



Determinants of childhood burns in rural Bangladesh: A nested case–control study

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ABSTRACT

Background: Burn is one of the major causes of childhood illnesses in Bangladesh and is the third leading cause of illness of 1- to 4-year-old children. Rural children are more at risk compared to urban-dwelling children.

Objective: The study was designed to identify the risk factors of childhood burn in rural Bangladesh.

Methods: This nested case–control study was conducted in rural Bangladesh. The study population was children of less than 10 years old in three sub-districts of Bangladesh.

Results: 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* significantly reduces the risk of childhood burn. Children of nuclear families were at significantly higher risk of burn compared to combined families.

Conclusion: Cooking in an open place and use of the traditional kerosene lamp are the major determinants of childhood burn in rural Bangladesh. A combined family environment reduces the risk of childhood burn. Childhood burn can be reduced by prohibiting use of *kupi bati* and limiting children's access to the cooking area. Promoting combined family could be an initiative of childhood burn prevention program.

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1. Introduction

Burns are one of the most devastating injuries in the world [1]. Children are the most vulnerable group as they have limited perception of dangerous situations and limited ability to react promptly and properly [2]. The survival

of burn patients has markedly improved with the advancement of medical care, however in terms of morbidity and disability it still remains a huge public health problem all over the world [3]. It remains a major cause of unintentional injuries in many of the high income countries [3–6]. In Africa and many of the South-Asian countries, including India, Pakistan, Nepal, Sri Lanka and Afghanistan, burn injuries have emerged as a major public health issue [7–14].

About 173,000 children are burnt every year in Bangladesh and among them 3400 children become permanently disabled [15,16]. Childhood burn was ranked as the fifth leading cause of childhood illness among 1- to 17-

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year-old children and is the third leading cause of illness among children aged 1–4 years old [15]. It was found to be a major cause of hospital admission and prolonged hospital stay [17]. Alongside permanent disability, it is a major cause of school absence and workday loss for children [16], creating a huge social and economic burden for the families and the nation [16,17]. Compared to urban children, rural children are 4 times more likely to suffer a burn [15]. To address this huge burden to health, social and economic issues a comprehensive burn prevention program is necessary. To design a prevention program the risk factors of burn injury must be identified. This study was designed to identify the determinants of childhood burn in rural Bangladesh.

2. Methods

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. The study area is in three sub-districts of Bangladesh, represent the majority of rural Bangladesh.

2.2. Study population

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

2.2.1. Cases

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.

2.2.2. Controls

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

2.2.3. 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 three 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

2.2.4. Sampling procedure

In the previous 12 months, all of the burn cases under 10 years of age in CIPRB's surveillance area were recruited

as cases and children of the same geographical area of similar age and sex were selected as control. Among the cases 420 were randomly selected, 140 from each sub-districts. Each of the control then selected from the same locality by matching age and sex. The matching age never varied by more than one and half years.

Selection criteria of cases

1. Burn cases
2. Aged below 10 years
3. Willing to participate in the study

Selection of controls

1. Children of same age and sex
2. Children living in same geographical area
3. Willing to participate
4. No history of burn

2.2.5. 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 collected data through face-to-face interviews at the household level. Mothers of the selected children were the potential respondents. In case the mother is absent, the children's major caregiver 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 the home, behavioral factors of household occupants, activities of mothers and supervision status of children and other relevant information needed.

2.3. Data analysis

Associations were made between burn injury and the type of family, use of traditional kerosene lamps, having a kitchen at home, where the cooking takes place and supervision by an adult. The 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.

3. Results

The study was conducted to explore the association between childhood burn and the physical environment of the home and the behavioral practices of the household occupants (Table 1).

The type of family which the children lived in, that is either nuclear or combined, was identified as one of the contributory factors for childhood burn. Compared to nuclear families, children living in combined families were found to be safer from burn injury. Children of nuclear families were at a significantly higher risk of burn compared to combined families (OR 1.42; 95% CI 1.01–1.99). About 29%

Table 1
Determinants of childhood burn in rural Bangladesh.

	Burnt	Not Burnt	OR	95% CI	AR%
Type of family					
Nuclear	345 (52.6%)	311 (47.4%)	1.42	1.01–1.99	29.57%
Combined ^a	75 (43.9%)	96 (56.1%)			
Using traditional kerosene lamp (<i>kupi bati</i>)					
Yes	408 (51.3%)	387 (48.7%)	3.16	1.58–6.35	68.38%
No ^a	11 (25.0%)	33 (75%)			
Use of <i>kupi bati</i>					
Kitchen and bedroom	201 (55.7%)	160 (44.3%)	2.06	1.27–3.32	51.36%
Only in kitchen ^a	33 (37.9%)	54 (62.1%)			
Place of cooking					
Courtyard	254 (55.8%)	201 (44.2%)	1.67	1.27–2.19	40.01%
Kitchen ^a	166 (43.1%)	219 (56.9%)			
Have kitchen					
Yes ^a	265 (46.1%)	310 (53.9%)	1.65	1.22–2.24	39.39%
No	155 (58.5%)	110 (41.5%)			
Have door in kitchen					
Yes ^a	103 (41.5%)	145 (58.5%)	1.38	.98–1.96	27.53
No	162 (49.5%)	165 (50.5%)			

^a Reference category.

of the affected children of nuclear families could be saved from burn injury if they were not in nuclear families.

Another major determinant of childhood burn in rural Bangladesh was the use of the traditional kerosene lamps (*kupi bati*). Children were 3 times more at risk of burn in households where a *kupi bati* was used than in homes not using a *kupi bati* (OR 3.16; 95% CI 1.58–6.35). It was calculated that 68% of the injured children in these households could be saved if the *kupi bati* was not used in the home. There was also a significant association between the extent of use of the *kupi bati* and childhood burn. Homes using a *kupi bati* only in the kitchen were found to be safer compared to homes using a *kupi bati* as the only source of light.

Where the cooking took place was identified as another important determinant of childhood burn in rural Bangladesh. Children were at significantly higher risk of burn in houses where cooking took place in the courtyard (OR 1.66; 95% CI 1.27–2.19) compared to cooking in the kitchen. Children were 2 times more likely to suffer a burn in a household which did not have a kitchen (OR 2.06; 95% CI 1.27–3.32). Though not statistically significant, it was also found that kitchens with doors reduced the risk of childhood burn.

Children were found to be at higher risk when hot food was kept within their reach (OR 1.168; 95% CI .889–1.536). Higher risk of childhood burn was also found where mothers stayed outside the home for more than 8 h a day (OR 1.424; 95% CI .818–2.477), in both of the cases association was not statistically significant. Presence of a person at home other than the mother to look after children proves to offer a wider safety net of protective against childhood burn, however this association was also not found to be statistically significant (OR .678; 95% CI .586–1.008).

4. Discussion

The risk of childhood burn associated with age, sex and socioeconomic condition of families has been investigated

in Bangladesh in previous studies [15,18]. However not much information has been explored regarding the physical environment of the household and the home occupant's behavior which are important predictors for child survival and development [19]. This study explored the risk factors of childhood burn related to these factors.

We found children of nuclear families were at significantly higher risk of burn compared to children living in combined families. In Bangladesh three generations of family living in one household is still not an uncommon scenario but it is gradually losing ground. This spectacular cultural, social and family value could be important for the safety and development of children by providing an improved physical and emotional environment through the presence of more adults and therefore greater supervision. Sustaining and promoting these traditional social values and family structures might help in not only childhood burn prevention, but also many other safety and developmental issues of children.

The source of light at home was identified as a major determinant of childhood burn in this study. Children were at significantly higher risk of burn when traditional kerosene lamps (*kupi bati*) were used at home. Even restricted use of *kupi bati* would reduce the risk of burn significantly. The *kupi bati* is a cheap, portable kerosene lamp which burns with an open-flame. Its portability and open-flame design means the *kupi bati* can easily be knocked over and spill kerosene. This traditional kerosene lamp has also been identified as a determinant of burn in neighboring countries like Sri Lanka, India and Nepal [8,10,20,21].

Similar to many other regional countries, the majority of childhood burns in Bangladesh take place at home, mostly in the kitchen or cooking area [8,10,15,20,21]. Burns occurring in the cooking area constituted more than 50% of childhood burns at home in this country [15]. This study identified the physical environment of the cooking place as an important predictor for childhood burn. Children were found to be at a significantly higher risk of burn where

cooking took place in the courtyard or in an open place. In homes with a kitchen the children were found to be significantly safer from burn. Findings of this study revealed that a protected cooking area can significantly reduce the risk of childhood burn. So the isolation of the cooking area could be a great initiative in childhood burn prevention in Bangladesh. The poor who do not have the financial capacity to construct a kitchen in their home could build a low-cost mud barrier around the cooking place in the courtyard with a low gate of bamboo or wooden planks.

The mother's absence from home for more than 8 h a day and the presence of a person at home to look after children other than the mother, both affect childhood burn incidences. Findings indicate that better supervision could help in reducing childhood burn in rural Bangladesh.

4.1. Strengths and limitations

As this was a nested case–control study, it provides results as precise as a cohort study [22]. Children of the same age and sex were selected as controls from the same geographical area. The same geographical area was considered in matching socio–demographic characteristics. However the geographical consideration might not match all socio–demographic variables accurately and some confounding factors may be present. 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 better consistency of findings [23].

4.2. Conclusion

The cooking area is a very important determinant for childhood burn. Preventing the child's access to the cooking area could be an important approach of a childhood burn prevention program in Bangladesh. Childhood burn could be reduced by avoiding use of the traditional kerosene lamp (*kupi bati*). Even the restricted use of the *kupi bati* can reduce the risk of burn significantly. Children belonging to combined families are better protected from burn injuries compared to children of nuclear families in rural Bangladesh.

4.3. Recommendation

The cooking area should be a separate room complete with doors or an area properly isolated from children by creating a barrier around it. The poor who are not able to make a kitchen for cooking can isolate the cooking area by building a mud barrier around it which is almost of no cost except their labor.

The use of the traditional lamp (*kupi bati*) needs to be stopped. *Kupi bati* can be replaced by *hariken* which is also a kerosene lamp but the flame is protected by a glass chimney and there is no chance of oil spillage.

Introducing 'Parents Education Program' to ensure better supervision of the children.

Competing interests

None declared.

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Ethical issues

Ethical clearance was obtained from the ethical committee of Centre for Injury Prevention and Research Bangladesh. Participants were informed about the benefits and objectives of the study. Verbal consent was obtained from each head of household before proceeding with the interviews.

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