0.58 (0.41, 0.82)	0.002	
Caregiver's occupation					
Employed/able to work	622 (77.1)	185 (22.9)	…	…	0.577
Unemployed/unable to work	178 (78.8)	48 (21.2)	0.91 (0.64, 1.28)	0.577	
Family size					
≤ 4 people (small)	135 (75.8)	43 (24.2)	…	…	0.368
5-8 people (medium)	462 (76.6)	141 (23.4)	0.96 (0.65, 1.42)	0.830	
> 8 people (large)	203 (80.6)	49 (19.4)	0.76 (0.48, 1.20)	0.234	
Family members over 18 years of age					
≤ 2 people	304 (74.0)	107 (26.0)	…	…	0.027
> 2 people	496 (79.7)	126 (20.3)	0.72 (0.54, 0.96)	0.027	
Ethnic groups					
Underprivileged	629 (78.7)	170 (21.3)	…	…	0.076
Privileged	171 (73.1)	63 (26.9)	1.36 (0.97, 1.92)	0.076	
Household income per month in 2 quantiles (NRs.)					
Q 1 (NRs. 1000-10,000)	431 (77.9)	122 (22.1)	…	…	0.678
Q 2 (NRs. 1000-1,40,000)	369 (76.9)	111 (23.1)	1.06 (0.80, 1.42)	0.678	
No. of floors in the house					
1-2	536 (78.6)	146 (21.4)	…	…	0.214
3	264 (75.2)	87 (24.8)	1.21 (0.90, 1.63)	0.214	
House ownership					
Owner-occupied	770 (78.2)	215 (21.8)	…	…	0.013
Rented	30 (62.5)	18 (37.5)	2.15 (1.17, 3.64)	0.013	
House age					
≤ 20 years	577 (78.0)	163 (22.0)	…	…	0.504
> 20 years	223 (76.1)	70 (23.9)	1.11 (0.82, 1.51)	0.504	
No. of rooms					
1-3	583 (78.0)	164 (22.0)	…	…	0.447
4-10	217 (75.9)	69 (24.1)	1.13 (0.82, 1.55)	0.447	

Appendix 5.7 Univariable logistic-regression results for the association between fall-related injury and potential confounding variables

Potential confounding variables	No fall N = 944 n (%)	Fall N = 89 n (%)	Adjusted for clustering at household level		
			Odds ratio (95% CI)	P-value	Wald test P value
Siblings under 18 years of age					
0 siblings	101 (91.0)	10 (9.0)	…	…	0.950
1-4 siblings	748 (91.3)	71 (8.7)	0.96 (0.48, 1.92)	0.905	
> 4 siblings	95 (92.2)	8 (7.8)	0.85 (0.31, 2.37)	0.757	
Caregiver's age (years)					
≤ 30	448 (90.5)	47 (9.5)	…	…	0.343
> 30	496 (92.2)	42 (7.8)	0.81 (0.52, 1.26)	0.343	
Caregiver's education level					
Not literate	412 (91.4)	39 (8.6)	…	…	0.590
Reading & writing ability	215 (90.0)	24 (10.0)	1.18 (0.68, 2.05)	0.560	
School education	317 (92.4)	26 (7.6)	0.87 (0.52, 1.45)	0.588	
Caregiver's occupation					
Employed/able to work	728 (90.2)	79 (9.8)	…	…	0.013
Unemployed/unable to work	216 (95.6)	10 (4.4)	0.43 (0.22, 0.83)	0.013	
Family size					
≤ 4 people (small)	157 (88.2)	21 (11.8)	…	…	0.076
5-8 people (medium)	549 (91.0)	54 (9.0)	0.74 (0.42, 1.28)	0.247	
> 8 people (large)	238 (94.4)	14 (5.6)	0.44 (0.22, 0.90)	0.024	
Family member over 18 years of age					
≤ 2 people	370 (90.0)	41 (10.0)	…	…	0.216
> 2 people	574 (92.3)	48 (7.7)	0.75 (0.48, 1.18)	0.216	
Ethnic group					
Underprivileged	744 (93.1)	55 (6.9)	…	…	0.001
Privileged	200 (85.5)	34 (14.5)	2.30 (1.43, 3.69)	0.001	
Household income per month in 2 quantiles (NRs.)					
Q 1 (NRs. 1000-10,000)	512 (92.6)	41 (7.4)	…	…	0.148
Q 2 (NRs. 1000-1,40,000)	432 (90.0)	48 (10.0)	1.39 (0.89, 2.16)	0.148	
No. of floors in the house					
1-2	633 (92.8)	49 (7.2)	…	…	0.026
3	311 (88.6)	40 (11.4)	1.66 (1.06, 2.60)	0.026	
House ownership					
Owner-occupied	907 (92.1)	78 (7.9)	…	…	<0.001
Rented	37 (77.1)	11 (22.9)	3.46 (1.73, 6.91)	<0.001	
House age					
≤ 20 years	677 (91.5)	63 (8.5)	…	…	0.855
> 20 years	267 (91.1)	26 (8.9)	1.05 (0.64, 1.70)	0.855	
No. of rooms					
1-3	694 (92.9)	53 (7.1)	…	…	0.006
4-10	250 (87.4)	36 (12.6)	1.89 (1.19, 2.98)	0.006	

Appendix 5.8 Univariable logistic-regression results for the association between fire-related/burn/scald injury and potential confounding variables

Potential confounding variables	No burn N = 966 n (%)	Burn N = 67 n (%)	Adjusted for clustering at household level		
			Odds ratio (95% CI)	P-value	Wald test P value
Siblings under 18 years					
0 siblings	104 (93.7)	7 (6.3)	…	…	0.988
1-4 siblings	766 (93.5)	53 (6.5)	1.03 (0.45, 2.32)	0.947	
> 4 siblings	96 (93.2)	7 (6.8)	1.08 (0.38, 3.10)	0.881	
Caregiver's age (years)					
≤ 30	459 (92.7)	36 (7.3)	…	…	0.323
> 30	507 (94.2)	31 (5.8)	0.78 (0.48, 1.28)	0.323	
Caregiver's education level					
Not literate	414 (91.8)	37 (8.2)	…	…	0.147
Reading & writing ability	227 (95.0)	12 (5.0)	0.59 (0.29, 1.19)	0.143	
School education	325 (94.8)	18 (5.2)	0.62 (0.35, 1.10)	0.101	
Caregiver's occupation					
Employed/able to work	757 (93.8)	50 (6.2)	…	…	0.466
Unemployed/unable to work	209 (92.5)	17 (7.5)	1.23 (0.70, 2.16)	0.466	
Family size					
≤ 4 people (small)	165 (92.7)	13 (7.3)	…	…	0.587
5-8 people (medium)	562 (93.2)	41 (6.8)	0.93 (0.47, 1.82)	0.824	
> 8 people (large)	239 (94.8)	13 (5.2)	0.69 (0.31, 1.54)	0.366	
Family member over 18 years of age					
≤ 2 people	377 (91.7)	34 (8.3)	…	…	0.059
> 2 people	589 (94.7)	33 (5.3)	0.62 (0.38, 1.02)	0.059	
Ethnic group					
Underprivileged	747 (93.5)	52 (6.5)	…	…	0.957
Privileged	219 (93.6)	15 (6.4)	0.98 (0.55, 1.77)	0.957	
Household income per month in 2 quantiles (NRs.)					
Q 1 (NRs. 1000-10,000)	511 (92.4)	42 (7.6)	…	…	0.118
Q 2 (NRs. 1000-1,40,000)	455 (94.8)	25 (5.2)	0.67 (0.40, 1.10)	0.118	
No. of floors in the house					
1-2	638 (93.5)	44 (6.5)	…	…	0.949
3	328 (93.4)	23 (6.6)	1.02 (0.61, 1.70)	0.949	
House ownership					
Owner-occupied	921 (93.5)	64 (6.5)	…	…	1.000
Rented	45 (93.8)	3 (6.3)	0.96 (0.30, 3.07)	FE 1.000	
House age					
≤ 20 years	691 (93.4)	49 (6.6)	…	…	0.773
> 20 years	275 (93.9)	18 (6.1)	0.92 (0.54, 1.59)	0.773	
No. of rooms					
1-3	697 (93.3)	50 (6.7)	…	…	0.653
4-10	269 (94.1)	17 (5.9)	0.88 (0.51, 1.53)	0.653	

Appendix 5.9 Univariable logistic-regression results for the association between cut/crush-induced injury and potential confounding variables

Potential confounding variables	No cut N = 980 n (%)	Cut N = 53 n (%)	Adjusted for clustering at household level		
			Odds ratio (95% CI)	P-value	Wald test P value
Siblings under 18 years of age					
0 siblings	106 (95.5)	5 (4.5)	…	…	0.440
1-4 siblings	779 (95.1)	40 (4.9)	1.09 (0.42, 2.81)	0.861	
> 4 siblings	95 (92.2)	8 (7.8)	1.79 (0.56, 5.64)	0.324	
Caregiver's age (years)					
≤ 30	470 (94.9)	25 (5.1)	…	…	0.910
> 30	510 (94.8)	28 (5.2)	1.03 (0.60, 1.78)	0.910	
Caregiver's education level					
Not literate	422 (93.6)	29 (6.4)	…	…	0.022
Reading & writing ability	223 (93.3)	16 (6.7)	1.04 (0.56, 1.94)	0.891	
School education	335 (97.7)	8 (2.3)	0.35 (0.16, 0.77)	0.009	
Caregiver's occupation					
Employed/able to work	771 (95.5)	36 (4.5)	…	…	0.063
Unemployed/unable to work	209 (92.5)	17 (7.5)	1.74 (0.97, 3.13)	0.063	
Family size					
≤ 4 people (small)	172 (96.6)	6 (3.4)	…	…	0.504
5-8 people (medium)	570 (94.5)	33 (5.5)	1.66 (0.69, 3.99)	0.258	
> 8 people (large)	238 (94.4)	14 (5.6)	1.69 (0.64, 4.42)	0.288	
Family member over 18 years of age					
≤ 2 people	388 (94.4)	23 (5.6)	…	…	0.576
> 2 people	592 (95.2)	30 (4.8)	0.85 (0.49, 1.48)	0.576	
Ethnic group					
Underprivileged	758 (94.9)	41 (5.1)	…	…	0.998
Privileged	222 (94.9)	12 (5.1)	1.00 (0.52, 1.92)	0.998	
Household income per month in 2 quantiles (NRs.)					
Q 1 (NRs. 1000-10,000)	527 (95.3)	26 (4.7)	…	…	0.497
Q 2 (NRs. 1000-1,40,000)	453 (94.4)	27 (5.6)	1.21 (0.70, 2.09)	0.497	
No. of floors in the house					
1-2	645 (94.6)	37 (5.4)	…	…	0.547
3	335 (95.4)	16 (4.6)	0.83 (0.46, 1.51)	0.547	
House ownership					
Owner-occupied	934 (94.8)	51 (5.2)	…	…	1.000
Rented	46 (95.8)	2 (4.2)	0.80 (0.19, 3.32)	FE 1.000	
House age					
≤ 20 years	703 (95.0)	37 (5.0)	…	…	0.761
> 20 years	277 (94.5)	16 (5.5)	1.10 (0.60, 2.00)	0.761	
No. of rooms					
1-3	705 (94.4)	42 (5.6)	…	…	0.247
4-10	275 (96.2)	11 (3.8)	0.67 (0.34, 1.32)	0.247	

Appendix 6.1 Topic Guide for FG Discussions

Topic Guide

Community-Based Home Injury Risk Assessment in Rural Nepal

(PhD Research, the University of the West of England, Bristol)

Introduction: At first, a brief introduction of the research project along with aim and objective of this focus group (FG) discussion was explained by a researcher (SB). FGs were conducted after completion of 20% survey of 740 households assuming that information obtained from survey might add some other aspects in the discussion.

Ground rules:

- Time approximate between 45-60 minutes (audio- recording, handwritten notes)
- Participants will be encouraged to speak clearly and only one at a time
- There will be no right or wrong views in discussion but in line with the topic
- Assurance of anonymity and confidentiality of participants and their views.
- The respondents will be anonymized as F1P1 - Participant #1 of the FG 1

Warm-up (Duration: 10 minutes): Introduction by participants with a brief background (e.g. number of children in their family, any interest/experiences of child injury or injury prevention etc.).

Discussion: Group discussion will be focused to explore the potential for utilization of the survey data for local change, along with the barriers and facilitators of such change at a community level. The term 'injury' means physical injuries, open wounds or internal injuries.

These may result from accidental falls, drowning, fire burns/scalds, accidental poisoning, animal related, suffocation etc. In this discussion, environmental risk means physical hazards that have the potential to cause injury in the home environment, and the term children refers to any person from birth to below 5 years (0-59 months).

The specific objectives are to obtain information from community people about:

Potential for local change (home environment) with minimum efforts and cost and by using local resources to prevent unintentional child injuries.

- Potential barrier to such interventions
- Potential facilitators for such interventions

To organize the discussion, the researcher (SB) divided the discussion into 4 major stages:

Part 1. Injuries and perceived hazards in the home environment.

Part 2. Possible changes that could be undertaken within their homes to improve the home safety.

Part 3. Potential barriers to each possible change to improve the safety of home environment.

Part 4. Potential facilitators for each possible change to improve the safety of home environment.

Now we shall begin our discussion. Now let's start our discussion in an organized way.

For this please think of children under 5 years of age or children from birth to 59 months old and only the injury occurring at home environment. We will not be including other environments such as road, school etc. in this discussion. Please start with an example you know about. Please tell us some examples too that you have seen in your home or in your community.

Guiding questions: **(Parents i.e. Mother and Father Group)**

Part 1 Injuries and perceived hazards in the home environment (Duration: 10 minutes)

1.1 What do you understand by childhood unintentional injuries?

1.2 What do you understand by injury hazards presence at home environment for child injury?

1.3 Where do most of injuries occur in the home? We are trying to identify the places where accidents and injuries occur. Which are the most vulnerable places at home environment?

1.4 What are the risk factors/hazards of child injury at home environment?

1.5 How safe is your home for your children? (How often does your child get injured at home?)

Part 2 Possible changes that could be undertaken within their homes to improve the home safety. (Duration: 10 minutes)

2.1 Whether anyone/everyone believes that injuries can be prevented.

2.2 Do you think there is anything that you can do to make your home safer for your children? (What would you do to your house to keep your children safer from injuries? Need to pull them back to HOUSE not CHILDREN.)

2.3 Are there things that other people can do or should do to make your home safer for your children? If yes, describe.

2.4 Are there changes you wish to make in your house to increase safety but cannot do by yourself?

2.5 If a child of someone in this group has had an injury, were any changes/modifications made to the house because of this injury and to prevent children from the similar injury events happening in the future?

2.6 What you can do for your children so that the incidents of injuries are not repeated in future?

Part 3 Potential barriers to each possible change to improve the safety of home environment. (Duration: 10 minutes)

3.1 What would make it difficult for you to make your home safer? Please describe with example if possible.

3.2 Suppose you don't have financial problem, then what would be the barriers to making your home safer for child injury prevention? If yes, describe.

Part 4 Potential facilitators for each possible change to improve the safety of home environment. (Duration: 10 minutes)

4.1 Is there anything that would help you to make your home safer? If yes, what? Please give some practical examples in this regard.

4.2 What short of things would help you to make your home safer from injury incidents? Please think all potential ways that could assist you regarding on this.

Guiding questions: **(FCHV and ECED Teaches)**

Part 1 Injuries and perceived hazards in the home environment (duration: 10 minutes)

1.1 What do you understand by childhood unintentional injuries?

1.2 What do you understand by injury hazards presence at home environment for child injury?

1.3 Where do most of injuries occur in the home? We are trying to identify the places where accidents and injuries occur. Which are the most vulnerable places at home environment?

1.4 What are the risk factors/hazards of child injury at home environment?

1.5 How safe are the homes for children in this community? (How often do children get injured at home?)

Part 2 Possible changes that could be undertaken within their homes to improve the home safety. (Duration: 10 minutes)

2.1 Whether anyone/everyone believes that injuries can be prevented.

2.2 Do you think there is anything that community people could do / change to make their home safer for children? (What would community people do to their house to keep their children safer from injuries? Need to pull them back to HOUSE not CHILDREN.)

2.3 Are there things that other people can do or should do to make their home safer for their children? If yes, describe.

2.4 What changes might community people wish to change in their house to increase safety but cannot do by their self?

2.5 If a child of someone in this community has had an injury, did they make any changes/modifications to the house because of injury and to prevent children from the similar injury events happening in the future? If yes, what changes were made?

2.6 What community people could do for their children so that the incidents of injuries are not repeated in future?

Part 3 Potential barriers to each possible change to improve the safety of home environment. (Duration: 10 minutes)

3.1 What would make it difficult for them to make their home safer? Please describe with example if possible.

3.2 Suppose someone doesn't have financial problems, are there barriers that to making his/her home safer for child injury prevention? If yes, describe.

Part 4 Potential facilitators for each possible change to improve the safety of home environment. (Duration: 10 minutes)
4.1 Is there anything that would help them to make their home safer? If yes, what? Please give some practical examples in this regard.
4.2 What short of things would help community people to make their home safer from injury incidents? Please think all potential ways that could assist them regarding on this.

Guiding questions: **(Young School Students)**

Part 1 Injuries and perceived hazards in the home environment (duration: 10 minutes)
1.1 What do you understand by childhood unintentional injuries?
1.2 What do you understand by injury hazards presence at home environment for child injury?
1.3 Where do most of injuries occur in the home? We are trying to identify the places where accidents and injuries occur. Which are the most vulnerable places at home environment?
1.4 What are the risk factors/hazards of child injury at home environment?
1.5 How safe is your home for young children/your siblings? (How often do children get injured at your home?)

Part 2 Possible changes that could be undertaken within their homes to improve the home safety. (Duration: 10 minutes)
2.1 Whether anyone/everyone believes that injuries can be prevented.
2.2 Could your parents do / change anything to make your home safer for children? (What would your parents do to your house to keep children safer from injuries? Need to pull them back to HOUSE not CHILDREN.)
2.3 Are there things that other people can do or should do to make your home safer for children? If yes, describe.
2.4 Are there changes you wish to make in your house to increase safety but cannot do by yourself or by your parents?
2.5 If a sibling of someone in this group has had an injury, did you or your parents make any changes/modifications to the house because of this injury and to prevent children from similar injury events happening in the future?
2.6 What you or your parents could do for your children so that the incidents of injuries are not repeated in future?

Part 3 Potential barriers to each possible change to improve the safety of home environment. (Duration: 10 minutes)
3.1 What makes it difficult for you/ your parents to make your home safer? Please describe with example if possible.
3.2 Suppose your parents don't have financial problems, are there barriers to making your home safer for child injury prevention? If yes, describe.

Part 4 Potential facilitators for each possible change to improve the safety of home environment. (Duration: 10 minutes)
4.1 Is there anything that would help your parents to make your home safer? If yes, what? Please give some practical examples in this regard.
4.2 What short of things would help to make your home safer from injury incidents? Please think all potential ways that could assist you or to your parents regarding on this.

Ending the discussion by saying: We have been discussing for about an hour. Do you think we missed something to discuss?
Wrap-up (duration: 10 minutes)**:** At the end, there will be a short session for summarizing and recapping the whole discussion on a flip chart, thanking the participants, and serving refreshments followed by immediate meeting between moderator and note-taker

Appendix 6.2 Sample transcripts of FCHV group

Date: 2071/11/29
VDC: Ambhanjyang
Ward No.: 3 Dhading
Location: In the meeting hall of Ambhanjyang health post building
Type of Target Group: Female Community Health Volunteer (FCHV)
Number of participants: 8 (all are the FCHVs of Ambhanjyang V.D.C)
Age group: 21 to 52 years old females
Level of education: No. 3 is attending adult education and other participants are volunteers who have passed class 5 to class 12.
Length of session: 72 minutes
FACILITATOR: Santosh Bhatta
Note keeper: Mangalmaya Manandhar (MIRA staff)
Observation: Rita Shrestha (MIRA staff)
Recorder No.: WS600130 (Folder c)
[**Note**: the respondents are anonymised as V with their number]

FACILITATOR: What do you understand by unintentional injuries that happens to children below 5 years of age?
V6: Unintentional injuries means when the parents by mistake leave the knives in the chopping block while cutting the straw litter into small pieces, and the children while trying to copy their parents cut their hands. Fire is left in the stove just like that and the parents go to work, and the small children play with it and end up burning their hand. Children also fallen from the stairs, sometimes they have suddenly fallen off the balcony. Those who have houses on the side of the road, usually get hit by the motorbikes. Few days before, a child was hit by a motorbike. Although the bike came slowly the child suddenly crossed the road and was hit by. Luckily nothing happened. All these accidents can be happened.
FACILITATOR: What else can be there in your opinion?
V3: If there is irrigation channel in front of the house, then it might wash away the child with it. It happened few days back in our village. In Simaltaar, there is a house where the irrigation channel is near. When the child was kept there, and mother went downside, the child fell into the water and reached to the end of the channel. In the night when the women had finished cooking and went down to throw the wastage, one person saw there was this big (shows by hand) thing wrapped there. They looked at it wondering who threw it and later realized it was their neighbour's child. Everyone was very amazed. The child was very serious and weak. Such accidents also happen. Let's say some houses do not even have family members. Because they do not have family members there is no one to take care if a child is born. When there is no one to look after the child, the mother ties the child around and carries with her. We have seen such things in village.
FACILITATOR: That is about how to control the accidents. Now we are asking what you understand by unintentional accidents or injuries.
V3: They also carry the children in the "chhapne" (cover) sister. They carry the children in that and most of the time they jump and fall off. Then they carry the children who are bleeding in the cradle and bring to health posts. I have bandaged such children myself. The mother only knows such incident when the child is crying…
FACILITATOR: What else other than that? One is when there is irrigation channel or road close to the house then there are chances that the vehicles might hit the child, or they might drown into water and flow with it, and the children might get injured… (No. 6 speaks in middle)
V6: If we have kept the water in the bucket then that can also be hazardous for the children. There have been many cases when the children have got into the bucket in the upside down and suffocated.
V2: What happened once was, the mother took her daughter to the tap. She kept the daughter on one side and was busy talking on the other. The child fell in the tap and broke two of her teeth. After that she started crying like anything. My sister-in-law was also there. She told see what has happened to the little sister and when they looked properly they knew she broke her teeth. She fell badly on the cemented floor of the tap. After that her teeth were gone. These things are happening here. In the village there are taps, wells where we go to fetch water, there are walls in the courtyard. The village is not plain. When it is not plain then they fall off the walls in the porch and get injured. It happens many times. My son also fell from the balcony and he had a cut in the shoulder (points to the back) and still there is a mark. That wound got infected and became very big. He was not even 2 years old. A lot of pus came out of the wound. I cannot even imagine the pain of that time. Such things happen in the village. We have to leave the children and go for work because there is no one to look after. We have to leave depending on the child. We have to keep water in big drums (shows by moving the hands) and even if the child drowned, we would not have found. My son was also nearly fell into the drum but one of the neighbour show him and took out, but son got some cut injury from sharp border of drum. There is still wound mark on my child's body. That began this big by infection. There are many incidents like that. So many things happen to my son, once he fell off the top window, another time from the hill within 2 years' time. Next time from the drum, it's been 3 times my son had to go through such incidents.
FACILITATOR: In the small age?
V2: Yes, in the small age.

V6: It is not only that. We saw a grown-up boy, he did not have eyes. When we asked his mother, what had happened to his eyes, she said he was pecked by a hen. When he was small he was left in the sun after oil massage. That was the thing to be taken care of by the mother. She just made him sleep in the sun just like that and later the hen came and pecked him, and he does not have one eye now. That is also one accident. Around the house (No.2 speaks in the middle).

V2: That is also can accident.

V3: We do not know how to say everything fluently but there are lots of accidents happening with the children.

FACILITATOR: What are the accidents that happen a lot?

V1: Some children burn their hand while parents are cooking foods. In my village also, while the mother boiled some water to make the porridge from maize flour, and got involved in talking. At the same time a kid went to put the flour in the water, but all the hot water fell into him. Even my child fell in the food that was prepared for the cows and cattle. He was playing and all the sudden got into it from backside. My youngest son back is all burned (points in the backside).

V3: What is the thing that burns called? The few days back, just today the child who wears a sari of 8 or 9 thousand calls it something, it's acid or something…

V1: Acid, acid.

V3: He threw away the acid. While throwing it like that, it fell into a sari and sari was damaged. Some drops of acid got into the child's hand also and he burned his hand (she shrugs her hands). All the people gathered in no time, bought some tomatoes and put it all over his hands. Even acid can (correcting in the middle).

V1: Acid, acid. Acid spoils everything.

V2: The sari was totally damaged. How is that acid actually?

V6: We are talking about acid here. In front of our house sir, Bhupendra sir used to say. He had kept acid in a bottle to clean the toilet. Our Manju sister from here (showing the health post), her daughter was Aakriti. Poor child went to the toilet and used it to wash thinking it was water. She was badly burnt.

FACILITATOR: You have said about so many injury events that happen in the home environment. You have said about all these things in respect to your work. Now can we discuss where these types of events occur frequently in and around the home?

V5: There are kitchen gardens in the villages. Sometimes they fall in the kitchen garden, sometimes from the stairs and break their legs. They are like that only.

FACILITATOR: What else than that?

V1: Falling from the stairs. See Ramchandra's child fell from above and broke his hand.

V4: If there are small children. One is 4 years old, another is 2 years old. My sister-in-law's son saw water in the vessel. The son is about to be 5 years old. The daughter got on him upside down. The boy slept saying the sister did not cry. The mother had gone to the field. If Suntali sister was not there, the daughter would die. She was bought to your place only (showing towards the sir of health post). All the way, Suntali didi sprinkled water, shook her leg and did many things otherwise the child would have died.

FACILITATOR: Does these things happen to small children?

V4: Yes, it happens. Small children do not have mind to understand these things can kill them.

V2: Small children are the ones who are very happy to play with water.

V4: That is how the back got hurt.

V3: I will ask one thing now. Now you people from MIRA are walking around the village to see the children, to write about them. Can we also say about things as said from the village? Can I say? (Asks the FACILITATOR).

FACILITATOR: Yes, you can say.

V3: This MIRA comes every year to see how the children are; they ask what has happened to them. They ask that since eventually MIRA does not give anything, what are they here to ask about? We do not know what answer to give them.

V2: No (Cuts what no.3 was saying)

FACILITATOR: We will give the answer to this question later, okay?

V6: No, some people have said such things while some people have said that when MIRA is there we have experienced that many groups were operating. Now it is difficult. When MIRA was there before, it was easy to run the groups. Now that MIRA has left it has become very difficult. Some people who do not understand say that now people are happy if red sarees are distributed. Those who understand say good things but after MIRA left it has been difficult for us to work.

V1: No matter what happens to others, it has been difficult for us after MIRA left.

V3: No matter what others say…

FACILITATOR: There are different things in this. You people have already said a lot of things. In some places we have heard that, yesterday when we went for discussion at Harnamadi, they said the poisonous things are also used by the children? How often have you heard that?

V6: Yes, we have heard of that, why not…

V1: Don't you know what happened in Simaltaar Rita sister? They had kept the poisonous medicine for houseflies and that was eaten by the child and was rushed to Bhaktapur. Don't you know? (Asks no.6).

V6: When the housefly medicine was kept here, no.8's two children got into it, didn't they?

V2: I will say. Those were my nephew and niece. One was nephew and the other was niece. Both my brothers were abroad. Small nephew was very small and youngest niece was sick. My mother and my sister-in-law went to the field to cut millet saplings. And my father went to do the household work by locking the children on the second floor. Two children on two sides would not let him work so he locked them on the second floor and went downstairs to cook food. The niece was sleeping separately on the bed because she was sick and brought home from the hospital only on the previous day. My father thought children would play so he went to prepare the food. My father had kept the medicine above 5 or 6 straw-mats and below 3 or 4 mattresses. He kept it between them properly tied with rope in such a way that it could not be reached no matter where you tried to poke it from. He thought it was his own bed so no one would come there to search for it except for him. He kept it without any tension as he was sure no one would search for it. Unfortunately, the kids were there the same day and it all had to happen and on the same day. They had to go there to make this thing a memory for lifetime. Children of 3 years old took out all the mattresses, blanket and straw-mats. They spilled the medicine here and there, and it even touched their hands and it was all over their body. The nephew and niece were amazing at that time, I heard they even cried. When they cried my father called the sister-in-law and told them to come home soon as the children were crying and would not let him cook food. After that the sister-in-law came and immediately started feeding the children. If they had washed their hands before feeding, the children would have been saved but they immediately fed them without washing. Children these days are so fond of sugar, so my nephew told them that he wants to eat sugar and asked them to bring it. That thing remains for a lifetime. And that very day the sugar was finished in the house. In villages, everything is not always there, and the shop is also far. Then they said there was no sugar and asked him to eat rice and milk only. But he started fighting saying that he wants to eat with sugar. While fighting he unknowingly touched his sister as well. No one knew that he had eaten the foret. No one knew that child had eaten that. How stupid. No one even smelled anything. And then niece started crying frantically. She did not stop crying, so they decided to take her to the witch doctor. That Jeete is now dead, right? I think it's good that it happened. When asked he did not even give something sour to them. If he had given something sour, it would have been good. It could be given to the child to eat. I cannot do anything to this child (makes artificial sound), he said. He is a Tamang, must have been tipsy at that time. He said he could not do anything. At that time, the witch doctor would not be available any time. Durga carried the little girl in her arms and went saying that she would come and work one day but just save her daughter. They did some mantras and traditional praying but before reaching home the daughter had already gone. After bringing her home and throwing everything, when they searched for the son, he was so scared. A boy of 3 years old had so much knowledge. He was telling his mother not to do him anything and was hiding on the bed covering himself by the blanket (shows by using own shawl). They thought he was also having the same problem and now had to be rushed. Do you know the place called Baajh? He was asking for noodles to eat when they were in river near this place called Baajh. He was telling them that he wants to eat noodles, but before crossing the river the boy had gone. When they reached Baajh, he was no more. This type of accident has never happened to any of us. Such incident happened and my both of them were gone. Many people said many things to my father. They said he had to die because he fed poison to his grandchildren. But he did not do any of it, did he? People said a lot of things about him. We stayed there for many days, almost for 9, 10 days. Such accident happened because of the poison.

FACILITATOR: Other things like that. In the villages, we do farming. We have weapons and equipment that we use in the fields. Not in this Ambhanjyang also, electricity is there…

V2: There have been many incidents of current. Few days back in number 6, 2 people died of current.

FACILITATOR: How often do you find these accidents happen here?

V2: 2 people have died because of the electric shock.

V6: Adult people have died. I don't know anything about the children below five years dying because of the current. In most of the places we have seen, like they have kept the electric plugs in the lower surface where children can reach it and even poke it. It is very dangerous.

V2: I have a grand daughter who plays with the weapons. Once she hurt her finger with the knife. After that this finger is still not proper. Some kind of muscle has grown on her finger. If I was there, I would have tied the bandage properly. I was not there that day, so they tied the bandage. After it was tied, I did not look at it. When I looked at it later, there was this big muscle there.

V6: It might have to be stitched.

V2: Accidents like these…

V6: Children put their feet inside their nose, inside their ears.

V3: They do put it inside the ear. When my daughter was 2 years old she took a red lablab bean and put it here, from here to there. I took her here and got it out. When we work on beans, children silently play with it and it goes inside and we cannot take it out.

V6: Once they came with corn inside. When I used to teach. They had brought him to hospital. I kept her at Rita's house and pushed here like this (catches the nose and shows). If I didn't push it would go inside. I held it here like this.

V3: Imagine how big the red lablab bean had been. It was this big and it went inside here.

V6: Children carry sticks, splinters with them and it pricks their eyes. Ramesh brother's son once carried this big bamboo stick and ran. While running it pierced his neck and was brought to the hospital. This went from here and inside.

V3: They should not carry sticks at all.

V2: Any accident can happen.

V6: The stick is dangerous. Sharp weapons, sticks are very dangerous.

FACILITATOR: What other things can be there, things that we can find inside and outside our house which can be dangerous to small children? What else can be there? Like we have cows and cattle, how dangerous can they be for the children?

V3: Yes, they are dangerous. A 2-year-old child can walk few steps. When the mother is doing something the child also goes there. He goes to the place where there are cows, he tries to get milk and the cow just hits him with his leg and horns. The goats may hit or step on them. It is very dangerous. The children do not know. The main thing is the mother should look after them.

V2: When doing the household works, many times they step on the children.
FACILITATOR: Is there anything you want to say?
V5: No, there is nothing.
FACILITATOR: Haven't you found anything, for small children?
V5: There are so many children.
FACILITATOR: Such kinds of...
V6: Usually in our village, they put bangles on small girls' hands. They put on glass bangles. The small children fall and get cut many times. Bangles are also dangerous.
FACILITATOR: Anything else like bangles?
All the participants are silent…
FACILITATOR: Is there anything else in this?
V3: When we must say, we don't know what to say. There are so many things like these, but we don't know what to say.
FACILITATOR: You said a lot of things. There are things inside our house that maybe dangerous for the children. What about the houses in the community? You are volunteers; you have been the leaders in your ward. You have seen the places in the village and have been doing social work. How safe are the houses in our community for the children?
V3: Some are safe, some are not. Some are safe, but some are not. Some pay attention very much to the children and don't let them go anywhere. They arrange for food and clothes and stay safe.
V2: I just remembered one incident. It happened nearby. The daughter is little strong head. She did not obey when her father called. It was the day when the procession of Bacchu Dai's 13th day of death was going on. That small girl was sitting with her grandmother to eat. It's difficult when the parents are not educated. They really do not understand. They only think of one way, do not care about what might happen next. They were like that. That girl was sitting with her grandparents in their main house, they could have let her eat at least or could have told her to come to go home after she finished eating. They just came and hit her hard on the head, on the eyes and cheeks. Her eyes were all red and there were wounds all around her eyes.
FACILITATOR: Who hit her?
V2: Her father. If your parents don't love what will others do?
FACILITATOR: What I am trying to say is whatever dangers are there in the house like balcony, terrace, stairs, courtyard, porch, rooms and other structures of the house. How safe are the children because of such dangers?
V6: They are not.
V2: They are safe in some, not safe in others.
V3: They are not safe in most of them.
V2: They are not safe in most of them. Even if there is balcony, it is all open. There is no fence in the porch. When there is no fence, it is not safe. If the child falls from the balcony, they fall in the courtyard.
V6: There are windows and children are inside. There are no grills in the house and they fall from the window.
V8: There was one sister in our village who left her 5 months old daughter sleeping in the balcony that was not barred. The child fell down from the balcony and died, because it was not barred.
V2: This accident happened in my house. I am still amazed. There was a child who was 2 or 3 months old. There was a bench in the balcony. It was even fenced. I am so amazed. My sister-in-law had brought one woman who had just given birth to a baby and her baby in the house. The baby was sleeping on the bench. We were just sitting and talking inside. Suddenly, the child was in the eaves, but was not hurt. How did she get to the eaves (smiles)? The bed was same as it was. Who carried her there? How did she get there? I am amazed about that. If something had happened, what would we say to the others? The baby has become big now but whenever I see her, I remember this incident.
FACILITATOR: Nothing happened to the child
V2: No nothing happened.
V6: That was luck by chance.
V2: Fell down from the balcony.
FACILITATOR: *Wasn't that balcony fenced?*
V2: Yes, it was fenced. The bench was above the balcony. She got down from the bench. Nothing had happened while she was sleeping. My sister-in-law had also come downstairs to talk.
V8: But there is nothing for the children in or village.
FACILITATOR: I remembered one thing while we were discussing before. In our village we have machineries like water pumps, so do such machineries also causes accidents to the children? Like suffocation…
V6: Yes, from water pump I remember one accident. My sister-in-law's niece's…
FACILITATOR: How old is she?
V6: 3 years old. The water pump was outside, and it was connected in the electricity. My sister-in-law had dressed the girl to go to her parents' house to attend the wedding. The daughter got tangled in the wire and the whole wire was on the floor. She shouted and called her mother. And then my sister-in-law came and unplugged the pump. Only then the child survived. It is very dangerous. The wire from the water pump…
FACILITATOR: How often do the accidents of suffocating happen? Small children suffocate…
V6: Yes, it happens.
V1: Sometimes they even die because they get covered by the blanket. Sometime, the children while playing with the clothes suffocate themselves.
V2: Also, while breast-feeding the child, the mother falls asleep and the child dies because her breasts press the child.
FACILITATOR: Have you seen such thing happen?
V2: Yes, I have seen. A 6 months old child died in our village.

V3: I don't know that.
V6: I don't want to say the name. She went to her parents' house to spend her after child-birth days. While staying there the child died because her breast pressed it, so she came back crying.
V2: It happens many times because of the breasts.
V8: In our village, also while breast-feeding the daughter at night, the daughter died because of the weight of the mother's body on her.
V2: They put the nipple in the child's mouth and fall asleep and after they fall asleep… No one intends to kill the child while breast-feeding.
FACILITATOR: The coins, stones get stuck…
V3: It is bad for the children.
V2: They put it in their mouth while playing and they don't even know when it's stuck.
V6: One child there… (No. 3 speaks in the middle)
V3: In our place, also it has stuck in the throat. And they hit upside down like this (shows by turning her head upside down).
V6: Was taken to Bharatpur because it was swallowed. They said it had to be operated but later on it got out from the stool and they came back.
V3: In the fasting during Teej (festival).
FACILITATOR: We discussed about how dangerous our home environment is for the children. We also discussed that many injuries happen. Now what are the things that we can do to protect our children below 5 years of age from such accidents? How can we minimize the possibility of such accidents taking place in the future? How can we eliminate them or at least minimize them? So that children do not have to lose their lives?
V6: If I have to say, I think whatever accidents happen, they happen because of the carelessness of the parents. On the one side, the houses are not safe. That is also parents fault. Others will not come and do it. And it is parents' fault because of the lack of awareness. They do not know, do not understand. If they knew such things would happen then they might also be cautious. But because they do not know, there should be some awareness programs related to protecting the children below 5 years of age, carried out in the wards. If they get some training, it will be better. All this is happening because the parents do not have the understanding.
FACILITATOR: She said that. Now what can the people in the community, especially the parents, can do in order to make the house safe and minimize such accidents? What can the parents do from their side?
V6: Now listen, if I have to say, before MIRA came here, there used to be no tests during pregnancy. They did not really go for the check-up. It is because of the lack of awareness. If they knew it could be dangerous for their and their children's life, then they would have gone before. MIRA set up the groups, but at the beginning it was difficult to run the groups. But later, they started realizing it. The sir is also there, and they have been coming to do the check-ups. In ward no. 3 also no child birth has taken place at home. All the pregnant women come either to the health post here or go to Hetauda, or Bharatpur. These things happen when people learn slowly. For example, it was not easy for them to take them to Bharatpur, but they did that because of the awareness. They realized it could be dangerous in the day to come that is why they took them there. It is not that they do not love their children. They do not have the knowledge that the children should not be kept on the bench while sleeping or about falling from the balcony. That balcony might be barred this big or the bench might also be very high. But these things are of no use if there is no awareness. I think when the women started coming to the group, and then they will slowly go for check-ups. Even when they are pregnant, 80% women go to the health posts ad hospitals. If this thing can also be done with such awareness programs, then people will be aware and there will be fewer accidents.
V3: If the mothers are trained, then I think they will understand.
V6: It is not necessary to have grills in the balcony. It is not necessary to have carved railings in the balcony. If they are made aware, then they can bring a bamboo and cover the area. If we talk about stairs, there are one-legged stairs in the village. It is difficult for children to come and go from there and because of that they fall. Small children want to climb to high places, play in the water. What they say in the infant education is we should let children play. They should not be tied or closed in the room, they should be given freedom. Like if a child wants to wash clothes, we give let them do it. He needs a lot of exercise. If he wants to study we should let them, if they want to break the splinter we should give them, if he wants to walk we should let them. We should never stop his excitement. In that context, we should make the surrounding safe for the children to do what they want to do. Even if he wants to climb the stairs, we should let him but be careful about how steep it is and how we should look after him while he does that. If we just make him stop saying not to climb it, he will never walk.
FACILITATOR: What sister said is right.
V6: As much as I know, any organization it may be, should bring awareness programs to the village to stop such things as many people in the village are not educated.
FACILITATOR: It is right. What we are trying to discuss here is, if the parents make some changes in the physical structure of the house to keep their children safe, can such accidents be eliminated? Can they be minimized?
V6: I also fear. I had some hens that once. After I had sold those hens I bought some anti-bacterial medicine and used to sprinkle it. What I think now is I am right, I am good. Now, for short time I may lose my mind. If a person says he will die right now the no one will look after him. Now, anything can come to your mind. But I never kept the remaining medicines at home. The children might consume it.
FACILITATOR: Medicine for what?
V6: Medicine that kills bacteria. Poison. After I sprinkle the medicine, I never keep it at home. Who knows I might feel like eating it tomorrow. Sometimes we don't know what goes around in a person's mind. The main thing is those things should not be kept in the house.
FACILITATOR: Those things should not be kept.

V6: Should not be kept in the house. Children have excitement in them. They want to learn more and explore more. They ask the same question to the parents so many times. Mommy what to do with this? What does it do? Where does it go? Children always look for something. If they find one medicine by throwing the mattress, they might want to throw another. They have to pass the time. While searching, they fight for it and start eating it. They take it to their mouth. If such thing can happen then it is because of the weakness of the parents. Sometimes even if we try our best but still the child gets sick, that is something different but the injuries that children get is because of the weakness of the parents.
FACILITATOR: Here we are talking about parents. Here the things we have discussed before has also come. For example, leaving the tap water open, keeping the cow sheds open, keeping the sharp weapons around the house. Now what can we do to the structures of the house to keep the children safe from such accidents? What improvements can be done in the house so that such accidents can be minimized? What can the parents do…?
V4: If there is slope in the courtyard, then it should be barred so that the children won't fall. If the house is fenced with the hope that the children will not break their hands or legs, then they won't fall. If it is plain, then they might fall there. In our house, if they fall from the courtyard then they will directly reach to the river. There is no place to hold on. At our place…
V3: If there is water drainage near the house and if it is protected with wood then the children will not fall there.
V6: The child is sleeping at one place; the hen comes to that place. The parents should be careful that it might peck the child or step on it. Because of lack of that, the child had to lose one eye.
FACILITATOR: What should be done for that?
V6: For that the hens should be raised safely.
V3: The children should not be left alone while sleeping. We should also stay there and watch over the children.
V4: If the child is sleeping then the hen should not be let out.
FACILITATOR: What else than that. Lot of things was said before.
V5: The fire should be put off after the work in the kitchen is finished. The child should not be left sleeping in the bed that is too high and should not be left alone.
V6: Once what happened was, the child was crying while the mother was trying to make him sleep. She was very tired, so she let the child sleep on the cradle and she slept on the bed beside it. The cat came and sat over the child and the child died. Is not that the parents' fault? The cat came in search of warmth. It was warm on the cradle and the cat sat on the face of the child. The child was small so died of suffocation. There are lots of such dangers for the children.
V3: A child also died once. The clothes did not dry in the monsoon. So, they just tried to dry the clothes on fire and covered the child. They did not even know when the fire caught. The mother went to cut grass covering the child with the blanket. After she came back with the grass, the child was already dead.
FACILITATOR: How can we make the structures of our house safe? I am not asking about reconstructing the existing house but what slight changes can we make? Like you said before, if there is drainage in the courtyard then wood should be placed. What else can be done to the structure of the house? Because of which the accidents can be minimized.
V1: If the balcony is open, then it should be fenced with the bamboo.
V3: And when the child starts walking few steps, it is better to keep him at home even though it makes him cry. Sometimes they should be tied as well.
V6: Nowadays they do not tie the children.
FACILITATOR: Instead of tying the children, how can you keep them safe?
V3: Let's not hide things. Why do we need to hide the things that we have done? In order to save the children from dying and not let anything happen to them, we have tied them. We should say what we have done.
V6: We should not talk about things of that time. We should not tie them.
V3: We tie them even these days also.
V6: There is another alternative until the children are small. It is giving birth to the less number of children. Rather give birth to one child and keep him/her safe. Another thing is if you cannot look after a child, take them to the child care centres where they take care of them. They take children above 2 years of age. Take them there and leave for 2, 3 hours. While they are there, the mother should work faster. Tying up the children and covering their mouths is not the solution.
V1: In our times, we used to lock them in the room and then went to cut the grass. But now, looking after the children is one work and cooking is another work. Either mother-in-law cooks, daughter-in-law looks after the child or vice-versa. No tying or locking up is done these days.
FACILITATOR: Taking care of the children…
V5: We should keep the weapons in the place where they cannot find them. Things made up of glass or things that cut should be kept out of reach.
FACILITATOR: You said, weapons should be placed where they cannot find. How to keep in such place?
V6: They should be kept in high places.
V5: It is safe in higher places.
V2: They should be locked.
V5: They should be kept up in the khopas (small partitions made to keep things).
V6: The children can even reach up. It should be kept where they cannot find.
V3: They should be kept where we can find, and the children cannot find.
V6: Small children should not be given milk in the glass that can break. While drinking from the glass, they fall and cut their hands. There are many ways to keep them safe.

V5: Just yesterday my son cut himself by the glass and I had to put medicine on him. Even though we don't want to give, he tries to pull it again and again.
FACILITATOR: Like weapons, there are other things at home that can be harmful for the children. We use water, fill water in the bucket. There is compost natural gas in your village…
V5: While making the compost gas, they have the big opening of water (nath). The children while playing with the water may drown in there.
FACILITATOR: What should be done for that?
V2: The nath is as big as a pond for swimming.
V6: Don't you remember Lati's daughter. While mother was washing the clothes, and fetching water from the well, the daughter got into the bucket and died.
V3: Is it? (Asks with amazement).
V4: The behaviour of the family members should be changed.
V5: The toilets should be locked as far as possible. I also have a toilet; whenever my son gets a chance he goes to the toilet and plays with the water that is in the bucket.
FACILITATOR: It should be locked, isn't it?
V5: Yes, it should be locked.
FACILITATOR: What other things like that can be done? For some small children, the water in the bucket can also be dangerous.
V6: Sometimes the children of 3 or 5 years of age also cut their hands by putting then inside the chain of the bicycle.
FACILITATOR: What safety measures can be applied for that? In order to keep them safe?
V6: Main thing is the weapons should be kept where the children cannot find them. And there should be proper bars so that they do not fall.
V4: They should be properly looked after. They should not be left just like that like we used to do before. They should give birth to less number of children.
FACILITATOR: In our previous discussion, many things came like the children might fall, drown in the water, might get caught by the current, may intake poison and die. Even it happens sometimes because the animals may hit them.
V6: It is not only that most of the time because of the medicine they eat also things happen to children…
FACILITATOR: What can be done to minimize such dangers?
V3: That is, it. Things should be kept where the children cannot find them. The weapons, medicines should be kept here and there. They should be kept in safe place.
FACILITATOR (Santosh Sir): What do you mean by safe place?
V5: Safe place means the rooms where all the things are kept. The weapons should be kept separately in a room where children cannot find.
FACILITATOR: How can be done to save them from the dangers like falling?
V3: There should be bars in the balcony. Holes should be covered.
V4: The children should also be properly looked after. They should not be left alone.
V5: They might fall anywhere.
V4: The children should also be looked after.
FACILITATOR: Looking after them is there, what can be done to minimize where they fall from?
V6: In order to minimize, if there are houses in the hill side they should be properly barred so that the child does not fall from there. If the house is on the roadside, the children should be kept safe so that they cannot go to the road. They should not be left on the road. The weapons should not be kept in the place where they can find them, like the sickle the mothers use to cut grass. The child goes there and does the same and ends up doing the same. They should be kept safe from such things as well.
FACILITATOR: What do you mean the place where they cannot find?
V6: The place where they cannot find means places like khopa (small partitions made to keep things). They can be kept in the khopas, or in nidaals. The main thing is the child should not be able to find them. After cutting the logs, they just leave the axe just like that. The children just try to copy what their parents do. They also go and start hitting the logs but hit somewhere else. Those things should be kept safe.
V3: Near my house, there was a 2-year-old child. It happened last year. I went to my neighbour's house for a while. The 2-year-old child was going here and there leaving the house. There was a fence as well. There was a small stream down there. While he was running, he just fell from there. He went rolling down from there. Shambhu's grandson went running to him. When his father went down to see him, his nose was bleeding. He had a wound on one side. Nothing else had happened.
V2: It does not work; my own son fell almost 10 hands down. He just went rolling down, I was looking at him from up. I could not go straight to him. I was just looking at him thinking what would happen if he gets into the wood. My brother-in-law's daughter saw him from the other side. She jumped to get him. Both of them reached down at the same time. When they reached near the wooden cow shed, he had a small wound here (shows her head). Nothing really happened even when he rolled all the way down. We have fence on the other side of our house but in the same slope, he just fell like a ball (smiles).
FACILITATOR: Like you said before, what can be done to save them from catching the current? What can be done to save the small children, so that accidents won't happen?
V6: They catch current because in the villages, they bring the electricity lines without any meter box. They have fuse in various places. If it is touched just once, the fuse may just collapse. The lines are brought in an unsafe manner.
FACILITATOR: What can we do on our own?

V3: If some place is dangerous and if you have a child, then you should turn off the meter and do your work. If the meter is turned off, then nothing will happen even if the child touches it.
FACILITATOR: We should turn off the switch. What else solution can be there?
V6: Another thing is, while doing the wiring also it should not be done too low where the children can reach. It should be done high on the walls.
V2: The wiring is not done on the place where a 2-year-old can reach. It should be on high place.
V6: Few days back, a house caught fire here. An adult was ironing the clothes. When he heard that outside someone was beating someone, he just left the iron on the quilt without turning it off. When he came back home, the house was all gone.
V2: Was it Sijan? (Asks no.6)
V6: Let's not take names.
FACILITATOR: These were all about how we as parents keep our house safe for the children. What can others do? What can others do in order to control the injuries?
V6: Others should mainly bring the awareness programs.
FACILITATOR: Who should do the awareness programs?
V6: Awareness related programs should be done by some organizations, like MIRA. There are organizations that are related to health. They can bring some programs and inform people. The parents leave their children just like that because they do not know. We know a little and we can say these things, but all the parents cannot say. If they knew, they would not let the axe there just like that. If they knew, they would protect their children in the balcony…
FACILITATOR: One can be organizations, what can others be?
V6: What else can be there other than the organizations? Government of Nepal is not even able to write the constitution. There is no hope from the others. Because organizations do well, we tell the organizations only.
FACILITATOR: Let's keep organizations in Number 1.
V6: Main thing is…
FACILITATOR: Local authorities are also there.
V6: Yes, there are local authorities, forests. They do not know about these things. The children of those who live in the forest are like that.
FACILITATOR: What about V.D.C?
V6: The V.D.C has not done anything. We can try to ask with the V.D.C but it is not sure. If the budget comes, it is not enough after dividing it. First, they say this much is for the ward but later they keep on cutting it one by one and there is nothing left for the V.D.C.
FACILITATOR: Like there could be leaders of many political parties who can do such things.
V6: They can do, why not? But they do not want to do. They do not really care.
V1: No one really cares about health-related things.
FACILITATOR: They do not care?
V6: They only bring lodgers and dozers and dig the roads. In that hill sides,
FACILITATOR: Only physical.
V6: Only physical, nothing more than that. They only bring lodger and dozer and bring budget for a road. What gain does it provide us?
V1: Nothing happens anywhere (laughs).
FACILITATOR: Lots of things have come up. They can do if they want. But they do not show interest. If one organization does it, then can it be done?
V6: One thing that has come to my mind is, previously we did very less tests during pregnancy. Very less women came to give birth because of lack of awareness. The women were changed from that. This thing will also change. This thing will change even sooner.
FACILITATOR: You have been providing service as volunteers. In this context, how often can volunteers like you make some effort in this regard?
V6: We have been making efforts. I tell people around my house. I tell them not to keep the sharp weapons just like that because the child might use it. I also tell them not to leave the child on the roads as motorbikes may come and hit them. We do as much as we can and when we see.
FACILITATOR: Just like that, can school also help in some way to minimize such things?
V6: Schools don't do. Even around the schools…
V3: No one does it.
FACILITATOR: In order to do the programs to eliminate the accidents?
V6: All schools can do is conduct rallies. Like if they go and tell the students, it is not possible for students to do everything.
FACILITATOR: Is there anything else in this?
V6: There is nothing else in this.
FACILITATOR: What about mother's group?
V6: We can say such things to the mother's group.
V4: We can go to the mother's group and say such things.
V1: We can go to the houses and if we see anything, we can tell them not to do that because the children might get hurt.
V6: Not all of them come in the mother's group.
V2: No, they do not come. In some month, some women come, in some month other women come.
V6: There are only 15, 20 people. Not all from the ward are here. Some people are less.

FACILITATOR: What are the things that the parents really want to do in order to keep the surrounding of the house safe but have not been able to do it? What are the things that they have not been able to do on their own?
V6: The women cannot do all the things. They have to cut a bamboo and bring it home to put a bar around the balcony. The men should help. It is not possible if only the women do it. If there is a stream near the courtyard of the house, then a man should put something on top of it.
FACILITATOR: You all know different kinds of accidents happen in the community. In one village, an accident happens once. Now have you found them doing some improvements to make sure such accidents do not happen again? You must have seen while moving around in the village.
V6: There have been no improvements done.
FACILITATOR: Any improvement to make sure that once an accident happens, it will not repeat again. Like you said before, if you find some poison, has anything been done to manage it?
V2: That same day they threw away the poison in the river. After that whether there is poison in that house or not, no one knows.
FACILITATOR: Any improvements to not let such accidents happen again?
V4: Lots of improvements have happened. They do not keep the poison.
V2: The old people from the past times…
V6: The poisons might have been taken care of, but the weapons are still left just like that, after the wood have been cut, the weapon is still left there. When we go around in the ward to give people medicine for elephantiasis, we see at that time things are left just like that.
V4: They cut the wood with an axe and leave it there.
V6: They cut and bring the grass home and leave the sickle just like that. It has not improved.
FACILITATOR: Has not there be any improvements in order to prevent the accidents from happening again?
V6: No no.
FACILITATOR: What can be done for this?
V3: How can anyone do anything? We all have to improve our own selves. What do we have to do to others? No one obeys or does when we tell them something. We should use our own intelligence and do things.
V2: We always do things according to our intelligence, who sits depending on what others teach? You might teach me something, but I forget it when I get home.
V6: It's always been because of our own intelligence? Does that mean all the nurses and doctors go on injecting the syringe because of their own intelligence? They do all that because they have studied it.
V2: They do it because they are educated. But the sisters from the village do not do it.
V6: There should be awareness. We cannot say all the people do it because of their own intelligence.
V2: If someone has then they just ignore.
V6: Let me tell you something to you all. There are no parents who ignore thinking their children should die. It is because they do not know. All the doctors and engineers should have left thinking they would do it by their own intelligence, but it does not happen. They should bring awareness program.
FACILITATOR: Like if an accident happens once, they have not paid any attention so as to not to repeat such accident again. Can such improvements be done?
V6: If really wanted, that can be done.
FACILITATOR: What can be done?
V3: We can put bars on the place where the children might fall. Children fall in different places. Bars should be kept in such places. We should not keep poisonous things in the house. We should keep things where they cannot find. If there is stream ahead of the house, then that should be covered.
V6: The children should not be let to go in the sheds where cows and buffaloes are kept. If there is fire, it should not be left just like that while going out. Many times, there has been fire. The children have been burnt.
V3: The children get burnt. The mother should put off the fire. The children should not be let near there. There should be one person to look after, when there is a child in the house.
FACILITATOR: What else like that? From this side?
V8: Even the hens have pecked the children. The hens should also be managed properly.
V3: Even if there is no hen, it is not a big deal.
V8: They raise hens.
V2: Do you have hens? (Asks no.3)
V3: No.
V2: That is why you are saying (everyone laughs).
V3: Those who do business do raise them.
V8: We have raised everything, hens, and goats.
FACILITATOR: I just remembered something while discussing here. I have seen in our villages. I saw this when I went to Bhaise. When I went to Bhaise, a small child was in the house. A small child does not go anywhere. In Bhaise No.6, someone else brought some killer bees, and the child was stung by the insects. Has anything as such happened here?
V1, V2, and V3: Yes, died because the killer bee stung him.
V2: They die because they get stung by the killer bee.
V6: They even die because of the honey bee. People die because they get sting by different kind of bees.
FACILITATOR: Small children?
V6: Yes, small children also die. Why not?
V3: Yes, they have died. They have died because the killer bee stung them. Bahun Rajan's sister had died.
V2: When they see, they throw stones at them. After that the bees attack.

V8: An adult has died. In our place, also one person has died. Sanjel's son. But he was above 5 years old.
FACILITATOR: How old was he?
V8: Ten years old.
FACILITATOR: Have children died because of such accidents
V6: Getting stung by the bees.
FACILITATOR: I said before that in order to prevent such accidents from happening improvements can be done. Now what we do in the future to never let such accidents happen? In order to make sure there are no such accidents. It is something that we should be aware of once it has already taken place. If there is some accident like if a child dies because he ate poison, we should keep that poison separately. You said it should be kept in the trunk, or where the children cannot find it. But what I want to ask is, in order to never let such accidents, happen, what can the people in the community or parents do? Like not to let the accidents and injuries happen?
V6: Whatever work we do should be done in a safe way. The children should be raised safely. After giving birth to a child, women in the village look after the cattle more so that they give more milk. They don't look after the children that is why.
FACILITATOR: Apart from looking after the children, I am asking about the structures of the house. We need everything in the house. We need water, fire, wood, and weapons. How can we manage all those things so that there will be less injuries?
V6: All those things should be kept separately in a safe place by arranging them properly.
V2: They should be kept where the children cannot reach.
FACILITATOR: Safely means how have you kept them in your house? Where have you kept them? Should they be placed up or in the box?
V6: That…according to the place and the situation. If someone can make a box, then they have to keep accordingly in the box. Those who cannot make one should keep in the khopas, located on the top sir.
FACILITATOR: You cannot demolish your house and reconstruct it to make it safe. Whatever is there in the house, how can they be managed to make things safe?
V6: One is they should be covered using the planks of wood. The children will not reach there.
V2: It is not even necessary to use the planks. The bamboo should be hung there.
V3: Let's not only talk about ourselves…for the whole village.
V2: If we want to hang the sickle, scissors, axe or any other things we can easily get bamboos in the village. The child will find it when it is kept down. If they are kept in the windows or they are hung up like this (shows using the hand), it will be like this. We hang the bamboo on two sides, break them and take it out when we need them. When we do not need them, keep it there. If we throw it in the courtyard, then the children will find them.
FACILITATOR: Not only children, even the adults can be harmed?
V2: Yes, it even happens to the adults. If we step on the sickle while we are walking, then it can cut our feet too.
V6: If the child is to be kept on the balcony then something like upside down should be build there.
V2: If the second floor is to be kept safe then an upside thing (ghopte) should be made at the bottom of the stairs. Then the child cannot go upstairs. We can open it when we want to go. We do the same. That is how to make things safe. That is all. There is nothing else.
FACILITATOR: What about local resources?
V2: To save the children from fire, they should not be let near the fire.
V6: In the market area, people build 3-storeyed, 4-storeyed house. Few days back, in our place, a child broke his leg falling from 3rd stories. Railings should be made in such 3-storeyed, 4-storeyed houses. If a tall railing of bricks is build, then a 5-year-old child will not fall. If the parents want, then they can make things safe. It should be done for adults and children accordingly.
V4: If the fire is put off after the food is prepared, then also the child will not get into fire.
V6: In the village, if they make the khole (liquid animal food) and keep it on the floor just like that then the child will come there and get into it. That khole could also be placed in a separate place away from children or it can be covered by the basket or something. There are many ideas.
V2: These are the solutions in our village.
FACILITATOR: Can anything be done to the stairs?
V2: Stairs…
FACILITATOR: To make sure that the child does not go to the stairs?
V2: To make sure the children do not go to the stairs; we just tie the baskets on the bottom of stairs/ladders. Then the children cannot go there.
V5: I have also been keeping the basket.
V2: The child cannot push it away and cannot climb over it. That is the solution.
V6: Children below five years of age are very small. If the tap is nearby, then also they may slip and break their head. That tap area should be cleaned and should be scrubbed by the brush then they will not fall. Even adults fall. Let's not only say children below 5 years. When they go to the toilet, they slip, and their leg gets stuck there and they break their legs. We should clean it ourselves.
FACILITATOR: Is there anything else in this?
V3: I think it is all.
FACILITATOR: We have talked about a lot of things. When I ask you questions, instead of telling us what to say, you people have been giving good points. Now what are the possible obstacles or hindrances that can come in our way to make our house safe? What problems do the parents in our community face when they try to change things to keep their houses or their surrounding safe? Like in our community…

V6: One thing is, to fall from the hill side is because of the physical topography. The houses are in the hills and there is no proper place for the children to play in the courtyard. It is very narrow and while stepping there they just fall. That is the one thing. The other thing is because of the parents themselves.
FACILITATOR: Awareness…
V6: Because of the lack of awareness.
FACILITATOR: What else is there?
V6: We should not bring a cupboard costing 10 or 12 thousand to keep the weapons. We can bring one small plank of wood and keep them. It is not something that cannot be done. While raising the cattle also, they should be tied properly in the shed or shed should be fenced, which is also not a thing that costs much. A hen has pecked an eye of the child. Small place should be built for the hens, or even bamboos can be cut and used to cover them up. All of this is weakness of the parents. If it required crores of rupees we could have said it is because of the financial difficulty. The main thing is because of lack of awareness.
FACILITATOR: The main thing is because of the lack of awareness. Apart from that, what else can be there? What can be the problems and obstacles that occur while keeping the house safe? One main thing is lack of awareness.
The participants are sitting quietly…
FACILITATOR: You said, one thing is the physical topography of the house makes it difficult.
V3: Some people do not have money. They do not have money and the child is already born. It is difficult to make bars around there. The people of the house have to go to work.
V6: Those who buy the sickle. They buy the sickle and cut the grass. They can afford that. But throwing the sickle, or axe outside is not because of the financial problem. I do not agree on that.
V3: No, I was saying about other things like fencing…
V6: It is not because of the financial problem. Throwing the sickle or axe outside is not because of the financial problem. Last time a child was brought; he was brought even today. He is just 2.5 months old child. It is because of lack of finance or because of lack of awareness that he left the child sleeping in the heat of the fire. That child's two feet are burnt till here (showing the leg). What is it? Awareness or financial? If I have to say, I say it's because of lack of awareness.
V3: Some people also have financial difficulty.
FACILITATOR: It is all our opinion.
V3: Yes, it is all our opinion.
V6: I have always said what I felt in my heart. No matter what others say, I say what's in my mind. Yes, that is because of the lack of awareness. But being unable to keep big big railings on the balcony is because of the financial situation.
V1: To fence the balcony and to make the ghopte is because of the financial situation.
V6: If we talk about fire, or place to keep weapons, it is because of the lack of awareness sir.
FACILITATOR: Let's consider we have money, there is no lack of money. But still what obstacles can come on the way?
V6: The child could be kept warm by covering him with the cloth or blanket. But they left the children near the fire thinking that it would be warm for them. They always bring 2 children there, I have to do the dressing, and I feel much tensed. Is not that because of lack of awareness? Even if there is financial difficulty, the children should not be kept near the fire to sleep. The main thing is lack of awareness.
V4: May be because they did not have cloth.
V6: Why not? They have. They live nearby, we know (laughing). We know when we live nearby each other.
V2: That maybe because of own…
FACILITATOR: It maybe because to do that particular thing we lack the resources. What do you think?
V6: I do not know about the availability. And about the resources, they need blankets to cover, they have it. That mother has it, why not…
FACILITATOR: One thing is about burning the child. But to keep the weapons in the house in managed way, we have to make some equipment and for that we need some resources. How to make it? We want to make it…
V4: After you buy a readymade weapon, they can keep one plank on the ceiling and keep it there. It is not a big thing to do.
V6: Everything is not there.
FACILITATOR: There are obstacles like…
V6: It's not that. Listen to me. I spoke in middle. If we say, there is lack of resources then there are people who sell many trips of potatoes but still are very careless. Some people who buy and eat 10 kilograms of potato are still the same so what to say here? If we say they do not have resources, they sell trips of potatoes, also sell milk. If we calculate the income, it is also there. If we could see only the people with resources would do things and not others, we could say it's because of lack of resources. But both kinds of people are equal here. So, who can we say? If the buffalo gives little less milk, then they go around searching for medicine, to feed the buffalo with Vitamins but are careless about the children. People who are money minded always worry about money.
FACILITATOR: So, it is not because of the money problem?
V6: Yes, it is but not for all.
FACILITATOR: Like Mandira didi (sister) said a lot of things about looking at the situation and doing what is required. Is there anything else in this?
V6: Tell us if there is something else.
Silence…
FACILITATOR: We just discussed about the obstacles that come on the way. Now we are discussing about the things that make it easy for us to bring the changes required to make the house safe. Like what things or factors

would help the people or parents in the community to make the surrounding of the house safe? Because of what things will it make them to make the house environment safe? What makes it easy for them to minimize the injuries?
V4: First thing is the awareness.
FACILITATOR: What about awareness?
V6: Just like we are discussing things here, if we could make such discussions in the village, it would help the community to improve their home safety.
FACILITATOR: You said awareness. Who should do that?
V6: We are saying organizations and institutions. If MIRA could do too, it would be better.
V2: If MIRA would come and do such things, our eyes would open. If MIRA did do it, we would be able to remember for a long time. The sisters will remember forever.
V6: Yes, that is true.
V1: Until MIRA was here, in the groups also they did by showing the pictures. Now there is no such thing.
FACILITATOR: What should be there to make it easy? In order to make the house and household surrounding safe? One is awareness that should be provided by the organization. What else?
V2: Are there videos about the injuries that happen or not? If such videos could be used, then they will remember.
FACILITATOR: Should that be shown?
V2: Yes. It will help to make them aware. Instead of listening, if they can see it would be better. I think so.
FACILITATOR: What else can be there that can help or make it easy?
V3: (Laughing) now it is finished.
FACILITATOR: Just before we talked about obstacles. You said if there were financial resources, awareness, you talked about videos, about organizations' involvement. And you also said there is no need of bringing the latest equipment from the market. In the balconies, bamboos, wood or local resources can be used.
V6: Yes, according to the personal situation.
V2: It's like that in the villages.
V6: Like the rich people keep the grills on the doors and windows. Those who cannot do that can bring the bamboo and cover the area to keep the children safe. Same can be done to the cow-shed.
FACILITATOR: What things that the parents can do would make it easy? But you have not been doing? What has been stopping it? Let's say the family members of the house have not been able to do it, but what help from the others would make it easy?
V3: If some poor person was given something than he could do the rest. Not everyone in the society is rich. There are some poor people with bad financial condition. He has less area of land and it is not enough for him to eat. There might be 2 children, they should be fed and given clothes to wear. He does not have money. He might have it in his mind that if someone helped him with some money or some wood, he would also keep the railing in the balcony. There are so many things in the mind. Although such things come to his mind, he cannot just go and ask.
V2: He cannot go and ask money to keep railing in his house.
V3: If the community forest gives some amount of wood, then I could cover the stream. The wood would just get damaged after some time. It might also turn and break. If it is cemented, then it lasts a lifetime. The children will not die drowning in the water. There are lots of things. The time is very less now. All the friends here have to go far.
FACILITATOR: If the materials are made available, then it would be easy. What else can be there? You talked about financial help. You also said about materials. What else can be there like that? Is there anything else?
V3: We have finished from our side; you say now (laughing).
FACILITATOR: We have learned from you. You people are a lot more experienced than us.
V6: We just roam around 1 ward; you roam around 36 wards (laughing).
FACILITATOR: You said that it differs from place to place. You people know about your place. We do not know that much.
V2: We said about our place. That is all, we have finished saying now.
FACILITATOR: You might need one thing there but the outsiders or the organizations may bring something else, then it might not match your need.
V6: There they have 1 tap for 8, 9 families. No matter what, no one cleans the tap. People are like that. Some keep on doing. People in the community are like that. In our tap, also we 2 or 3 people work very hard. 1 or 2 people just sit and look from their balcony.
V3: In my case also 2, 3 houses share the same tap. Mine is also the same. Only I am the one who does it. I clean it thinking what people walking by this road would say. I scrub and clean it. No one else does.
FACILITATOR: Everyone should take care of their things. There should be involvement of everyone. If there is public tap, all the people should come together to clean it so that no moss is formed. Everyone should do turn by turn.
V3: Yes, turn by turn. When it is dirty, anyone can clean it. They fetch the water, but they do not even clean the dirt that their slippers carry. They leave it just like that. I wash it with water myself and clean it. I used brush to clean it. I feel very awkward. People go there and see that a volunteer's tap is so dirty. Many people know me. The tap is shared among 3, 4 people but no one scrubs it. I just do it without saying anything.
FACILITATOR: Is there anything in which the local authorities can help or bring some programs to help in the matter where it is dangerous for the children or to clean the surrounding?
V6: The local authorities have done few things. Once when there was some toilet issue, PLAN did some work. When they did that, then also people did not do anything. They simply do not do anything. They do not want to do anything. Even if the PLAN gives or anyone else gives, they will just give the cement, but they have to make by themselves. They just become hopeful that everything should be given to them. The main thing is awareness. No matter what anyone says, it is because they lack awareness. PLAN gave so much for raising the goats to the people. They just sold

it and ate. Isn't it because of lack of awareness? They do not have any urge to do anything when others help. I think the main thing is awareness.
V2: Awareness is the main thing.
FACILITATOR: That sister did not say anything.
V6: There are many rich people here with 20 kattha, 25 kattha of land. These people also throw sickle, scissors, axe outside. Doesn't that lack of awareness? It does not even require 1 sack of potatoes to make that. If we see the house, it is very big, but the door of the toilet is left open. They do not even cover the pipes in the area where the children walk; they leave it just like that. They trip and fall. Things are like that even in our area no.3. I also say it is lack of awareness.
V2: You say the children may trip and fall. I almost die in my own house (everyone laughs).
V6: I also went to a place where a person had died. A person had died so everyone had gone there so I also went. I went there, the pipes were just coming out, and they had not covered it. The children can get tangled there, and sometimes they can also get tangled. Even a woman can dig a little. If they dug a little and cover the pipe with mud, then it is not dangerous.
V2: We need to keep the pipe high to fill the drum. I don't have the habit of walking with high steps. I walk with my feet crawling in the ground. I could not walk over the pipe. I feel so hard, I hit my hand and also ripped the skin off the knee. I thought I had died (laughs). While falling also I had some sense.
V6: You are talking so much about dying.
V2: I could have died. My hand still hurts. I had difficult working for someday. What happens is I cannot walk taking high steps, I take very low steps.
V6: Maybe you cannot raise your feet because you are fat.
V2: It is my habit from the very beginning.
FACILITATOR: Now I will ask you the last thing. Now just think and say what things would help you keep your houses safe? What kind of help or what things would help you make your house or environment safe? First of all, think and say by yourself. Keep yourself in that place and safe. If these things were there, I could do it. Such things should be there so that I could do these things. Is there anything like that?
Let's just leave the community for now. Just keep yourself in that position and say.
V1: In order to keep the railings in the house if someone provided the wood or bamboos then we could do it. We could also make the ghopte if someone gave wood.
FACILITATOR: Things only?
V1: Yes, if they helped with things, we could do it.
V2: We also need 1000 rupees per day to give to the carpenter. We also need money.
V3: Only wood is not enough. We don't have skills in our hands.
V2: We also need skills.
V6: Those who work are drunkards. If they work one day, they go to drink for five days. And then they do not go to work. They have many people dying in their houses too. It is not possible for others to give them too. The main thing is it has been worse because of that also. Such people should be closely scrutinized and if they are from very lower class then what can be done to arrange the income source for them should be done. The class should be categorized.
V1: Along with awareness if they were given something then they will be energized to do things thinking that someone else has helped.
V6: There are so many things to give. What to give? How much to give to someone who throws the sickle and scissors just like that? How many thousand to give to someone who just have to make a wire and fit?
V2: Bamboo should be cut into small pieces and kept (laughs).
V6: It is impossible sir.
V2: What else to give then? If you want to give, tell us what you will give?
V6: The best thing is if awareness is given, they will do by themselves. They will look for a place.
FACILITATOR: For how long should the things be given? If things are given just once, it will finish in no time.
V6. Sir, the money should not be given. As far as I know, if money is given it will never be enough. Even if a wealthy girl gets married to a poor man, the wealth from her parents' house will never be enough. They should earn enough for themselves. That's why as far as I know they should be given awareness. MIRA gave awareness. Now the pregnant women come for check-up, form groups and things are good. Now people have come with enthusiasm, we cannot forget that. Just like that is MIRA brings some awareness program, its better if some meetings are held in different places of the V.D.C. We also hadn't brought this topic during mother's group meeting. It was not necessary, so we did not do it. Now you have come searching for it, now we will also bring it in the mother's group. Financial help will not make it possible. If money is given, they will spend it in alcohol and finish it. Those who do, have done it anyhow. Like I said before it is not necessary to build a house as big as a palace. In order to keep it safe even a hut is enough if things are kept in right places, if children are properly looked after, the cattle are tied safely, and the hens should be covered. If such things are done, then it is enough. If there is no awareness, then there is no one who does things for you. Others are not going to come to cover your hen or to keep your weapons in right places. You are not going to do that for people. It is not going to happen at all. The main thing is awareness.
FACILITATOR: We discussed in different phases. You have given so many examples about how by falling, by cutting themselves, by eating the poison especially the children below five years of age face unintentional accidents and injuries. You have also given example about the accident that happened in your house. Similarly, if we talk about dangers, they are everywhere. Not only for small children, there are dangers for adults as well. You also talked about the things, the carelessness of which will cause the unintentional accidents. In order to minimize it, according to the situation some help should be done and only financial help is not enough. The main thing is awareness. You also gave an example. In the past, the number of pregnant women who went for check-up was very less. But now it has

increased because of awareness. You said that in the days to come if people are made aware about the dangers that can cause the injuries or accidents to the children below five years of age, about how to create safe environment and children friendly surrounding through groups, meetings then it would be better. You said the obstacles are normally money and awareness, and skills. You also talked about things you want to do but have not been able to do, and also said about how those things can be done. At last, you said that awareness is the main thing that will help to make the environment possibly safe. If you still want to say something that has been left out, you can say. Is there anything like that?

V3, **V6**: No no.

FACILITATOR: You gave us time, shared your experiences with us.

V3: Whatever we knew, we said all of them.

FACILITATOR: Okay, thank you everyone.

Appendix 6.3 Process used to generate themes and subthemes

Codes	Clusters	Subthemes	Themes
Unintentional injuries	Unintentional home injury	General perception of unintentional home injury	Home injury and associated hazards
Accidents			
Unintentional/unknowing			
Beyond their control			
Small obvious injuries			
Safe home	Home safety	Knowledge about home injury hazards	
Unsafe home			
Home: safe or unsafe			
Difficult issue			
Belief on own practices			
Burn or scald hazards	Home injury hazards		
Cut injury hazards			
Fall hazards			
Poisoning hazards			
Choking hazards			
Suffocation hazards			
Electrical hazards			
Drowning hazards			
Animal-related hazards			
Environmental change	Installation of safety equipment/devices	Installation of safety equipment/devices	Potential environmental change or modification
Safety equipment			
Stair's and barriers			
Covering bodies of open water			
Fenced around home			
Fenced cattle sheds			
Fenced balconies			
Installation of railings or bars			
Reduced height of bed or cot			
Wiring out of reach			
Use bamboo			
Grills on the windows			
Keeping hazards out of child's sight	Keeping hazardous things out of child's reach or sight	Removing potential hazards	
Keeping hazards out of child's reach			
Safe storage of water			
Safe storage of chemicals			
Safe storage of medicines			
Safe storage of weapons			
Turn off electricity when working	Behaviour change to improve safety	Behaviour change	
Put out the fire after use			
Do not use glass utensils			
Empty water bucket when not in use			
Lock toilet and kitchen after use			
Teach the children			
Incapability	Lack of awareness of injury risk	Lack of awareness of injury risk and their management	Barriers to environmental change or modification
Lack of risk identification			
Lack of risk management			
Lack of knowledge			
Limited or no skill			
Lack of education			
Low income	Poor financial situation and lack of resources	Poor financial situation and lack of resources	
Lack of resources			
Cost of maintenance/equipment			
Labour cost			
Difficulties in adapting home	Geographical constraints and poor housing types	Geographical constraints and poor housing types	
Poor quality housing			
Small area of land			
Work load	Life style/culture	Lifestyle/culture	

An unimportant issue			
Negligence			
Family as a barrier			
Lack of shared responsibility			
Time constraints			
Awareness of risk	Awareness programme for predicting risk	Provision of awareness programme	Facilitators of environmental change or modification
Risk assessment			
Support from organisations/institutes			
Education and training	Training and skill of risk management		
Knowledge and skill			
Risk management			
Support from organisations/institutes			
Support from school	Resources and financial support	Resources and financial support	
Support from VDC office			
Transportation			
Support from organisations/institutes			
Group meeting	Involvement of family and community	Involvement of family and community	
Mothers groups			
Support from family			
Health volunteer's support			
Prioritise deprived households			
Share responsibility			
Share information			

Appendix 7.1 Summary of studies conducted in LMICs that reported child injury incidence

Author, Year and country	Study Type	Age group	Injury defined in the study	Injury incidence and recall period
Pant et al. (2015a) Makwanpur, Nepal	Community based household survey	<5 years	Injury that required treatment or caused the child to be unable to take part in usual activities for three or more days.	3% 12 months
Bashour and Kharouf (2008) Damascus, Syria	Community-based household survey	<5 years	Unintentional accident that occurred to the child and required medical attention, not necessary professional (i.e. home management was included).	23% 12 months
Alptekin et al. (2008) Central Anatolia, Turkey	Household-based survey design	0-4 years	Unintentional home-related injuries requiring some form of medical attention.	23.3% 12 months
Aloufi (2017) Makkah, Saudi Arabia	Cross-sectional study. Interview with mothers attending vaccination clinic	Up to 12 years	Unintentional home-related injuries that required either medical attention or managed at home.	20.9% 12 months
Kamal (2013) El Minia Governorate, Egypt	Community-based cross-sectional survey using face-to-face interview	<5 years	Any episode of unintentional injury that took place in the home environment (severity is not defined)	20.6% 12 months
Studies that reported higher injury incidence rate than current study				
Erkal and Safak (2006) Tuzluçayır, Turkey	Cross-sectional study	0-6 years	Domestic accidents (injury is not defined clearly)	28.8% 12 months
Nouhjah et al. (2017) Khuzestan province, Iran	Population-based survey	<5years	Unintentional home injuries. WHO guideline for external injury (injury that required medical attention)	30.7% Since birth
Banerjee et al. (2016) West Bengal, India	Community based cross-sectional study	12-59 months	Unintentional home injuries that required: any type of medical care or cessation of regular activity, such as playing, for at least one day as a sequel of sustaining injury.	37.4% 3 months
Eldosoky (2012) Qalubeya governorate, Egypt	Cross-sectional study. Interview with mothers	Up to 12 years	Home-related injuries (severity is not defined).	38.3% 4 weeks
Shriyan et al. (2014a) Costal Karnataka, India	A cross-sectional study. Interview with mothers	<5 years	Unintentional injury attending anganwadi centres (rural mother and child care centre) in Udupi taluk	46.3% 4 weeks
Abd El-Aty et al. (2005) Assiut governorate, Egypt	Community based study. Interview with mothers	<6 years	Home accidents as perceived by their mothers (home accidents may not be same as injury)	50.3% 12 months
Studies that reported less injury incidence rate than current study				
Rezapur-Shahkolai et al. (2016) Twiserkan, Iran	Cross-sectional study. Interview with mothers	<5 years	Unintentional -home related injuries that had mild, moderate, or severe outcomes	10% 12 months
Ahmed et al. (2015) Khartoum State, Sudan	Cross-sectional study Household survey	1-4 years	Only mentioned home accidents (injury is not defined clearly)	10.3% 12 months
Xu et al. (2014) Beijing, China	Community based household survey	<6 years	Unintentional injury that received hospital treatment and was diagnosed as a medical damage, received emergent medical treatment or rested for more than half a day.	12.9% 12 months
Khan et al. (2013) Karachi, Pakistan	Pilot study, Household survey	12-59 months	Unintentional home-related injuries that required either medical attention or managed at home.	18.4% 3 months

Appendix 8.1 Four days' workshop at CIPRB in Dhaka, Bangladesh

CIPRB

Memo: CIPRB/Admin/2014/101

Date: 12 August 2014

Mr. Santosh Bhatta
PhD Student,
University of the West of England (UWE)
Centre for Child and Adolescent Health

Address:
Oakfield House, Oakfield Grove
Bristol, BS8 2BN

Subject: *Invitation to the Centre for Injury Prevention and Research, Bangladesh (CIPRB), Dhaka, Bangladesh to attend in a workshop on community mobilisation for child injury prevention in low-income countries (1-6 September 2014)*

Dear Mr. Bhatta,

We are pleased to invite you to attend the Centre for Injury Prevention and Research, Bangladesh (CIPRB) hosted workshop on effective community mobilisation for child injury prevention and establishing household injury risk assessment in rural settings. This workshop will also include field exposure visits of the delegates to an Anchal (community crèche) developed by CIPRB in Dhaka.

We are delighted that you have been working out for conducting a study on home risk assessment for child injury in rural Nepal. We are also happy to provide technical support from CIPRB in establishing child injury prevention activities in Nepal. The workshop will also provide an opportunity to discuss about future collaborations in this regard. We, therefore, like to invite you to the Centre for Injury Prevention and Research, Bangladesh (CIPRB) to attend the workshop and also visit the project areas during 1 to 6 September 2014.

Your kind cooperation will be highly appreciated.

Look forward to seeing you in Dhaka

Thanking you

Prof. Dr. AKM Fazlur Rahman
Executive Director

Centre for Injury Prevention and Research, Bangladesh (CIPRB)
House # B-162, Road # 23, New DOHS, Mohakhali, Dhaka-1206

Tel : +8802-8814988 e-mail : info@ciprb.org
Fax : +8802-8814964 Web : www.ciprb.org

Centre for Injury Prevention and Research, Bangladesh (CIPRB)
H/O: House # B-162, Road # 23, New DOHS, Mohakhali, Dhaka-1206

Attendance Sheet

Purpose : Workshop on "Child Injury Prevention"

Venue : CIPRB Conference Room

Date : 02 September 2014

Sl No	Name & Designation	Address & Contact No.	Signature
1	Prof. AKM Fazlur Rahman	CIPRB	[illegible]
2	Dr. AMINUR RAHMAN	CIPRB	[illegible]
3	Santosh Bhatta	CCAH, UWE	[illegible]
4	Dr. Kamran ul Baset	CIPRB	Kamran
5	Dr. Md. Al- Amin Bhuiyan	CIPRB	Al-Amin
6	Salim Mahmud Chowdhury	CIPRB	[illegible]
7	Puspa Raj Pant	UWE	[illegible]
8.	Dr. Jahangir Hossain	CIPRB	Hossain
9	Dr. Tajkera Noor	CIPRB	Tajkera
10	Dr. Farzana Islam	CIPRB	[illegible]
11	Dipa Nepal	Nepal	Dipa

Centre for Injury Prevention and Research, Bangladesh (CIPRB)
H/O: House # B-162, Road # 23, New DOHS, Mohakhali, Dhaka-1206

Attendance Sheet

Purpose : Workshop on "Child Injury Prevention"

Venue : CIPRB Conference Room

Date : 04 September 2014

Sl No	Name & Designation	Address & Contact No.	Signature
1	Prof. AKM Fazlur Rahman	CIPRB	[signature]
2	AMINUR RAHMAN	CIPRB	[signature]
3	Puspa Raj Pant	UWE	Puspa
4	Santosh Bhatta.	UWE	[signature]
5	Dipa Neral	UWE/MIRA	[signature]
6	Salim Mahmud Chowdhury	CIPRB	[signature]
7	Kamran ul Baset	CIPRB	Kamran
8.	Dr. MD. Al-Amin Bhuiyan	CIPRB	Al-Amin

Centre for Injury Prevention and Research, Bangladesh (CIPRB)
H/O: House # B-162, Road # 23, New DOHS, Mohakhali, Dhaka-1206

Sl No	Name & Designation	Address & Contact No.	Signature
	Saidur Rahman Mashreky	CIPRB	[illegible]