RESEARCH PAPER

Effectiveness of Child-To-Child Approach in Preventing Unintentional Childhood Injuries and Their Consequences: *A Non-Randomized Cluster-Controlled Trial*

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Background: Child-to-child approach is an innovative strategy for preventing and reducing the morbidity and mortality burden of unintentional childhood injuries.

Objectives: To test effectiveness of Child-to-child Approach in preventing unintentional childhood injuries and their consequences.

Study design: Community-based non-randomized cluster-controlled trial of parallel design.

Participants: 397 children and adolescents.

Intervention: Eldest literate adolescent of selected families of intervention area were trained on prevention of injuries. They were to implement the knowledge gained to prevent injuries in themselves and their younger siblings and also disseminate this knowledge to other members of their families.

Outcome: Data was collected from both intervention and control areas during pre- and post-intervention phases on the magnitude of injuries, time for recovery from injuries, place for seeking treatment, cost of treatment, knowledge and practice of participants and their families regarding injuries.

Results: During post-intervention phase, the intervention group experienced a significant reduction in incidence of injuries, increased preference for institutional treatment of injuries and increased knowledge and practice regarding injuries, in comparison to its pre-intervention data and data of the control group in post-intervention phase. Total time for recovery and cost of treatment for injuries also decreased in intervention group in post-intervention phase, though differences were not statistically significant.

Conclusion: Child-to-child approach is effective in reducing childhood injuries, improving choice of place for seeking treatment, increasing knowledge of participants, improving family practices regarding prevention of injuries and reducing expenditure on treatment of childhood injuries.

Key words: Accident, Educational intervention, Prevention, Trauma.

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With a change in epidemiological pattern of disease burden in the population, injuries are rising and contributing to a major part of morbidity and mortality in the entire population, including children. Childhood injury is currently an alarming problem in the world. Injuries constitute a large proportion of global burden of childhood death, particularly for older children in whom it accounts for almost half of the deaths. Analysis conducted using Global Burden of Diseases data revealed that unintentional injuries accounted for 18% of the estimated deaths among children between the ages of 1 and 19 years globally [1] and 11.2% of total DALY's lost in all age groups [2]. Cost incurred by families towards treatment of childhood injuries is also enormous around the world [3].

Strategies need to be worked out and implemented for prevention and control of the problem of unintentional childhood injuries. Child-to-child approach is one such innovative strategy [4], which has earlier been proved to be effective in health promotion among children [5-8]. However, this approach has not been tested for prevention and control of injuries in children.

The study was conducted with the objective of assessing the effectiveness of child-to-child approach in preventing unintentional childhood injuries and their consequences in terms of time taken for recovery and cost incurred on treatment.

METHODS

A community based non-randomized cluster-controlled trial of parallel design was conducted in rural area of Delhi. The study was approved by the Institutional Ethics Committee and written informed consent was taken from heads of the families and consent/assent was taken from all participants as applicable.

The study area comprised of one intervention and one control village in North-West Delhi, which were widely separated from each other with another habitation located in between, to prevent contamination. The villages for intervention and control groups were selected by purposive sampling considering logistic and operational feasi-bility. The main study was undertaken from August, 2017 to January, 2019 and comprised of 7 broad phases – recruitment, pre-intervention, intervention, reinforcement, washout, post-inter-vention and intervention in control group.

For operational purposes, injury was defined as physical damage to the child's body, caused unintentionally/accidentally. 'One injury' was defined as each injury of a different type or in different body part occurring in a child, even if occurring at the same time due to the same cause. 'One injury event' was defined as one child injured at one point of time, even if it resulted in multiple injuries.

Children and adolescents aged 0-19 years belonging to families having at least one adolescent and two younger siblings were included in the study. Mentally deranged or critically ill participants were excluded from the study. Consecutive families were selected for wide dissemination of the message which is the crux of child-to-child approach. Recruitment was done at the initiation of the study.

Sample size calculation was based on a pilot study which was conducted in a different part of the study area; 50 children aged 0-19 years with a recall period of 3 months were evaluated and the incidence of injury was observed as 15%. Expecting a 5% reduction in incidence of injury after the intervention and keeping alpha and beta errors at 5% and 20%, respectively, sample size was estimated as 90 as per the WHO guidelines [9] for a two-sided hypothesis test for an incidence rate, when the observations are censored at 4 months. As the study required more than one child from one family for implementing child-to-child approach, clustering effect was likely to occur due to similarity of participants within a family. Keeping this in view and to adjust for design effect, calculated sample size was multiplied by a factor of 2, making a size of 180 children. Since the study required follow-up of 20 months, possibility of non-response/attrition was considered and hence 10% was added to this and rounded off to final sample size of 200 participants each in intervention and control group.

Training was given to the eldest adolescents in the families of intervention area during intervention phase i.e., January-April, 2018. Eldest adolescents of the families of the control area were trained after the completion of data collection in post-intervention phase. Eligible adole-scents were trained on various aspects of injuries and their prevention. Training included three components: (*i*) First aid and cardio-pulmonary resuscitation (CPR) by St. John's Ambulance Services of Indian Red Cross Society, (*ii*) road safety and traffic rules as collaboration between Delhi Traffic Police and Hero MotoCorp, Hero Honda and (*iii*) injury prevention and immediate care by the research team. In addition, messages were given regularly to adolescents during home visits for data collection. At the end of training, the trained adolescents were each given a module highlighting salient points covered in the trainings regarding common injuries and their pre-vention, a first aid kit and a box with child lock for safe storage of items likely to cause injury. Trained adole-scents were told to be vigilant and thus prevent occurrence of injuries in themselves and their younger siblings. They were also encouraged to pass on the knowledge they had gained through trainings to their adolescent siblings and all adult women in their families including mothers, aunts, grandmothers, elder sisters or sisters-in-law. Subsequently, weekly visits were made and reinforcement of information was done for 2 months (May-June, 2018), followed by washout period of 2 months (July-August, 2018). Control group was also visited at similar frequency and interval, but only general health messages were given with no special mention regarding injuries.

Data was collected using a pre-tested semi-structured proforma, during pre- and post-intervention phases of four months each, in same months of the year, pre-intervention data being collected during September-December, 2017 and post-intervention data collected during September-December, 2018. Ongoing data collection regarding injury events continued during intervention, reinforcement and washout phases. Each family was visited once a week during data collection periods and details regarding injuries that had occurred in the previous week were enquired into. Families were also given a notebook each and were told to note down the relevant details which were assessed by the field investigators at their subsequent weekly visit and cross-checked by investigators. Data variables included details about injuries that occurred, time for recovery from the injury, health care facility availed for treatment and expenditure incurred for treatment. Expenditure incurred for treatment for all injury events included doctor's consultation fee, medicines, investigations, operations, bed charges, expenses for travel and expenses for accompanying person. Wage loss was also considered. For calculating cost of treatment in private sector, information was taken about amount actually paid for availing services, while that in government sector included the cost of medicines, investigations and procedures as calculated on the basis of rate contract of Delhi Government Central Procurement Agency for medicines and the amount prescribed for reimbursement for investigations and procedures

under Delhi Government Employees' Health Scheme. In addition, the field investigators during their weekly visits distributed medications for symptomatic treatment under guidance of investigators of this research.

Prior to the intervention, baseline knowledge of participants and practice of families as reported by participants was assessed by interview of adolescents eligible for training, all other adolescents and all women aged 20 years and above of the families. Family practice was assessed as reported by respondents, on two aspects i.e. measures taken for prevention of injuries and treatment seeking behavior in case of occurrence of injuries. Each response was scored and the total knowledge and practice (KAP) score was calculated. Maximum attainable score was 29 for knowledge, 60 for practice and 89 for total KAP score. Higher score implied better knowledge and safer practice.

Statistical analysis: Primary outcome measure was magnitude of injuries, while secondary outcome measures included time taken for recovery from injuries, choice of health facility for treatment of injuries, cost for treatment of injuries, knowledge of participants and practice of families regarding injuries and their prevention. Comparison was made between data of intervention and control groups during pre-intervention phase to establish matching, pre- and post-intervention phases of intervention group to assess changes following intervention, and intervention and control groups during the post-intervention phase to establish that changes occurred mainly due to the intervention. For all comparisons, *t* test for difference between means and *z* test for difference between proportions were used for quantitative and qualitative data, respectively. Chi-square test with Yates correction was done for comparison of health care facility availed. For comparison of mean and median cost, Mann Whitney U test and median test were done, respectively. *P* value of <0.05 was considered significant.

RESULTS

We included 197 and 200 participants each in the 59 and 57 families, respectively of the intervention and control groups. Recruitment of participants is shown in **Fig. 1**. Participants in both the areas were comparable in terms of sociodemographic profile.

Throughout the period of study there was no fatal injury and none of the injured participants required hospital admission. **Table I** shows the incidence of injuries in the two areas. Annual and monthly incidence of injury events were calculated as number of injury events occurring per 100 children per year or month as applicable. Annual incidence of injury events in the total participants was 32.24 per 100 children per year with average monthly incidence of 2.69% (2.62 in intervention group and 2.75 in control group), with no statistically significant difference between the two groups. In the intervention group, the monthly incidence dropped significantly in post-intervention phase. Though monthly incidence had dropped slightly in control area also in the post-intervention phase, it was still significantly higher than that in intervention group.

The mean time taken for recovery from injuries in total study participants, which included the total duration for the

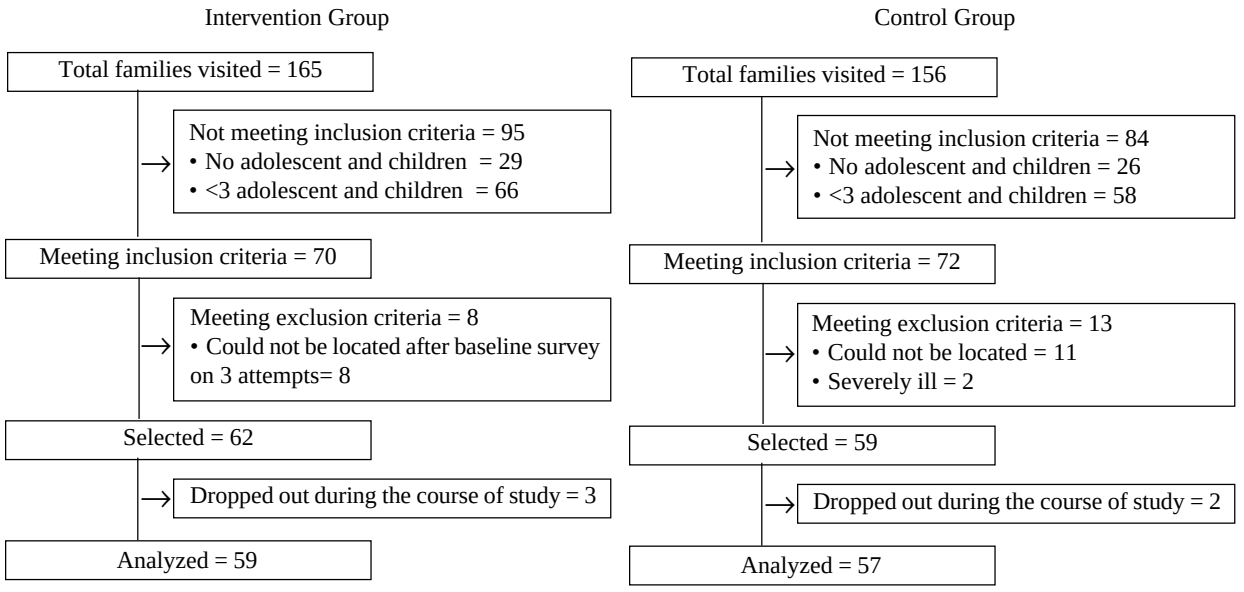

Fig. 1 Flow chart showing recruitment of participants based on eligibility criteria.

Table I Total Injury Events and Monthly Incidence in the Participants in the Intervention and Control Groups

Phase of study	*Intervention group (n=197)*	*Control group (n=200)*	*P value*	*Total (N=397)*
Pre-intervention	25, 3.17 (0.72-5.6)	26, 3.25 (0.79-5.7)	0.86	51, 3.21 (1.48-4.9)
Post-intervention	16, 2.03 (0.06-4.0)	29, 3.62 (1.03-6.2)	<0.001	45, 2.83 (1.2-4.46)
Annual incidents of injuries[a]	62, 31.47 (24.9-37.9)	66, 33.00 (26.5-39.5)	0.74	128, 32.24 (27.6-36.8)

Data expressed as total injury events, monthly incidence (95% CI). P=0.009 for pre- and post-intervention periods in intervention group and P=0.0002 for post-intervention period in intervention and control groups. [a]Includes injuries that occurred from September, 2017 to August, 2018.

wound to heal/ medicines to be stopped/ normal activities to be resumed (as applicable on a case-to-case basis), was similar in the two groups in the pre-intervention phase (*P*=0.58). Both the intervention group [5.7 (2.4) vs 5.9 (2.9); *P*=0.79] and control group [7.8 (19.0) vs 7.0 (4.5); *P*=0.82] did not show any significant differences in their respective pre- and post-intervention time for recovery. Total time for recovery from all injuries had reduced in post-intervention phase in intervention group (143 vs 95 days), while it remained same in control group in both phases (204 days).

Table II shows the choice of health care facility by the families for treatment of injuries. Families had taken treatment from government or private hospital/health center/clinic, registered medical practitioners (RMP), over-the-counter treatment by buying medicines from the pharmacy without consulting a doctor, and home treatment. In the pre-intervention phase, majority of injured participants in both groups (>75%) had taken treatment from unqualified providers, which decreased to 18.1% in the intervention group in post-intervention phase, in contrast to 86.2% participants in the control group (*P*<0.001) (**Table II**).

The total and the median (IQR) cost of treatment for injuries in the intervention group decreased from Rs. 5962.9 to Rs 4949.5, and Rs 90 (102.5) to Rs 19.8 (116.28), respectively (*P*=0.84). The corresponding values in control group were Rs 4734.5 and Rs 7013.4 and Rs. 46.5 (153.75) and Rs. 40 (135.31), respectively. These differences were statistically insignificant. The post-intervention median costs in intervention arm and control arm were comparable.

Table III depicts the KAP scores of all three groups of participants. These scores were similar for all participants during the pre-intervention phase. Mean scores in all aspects had improved considerably during post-intervention phase in all participants in the intervention area. Scores had improved slightly in all groups of control area also. KAP scores in all groups of participants between pre- and post-intervention phases in intervention area and between post-intervention phases in both areas showed statistically significant differences, indicating dissemination of safety messages.

DISCUSSION

This community based non-randomized cluster-controlled trial of parallel design was conducted in rural area of Delhi, to test the effectiveness of child-to-child approach by training the eldest adolescent members of the families for preventing unintentional childhood injuries in themselves and their younger siblings. During post-intervention phase, the intervention group experienced statistically significant reduction in incidence of injuries, improvement in preference for health facilities for seeking treatment, and increase in knowledge and practice regarding injuries, in comparison to its pre-intervention data and data of control group in post-intervention phase. Total time for recovery and cost of treatment for injuries including out-of-pocket expenditure also decreased in intervention group in post-intervention phase, though differences were not statistically significant.

However, the study had some limitations. Firstly, a randomized controlled trial could not be done as study design required consecutive families be included for

Table II Type of Health Facility Attended for Treatment of Injury Events

Type of facility	*Intervention group*		*Control group*	
	Pre-intervention (n=25)	*Post-intervention (n=16)*	*Pre-intervention (n=26)*	*Post-Intervention (n=29)*
Hospital/health centre/clinic	6 (24.0)	13 (81.3)	3 (11.5)	4 (13.8)
RMP/FI/OTC/ home/none	19 (76.0)	3 (18.7)	23 (88.5)	25 (86.2)

Data in no. (%). RMP: registered medical practitioner; OTC: over the counter.

Table III Knowledge and Practice Scores Regarding Injuries in the Study Groups

	Intervention group			*Control group*		
	No.	*Pre-intervention*	*Post-intervention*	*No.*	*Pre-intervention*	*Post-intervention*
Adolescents for training	59			57		
Knowledge		8.8 (1.9)	11.6 (2.6)		9.0 (1.9)	9.0 (1.6)
Practice		39.6 (4.9)	47.5 (4.8)		37.9 (5.7)	41.2 (3.7)
Total score		48.5 (5.3)	59.1 (6.4)		46.9 (6.6)	50.3 (4.2)
Other adolescents	93			81		
Knowledge		7.9 (2.2)	9.8 (2.3)		8.5 (1.7)	8.4 (1.4)
Practice		38.4 (3.9)	47.0 (5.2)		37.5 (4.3)	41.1 (3.8)
Total score		46.4 (4.8)	56.8 (6.5)		46.0 (5.0)	49.5 (4.2)
Adult women	93			86		
Knowledge		8.0 (1.7)	10.5 (2.3)		8.2 (1.6)	8.7 (1.5)
Practice		40.4 (4.7)	48.4 (4.1)		41.4 (4.6)	44.2 (4.1)
Total score		48.5 (5.4)	58.8 (5.3)		49.6 (5.2)	52.9 (4.6)

Scores expressed as mean (SD). Data were compared for knowledge scores, practice scores and total scores for all three groups viz., adolescent for training, other adolescents and adult women. For comparison of pre-intervention data of intervention and control groups, all P>0.05; for pre- and post-intervention data of intervention group, all P<0.001; for post-intervention data of intervention and control groups, all P<0.001.

dissemination of information and blinding also could not be done due to obvious reasons. Secondly, the pre- and post-intervention data collection periods were short due to operational feasibility. Since data regarding injury and treatment details was self-reported, these may have been under-reported although efforts to minimize the same were done by asking participants to record the events in notebooks which were assessed on a weekly basis by the research team. Strengths of the study included a good follow up with an attrition rate of only 4.6%. Frequent visits by field investigators also resulted in a good rapport-building and ensured cooperation from the community. A control group was used that resulted in drawing valid conclusions regarding outcome. The study groups of both areas at the time of recruitment were matching in all characteristics of the study participants and families. Extensive trainings could be given to the adolescents, two of those being formal trainings from professional organizations. Pre- and post-intervention data were collected during the same months of the year to rule out the chance of seasonal variation. Data regarding injuries was collec-ted by weekly house visits and hence recall period being very short ensured good quality of data.

Childhood injury is an area of concern in the entire world, including India. Studies conducted on childhood injuries in India and abroad have reported various levels of magnitude [10-20]. Higher annual incidence observed in the present study was due to weekly active surveillance undertaken that could capture even minor injuries which are usually attended at home and hence remain unreported to the health system. To prevent and control such an alarming problem, various researchers have reported success of implementing intervention measures as part of their research on home injury hazards [21], first aid [5,6], nutrition [7] and health education in general [8]. Intervention in some of these studies was by implementation of child-to-child approach [5-8]. Though two of these studies were on improving knowledge regarding injuries and first aid, there was no study using this approach on injury prevention or cost reduction. Slight decrease in incidence of injuries and increase in KAP score was obser-ved in the control area also, probably due to increased awareness through repeated visits and enquiry regarding injury occurrence.

The present study highlights the need for introduction of safety education in school curriculum to make children aware of injuries, their consequences and methods of prevention. Training on first aid and CPR may be made compulsory in all schools and colleges, with regular mock drills for injury management in educational institutions, occupational institutions and community. Child-to-child program needs to be implemented by training older adolescents in schools, encouraging them to take care of their younger siblings at home and disseminate the messages widely. It can also be implemented by integrating with other community based health programs and delivered through primary health care platforms, which will go a long way in combating the problem of unintentional childhood injuries in the country.

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WHAT IS ALREADY KNOWN?

- Implementation of child-to-child approach is an effective way to improve awareness of school children regarding unintentional childhood injury and first aid.

WHAT THIS STUDY ADDS?

- Child-to-child approach is effective in reducing number of injury events, total time for recovery from injuries, cost for treatment of injuries and out-of-pocket expenses of families, as well as in improving knowledge of participants and practice of families regarding injury prevention and control.

Ethical clearance: Institutional Ethics Committee, Maulana Azad Medical College; No. IEC/MAMC/(56)/2/2017/No 74, dated 17 May, 2017.
Contributors: BB contributed to designing the study, analyzing and interpreting the data, and drafting the manuscript; RB contributed to analyzing data, and drafting the manuscript; GKI contributed to designing the study and revising the manuscript; PM contributed to acquiring and analyzing data; NS contributed to analyzing data and revising the manuscript; SG contributed to analyzing data and revising the manuscript. All authors approved the final manuscript and agreed to be accountable for the work.
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