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Developing a Framework for Prevention of Childhood Burn in a Low-Income Country Perspective: Epidemiological Appraisals



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ABSTRACT

Childhood burn is a major issue in children's health in Bangladesh however it was not studied and documented systematically earlier. A comprehensive prevention programme is necessary to address this child health issue. Designing a community based prevention programme with adequate information about epidemiology, risk factors, social, cultural and economic factors and people's perception about the problem is necessary. This thesis attempted to determine the epidemiological features, the social and economic consequences and risk factors of childhood burn. It also explored the health seeking behaviour of parents and people's perception concerning burn and the issue of prevention. Six studies were carried out in this dissertation, four of which included a qualitative study using the data of the Bangladesh Health and Injury Survey (BHIS). A nested case control study was conducted by using the existing injury surveillance system of Centre for Injury Prevention and Research Bangladesh. Finally a framework for a childhood burn prevention programme for rural Bangladesh was designed based on the findings of both quantitative and qualitative studies.

The first study enabled us to calculate the incidence of childhood burn and its relation with age, sex and place of residence. The incidence of burn among children less than 18 years was 288.1 per 100,000 children with the highest rate among the 1 to 4 years age group at 782.1 per 100,000 children. This study also revealed the place of occurrence, time and cause of childhood burn in Bangladesh. The second study enabled us to learn social and economic consequences of childhood burn. It explored the hospitalization rate, hospital stay, workdays lost/school days lost and permanent disability due to childhood burn injury. The rate of permanent disability was found to be 5.7 per 100,000 population year. The average direct expenditure incurred by a family for treatment of severe burn was determined to be USD462 which was more than their annual income. The third study illustrated how the parents seek health care for their children after a burn injury and how health seeking behaviour varies with the economic condition of the family, parents' education, family size, birth order of children and gender of the children. About 60% of parents seek health care from unqualified service providers for their children during a childhood burn injury.

The fourth study determined the relationships of childhood burn with the type of cooking area at home, use of traditional kerosene lamp and type of family. Children were at significantly higher risk of burn in families who did not have a separate kitchen in their home.

The fifth study looked into people's beliefs, emotions and judgements about childhood burn injuries, people's perception about place, time and cause and prevention of childhood burn.

Finally the sixth study provided a framework for a childhood burn prevention programme for rural Bangladesh.

In conclusion the thesis illustrated the high incidence of childhood burn in Bangladesh. The thesis demonstrated consequences, risk factors and characteristics of childhood burn. It explored the health seeking behaviour of parents and people's perception about child burn and its preventive issues. Finally considering all this information a frame-work for childhood burn prevention programme was developed for rural Bangladesh, which can be replicated in countries with similar socio-cultural conditions.

Key words: burns, childhood, low income countries, prevention.

LIST OF PUBLICATIONS

The thesis is based on following publications

- I. □ Mashreky SR, Rahman A, Chowdhury S M, Giashuddin S, Svanström L, Linnan M, Shafinaz S, Uhaa I J, Rahman F. Epidemiology of childhood burn: Yield of largest community based injury survey in Bangladesh. *Burns* 2008; 34: 856-862
- II. □ Mashreky SR, Rahman A, Chowdhury S M, Giashuddin S, Svanström L, Linnan M, Shafinaz S, Uhaa I J, Rahman F. Consequences of childhood burn: Findings from the largest community-based injury survey in Bangladesh. *Burns* 2008; 34:912-918.
- III. Mashreky S R , Rahman A , Chowdhury S M , Svanström L, Shafinaz S , Khan T F, Rahman F. Health-seeking behavior of parents of burned children in Bangladesh is related to family socioeconomics. *Injury* 2010 41: 528-532
- IV. Mashreky S R, Rahman A, Khan TF, Svanström L, Rahman F. Determinants of childhood burns in rural Bangladesh: a Nested Case-Control study. *Health Policy* 2010; 96: 226-230.
- V. □ Mashreky S R, Rahman A, Chowdhury S M , Svanström L, Shafinaz S , Khan T F, Rahman F. Perceptions of rural people about childhood burns and their prevention: A basis for developing a child hood burn prevention program in Bangladesh. *Public Health* 2009;123:568-572
- VI. Mashreky S R, Rahman A, Svanström L, Linnan M, Shafinaz S, Rahman F. Experience from community based childhood burn prevention program in Bangladesh: Implication for low resource setting. (Manuscript ready for submission)

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LIST OF ABBREVIATIONS

- AR □ Attributable Risk
BHIS □ Bangladesh Health and Injury Survey
CI □ Confidence Interval
CIPRB □ Centre for Injury Prevention and Research, Bangladesh
EPI □ Expanded Programme on Immunization
FGD □ Focus group discussion
HICs □ High Income Countries
LICs □ Low Income Countries
MDGs □ Millennium Development Goals
OR □ Odds Ratio
PRECISE □ Prevention of Child Injuries through Social Intervention and Education
TASC □ The Alliance for Safe Children
UNICEF □ United Nations Children's Fund
WHO □ World Health Organization

1. INTRODUCTION

In terms of morbidity and long term disability, burn poses a major public health issue throughout the world, especially in low income countries (Heimbach, 1999). Considering physical, psychological, social and economic consequences, burns have been identified as one of the most devastating causes of child injury (Crawley-Coha, 2000; Taal, & Faberb, 1998; Macarthur, 2003; Drago, 2005). Children are the most vulnerable group for burn injury as they have less perception about dangerous situations and a limited ability to react promptly and properly (Bang, Ebrahim, & Sharma, 1997).

In recent years medical care for burns has markedly improved survival rates for high income countries (HICs). This increased survival rate has come at a price, however, and that price is a large number of patients with disfiguring and disabling scars (Rivara, 2000). However it remains the major child health problem of low and middle income countries (LMICs). The death rate due to burn was found to be eleven times higher in LMICs compared to HICs (WHO, 2008).

In Africa and many of the South-Asian countries (e.g India, Pakistan, Nepal, Sri Lanka and Afghanistan), childhood burn injury has emerged as a major public health problem (Marsh *et al.*, 1996; Liua *et al.*, 1998; Ahuja & Bhattacharya, 2004; Laloë, 2002; Razzak, Luby, Laflamme, & Chotani, 2004; Calder, 2002; Nega, & Lindtjörn, 2002; Mzezewa, Jonsson, Aberg, & Salemar, 1999).

In low income countries (LICs) burn care is a complicated health care issue as it requires specialized staffing and technologies that are expensive and not always readily available (Lari, Panjeshahin, Talei, Rossignol, & Alaghebandan, 2002). Burns are associated with a prolonged hospital stay, higher permanent disability, emotional stress and represent an enormous health problem, especially among economically and socially deprived populations (Shan, & Sikron, 2003). The long recovery period and complicated morbidity associated with burns adds to the high cost of rehabilitation (Mandelcorn, Gomez, & Cartotto, 2003) and creates economic burden to the families.

There is little debate that the best treatment approach to burn is prevention (Burd, 2003). Consequently prevention of burn requires adequate knowledge of its epidemiological features, related risk factors and information of the effectiveness of prevention and control efforts. Many of the proven prevention programmes for burn injuries found in HICs are not effective for LICs. Prevention efforts of HICs might not be similar to LMICs because of different social, environmental and behavioural issues (Forjuoh, 2006).

Very few studies have been conducted in Bangladesh on burn injury and most of them were hospital based. Population based epidemiology of childhood burn has not been studied and documented. Thus the studies included in this thesis have made an attempt to expand the understanding of epidemiology and determinants of childhood burn, perception of people about childhood burn and provided a basis for developing a framework for prevention.

2. BACKGROUND

Globally burns have been identified as a serious health hazard for people. According to the WHO Global Burden of Disease estimate for 2004, fire related burns kills 310,000 people and 30% of them were under the age 20 years. Fire related burns are the 11th leading cause of death for children aged 1-9 years (WHO 2008). Although burn is a global health problem, people of LMICs suffer more (Peden, McGee, & Sharma, 2002). An estimated 128,000 persons died of burn injuries in countries of the South East Asia Region in 2000. It's also estimated that half of the global burden of fire related burn was from South-East Asia (WHO, 2002). Fire related burn is one of the leading causes of disability-adjusted life years (DALYs) lost in the LMICs (WHO, 2008).

2.1 OVERVIEW OF BANGLADESHI STUDIES

Very few studies have been conducted on burn injuries in Bangladesh. The majority of studies conducted on burn injury were on acid burn and most of them were acts of violence. Females were the major victims of acid burn and the majority were due to refusal of love proposals (Faga, Scevola, Mezzetti, & Scevola, 2000). A multi-country study revealed that the highest incidence of chemical assault had occurred in Bangladesh (Mannan, Ghani, Clarke, Butler, 2007). A hospital-based study revealed that burn was a major cause of injury death among women aged 10-50 years in Bangladesh (Yusuf, Akhter, Rahman, Chowdhury & Rochat, 2000). Another child hospital-based study showed that more than 9% of admissions in surgical wards was due to burn and represents the second most common cause of surgical problem in Bangladesh (Masood, Khan, Islam, 1991).

In the age group less than 12 years, male children were found more vulnerable to burn injury compared to female children. Children of low socio-economic conditions were at a higher risk of burn injury. Keeping cooking utensils within reach of children, literacy level of parent and pre-existing impairment of the children were the risk factors for childhood burn identified in Bangladesh (Daisy, Mostaque, Bari, Khan, Karim, & Quamruzzaman, 2001). The traditional kerosene lamp "kupi" was found as one of the major sources of childhood burn in Bangladesh (Ahmed, Hussain, Rahman, Halim, Rahman, 2009).

2.2 FACTORS ASSOCIATED TO CHILDHOOD BURNS

There are a number of factors which have varying degrees of associations with the risk of childhood burn (Daisy *et al.*, 2001; Forjuoh, Guyer, Strobino, Keyl, Diener-West & Smith 1995). This review includes factors related to personal and family level, hazards in household environment and hazards in the neighbourhood.

Age and sex: Young children are the most vulnerable group for burn injury. A disproportionately higher incidence of burn was found in the less than five years age group (Forjuoh, 2006; Ying & Ho, 2001; Adamo, Esposito, Lissia, Vonella, Zagaria & Scuderi, 1995; Mercier & Blond 1996; Mukerji, Chamania, Patidar, Gupta, 2001; Groohi, Alaghehbandan, & Lari, 2002; Kumar, Chirayil & Chittoria, 2000). Study findings in different countries reveal that children aged less than two years constitute approximately 42-52% of childhood burn admissions (Ying & Ho, 2001; Goldman S, Aharonson-Daniel & Peleg, 2006; Fukunishi, Takahashi, Kitagishi, Matsushima, Kanai, Ohsawa, Sakata, 2000).

Boys are more vulnerable than girls in younger age groups. (Lari *et al.*, 2002; Panjeshahin, Lari, Talei, Samsina & Alaghehbandan, 2001; Anlatıcı, Ozerdem, Dalay, Kesiktas, Acarturk & Seydaolu, 2002; Adamo *et al.*, 1995; Mercier & Blond 1996; Mukerji *et al.*, 2001; Groohi *et al.*, 2002; Kumar *et al.*, 2000; Forjuoh *et al.*, 1995). However, the situation is the opposite in older children,

where girls in older age group are more vulnerable to childhood burn compared to boys (Panjeshahin *et al.*, 2001; Anlatıcı *et al.*, 2002; Groohi *et al.*, 2002; Kumar *et al.*, 2000). Childhood burn occurs frequently among adolescent girls because they help their mothers in the kitchen and become more exposed to fire, hot liquids and hot substances (Nega & Lindtjörn, 2002; Mzezewa, Jonsson, Aberg & Salemar, 1999; Albertyn, Bickler & Rode, 2006).

How does burn occur: Forjuoh (2006) affirms that for all age groups, scalding from hot liquids accounted for one-third to one-half of all burns. Scalding was found as the most frequent type of burn injury among children in other studies too (Ying & Ho, 2001; Lari *et al.*, 2002; Anlatıcı *et al.*, 2002; Mukerji *et al.*, 2001; Sharma, Bang, Al-Fadhli, Sharma, Bang & Ghoneim, 2006; Kumar *et al.*, 2000). However, a number of studies documented flame to cause burn more frequently among the older children (Lari *et al.*, 2002; Mukerji *et al.*, 2001; Sharma *et al.*, 2006). Many of the studies revealed that scalding is the most frequent type of burn in all age groups (Franco, Gonzaáles, Dýáz, Pardo, & Ospina, 2006; Adamo, Esposito Lissia, Vonella, Zagaria & Scuderi, 1995; den Hertog, Blankendaal, ten Hag, 2000). Conversely other studies show that flame is the most frequent cause of burn in all age group populations (Anlatıcı *et al.*, 2002; Lari, Alaghebandan, Nikui, 2000; Panjeshahin *et al.*, 2001; Groohi *et al.*, 2002; Laloë, 2002; Liua, Khatri, Shakyab & Richardb, 1998; Mzezewa *et al.*, 1999).

Personal and family related factor: Pre-existing impairment is a risk factor for childhood burn. Children have a higher risk of burn where there is a history of burn among siblings or sibling's have died due to burn (Daisy *et al.*, 2001; Forjuoh *et al.*, 1995). The risk of burn was found to be higher when children are not the first-born and who have a pregnant mother (Werneck, Reichenheim, 1997).

Socio-economic factors: Childhood burn is associated with socio-economic factors. The risk of burn is higher among children of low socio-economic conditions (Daisy *et al.*, 2001; Forjuoh *et al.*, 1995; Cronin, Butler, McHugh, & Edwards, 1996; Delgado, Ramírez-Cardich, Gilman, Lavarello, Dahodwala, Baz-n, Rodríguez, Cama, Tovar & Lescano, 2002). Single parents and mothers recently dismissed from a job are the other factors related to a higher risk of childhood burn (Werneck & Reichenheim, 1997; Libber & Stayton, 1984). However, maternal education is a preventative factor for childhood burn (Daisy *et al.*, 2001; Forjuoh *et al.*, 1995; Delgado *et al.*, 2002).

Household environment: Home is the most common place of childhood burn (Ying *et al.*, 2001; Lari *et al.*, 2002; Panjeshahin *et al.*, 2001; Anlatıcı *et al.*, 2002; Mukerji *et al.*, 2001; Mercier *et al.*, 1996; Goldman *et al.*, 2006) and the kitchen is the most common area for childhood burn in the home. (Kumar *et al.*, 2000; El-Badawy & Mabrouk, 1998; Mukerji *et al.*, 2001).

Poor living conditions and overcrowding are associated factors for childhood burn at home (Delgado *et al.*, 2002; Werneck *et al.*, 1997; Daisy *et al.*, 2001; Kumar *et al.*, 2000; Nega *et al.*, 2002). The overcrowded conditions causes young children to play in the vicinity of the cooking area leading to scalds from foods or hot fluids that have spilled (Kumar *et al.*, 2000).

Storage of flammable substances at home is a risk factor of childhood burn (Forjuoh *et al.*, 1995). The use of a kerosene lamp and kerosene stove at home causes childhood burn (Laloë, 2002; Liua *et al.*, 1998; Kumar *et al.*, 2000). The use of an open fire at floor level for cooking, lighting and heating is also associated with a high incidence of burn at home (Mzezewa *et al.*, 1999; Kumar *et al.*, 2000; Calder, 2002). Young children very often stay near their mothers while they cook which make children exposed to burn risk (Lari *et al.*, 2002). In some LICs people use open fires for cooking and heating. They cook their meals in the room they use for sitting and sleeping which makes them and their children more exposed to the risk of burn (Mzezewa *et al.*, 1999).

2.3 PREVENTION

People living in poorer economic situations suffer disproportionately higher from burn injuries. However the vast majority of burn injuries can be prevented with the exception of some natural disasters (Roberts, 2000). Incidence of burn has been reduced in many HICs by introducing different intervention programmes (Sarhadi, Reid, Murray, Williamson, 2000; Clark, Dainiak, Reeder, 2000; Clark, Katz, Campbell 1992). Nevertheless, tested burn prevention programmes are almost absent in LICs.

Both active and passive approaches are needed to be considered in burn injury prevention strategies. Changing lifestyle or behaviour through education is an active measure while on the other hand safety product design and legislation are the passive measures (Liao *et al.*, 2000). Roberts (2000) identified a number of ways to prevent burn such as education; publicity; making home, work or leisure safer, by legally banning dangerous activities, equipment, etc. Forjuoh (1995) suggested that along with parent education, ensuring adequate child supervision and general child wellbeing can be an approach for childhood burn prevention. Ghosh and Bharat (2000) reported the impact of educational intervention on domestic burn prevention and first aid awareness in India. Marsh *et al.* (1996) suggested that environmental modifications in the kitchen and providing education and training to household occupants could be an approach to burn prevention. Providing information through campaigns in different settings was found to be an effective approach to burn prevention in New Zealand (Skinner, Brown, Peat, & Muller, 2004).

In preventing such injury, community based programmes are found to be very successful. Safe community programmes in different parts of the world are the notable examples, especially in developed countries. Many studies have suggested community based programmes in burn injury prevention (Sarhadi, Reid, Murray, Williamson, 2000; Shani, Bahar-Fuchs, Abu-Hammad, Friger, Rosenberg, 2000). Prevention programmes should be directed at behavioural and environmental changes which can be easily adopted into a person's lifestyle. The programmes need to be executed with patience, persistence and precision, targeting high risk groups (Ahuja & Bhattacharya, 2004).

By designing and implementing accurate preventative measures, devastating burn injury can be avoided. With this intention the current study has been designed to develop and implement an intervention package, which is expected to reduce burn related child mortality and morbidity in Bangladesh. The experience gained from this study will help to develop effective childhood burn prevention programmes in other low-income countries in similar socio-cultural and geographical settings.

2.3.1 Prevention barrier

Burn management in developing countries is riddled with difficulties. Lack of government initiative and low literacy rates preclude effective prevention programmes. Many uneducated households are fraught with superstition, taboos, unconventional religious rituals and faith in alternative systems of "medicine," which complicates management (Ahuja & Bhattacharya, 2004).

3. AIMS

The overall aim of this thesis was to depict epidemiological features including social and economic consequences and risk factors of childhood burns and to design a framework for childhood burn prevention programmes for rural Bangladesh.

A number of studies were carried out to achieve the overall aim of the thesis. This includes the following specific objectives:

- To determine the magnitude and characteristics of childhood burn injury in Bangladesh (study I)
- To evaluate the consequences of childhood burn regarding hospitalization, disability and expenditure (study II)
- To explore health seeking behaviour of parents of burned children in Bangladesh (study III)
- To determine the risk factors of childhood burn injury (study IV)
- To gain an in-depth understanding of people's perception of childhood burn and its prevention in rural areas of Bangladesh (study V)
- To design a framework for community-based childhood burn prevention programmes for rural Bangladesh (study VI)

4. FRAMEWORK OF THE THESIS

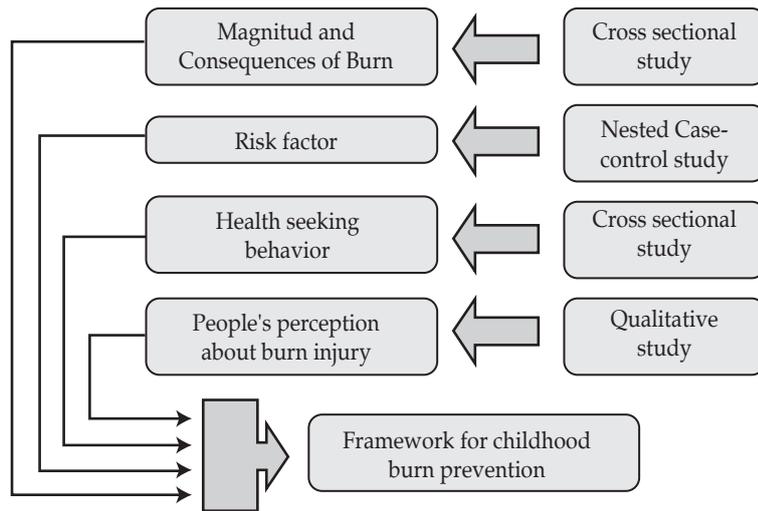


Figure 1 Framework of the thesis

5. METHODS

5.1 SETTING

Bangladesh emerged as an independent and sovereign country in 1971 following a nine-month war of liberation. It is located between 20° 34' and 26°38' north latitude and between 88°01' and 92°41' east longitude. It is surrounded by India around the north and west, by Myanmar to the east and by the Bay of Bengal to the south.

It is one of the largest deltas in the world with a total area of 147,570 sq. km. With a unique communal harmony, Bangladesh has a population of approximately 140 million, making it one of the densely populated countries in the world. The majority (about 88%) of the people are Muslim. More than 75% of the population lives in rural areas. The economy is mostly an agrarian economy. The per capita income is US\$520. The crude death rate, infant mortality rate and under 5 mortality rate are 5.6, 45 and 62 per thousand population per year respectively. The crude birth rate is 20.6 and life expectancy at birth is 65.4 years. Over 98% of the people speak Bangla. English, however, is widely spoken. Dhaka is the capital city of the country. The country is divided in 6 divisions, 64 districts and 493 upazilas (sub districts).

5.2 DATA SOURCE

Study-I, study-II, study-III and study-V of the thesis were prepared from the data source of Bangladesh Health and Injury Survey (BHIS), which was carried out during 2003.

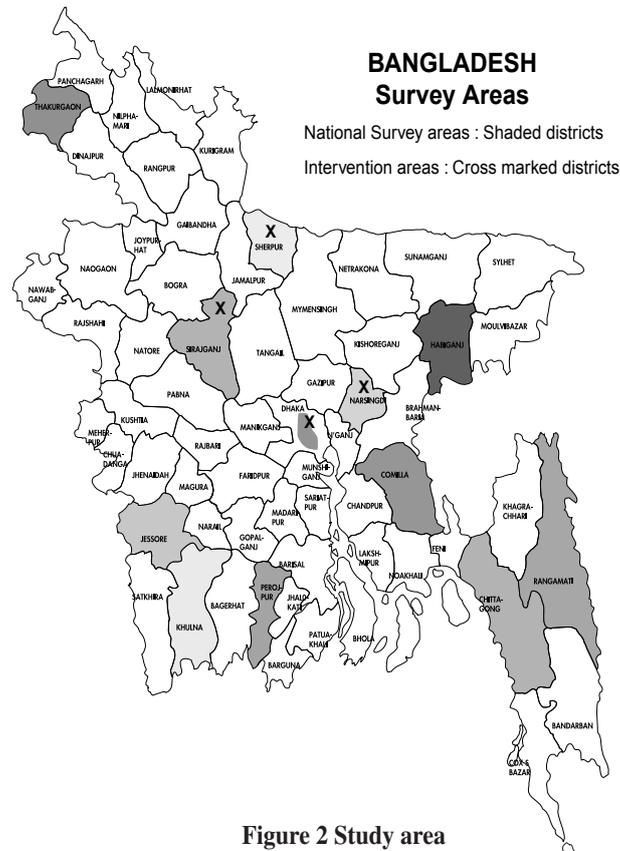


Figure 2 Study area

Quantitative data of the national survey was collected from the 12 districts of Bangladesh (Thakurgaon, Sherpur, Sirajganj, Narshingndhi, Habiganj, Comilla, Cittagong, Rangamati, Pirojpur, Khulna, Jeshor, Shariatpur) and Dhaka (metropolitan city). These 12 districts were selected randomly from six divisions of the country. Two districts were selected randomly from each of the division. For the qualitative study (study-V) data was collected in Shibpur sub district of Narshingdi district, 70km from the capital city Dhaka. Centre for Injury Prevention and Research, Bangladesh (CIPRB) is implementing a community based injury intervention programme with an in-built injury surveillance system in Sirajganj, Sherpur and Narshingdi districts. The intervention programme and the surveillance system included a total population of 600,000. The nested case control study (study-IV) was carried out by using data from the injury surveillance system of CIPRB. The childhood burn intervention programme (study-VI) was a part of the injury intervention programme of the CIPRB.

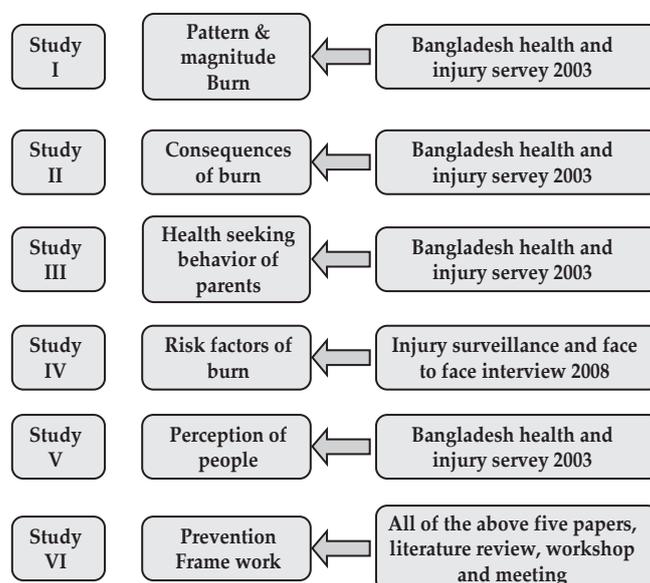


Figure 3: Objective and data sources for each of the studies

5.2.1 Study-I, Study-II and Study-III

Bangladesh Health and Injury Survey data were utilized in these studies.

5.2.1.1 Study design

A cross-sectional survey was conducted during the year 2003 (January to December).

5.2.1.2 Study population

A multi-stage cluster sampling was used to choose a total sample size of 171,366 households; 88,380 from rural areas, 45,183 from district towns (urban areas) and 37,803 households from Dhaka Metropolitan City. This encompassed a population of 819,429 including 351,651 children under 18 years of age.

In Bangladesh there are 64 districts. A total of 12 districts were chosen by simple random sampling. Each district comprises of several upazilas (sub-district). One upazila was randomly selected from each selected district. Again each upazila is comprised of a number of unions. A union is the lowest administrative unit comprising of 20,000 population. From each upazila two unions were selected randomly and each union was considered as a cluster for rural area. All households in the union were included in the survey. The district headquarters of the 12 selected districts and Dhaka Metropolitan City constituted the urban areas. In the urban areas, mohallas (a mohalla is the lowest unit in an urban area) served as clusters and systematic sampling was done to achieve the required number of households. However, Dhaka Metropolitan City was selected purposively.

5.2.1.3 Case ascertainment

Anyone under 18 years of age was considered as a child. Children were identified as a burn patient when s/he took any treatment or could not perform normal activities at least for three days due to the burn injury.

5.2.1.4 Data collection and interview

Forty-eight data collectors collected data from respondents using face to face interviews. Along with the researchers, six full-time supervisors were employed for the supervision and monitoring of the data collection process. Mothers were primarily preferred as respondents. However, if the mother was not available the most knowledgeable members of the household were considered as respondents. Where possible, it was the head of the household and as many members of the household were present as possible to corroborate or add detail to the respondents' interview answers. Screening forms were used to identify any mortality or morbidity in the household. A household member was defined as a member living in the same house including domestic helpers, long term guest etc., who share meals and information.

The respondents were first asked whether any deaths had taken place in the household in the last two and three years in the national survey and Dhaka metropolitan survey respectively or any illness had occurred in the last 6 months. If any deaths or illnesses were identified, the interviewer proceeded with further clarification regarding the death or illness. Structured questionnaires were employed if burn injuries caused the death or illness. Repeat visits were made to the household where respondents were unavailable at the first visit. In spite of repeated attempts, 2.7% households could not be interviewed. A total of 166,766 households participated in the study.

5.2.2 Study-IV

5.2.2.1 Study design and population

A nested case-control study was conducted to determine the risk factors of childhood burn in rural Bangladesh. The study was conducted in 2008 in the project area of Centre for Injury Prevention and Research, Bangladesh (CIPRB) where all of the 600,000 population is monitored through a sentinel surveillance system.

5.2.2.2 Study population

The study population consisted of children less than 10 years old in 3 sub-districts of Bangladesh where the sentinel surveillance system was maintained by CIPRB.

5.2.2.3 Selection of Case and Controls

Cases were defined as children less than 10 years of age who were burnt within the previous year in the surveillance area of CIPRB. Data was collected during the month of August 2008.

By matching age and sex, one control was selected for each of the cases. During age matching, the age range was ± 1 year. Socio-demographic matching was done by selecting children from the same geographical location.

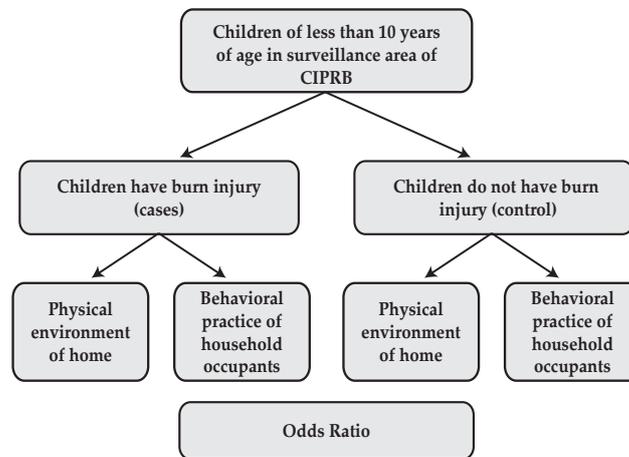


Figure 4: Study design of nested case control study

5.2.2.4 Sample Size:

A total of 420 cases and 420 controls were selected for the study. 140 cases and 140 controls were selected from each of the 3 sub-districts of the surveillance area.

The sample size has been calculated using the following considerations:

- Ratio of exposed and non-exposed: 1
- Incidence of exposures (socio-demographic, environmental and caring) among control: 50%
- Power: 80%
- Confidence level: 95%
- Relative risk worth detecting: 1.5

5.2.2.5 Sampling Procedure:

All of the burn cases under 10 years of age in the surveillance area of CIPRB during the previous year were recruited as cases, and children of the same geographical area of similar age and sex were selected as control.

5.2.2.6 Selection criteria of Cases

- Burn cases
- Aged below 10 years
- Willing to participate in the study

5.2.2.7 Selection of Controls

- No history of burn
- Children of the same age and sex
- Children living in the same geographical area
- Willing to participate in the study

5.2.2.8 Data Collection:

Parents or guardians of study subjects gave their oral consent under a protocol approved by the CIPRB Ethics Committee. A number of trained data collectors obtained data through face-to-face interviews at the household level. Mothers of the selected children were the potential respondents. In case of the absence of the mother, the major caregiver of children or any

responsible adult member of the household was the respondent of interview. A pre-tested structured questionnaire was used as the data collection instrument. The questionnaire contained close-ended questions which included questions on the physical environment of home, behavioural factors of household occupants, activities of mothers and supervision status of children and other relevant information needed.

5.2.3 Study-V

Data Collection by using a qualitative method

5.2.3.1 Study design

To gain an in-depth understanding of people's perception of causes of childhood burn and also to explore their concepts of prevention measures, a qualitative study was conducted. The study used focus group discussion (FGD) technique.

5.2.3.2 Respondents

Five groups of respondents were selected from four different villages of Shibpur, a sub-district of Narsingdi district, which is situated about 70 kilometres to the north-east of Dhaka city. The FGD's with mothers, fathers and local community leaders were held in residences and at schools with the adolescent students. The number of respondents in the groups ranged from 8 to 12.

5.2.3.3 Research instrument

A checklist comprised of a series of prompts was used to collect data. After vigorous field testing the series of prompts were finalised by the authors.

5.2.3.4 Data collection procedure

Two trained teams conducted the FGDs. Each team consisted of one facilitator, two note-takers and one organiser. The discussion sessions were carried out during August and September 2003. In each session the facilitator requested one of the participants to tell a burn event that s/he had observed or heard about. This story telling was an ice-breaking exercise as well as a thought provoking instrument for the participants. The facilitator then progressively introduced the series of prompts to explore desired information. Each session was audio-taped with the respondents' permission. The investigators supervised all the sessions.

5.2.4 Study-VI

To design the framework of the childhood burn prevention programme for rural Bangladesh, the following methodologies were adopted:

- Building up relevant information on childhood burn and prevention methods.
- Arranging workshops and consultation meetings with experts and related stakeholders.
- Piloting components of the programme on a small scale.

5.2.4.1 Building up relevant information

An extensive literature review was conducted to gather relevant information on the magnitude, risk factors, health seeking behaviour and people's perceptions of childhood burn. The majority of the information collated, regarding epidemiology, consequences, health seeking behaviour, perception of childhood burn and its prevention issues, was obtained from the author's own studies conducted in Bangladesh (Study-I, II, III, IV &V). Effective childhood burn prevention measures in other countries of the world were also reviewed. All relevant findings were documented.

5.2.4.2 Organising workshops

A number of childhood burn prevention measures were identified through a series of workshops and consultation meetings with relevant experts.

The magnitude, risk factors, health seeking behaviour and peoples' perceptions about childhood burn and other relevant information were presented in workshops to identify prevention issues and strategies.

The socio-economic, environmental and cultural conditions were strongly considered during identification of activities for childhood burn prevention programmes. Community participation was the guiding principle for strategy development.

5.2.4.3 Small scale piloting

After designing the framework, small scale piloting was done in four villages of a sub-district of Bangladesh. After three months (October-December 2005) of implementation, community responses were explored through qualitative methods.

5.3 ETHICAL CONSIDERATIONS

Informed consent was obtained from all respondents before collecting data. Respondents were assured that the data would only be used for research purposes and all answers were confidential. Consent was also obtained for photographs and audio recordings. For the study I, II, III, V ethical permissions were obtained from the Ethical Committee of the Institute of Child and Mother Health, Dhaka, Bangladesh. For the paper IV and VI ethical clearance was obtained from the Ethical Committee of the Centre for Injury Prevention and Research, Bangladesh.

5.4 STATISTICAL ANALYSIS

5.4.1 Study-I

Incidence rate of burn was calculated from the number of occurrences of childhood burn in 6 months multiplied by two, as data were collected considering a 6 month recalled period. Rates were calculated with 95% confidence intervals (CI). Relative risk (RR) was calculated to compare the burn risk in different age groups, place of residence and sex by using two by two table in EPI info software.

5.4.2 Study-II

Temporary disabilities were categorized according to the duration of disability. Proportions were calculated according to duration of school absence. The mean duration of hospital stays were calculated according to severity, age and gender. The cost of the treatment was calculated according to the severity of the burn. Yearly incidence rate of permanent disability was calculated from the number of occurrences of permanent disability in 6 months multiplied by two, as data were collected considering a 6 months recall period. Like the rate of permanent disability, the rate of hospitalisation was also calculated. Rates were calculated by using EPI6 software.

5.4.3 Study-III

Results were expressed as percentages according to the type of service provider. 'Type of service provider' was considered as dependent variables. The literacy level of parents, monthly family income, birth order of the child, place of residence, total number of children and sex of the children were considered as independent variables or predictors of health seeking behaviour. Initially Chi-square test was conducted to see a significant association between dependent and independent variables.

Both crude and adjusted model of logistic regression were carried out to identify the factors influencing care seeking behaviour with 'type of service provider'. A crude model shows how a single covariate influences the dependant variable. An adjusted model shows how two or more covariates influence the dependant variable after adjusting the effect of each other. Sex of the children had no significant association with 'type of service provider'. As such, it was excluded from the regression model. Predictors of the care seeking behaviour were estimated by calculation of odds ratios (OR) and 95% confidence intervals (CI).

5.4.4 Study-IV

Associations were made between burn injury and type of family, use of traditional kerosene lamp, having a kitchen at home, place of cooking and supervision by an adult. Chi-Square test was conducted to show the statistical significance of association. Odds Ratio (OR) was calculated at a 95% confidence level. Attributable risk (AR) percent of determinants were computed using the calculated OR. All of the analyses were conducted by using EPI6.

5.4.5 Study-V

Transcripts of the audiotapes were prepared and then analysis was done by examining the transcripts and note-takers' notes in detail to identify the range of ways in which the participants responded to various childhood burn issues and its preventive measures. After sorting and categorizing the responses, excerpts from the transcripts were chosen to illustrate the summary statements, which were also used to validate the findings.

5.4.6 Study-VI

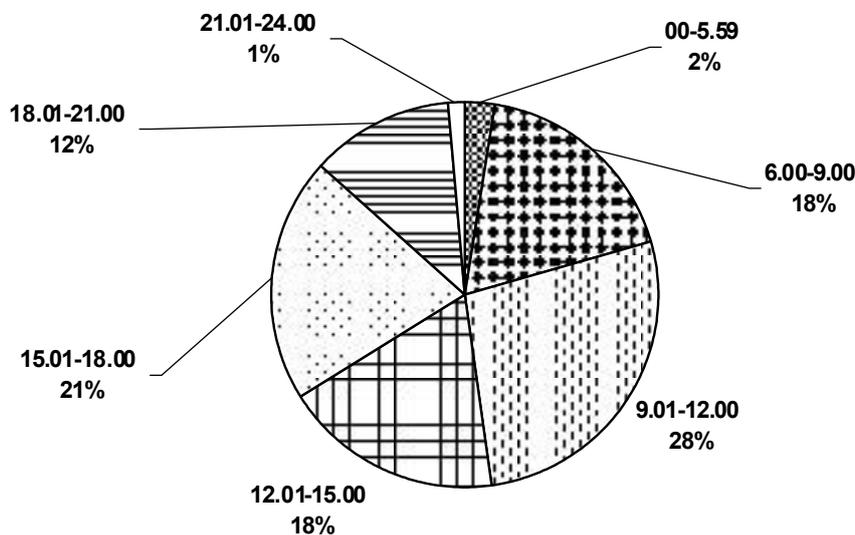
Study six was the framework of the childhood burn prevention programme for rural Bangladesh. Literature review, workshops and meetings were the different methodologies used in this study. Therefore, no statistical analysis was carried out for study-VI.

6. RESULTS

6.1 STUDY-I

6.1.1 Epidemiology of childhood burn: Yield of largest community based injury survey in Bangladesh.

The rate of non-fatal burn among children under 18 years of age was calculated as 288.1 per 100,000 children-years. The highest incidence (782.1/100,000 children-year) was found among the 1 to 4 years age group. The incidence of childhood burn was found to be more than four times higher in rural children than urban children. Ninety percent (90%) of the childhood burns occurred at homes and the kitchen was the most risky place. The rate of fatal burn was 0.6 per 100,000 per year among all children.



□

Figure 5: Distribution of time and incidence of burn

Figure 5 shows that daytime is the most vulnerable time for childhood burn with about 85% of the total childhood burn taking place during 6 a.m. to 6 p.m. About 50% of burns occurred during breakfast to lunch time.

6.2 STUDY-II

6.2.1 Consequences of childhood burn: findings from the largest community-based injury survey in Bangladesh

In the survey, 1,013 children were found with different degrees of burn in the preceding one year. Among them 20 children were permanently disabled. The rate of permanent disability was found to be 5.7 per 100,000. The average loss of school days was found to be about 21 days. More than two-thirds of the burn victims required assistance in their daily activities for different durations of time. More than 7 percent of the children needed hospitalisation due to their burns. The rate of hospitalisation was 21.9 per 100,000 and the average duration of hospital stay was 13.4 days. The highest duration (40 days) of hospital stay was found among girls 10-14

years old. The highest expenditure for the treatment was also found in this age group. The average direct expenditure incurred by a family for treatment of severe burn was determined to be USD462. In this study it was found that more than 61% of the families earn less than \$50 a month.

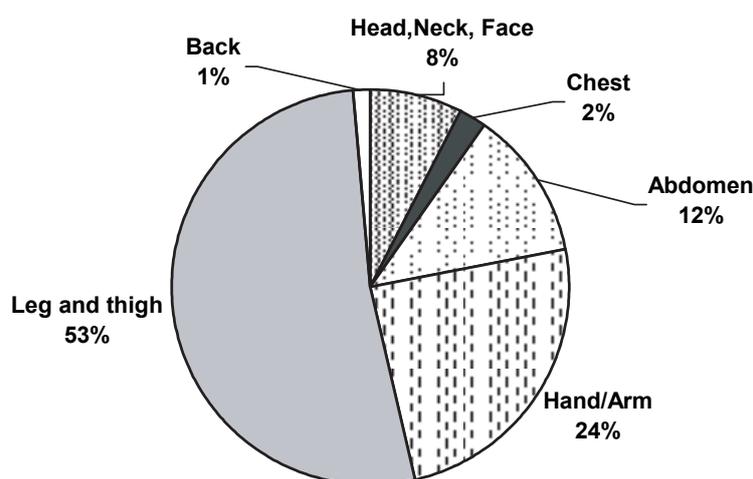


Figure 6: Distribution of burn by body parts

Figure 6 shows that more than 50% cases of burn occur on thighs and legs. Hands and arms were the second most common parts of the body burnt. Abdomen, head, neck and face are the other common parts of the body frequently burnt.

6.3 STUDY-III

6.3.1 Health seeking behaviour of parents of burned children in Bangladesh is related to family socioeconomics

About 60% of parents seek health care from unqualified service providers for their children during a childhood burn injury. The educated and higher income parents choose qualified service providers at significantly higher rate compared to illiterate and poor. A higher proportion of parents of urban residences choose qualified service providers compared to rural. No significant difference of health seeking behaviour of parents in choosing a care provider was found in relation to sex of the children.

6.4 STUDY-IV

6.4.1 Determinants of childhood burns in rural Bangladesh: A Nested Case-Control study.

Children of families who did not have a household with a separate kitchen, a common occurrence in rural areas, were at significantly higher risk of burn (OR 1.65; 95% CI 1.22-2.24). A kitchen without a door was also found to create a more hazardous environment compared to a kitchen with a door. The traditional kerosene lamp (kupi bati) was found to be one of the major determinants of childhood burn in rural Bangladesh (OR 3.16; 95% CI 1.58-6.35). No use or restricted use of kupi bati reduces the risk of childhood burn significantly. Children of nuclear families were at a significantly higher risk of burn compared to combined families.

6.5 STUDY-V

6.5.1 Perceptions of rural people about childhood burns and their prevention: A basis for developing a childhood burn prevention programme in Bangladesh

Respondents of the focus group discussions knew quite well about the devastating consequences of childhood burn injury. They identified younger boys and older girls being at higher risk of burn injury. They identified the home to be the most common place of childhood burn injuries and pointed out that occurrence was more frequent in the winter season. They held the household members or caregivers responsible because of their lack of supervision and carelessness. They suggested that people should be careful about supervision of their children and should take initiative to modify the home and premises as necessary so that children would not have access to sources of burn. Regarding first aid, they had been able to identify prevailing harmful practices which made injuries worse.

A safety education programme could be an effective intervention for improving the knowledge and practices of the rural people with regard to prevention of burn injuries to children.

6.6 STUDY-VI

6.6.1 Experience from community based childhood burn prevention programme in Bangladesh: Implication for low resourch setting.

Lack of supervision to the children, hazardous environment at home and the low level of awareness about injury were identified as the major attributes for the childhood burn in Bangladesh and to address these factors "Triple S" strategies were identified for the prevention framework and following are the strategies:

Safe Environment.

Supervision.

Skill development.

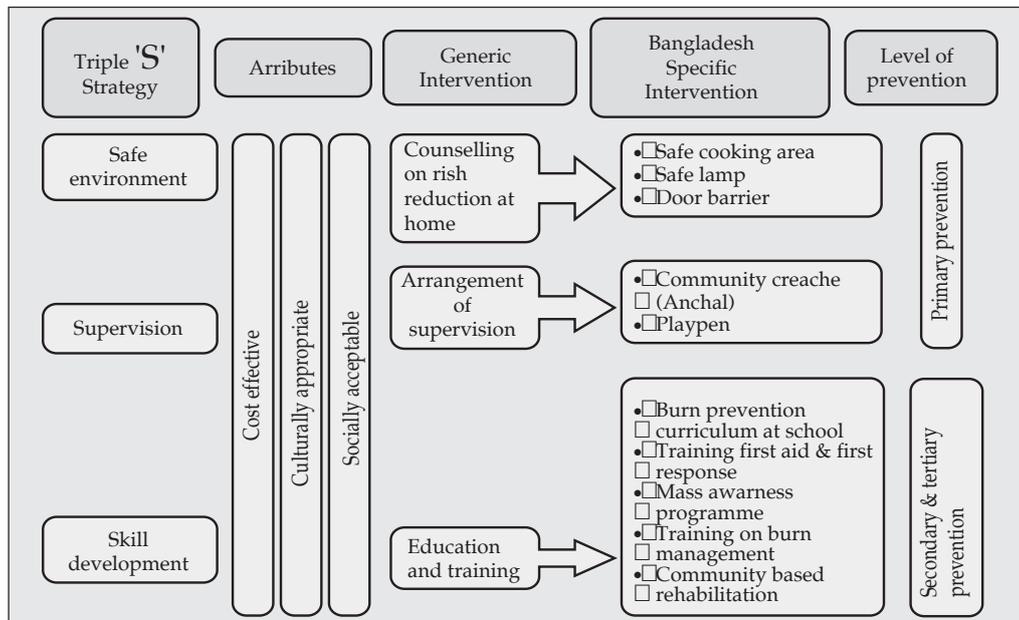


Figure 7 "Triple S" strategy for the frame work of childhood burn prevention programme in Rural Bangladesh

According to the strategies, the following were the major interventions that were adopted in childhood burn prevention framework in Bangladesh:

Table1 Programmes and key activities of the childhood burn prevention programme framework

Programme	Key activities	Expected Outcome
Home safety programme	Safety counseling Safety demonstration	Knowledge about child safety and supervision improved Hot liquid and food kept out of reach of the children. Traditional kerosene lamp (kupi bati) not in use at home Create a barrier around the ground level cooker.
Community crèche programme	Supervision	Children are safe from burn injury
School safety programme	Safety education	Safety knowledge and practice improved
Training first aid and first response	First aid and first response training	Knowledge and skill improved in first aid and first response in relation to burn injury
General awareness programme	Theatre, video show, meeting, poster advocacy, booklets	Safety knowledge and practice improved
Formation of community groups	Meetings	Participation of people in child injury programme enhanced

After developing the framework, small scale piloting was done in four villages in one sub-district of Bangladesh.

From the qualitative evaluation it was found that a prevention framework is highly acceptable. As the programme is very low cost it is expected that the framework will be feasible and sustainable.

7. DISCUSSION

Overall discussion

Few studies have been conducted on epidemiology of childhood burn in Bangladesh, but the main limitation was most of them having been carried out in hospital settings. The magnitude, consequences, pattern of occurrence and risk factors of childhood burn has never been studied at a population level. Thus, childhood burn was not considered as a child health problem considering other childhood illnesses. Childhood burn has never been documented clearly as a health burden in Bangladesh and thus no prevention initiatives have been designed to address this neglected and less recognised problem.

The overall aim of this thesis is to generate information for formulating and developing a childhood burn prevention programme especially for rural Bangladesh. Both qualitative and quantitative methods were used in generating the required information to formulate a prevention framework.

Considering study designs

This thesis comprised both qualitative and quantitative approaches. The quantitative methods revealed the epidemiology, consequences and determinants of childhood burn and explored the health seeking behaviour of the parents of burnt children in Bangladesh.

Perception of the community about childhood burn injury was explored through qualitative study methods. The framework of a childhood burn prevention programme was developed on the basis of generated information regarding childhood burn in Bangladesh.

Considering study outcomes

The study on epidemiology of childhood burn in Bangladesh (Study-I) the first community based study ever conducted to explore the complete epidemiology, enabled us to calculate the incidence of childhood burn and its relation to age, sex and place of residence. This study also revealed place of occurrence, time and cause of childhood burn in Bangladesh. It also captured information about children's activity prior to a burn incidence, which is very important in considering a safer programme.

The second study revealed the physical, social and economic consequences of child burn (Study-II). This study also explored the rate of hospitalization, duration of hospital stay, workdays lost/school days lost and permanent disability due to childhood burn injury. It also provided information on economic loss of the families due to childhood burn.

The third study explored the health seeking behaviour of the parents (Study-III). It showed how the parents seek health care for their children after a burn injury and how health seeking behaviour varies with economic condition of family, parents' education, family size, birth order of children and gender of the children.

The fourth study revealed determinants of childhood burn in Bangladesh (Study-IV). This paper showed the relationship of childhood burn with the type of cooking area at home, use of traditional kerosene lamp and type of family.

The fifth study explored the perception of people regarding childhood burn and its prevention (Study-V). The study looked into people's beliefs, emotions and judgements about childhood burn injuries, people's perception about place, time, cause and prevention of childhood burn.

Finally the sixth paper provided a framework for childhood burn prevention programme (Study-VI) for rural Bangladesh. The framework was developed considering the epidemiology, risk factors, health seeking behaviour and people's perception about burn injury and burn prevention. The framework was piloted at a small scale for measuring its acceptability, feasibility and sustainability.

7.1 CIRCUMSTANCE AND CONTEXT

7.1.1 Vulnerability with age and sex

Age was found as an associated factor for vulnerability of childhood burn (WHO, 2008). In study-I children of 1-4 years of age were found as the most vulnerable group for childhood burn. Vulnerability reduced with the increase of age, the rate of burns in children aged 1-4 years was more than nine times higher than the 15-17 years adolescents (study-I). The finding was very much consistent with findings of many other countries (Mercier *et al.*, 1996; Han *et al.*, 2005; Tung *et al.*, 2005; Tarim *et al.*, 2005, Niekerk, Rode, Laflamme 2004; Lau, 2006; Adamo *et al.*, 1995). Natural curiosity, impulsiveness, less acute perception of dangerous situations and a limited ability to react promptly and properly to the risks are the various reasons for higher vulnerability of young children (Bang, Ebrahim, & Sharma, 1997).

Younger boys and relatively older girls were found at most risk in the population (study-I). From birth until 4 years, a higher incidence was reported for males. Thereafter, a higher incidence was reported for females (Forjuoh, 2006). Vulnerability of younger boys may be because boys are more active, higher in sensation seeking, and less compliant with rules (Morrongiello & Dawber, 1998). Boys engage in greater risk taking than girls which make them more exposed to injury (Morrongiello & Matheis, 2007). On the other hand older girls are at higher risk of burn as they start helping their mother in the kitchen. Study-I reported higher incidence of burns found among girls aged 10 years and above, which corroborate earlier finding from Zimbabwe, Ethiopia, other African countries (Nega *et al.*, 2002; Mzezewa *et al.*, 2006; Albertyn, Bickler & Rode, 1999). When the girls in Bangladesh grow older (10 years and over) they started helping their mothers in household chores including cooking which could be one of the main reasons for higher incidence of burn among older female children. Similar behavioural patterns can be found in African countries, as traditionally females are involved in the cooking for the family and therefore have a higher incidence of domestic burn (Nega *et al.*, 2002; Mzezewa *et al.*, 2006; Albertyn *et al.*, 1999).

7.1.2 Place of residence, time and home environment

Home is the most common place for childhood burn injury in Bangladesh (study-I) and the findings are very much consistent with findings of many other countries (Forjuoh, 2006). Physical environment of home, attitude and practice of home occupants and socio-economic condition of parents are the related factors to childhood injury at home (Glik, Greaves, Kronenfeld, & Jackson, 1993). The kitchen is the most hazardous place for childhood burn at home (Study-I), which is what has been observed in from many developed and developing countries like the United States, India and Ghana (Drago, 2005; Kumar, Chirayil & Chittoria, 2000; Mukerji, Chamania, Patidar, & Gupta, 2001; Forjuoh, Guyer, Smith, 1995).

In Bangladesh more than 75% of the population live in rural areas and the rate of childhood burn was found to be more than five times higher in rural areas compared to urban areas. Educational status, socioeconomic condition and home environment could be the factors related to a high incidence of childhood burn. Rural communities usually use an open space in the courtyard for cooking instead of a kitchen. Because of having an open cooking space at ground level, children have easy access to the earthen oven (choola) and hot utensils. Cooking practices in rural areas are risky, because usually the oven has a hole at ground level and wood, dry leaves and dried cow dung are used as fuel which produce immense and uncontrolled flames. A higher incidence of burn in Bangladeshi kitchens could also be due to utensil types (hari/patil). These utensils have dome-shaped bottoms which can easily get tilted and spill liquid, causing scalding burn. About 50% of the total childhood burn in Bangladesh took place in cooking areas (study-I), which can be prevented by creating a barrier around the cooking place and making the hazardous place inaccessible to children.

Kupi bati (traditional kerosene lamp) was found as one of the most hazardous elements causing childhood burn. It was found that children were more than 3 times more vulnerable in families using kupibati in their home (study-IV). *Kupi bati* can be replaced by a safe lamp (hurricane lamp) which is also a kerosene lamp but the flame is protected by a glass chimney and there is no chance of oil spillage. Similar risks of childhood burn were found in regional countries like Sri Lanka and India (Laloë, 2002; Lau, 2006; Singh, Singh, Sharma, Sodhi, 1998).

The time between breakfast and lunch was found to be the most vulnerable time for childhood burn injury in Bangladesh. The majority of the childhood burns took place during this period of time (study-I). After breakfast, the father goes to work, elder brothers and sisters go to school and the mother becomes busy with her regular household chores. Children during this time stay unsupervised and can fall victim to burns or other injuries.

7.1.3 Socio-economic condition

Poverty, crowding and low maternal education were found as significant risk factors for childhood burn injury (Delgado *et al.*, 2002). In Bangladesh too, higher childhood burn was found among the poor families (study-II). It was also found that families with higher income and parents with higher education brought their children to qualified service providers after a burn injury at a significantly higher rate than poor and illiterate parents (study-III). Other studies in Bangladesh too have shown association among childhood burn and mother's education and economic condition of the family (Daisy *et al.*, 2001).

7.1.4 People's perception about burn injury and its prevention

In Bangladesh rural people have sufficient knowledge about how, where, when and why childhood burns can happen but they are not paying much attention towards prevention. It is because rural parents are not considering prevention to be their responsibility. Without anyone to make them aware of the ways of prevention, the rural people of Bangladesh are more likely to accept this mishap as a way of life, leaving everything to fate or God's will. According to their own comments, their poverty and illiteracy prevents them from thinking that they can arrange simple preventive measures themselves (study-V).

The people perceived a lack of supervision and a hazardous home environment to be the main factors for childhood burn injuries in rural Bangladesh. Constant supervision and environmental modifications around the house were suggested as preventive approaches against childhood burns (study-V). Findings of the study are very much consistent with the findings of studies conducted in Africa (Niekerk *et al.*, 2007; Munro *et al.*, 2006).

Knowledge and practice regarding first aid during a burn injury is an immense issue in prevention perspectives. It was found that prevailing practices in rural Bangladesh for first aid in burn injury are very harmful which are likely to make injuries worse.

In rural Bangladesh people were using items such as raw eggs, rotten banana trees, mud, lime water, coconut oil, kerosene oil and salt on the wounds as first aid or treatment (study-V). Such practices are liable to make the injury more complicated, facilitating infections, prolonging the illnesses and contributing to permanent disabilities. This picture is similar to traditional first aid practices revealed in other developing countries (Ramcharan 2003). Lack of appropriate knowledge and having incorrect knowledge is the reason for such improper practices. For minor burns, use of water is recommended. Active cooling removes heat and prevents progression of the burn. This also removes noxious agents and reduces pain, and may reduce oedema by stabilising mast cells and histamine release (Hudspith, Rayatt, 2004). Rural people of Bangladesh did not know the use of cold water as first aid for burn injuries, except for acid

burns. In Bangladesh more than 233,000 people get burnt every year (Mashreky *et al.*, 2009), where only about 150 are due to acid burn. This knowledge of using cold water in the case of acid burns is because, in Bangladesh, the government and a number of non-governmental organizations are seriously working on acid burn prevention. The media is actively involved in promoting acid burn prevention programmes and messages. Awareness of good practices for acid burn treatment is the outcome of these programmes. This finding supports the fact that awareness programmes could contribute to a positive behaviour change regarding burn prevention and first aid. Such an educational programme for burn prevention would have a significant effect on the reduction of burn morbidity, mortality and disability (Skinner, Brown, La, Peat, Muller. 2004; Peleg, Goldman, Skiron, 2005).

7.2 PREVENTION

Management of burn is a very costly procedure and a higher incidence of burn is found among the poor. Poverty was found as a significant risk factor for burn injuries (Delgado *et al.*, 2002; Locke, Rossignol, Burke, 1990). In Bangladesh, children of poor families were found to be more vulnerable to childhood burn (study-II). On the other hand management of burn is a complicated and painful procedure, especially when children are the victims. Even after good management many of the victims remain with physical and psychological consequences (Ztritlin, 1997; Zeitlina, Järnberg, Somppi, Sundell, 1998). As such, primary prevention should be pivotal when considering a burn management strategy.

Adequate knowledge of the epidemiological characteristics, associated risk factors, social, cultural and economic factors, all of which contribute to burn causation, are required for designing a burn prevention programme. Targeting high-risk groups, the programme needs to be implemented with patience, persistence, and precision. (Atiyeh, Costagliola & Hayek, 2009). But in many of the low income countries required information is absent due to non-digitalized data. In Bangladesh, epidemiology, risk factors and consequences of burn injuries were explored in study-I, II & IV. For designing a prevention program, health seeking behaviour of parents for their children during a burn injury was also explored in this study-III. As an issue of prevention, the perception of the people of the rural community about child burn and its prevention was also investigated in study-V. All this information helped to design a community based childhood burn prevention framework for the rural children of Bangladesh. Socio-economic and cultural condition of the people was considered sincerely in designing the programme.

7.3 CHILDHOOD BURN PREVENTION IN BANGLADESH

Both active and passive approaches of a prevention strategy were considered during the designing of a childhood burn prevention framework in Bangladesh. Establishing 'community crèche' was a very strong passive strategy for childhood burn. Both active and passive approaches were adopted in the '*home safety programme*' for childhood burn prevention. In the home safety programme, mothers and other adult members of the home were taught about safety and supervision of the young children. They were also taught how to prepare a barrier around the cooking area by mud. The school safety and general awareness programmes were the active approaches in the child burn prevention framework in Bangladesh.

7.3.1 Community Crèche (Anchal)

More than 40% of childhood burn injuries took place in the first half of the day, during break first to lunch time, when mothers are busy with their household chores. Fathers are at work and older siblings are at school (study-I). Lack of supervision was identified as one of the major determinants of childhood burn. Consequently, ensuring regular supervision was identified as a possible intervention during this most vulnerable period.

The development of a community crèche was identified as the solution. The mother, unable to devote adequate time to looking after her children during her busiest period of the day is able to have her children looked after by an educated professional, whose sole duty it is to supervise the children.

Each of the community crèches provides a safe environment to 20-25 children, aged 1-5 years-old. Initially the crèche was made available for children aged 1-4 years, as this age group was identified as the most vulnerable (study-I). However after small scale piloting it was revealed that rural children start going to school in Bangladesh from six years of age. Therefore, to include those children within the supervision programme the age group was extended to 1-5 years.

The profile of community crèche caregivers are women from the community, married and aged between 18 and 35 years old. The crèche caregiver utilises a room in her home for the crèche activities. They are trained in safety, supervision and early childhood development (ECD), ensuring maximum safety and giving early childhood development stimulations to the children from morning to noon, six days a week.

7.3.2 Home Safety Programme

About 90% of the childhood burns in Bangladesh occur at home, and among them 54% occur in the cooking area (study-I). Considering the magnitude, home safety interventions were adopted to combat childhood burn at home by making the home a safe haven for children. Modification of the home environment to eliminate burn hazards and improve supervision was the major strategy.

A community health worker visits the home every month with a checklist, to identify risk and hazards in the home. The health worker also counsels the household occupants, especially mothers, on ways of minimizing and getting rid of risky conditions inside and outside the household premises.

Attempts to improve the quality of supervision are implemented by informing the household occupants and care givers about burn risks and prevention methods.

The majority of the rural people in Bangladesh do not have a separate kitchen. They cook their food in an open place, exposing children to flames, hot liquids and food which pose serious burn risks. The study found that children were at a significantly higher risk of burn when cooking took place in the courtyard or in an open place compared to cooking in the kitchen (study-IV).



Figure 8 Mud barrier around a cooker

Preventing access of children to the cooking area was identified as one of the major strategies required in a childhood burn prevention programme. Preventing access of children to the cooking area could combat 54% of childhood burn at home that took place in the cooking area (study-I). Where a separate kitchen was not possible due to poverty, creating a barrier wall around the cooking area was identified as a preventive measure against childhood burn.

To address this, during the household visits, a health worker demonstrated how to prepare a barrier around the cooking area. The barrier wall was built with mud which is locally available and costs almost nothing. A door was also prepared by bamboo to keep children outside the cooking area. The health worker also counselled the mother and other household occupants of specific burn risks like hot objects and/or flammable objects (matches, fire-crackers, spirits and oils, etc) found within reach of children in the household.

Home occupants are discouraged from using the traditional kerosene lamp (kupi bati), which is a major source of flame burn injuries (study-I). They are motivated to keep hot food and liquid out of reach of children, which are major causes of scalding in Bangladesh (study-I).

7.3.3 General awareness building activities

To improve knowledge and create awareness of burn prevention among the community, various communication strategies have been adopted including courtyard meetings, documentary drama, video-shows, performing interactive popular theatre with burn prevention as themes for the drama and distribution of booklets and posters.

Social autopsy meetings are conducted after a death due to burn. The social autopsy is designed to assess why the fatal incidence occurred and what measures can be taken to prevent such deaths in the future.

These community activities were designed to increase men's participation in the programme. In the Bangladeshi context it is often difficult to reach men during the day, due to work commitments. So, most of these activities are organized during their leisure time in the afternoons or the evenings to ensure their increased participation.

7.3.4 School Safety Programme

Pictorial textbooks were developed for the students of grades I to VIII. The textbooks include information on burn and its prevention. A first-aid course has also been included in which the students are taught the skills of first-aid.

It is expected that children will be able to practice safety and act as a motivating agent in the family and community to promote and sustain safety issues.

7.3.5 Formation of village committees

Community mobilization and participation were identified as crucial for a successful injury prevention intervention at the village level. A committee was formed in each of the villages (geographical area comprising about 300 households). Local community leaders comprised the committee members. Village injury prevention committees are voluntary institutions that meet every month to review the injury prevention activities in their community. As people of the community respect them, the committee can advise people to practice injury prevention activities at the individual, family and community levels. Members of the village committees were trained in injury prevention activities of the programme.

7.3.6 Basic first response to burn injury

Traditionally, people use items such as raw eggs, rotten banana trees, mud, lime water, coconut oil, kerosene oil or salt on burn wounds as first aid or treatment. Such practices threaten to compound the injury, resulting in further health complications, facilitating infections, prolonging the illness and contributing to permanent disabilities (study-V). To address this, basic first response training for local volunteers has been introduced.

7.4 METHODOLOGICAL CONSIDERATION

7.4.1 Study base

The major strength of this thesis is the study base. A nation-wide survey was conducted to determine the magnitude, characteristics and consequences of burn. Stratified multi-stage sampling scheme generated a national sample size of 171,366 households with a population of 819,429 including 351,651 children of 0-18 years.

7.4.2 Recall bias in national survey

Recall bias was taken into consideration in this thesis. To ensure a sufficient number of deaths in the survey, the recall period considered was two years in areas other than Dhaka Metropolitan City and three years in Dhaka Metropolitan City (The national sample of 130,000 households was sufficiently large enough to allow a two year recall period. The sample size in Dhaka was only 40,000 households, requiring a longer recall period). An analysis of deaths by year of recall showed that most fatal events were recalled in the first year of the recall period with a rapid fall off in each year after. Due to this, a final analysis was conducted using deaths from the most recent year to obtain the most accurate fatality rates.

In the case of morbidity, the recall period was six months in both Dhaka city and areas other than Dhaka. As the recall period was long, no minor burn was included in this study and only moderate to severe burns were included in this study. A structured definition of moderate, serious and severe burn was made for this study.

To minimize the recall period, minor burns were excluded from this study however many of the moderate burn injuries can not be captured due to this long recall period which might have created some underestimation of the incidence of burn.

7.4.3 Classification errors in national survey

The classification process was standardised. When each household was visited a screening form was used to collect information on the household, including information about the number of household members, age, sex, number of deaths in the household in the last two or three years (depending on the study area), and the number of sick (ill or injured) persons in the household in the last six months.

Forty eight data collectors were involved in the data collection. There might be a variation in defining morbidity or there might be an inability in understanding the definition by the respondent which might cause some inaccuracy in the number of moderate morbidities. Rigorous training and continuous supervision was applied to reduce the definitional variation.

7.4.4 Case-control study

In determining risk factors of burn a nested case control study was conducted. Nested case control study is better than case control study, as it provides results as precise as a cohort study (Rothman & Greenland 1998). In selecting cases and controls, assistance was obtained from a sentinel surveillance system which helped in better matching cases and control. However there

were some limitations, like children of the same age and sex were selected as controls from the same geographical area. The same age was not exactly the same date of birth. It was ± 1 years. Furthermore, the Bangladesh birth registration system is not well practiced, so in selecting cases or controls, the mother might not recall the exact date of birth of her children in which case some variation in age may occur between case and control. The same geographical area was considered in matching socio-demographic characteristics. However the geographical consideration might not match all socio-demographic variables accurately and in that case some misinterpretation might occur. However, in most of the cases the socio-economic variable is the same in rural Bangladesh. Only one control was selected for each of the cases. It would have been better to select more than one control for checking bias and for a better consistency of findings (Ibrahim MA, Spitzer, 1979).

8. CONCLUSIONS

In terms of morbidity and disability, childhood burn is a major public health problem in Bangladesh. A lack of awareness about burn injury, risk factors and preventive measures among the people, a low level of supervision practice for the children and a hazardous environment at home are major factors related to a high incidence of childhood burn in Bangladesh.

A framework of prevention programmes was developed considering the magnitude, determinants, health seeking behaviour of parents and people's perception about childhood burn in Bangladesh.

During designing the framework, the socio-economic condition, environmental and cultural condition was considered robustly. Community participation was considered as the guiding principle in development of the framework. For example, initially the crèche programme was limited to children between the ages of 1-4 years of age because this is the most vulnerable group to burn injury because of lack of supervision. However, following feedback from the community it was modified to include children from the ages of 1-5 years. As rural children start school from age 6, the age allowance was raised, to ensure supervision until they start school.

The programmes in the framework use local technology and resources which are both accepted by the local people and are affordable. Rural homes most commonly consist of only one room, making it difficult to effectively exclude children from burn hazards associated with cooking. As it is not possible for most people to afford the cost of building a separate kitchen, the solution identified was simply to prevent access of children to the cooking area. A mud barrier built around the cooking area, using a bamboo door for access control is a simple, effective and affordable means to achieve this.

All of these efforts make the programme acceptable and feasible even to very poor people in rural Bangladesh.

9. RECOMMENDATION

The framework of the prevention programme is found feasible and acceptable in the community. The framework is now needed to be piloted in a large scale for exploring its effectiveness in terms of mortality and morbidity and then scaled all over the country as soon as possible.

This framework can be used with some modifications in countries with similar socio-cultural conditions.

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