Group interventions for the prevention of injuries in young children: a systematic review

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Objectives: This systematic review examined group based injury prevention interventions that targeted young children to determine the effectiveness of such strategies in enhancing children’s safety behaviors.

Methods: A comprehensive (manual and electronic) search of the literature was performed using the following study selection criteria: (1) intervention engaged children under the age of 6 years; (2) included a control group; (3) used a group intervention approach; (4) study written in English language; (5) addressed unintentional injuries; and (6) outcomes included injuries, knowledge, or safety behaviors. Data abstraction was performed independently by two researchers using a standardized approach.

Results: Nine studies met the criteria that included safety interventions of road crossing (4), car restraint (2), spinal cord safety (1), poison safety (1), and 911/stranger danger/street crossing (1). The types of interventions included videos, interactive activities, cartoons, stories, puppets, singing, coloring, games, simulation games, demonstrations, modeling/role playing, and rehearsal practice using seat belts, models, and real street crossing. The intensity and duration of interventions varied substantially and only two studies randomly assigned participants. The review revealed a positive effect (knowledge, behaviour, and/or attitude) for five of the studies, three had mixed effect, and one reported no effect.

Conclusions: Although no clear conclusions can be drawn from the limited number of studies of diverse design and rigor, researchers should attempt to minimize shortcomings occurring in community based research. Engaging community partners including teachers and parents who influence relationships and outcomes could provide opportunity for more rigorous, comprehensive, and integrated approach to longitudinal research that could identify key factors of successful strategies.

CHILDREN GROUP INTERVENTIONS AMONG YOUNG CHILDREN

There has continued to be much debate about the effect of injury prevention strategies targeted directly towards children, in particular, preschool age children. Some argue that children in this age group do not possess the cognitive ability and attention to permit the integration of injury prevention messages into their repertoire of skills. However, researchers have long advocated that as much as 90% of injuries could be prevented through coordinated and effective education, engineering, legislation, and enforcement strategies.

GROUP INTERVENTIONS AMONG YOUNG CHILDREN

The decision to include all experimental studies regardless of whether randomized or not was due to the nature of group interventions that most often occur in natural settings where it is often difficult to systematically assign participants randomly. Only studies with control groups were included in an effort to minimize bias. Only published English studies were included due to the limitations of the researcher to access translation services. No studies of intentional injuries (violence, bullying, and abuse) were included as strategies are typically delivered under different circumstances, usually in a healthcare setting where parents are the primary target population (for reviews see DiGuiseppi & Roberts).

METHODS

Inclusion criteria

Studies were included in the systematic review if they met the following criteria: (1) the intervention engaged children under the age of 6 years; (2) included a control group; (3) used a group intervention approach; (4) were written in English; (5) addressed unintentional injuries, and (6) outcome measures included injuries, knowledge, or safety behaviors. The decision to include all experimental studies whether randomized or not was due to the nature of group level interventions that most often occur in natural settings where it is often difficult to systematically assign participants randomly. Only studies with control groups were included in an effort to minimize bias. Only published English studies were included due to the limitations of the researcher to access translation services. No studies of intentional injuries (violence, bullying, and abuse) were included as strategies are often unique to this safety issue and may not be appropriate for unintentional injuries. Knowledge, safety

Abbreviations: CINAHL, Cumulative Index to Nursing and Allied Health Literature.
behaviours, and injury events were included although knowledge and safety behaviors are known to be the outcomes predominantly measured in these types of studies.9

Identification of studies
The search strategy used an electronic search of several databases including The Cochrane Library, CINAHL, Cumulative Index to Nursing and Allied Health Literature, PUBMED, Cambridge Scientific Abstracts, Dissertation Abstracts, and PsycINFO for the years 1980–2002 in an effort to enhance comparability between study designs. Search strategy included terms “child”, “risk taking”, “education”, “evaluation”, “prevention and control”, “safety”, and “injury prevention”. In addition, bibliographies of published studies and reviews were searched for relevant studies that met the inclusion criteria. A review of additional websites included: http://depts.washington.edu/hiprc/childinjury, http://www.safetylit.org, www.the-communityguide.org, and http://www.cdc.gov/ncipc/injweb/websites.htm. Abstracts from all 6th World Conferences on Injury Prevention and Control were also reviewed. Authors of relevant studies and reviews were contacted as well as recognized experts in the field of childhood injury prevention research. After screening titles and abstracts, 307 studies were identified as potentially eligible for inclusion. Potentially appropriate articles were further reviewed to determine if they met the inclusion criteria, yielding nine studies for full review.

Table 1  Study demographics

<table>
<thead>
<tr>
<th>Author (year), country</th>
<th>Study population</th>
<th>Interventions</th>
<th>Outcome measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chang (1995), US12</td>
<td>Preschool age</td>
<td>Car restraint</td>
<td>Pre and post % car restraint behavior</td>
</tr>
<tr>
<td></td>
<td>14 schools</td>
<td>2 week intensive classroom activities</td>
<td>Random knowledge interview (25% experimental group)</td>
</tr>
<tr>
<td></td>
<td>Intervention (402)</td>
<td>Children—film, flannel board, singing</td>
<td>2–3 weeks post intervention</td>
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<tr>
<td></td>
<td>Control (427)</td>
<td>Parents—workshop, home activities, written information</td>
<td></td>
</tr>
<tr>
<td>Renaud (1989), Canada14</td>
<td>5 year olds</td>
<td>Pedestrian skills</td>
<td>1. Attitude—perception of risk</td>
</tr>
<tr>
<td></td>
<td>4 schools</td>
<td>3 hour sessions</td>
<td>2. Behavior—pictures and questions</td>
</tr>
<tr>
<td></td>
<td>Intervention (102)</td>
<td>1. Attitude simulation-role play</td>
<td>3. Behavior observations</td>
</tr>
<tr>
<td></td>
<td>Control (34)</td>
<td>2. Behavior simulation—model training</td>
<td>10 days post intervention</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Attitude-behavior simulation—role play, modeling, training</td>
<td></td>
</tr>
<tr>
<td>Bowman (1987), Australia16</td>
<td>Preschool age</td>
<td>Car restraint</td>
<td>Restraint observation</td>
</tr>
<tr>
<td></td>
<td>30 schools</td>
<td>2 week intervention</td>
<td>1 week post intervention</td>
</tr>
<tr>
<td></td>
<td>Intervention (231)</td>
<td>Education—cartoons, songs, seat belt practice</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control (221)</td>
<td>4 week intervention</td>
<td></td>
</tr>
<tr>
<td>Rothengatter (1984), Netherlands19</td>
<td>Preschool age</td>
<td>Street crossing skills</td>
<td>Traffic knowledge</td>
</tr>
<tr>
<td></td>
<td>All schools in community</td>
<td>4 x 15 minute session</td>
<td>Street crossing behavior</td>
</tr>
<tr>
<td></td>
<td>Intervention (parent trainers) (21)</td>
<td></td>
<td>1 week post intervention</td>
</tr>
<tr>
<td></td>
<td>(Assistant trainers) (28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lurie (2000), US17</td>
<td>5 year olds</td>
<td>Stranger danger, calling 911 (North American emergency number), street crossing</td>
<td>Knowledge test</td>
</tr>
<tr>
<td></td>
<td>10 schools</td>
<td>6 month post intervention</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intervention (90)</td>
<td>One hour session</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control (91)</td>
<td>Lecture, practice, games, songs, coloring</td>
<td></td>
</tr>
<tr>
<td>Richards (1991), US13</td>
<td>Preschool age</td>
<td>Spinal cord injuries</td>
<td>Knowledge test</td>
</tr>
<tr>
<td></td>
<td>3 schools</td>
<td>Several sessions over 3 months</td>
<td>Self reported seat belt use</td>
</tr>
<tr>
<td></td>
<td>Intervention (72)</td>
<td>Rehearsal, practice, interaction, reinforcement</td>
<td>1 week post intervention</td>
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<tr>
<td></td>
<td>Control (36)</td>
<td>30 minute session</td>
<td></td>
</tr>
<tr>
<td>Thomason (1992), UK15</td>
<td>5 year olds</td>
<td>Street crossing</td>
<td>Behavior observation</td>
</tr>
<tr>
<td></td>
<td>Random selection</td>
<td>6 x 30 minutes over 3 weeks</td>
<td>1 week post intervention</td>
</tr>
<tr>
<td></td>
<td>Intervention (20)</td>
<td>Model practice</td>
<td>2 months post intervention</td>
</tr>
<tr>
<td></td>
<td>Control (10)</td>
<td>Road side training</td>
<td></td>
</tr>
<tr>
<td>Liller (1998), US14</td>
<td>5–6 year olds</td>
<td>Poison safety</td>
<td>Knowledge interview</td>
</tr>
<tr>
<td></td>
<td>6 schools</td>
<td>40 minute session</td>
<td>1–2 weeks post intervention</td>
</tr>
<tr>
<td></td>
<td>Intervention (84)</td>
<td>Interactive—songs, puppets, stories</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control (71)</td>
<td>Parents—home activities, written information</td>
<td></td>
</tr>
<tr>
<td>Thomason (1998), UK16</td>
<td>5 year olds</td>
<td>Street crossing</td>
<td>Behavior observation</td>
</tr>
<tr>
<td></td>
<td>3 schools</td>
<td>6 x 30 minute sessions</td>
<td>1 week post intervention</td>
</tr>
<tr>
<td></td>
<td>Intervention (30)</td>
<td>3 weeks</td>
<td>40 days post intervention</td>
</tr>
<tr>
<td></td>
<td>Controls (30)</td>
<td>Road side training</td>
<td>Model practice</td>
</tr>
</tbody>
</table>

Data extraction
Two researchers independently extracted the data after full articles were screened for inclusion. Data detailing study design, participants, and types of injury and interventions were documented (see table 1). Any disagreements were resolved by consensus. Quality assessments were not conducted due to the diverse study designs and the lack of randomized control groups. Descriptive analysis was chosen rather than meta-analysis as the data findings and statistical analysis reported for outcome measures varied considerably, making the combining of results inappropriate. Primary outcome measures were compared for differences between pre and post intervention between the control and intervention groups. Variability in study findings was examined with respect to study design and intervention characteristics.

RESULTS
The areas of safety interventions included four road crossing,15 16 18 19 two car restraint,12 13 one spinal cord safety,13 one poison safety,14 and one combination of 911 (North American emergency number)/stranger danger/street crossing.17 The types of interventions included videos, interactive activities, cartoons, stories, puppets, singing, coloring, games, simulation games, demonstrations, modeling/role playing and rehearsal practice using seat belts, and model and real street crossing. The parent directed activities included workshops, home activities, and written information. In addition to the variety of interventions delivered, the duration of delivery...
Table 2  Study descriptions

<table>
<thead>
<tr>
<th>Author (year), country</th>
<th>Intervention group</th>
<th>Control group</th>
<th>Weaknesses</th>
<th>Strengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chang (1995), US**</td>
<td>Behavior Pre: 21.9% Post: 44.3% p&lt;0.001</td>
<td>Behavior Pre: 22.1% Post: 23.8% p=NS Knowledge not tested</td>
<td>1. <strong>Blind observation not reported</strong> 2. <strong>No randomization</strong> 3. No report intent/dose 4. Random knowledge pre and post—7 days Some children</td>
<td>1. Matched for baseline seat belt use, schools size, education philosophy 2. Minimum essential program activities 3. Control group received intervention post testing</td>
</tr>
<tr>
<td>Renaud (1989), Canada*</td>
<td>Three intervention groups attitude, behavior, attitude/behavior v control Attitude mean difference 1. 0.60* 2. 0.72* 3. 0.52* Behavior mean difference 1. 0.33 2. –0.57 3. 0.94* Observation mean difference 1. 0.83 2. 2.48 3. 2.22</td>
<td>1. Attitude and behavior tested immediately following session 2. <strong>Blind observation not reported</strong> 3. <strong>Post test only</strong></td>
<td>1. Children randomly assigned 2. Trained observer 3. Measure validated 4. Control for gender and school in analysis</td>
<td></td>
</tr>
<tr>
<td>Bowman (1987), Australia**</td>
<td>Pre: 60.6% Post: 75.0% p&lt;0.009</td>
<td>Pre: 59.9% Post: 60.2% p=0.93</td>
<td>1. <strong>Intensity/dose not reported</strong> 2. <strong>Pre/post observation? Some children</strong> 3. <strong>Intervention previously tested</strong></td>
<td>1. Schools randomized 2. Trained observer 3. Interrater reliability 4. Matched for baseline 5. Intervention materials provided</td>
</tr>
<tr>
<td>Luria (2000), US**</td>
<td>Crossing street m = 1.90, p = 0.29 Calling 911 m = 4.15, p = 0.41 Stranger danger m = 1.33, p = 0.57</td>
<td>Crossing street m = 1.40, p = 0.29 Calling 911 m = 3.66, p = 0.41 Stranger danger m = 1.65, p = 0.57</td>
<td>1. Community instructors—training not reported 2. <strong>Blind observation not reported</strong> 3. <strong>Newly developed instrument—not tested</strong></td>
<td>1. Schools randomized 2. Instrument tested 3. Teachers trained</td>
</tr>
<tr>
<td>Richards (1991), US**</td>
<td>Knowledge m = 2.58, p&lt;0.05 Seat belt use 60–75%, NS</td>
<td>Knowledge m = 1.28, p&lt;0.05 Seat belt use 60–75%, NS</td>
<td>1. <strong>Intensity/dose not reported</strong> 2. <strong>Intensity not reported</strong> 3. <strong>Self report by preschoolers</strong></td>
<td>1. Program pilot tested 2. <strong>Instrument tested</strong> 3. Teachers trained</td>
</tr>
<tr>
<td>Thomson (1992), UK**</td>
<td>Demonstration Pre: 14% Post: 37% t = 2.41, p&lt;0.05 Post 2: 37% t = 2.83, p&lt;0.05 Road behavior Pre: 10% Post: 35% t = 2.17, p&lt;0.05 Post 2: 34% t = 2.36, p&lt;0.05</td>
<td>Demonstration Pre: 4% Post: 12% Post 2: 12%</td>
<td>1. Children randomly selected but no report of random assignment</td>
<td>1. Trained interventionist 2. Observation assessment—interrater reliability 3. Randomly selected 4. Control for gender 5. Consistent intervention—dose monitored</td>
</tr>
<tr>
<td>Liller (1998), US**</td>
<td>Knowledge OR 2.2–14.45, p&lt;0.05</td>
<td>Knowledge OR 2.2–14.45, p&lt;0.05</td>
<td>1. <strong>Post test only</strong> 2. School site selected by School Board 2. <strong>No randomization</strong> 3. <strong>Blind observation not reported</strong></td>
<td>1. Teachers prepared 2. Instrument pilot tested 3. No randomization 4. <strong>Blind observation not reported</strong></td>
</tr>
<tr>
<td>Thomson (1998), UK**</td>
<td>Road skill Pre: 15% Post: 43% t = 4.95, p&lt;0.001 Post 2</td>
<td>Road skill Pre: 15% Post: 43%</td>
<td>1. Matched sample for gender, school 2. <strong>-trained parent volunteers</strong> 3. <strong>Intervention previously tested</strong> 4. <strong>Interrater reliability established</strong> 5. <strong>Blind observation reported</strong> 6. Consistency of dose monitored</td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05

varied substantially from a minimum of one 40 minute session to two weeks’ intensive classroom instruction of unspecified session duration.

The participants ranged in age from 3–6 years of age. Eight studies engaged preschool students (3–5 years old) and one study** was conducted with kindergarten children (5–6 years old). All studies had a control group. The majority of school sites were chosen based on the cooperation of the school board/community resource agencies or the school/teacher willingness to follow protocol and the suitability of school environments for intervention. Some study sites were selected for their location, in high risk neighbourhoods or...
in different socioeconomic communities. The number of children participating in each study was broad, ranging from 30 to 829 children. Several studies either matched for gender and socioeconomic status or controlled for these potential confounding factors in the analysis phase. The interventions occurred in classroom groups in all nine studies with teachers delivering the intervention in four studies,12–14 15 19 trained parent/volunteer in three,15 16 20 the researcher in one,15 and unknown in one study.16 Most studies provided interventions to the entire class with only two studies using small groups of five15 and three.16 Table 1 includes descriptions of each study’s population, intervention, and outcome measures.

Four studies reported random selection, two by school12 17 and two by student.15 16 Measurement data were collected by teachers for the most part, and in two studies by the researchers themselves.15 16 Only one study reported blinded observations.16 Outcome measurement occurred anywhere from immediately following the intervention to six months after intervention. Overall, the review revealed a positive effect for five of the studies;12 14–16 19 three had mixed effects13 15 20 and one reported no effect.17 Of those studies demonstrating an effect, differences in behaviour,15 16 18–20 attitude,21 and knowledge11 15 18 20 were reported. No studies measured changes in injuries.

Table 2 includes descriptions of the intervention and control groups and the strengths and weaknesses of each study.

**Potential bias**

Many of the schools were chosen based on convenience and willingness of the school to permit research activities to take place, whereas other schools were chosen for their representativeness of different geographic areas and socioeconomic demography. Although attempts to select schools representative of the population are useful, the convenience sampling was one of practicality and consideration must be given to the potential for bias when convenience samples are used. Cluster randomization is often considered to be the gold standard in these types of studies but can be difficult to achieve and complex to implement in community settings.21 Only two of the studies used cluster randomization.12 17

Although most studies indicated that considerable effort had been made to ensure the individual responsible for the delivery of the intervention was well prepared before initiation of the intervention, some studies were vague about preparation15 and monitoring for consistency of program delivery. In fact, most studies reported that the delivery varied depending on the individual. Despite the reported attempt to establish a minimum expectation, investigators did not report on the comprehensiveness of delivery beyond the minimum nor did they monitor for fidelity of intervention that ranged from one 40 minute session to two weeks of intense learning opportunities. Furthermore, some studies actively engaged parents whereas others did not report on the level of parental involvement. In other respects, the follow up measurement varied considerably from immediately following the intervention to six months after intervention. Clearly the intensity and duration of intervention follow up and preparation of the interventionist may influence the outcome assessment.22 Outcomes were usually measured using observation techniques or knowledge tests based on the intervention content. Most assessments were primarily developed for the child’s repertoire of decision making skills about injury prevention rather than the traditional didactic approach to increasing children’s knowledge of safety behavior.13–16 18–20 A comprehensive approach that integrates such learning approaches into curriculum in the early years may be worthy of further research.

Regardless of the safety topic that was addressed, the majority of studies demonstrated some positive effects. This suggests that potential exists to positively influence the development of safety behaviors among young children using group interventions. The challenge remains as to whether these behaviors are transferable and can be incorporated into a child’s repertoire of decision making skills about injury risks. This could create the potential to influence the rate of injuries.

Future research needs to standardize intervention strategies in a variety of situations to better assess the ability of such interventions to impact on children’s safety behaviors and ultimately on the risk of injury. Although the challenges are numerous and often discouraging in community settings, it remains important to establish scientific rigor through the random allocation of children or groups of children to treatment and control groups. Studies that incorporate established data collection tools, blind observation, and long
term follow up would be useful to further our understanding. It would be valuable to explore whether outcome assessments are responsive to dose intensity, duration, or parental participation. If such strategies can be proved to be effective, it may be possible through early intervention to influence the development of more effective risk taking strategies for young children. Developing partnerships between researchers and education and community agencies could provide for future collaborative opportunities and help researchers to conduct more rigorous, long term studies.

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REFERENCES

Key points
• Group intervention programs have positive and mixed effects.
• More rigorous methodology is required.
• A collaborative researcher and community partner team approach is needed.

US child restraint use in 2004
Infants and toddlers in America continue to be restrained at high use levels when riding in motor vehicles, while use among children aged 4–7 has declined. This result is from the National Occupant Protection Use Survey (NOPUS), which provides the only probability based observed data on child restraint use in the US. The NOPUS is conducted by the National Center for Statistics and Analysis in the National Highway Traffic Safety Administration (NHTSA). Specifically, 98% of infants and 93% of children aged 1–3 observed in passenger vehicles stopped at a stop sign or stoplight in 2004 were restrained in some type of restraint, whether a rear or front facing safety seat, a booster seat, or a safety belt. In contrast, only 73% of children ages 4–7 were restrained, down from 83% two years ago. Drivers who restrain themselves continue to be more likely to restrain their child passengers. In 2004, 86% of 0–7 year old children driven by belted drivers were restrained, compared with 50% of children with unbelted drivers. This suggests that getting adults to buckle up may also result in more restrained children. For detailed analyses of the data in this publication, as well as additional data and information on the survey design and analysis procedures, see Child restraint use in 2004 – analysis, available at http://tinyurl.com/g8xm.