# Feasibility of teaching first response to children below 10 years of age in rural Bangladesh

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## Abstract

**Background:** The Bangladesh Anchal and SwimSafe research program included a community-based first response program incorporating CPR training for children. Previous research in rural Bangladesh demonstrated children 10 years and older could successfully learn first response in a low-literacy, low resource setting and retain the skills over time. Another study in Bangladesh found children rescue other children when they are in danger in the water. The average age of rescuer and rescuee was 9 years and 3 years respectively. Some rescues involved victims without pulse and respiration. This demonstrated a need for children younger than 10 years to be able to resuscitate young children. This study was done to demonstrate the feasibility of children 7 to 9 years acting as community first responders in rural Bangladesh.

**Methods:** Ten community swimming instructors (CSIs) received a two-day intensive training-of-trainers activity to teach first aid and CPR to children. Graduate CSIs taught a standard first aid course to children in the study using child manikins.

**Results:** A total of 1,611 children participated in the training programme. Among all participants, 88.4% of males and 86.9% of females met stated essential competencies. Succcessful completion rates in all age groups and both sexes were similar.

**Conclusion:** Children 7 to 9 years old can learn the skills of first aid and CPR. Further research is needed to demonstrate 1) CPR was effective by actual dynamic measurement; 2) skills learned are retained over time, and 3) they can provide successful first response actions in actual emergencies.

**Abbreviations:** Cardiopulmonary Resuscitation (CPR); Community Swimming Instructors (CSI; High Income Countries (HIC); Low and Middle Income Countries (LMIC); Training of Trainers (TOT); Centre for Injury Prevention and Research, Bangladesh (CIPRB); Body Mass Index (BMI); The Alliance for Safe Children (TASC)

## Introduction

Unintentional drowning is a significant public health concern in children globally [1]. Rates of child drowning are much higher in Low and Middle Income Countries (LMICs) compared to High Income Countries (HICs) [2]. The Bangladesh Health and Injury Survey 2016 found the fatal drowning rate among children under 18 years was 25.7/100,000. Children 1-4 years old had the highest rate at 71.7/100,000 [3].

Contributing factors for drowning in rural Bangladesh are frequent daily exposure to water bodies, lack of supervision, lack of rescue and swimming skills in children and non-existence of first response and emergency response systems. As a result, many victims needlessly die at the scene following rescue.

In 2012, a first responder training programme which included cardiopulmonary resuscitation (CPR) was developed in rural Bangladesh. Approximately 2,400 responders were trained over 14-months from March 2011 to April 2012. The responders were a mix of adolescents, adult community volunteers and community elders. Adolescent participants were 10 years of age and older. Each age group demonstrated that they could successfully learn CPR and retain the skills over time when judged by essential practice assessment [4].

A second prior research activity involved teaching children 4 years and older basic swimming skills and safe rescue. For children able to swim and reporting rescuing other children, rescuees were very young children (mean age 4.1 years) with a mean age difference between rescuer and reported victim of 5.9 years. Some rescues were unsuccessful as the victim lacked a pulse and respiration [5]. This demonstrated a need for children younger than 10 years old to be able to resuscitate young children after rescue. The objective of this study was to demonstrate the feasibility of teaching first response including CPR to children 7-9 years of age.

## Methods

### Study area

The study was conducted in 39 villages of Dhangara union (smallest administrative unit) Raiganj, a subdistrict of Sirajganj district in northern Bangladesh with 47, 000 population. The drowning rate for children under 18 years in this area is 29.6/100,000 [4].

### Study design

A-pilot project was conducted in 2014 and 2015. It began by reviewing the first responders training program used in the previous study. It included basic first aid for common injuries as well as CPR. Previously developed and tested low-literacy training materials were modified for this study. The European Resuscitation Council Protocol was used for CPR training [6].

Five male and five female trainers were selected for training of trainers (TOT) from the local community. These trainers, called community swimming instructors, (CSI) were recruited to train children in swimming, safe rescure and first reponse. Trainers received a-7-day intensive training, 5 days on swimming and rescue teaching and two days on first response which included basic first aid and CPR. Basic, non-instrumented Laerdal Little Junior mannikins and baby mannikins were used. Locally sourced materials including bandages and sticks for splints were used for the first aid portion of the training. Inclusion criteria for training were children between 7 and 9 years old and willing to learn CPR. A pre-tested training manual was used during the training. The study was approved by the Centre for Injury Prevention and Research, Bangladesh (CIPRB) ethical review committee and the University of British Columbia, Behavioral Research Ethics Board (H13-02776). Written consent was obtained from the parent/care provider of the child before enrollment for training. Children received two-days of first response training totalling 16 hours which included 5 hours for CPR. At the end of the training the children were asked to demonstrate essential CPR skills and answer knowledge-based questions. A structured checklist (Table 1) was used to record the responses. When both the skill performance and knowledge-based responses met pre-specified essential skills requirements, participants were declared first responder graduates by the instructor/supervisor (Table 1).

## Results

A total of 1,611 children participated in the training programme over a 24 month period. 879 were males and 732 were females in the different age groups. Similar numbers were achieved in each of the 3 ages (Table 2).

Among 1,611 participants who began the training, 1,413 (87.7%) graduated, 67 (4.4%) failed to qualify at the end due to inability to perform all essential skills and respond to the knowledge based questions, and 131 (8.7%) dropped out during training prior to final testing. Among all participants, 88.4% of males and 86.9% of females passed the assessment. Passing rates in all age groups for both sexes were similar with slight differences among 8 and 9 year old children. Among all ages, the highest passing rate (89.8%) was in 9 year old males and the lowest (86.5%) in females of the same age. However, this difference was not statistically significant (p = 0.3) (Figure 1).

## Discussion

This was a demonstration of the feasibility of training rural Bangladeshi children 7 to 9 years of age in first response skills including CPR. The training methods and materials used in this study were

**Table 1.** Skills of CPR and knowledge on first aid

| | Skills and knowledge tested during training |
|---|---|
| **Demonstrate first response to an unconscious casualty** | |
| 1. | Check for dangers* |
| 2. | Check for response* |
| 3. | Shout/Call for help* |
| 4. | Open the airway** |
| 5. | Check for normal breathing** |
| 6. | Demonstrate action for vomiting** |
| 7. | Turn into the recovery position** |
| **Demonstrate first response for an unconscious, non-breathing adult casualty** | |
| 8. | Check for dangers* |
| 9. | Check for response* |
| 10. | Shout/Call for help* |
| 11. | Open the airway** |
| 12. | Check for normal breathing** |
| 13. | Give 5 rescue breaths** |
| 14. | Perform 30 chest compressions** |
| 15. | Continue 30 compressions followed by 2 rescue breaths for a period of 2 minutes** |
| **Demonstrate chest compressions and rescue breathing for an unconscious child, 1-8 years** | |
| 16. | Perform 30 chest compressions** |
| 17. | Continue 30 compressions followed by 2 rescue breaths for a period of 2 minutes (child)** |
| **Knowledge of First Aid** | |
| 18. | Water Rescue** |
| 19. | Wound injury with bleeding** |
| 20. | Burn Injury** |
| 21. | Animal bite** |
| 22. | Casualty transportation** |
| * Best practice, not required to be done at assessment | |
| ** Essential practice, required to be done at assessment | |

**Table 2.** Distribution of participants according to age and sex

| Distribution of children by age and sex | | | | | | |
|---|---|---|---|---|---|---|
| Age category | Sex of child | | | | | |
| | Male | % | Female | % | Both | % |
| 7 years | 281 | 32.0 | 247 | 33.7 | 528 | 32.8 |
| 8years | 303 | 34.5 | 240 | 32.8 | 543 | 33.7 |
| 9years | 295 | 33.6 | 245 | 33.5 | 540 | 33.5 |
| Total | 879 | 100.0 | 732 | 100.0 | 1611 | 100.0 |

developed in a previous study, where the training was found to be acceptable by the community and effective in increasing participants' knowledge and skills in first response. That study included community residents aged 10 years and above [4]. The current results show more than 86% children 7 to 9 years of age and both sexes acquired the knowledge and essential skills of first response through the training programme, a similar proportion to the earlier study. This provides evidence that children 7-9-years-old in rural Bangladesh are capable of learning the knowledge and skills of first response when defined as essential skills.

Other studies have shown discordant results with young children and first response competence: a UK study showed no child 9 or 10 years old in the study was able to generate effective compressions when measured with an instrumented manikin [7]. However, a study in Austria found that children as young as 9 years old could generate effective compressions. Both these studies used instrumented manikins that generated actual depth of compression and tidal volume delivered. These were not available for the research in this study.
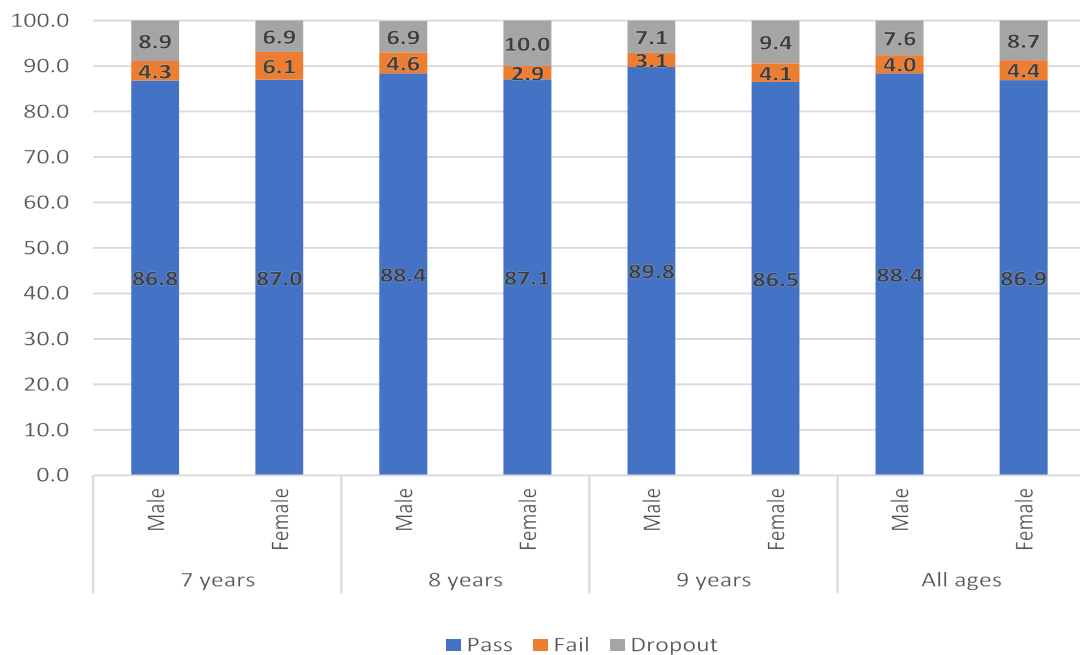
**Figure 1.** Distribution of children by age, sex and assessment result

A limitation in this study is the 'essential skills' training protocol was chosen due to the need for flexibility when testing young children. This age group demonstrated good understanding and mastery of the necessary mechanics but sometimes did not remember to check for danger and/or call for help before beginning CPR. As a result, it is difficult to compare the essential skills assessment with other studies of children which used full protocol norms. Another limitation was the lack of quantitative measurements due to unavailability of an instrumented manikin and the lack of body mass index measurements (BMI) in the children in this study. This is likely an important limitation given the known relationship between BMI and effective compression depth and adequate tidal volume for CPR by children [8]. BMIs were not calculated for the study children. Nutritional deficiencies are common and the mean BMI for children 7-9 years in rural Bangladesh is below HIC norms where the BMI relationship to compression effectiveness and tidal volume has been studied. Studies in HICs have found most children 9 years and younger (and many 10 and 11 years) lack sufficient BMI to generate effective compressions [8]. This will need to be studied in the future in the context of children in rural Bangladesh and other LMICs. Another limitation relates to the child age group which has a propensity to require significant repetition in other task learning exercises (e.g., school work) to prevent knowledge and skill degradation over time. It is unknown how rapidly the skills mastered remain effective without periodic refresher training. It is useful to note the Austrian study showed they were of high quality at 4 months after training. Another limitation is the lack of demonstration of the successful use of the skills learned for real life events in the community. This assessment is underway and results are hoped to be available for publication soon. Finally, the findings of this study may not be generalizable as the geographical area/cohort location has been chosen from communities participating in an injury surveillance system where community awareness is high. The populations have been used for multiple studies over the last decade and may not represent the average rural community in Bangladesh.

## Conclusion

A first responder training programme which includes CPR in a rural community of Bangladesh of children aged 7-9 years old is feasible. Further research is needed to demonstrate that skills, especially CPR, are effective, that they are mechanically sufficient for compression of chest walls in victims of all ages, that they are retained over time, and that once trained these young children can provide successful first response activities in actual emergencies that include CPR and reduce morbidity and mortality.

## Conflicts of interest

None

## Contributors

MK, AR, SB, JS, ML and FR participated in the study design. MK, AR and FR led the implementation and field work. MK, AR, and FR did the data management. MK, AR, SB, JS, ML and FR participated in the drafts and editing of this paper.

## Ethical approval

Obtained.

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