Simulation and education paper

Primary school children are able to perform basic life-saving first aid measures

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1. Introduction

First aid given by lay persons is a crucial factor in saving lives. Eisenburger and Safar have recommended that life-supporting first aid (LSFA) should be part of basic health education1 and that “all fit persons above the age of 10” should learn LSFA-skills including basic life support (BLS) and cardiopulmonary resuscitation (CPR). They have suggested a simplified content of what to teach including 6 items and the most important first aid measures as 4 simple actions: tilt, blow, pump and compress. A clear relationship has been shown between the level of first aid training and the quality of first aid measures provided.2 A young child can be the first person at the scene of an accident or medical emergency. If no adult person is around, children have to be able to call for help and to give first aid. It has been recommended to start teaching first aid in primary school.3 It has also been suggested that children aged 6–7-year-old can save cardiac arrest victims.4 A calendar with first aid themes has been used to enhance first aid teaching by school teachers for pupils in first grade.5 After using the calendar 17% could check responsiveness, 64% established a recovery position, 31% opened the airways and 74% were able to call for help.

Aim of the study was to evaluate the effect of a first aid course for 6–7-year-old school children given by first aid instructors of the Norwegian Red Cross on the children's performance in a simulated first aid scenario.

2. Materials and methods

Our hypothesis (H0) is that there is no difference in performance of 6–7-year-old children in a first aid scenario who underwent a first aid teaching program versus children without previous first aid training. Statistical comparison based on a difference in correct performance of 30% and 69 children in every group was estimated to have 90% power with a significance level of 1%. Because of an expected high number of drop-outs during the study period more than 200 children were included in the study. The main reason for this was that children who had not attended all 5 lessons were
excluded from the study group. Another reason was the intention of retesting children from the study group. Participants were randomised into two groups. The children were attending 9 different schools and each school was randomised either to the study group or the control group. The randomization of whole schools was done to ensure that no knowledge transfer occurred between the study group and the control group. The study group received a first aid teaching program consisting of 5 lessons (45 min each). A first aid instructor using a glove puppet to ease the contact to the children performed one lesson once a week. This teaching program is adapted to the needs and abilities of 6–7-year-old children to introduce elementary knowledge of first aid. The curriculum of the teaching program included basic first aid knowledge:

1. lesson: the body and its functions, assessment of consciousness and breathing;
2. lesson: wound treatment, bleeding;
3. lesson: unconsciousness, open airway and recovery position;
4. lesson: behaviour in emergency situations; emergency call;
5. lesson: first aid scenarios;

Chest compressions and defibrillation were not part of the course. The control group did not receive teaching or training in first aid. Children from both groups were tested in a first aid scenario. The scenario was the same for all participating children. In the scenario the children had to manage a child involved in a bicycle accident. The instructor told the child “A friend of yours has fallen from the bicycle and hurt his head. He is lying still on the ground and does not move. What are you going to do?” Questions from the children were not answered and no other help was given in order to accomplish the first aid measures. The children had to decide and to act on their own. A child, who had not been taking part in the course, played an unconscious victim. The “victims” where not told whether the children had been course participants or not.

The following items of the children’s performance in a first aid scenario were registered as tasks accomplished or not:

1. correct assessment of consciousness
   • the child had to talk to the victim and to try to wake him up;
2. correct assessment of breathing
   • the child had to look, listen and feel the breath;
3. knowledge of the correct emergency telephone number
   • the child had to tell the correct emergency telephone number (which is 113 in Norway);
4. giving correct information for the emergency call
   • the child had to tell the dispatcher what happened and the correct location of the accident;
5. performance of correct recovery position
   • the child had to place the victim in the correct recovery position;
6. correct airway management with open airway
   • the child had to tilt the head backwards.

Children from the study group were tested after course participation and retested after 6 months. The difference in performance between study and control group were tested by using Fisher’s exact test in SPSS 15.0. The project has been reported to the regional scientific ethics committee for medical research for South Norway located in Oslo. The participating children, their parents and teachers did get written and oral information before the start of the study. They were informed about the right to quit at any time without consequences for them. Written informed consent was given by the children’s parents before entering the study.

### Table 1

<table>
<thead>
<tr>
<th>Task no.</th>
<th>No course (% success rate)</th>
<th>Course participant (% success rate)</th>
<th>Course participant after 6 months (% success rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Correct assessment of consciousness</td>
<td>7</td>
<td>49***</td>
<td>12</td>
</tr>
<tr>
<td>2. Correct assessment of breathing</td>
<td>3</td>
<td>79***</td>
<td>37***</td>
</tr>
<tr>
<td>3. Knowledge of the correct emergency telephone number</td>
<td>16</td>
<td>77***</td>
<td>46***</td>
</tr>
<tr>
<td>4. Giving correct information for the emergency call</td>
<td>6</td>
<td>50***</td>
<td>69***</td>
</tr>
<tr>
<td>5. Performance of correct recovery position</td>
<td>1</td>
<td>87***</td>
<td>56***</td>
</tr>
<tr>
<td>6. Correct airway management with open airway</td>
<td>1</td>
<td>68***</td>
<td>24***</td>
</tr>
</tbody>
</table>

*** p < 0.001 success rate compared to no course.

### 3. Results

228 children were included in the study, 102 girls and 126 boys. One participant was 5 years (control group), 150 were 6 and 77 were 7 years old at the time the test was performed. 117 children got basic first aid training and 111 were in the control group. Results for the test are shown in Table 1 and Figs. 1 and 2. All the 6 items tested showed large and statistically significant differences between children who had participated in the course compared to those without training: correct assessment of consciousness ($p < 0.001$), correct assessment of breathing ($p < 0.001$), knowledge of the correct emergency telephone number ($p < 0.001$), giving correct emergency call information ($p < 0.001$), knowledge of correct recovery position ($p < 0.001$), correct airway management ($p < 0.001$). After 6 months 125 course participants were retested using the same first aid scenario as described before. A slightly different number of course participants tested shortly after the course (117) and 6 months later (125) was due to absence from school when testing was performed. At the 6-month retest there were still large and significant differences between children who had participated in the course compared to those without training in 5 of the 6 items. The only exception was correct assessment of consciousness (Table 1).

![Fig. 1. Number of correct fulfilled first aid measures—children from the control group without first aid course.](image-url)
and open airway in practical tests. Our results are different (see tasks for the measures check responsiveness, recovery position. Pupils in first grade without first aid training had 0% correct gestures that some children pick up first aid knowledge from other individuals as control groups has been used in other studies.5,6 The result of the study group which was tested shortly after the course in our study is far better on assessment of consciousness (49%), establishing adequate recovery position (87%) and securing open airways (68%). The study group was also marginally better on knowing the correct emergency telephone number (77%). The results suggest that the interactive method of teaching through a first aid instructor using a glove puppet was successful and better than the method described by Zakariassen et al.5 If first aid teaching should be given by teachers without certified first aid instructor education or by certified instructors is unclear. It would have been interesting to investigate the effect of both approaches on the children’s motivation to help in a real emergency situation. Nevertheless, all studies on primary school children and first aid show that they can learn to provide life-saving first aid and that it is highly recommended to integrate first aid in the school curriculum starting as early as first grade. In order to exclude influences from parents, television, media or other sources where children eventually can have learned or picked up first aid knowledge the present study used children who did not participate in the course as a control group. A similar approach with untrained individuals as control groups has been used in other studies.5,6 Pupils in first grade without first aid training had 0% correct tasks for the measures check responsiveness, recovery position and open airway in practical tests.5 Our results are different (see Table 1) and show a success rate of 7% for correct assessment of responsiveness, 1% for correct recovery position and 1% for correct airway management with open airway for children from the control group without first aid training. These results suggest that some children pick up first aid knowledge from other sources.

Skill retention of basic life support skills as to assess responsiveness, call 911 and overall performance of CPR declines significantly within 2 months after traditional AHA Heartsaver class as well as video self-training.5 For adults the recommended interval for refresher training for automated external defibrillation and CPR should not exceed 7 months.7 Contrary to this Riegel et al. found that core skills of CPR and AED were retained 17 months after initial training.8 No deterioration of CPR skills could be seen when retested after 12 months when using computer-based voice advisory feedback on manikins.9 In our study skill retention tested 6 months after the course was significantly better for five out of six tested tasks compared to children with no course (see Table 1). The only not significantly different item was correct assessment of consciousness, which was 7% for the control group versus 49% for the study group tested after finishing the course and 12% for the retest group after 6 months. One reason for this might be that children in a test situation possibly forget to do things which they perceive as “normal” such as talking to an unconscious victim and to try to wake him up. Another explanation could be the strict order for the instructors who tested the participating children that correct assessment of consciousness just should be approved when the child had both talked to the victim and tried to wake him up by touching. An ongoing follow-up study of our study group will help to investigate long-term skill retention after one and hopefully several years after course participation.

Several authors have recommended that first aid training should start early in life and that primary school children can learn to provide first aid.3–5,10,11 Lubrano et al.10 have shown that the first aid knowledge after practical training for 8–11-year-old primary school children tested by a multiple-choice test was significantly higher compared to children with theoretical training only. They concluded that first aid training should be integrated into the core curriculum of primary schools. A CPR teaching program for 10–12-year-old children has lead to a significant increase of knowledge tested with a questionnaire. First- and second-year pupils in Austria showed the ability to use a semi-automatic defibrillator after 1 week of training in LSFA by medical students and emergency physicians.4 Testing was done by placing illustrations in a correct sequence and video analysis of the children’s performance during the week. Unfortunately the quality of CPR was not investigated in the above-mentioned studies on primary school children. Although 9–12-year-old children can learn and provide the correct rate and correct hand position of chest compressions, they cannot perform chest compressions as well as adults.12 Our course included some skills of CPR (assessment of consciousness, calling for help, opening the airway, recovery position) whereas chest compressions were not included in our curriculum. A reason for this was the assumption that it is paramount to motivate children to give first aid rather than to teach them chest compressions taking into account the fact that Norway is partly a rural country without good access to public defibrillation and the long response time of the emergency medical service despite in the major cities. CPR or clearing the airway by bystanders is not frequently required whereas the most often used first aid measures are application of a dressing and positioning of the patient.2 Therefore it seems appropriate to start with basic first aid measures for 6–7-year-old primary school children and to introduce CPR/chest compressions at a later age. The age of 10 has been recommended for introducing CPR by Eisenburger and Safar.1 Repetition of first aid knowledge and extension of the curriculum throughout the school years could probably lead to an improvement of the motivation to provide first aid and to a better performance in a real emergency situation. Teaching first aid should include both knowledge transfer and motivation to give first aid.3 Starting in primary school could lead to the recognition of first aid as a “normal thing to do”, not as extraordinary.3 Our suggestion for a four step model of first aid education throughout life is shown in...
siveness and breathing, call for help and give correct information to the emergency medical service and establish recovery position to an unconscious patient. A training course with 5 lessons (45 min each) once a week leads to significant better results for trained children in comparison with a control group of children without training. Knowledge and skill retention after 6 months is good. Further research is needed to investigate skill retention after more than 6 months. All primary school children should receive first aid training starting in first grade.

Conflict of interest

The Red Cross provides training in first aid.

Acknowledgements

The authors want to thank the instructors from the Red Cross in Telemark who volunteered to participate in the study and who showed great commitment to teaching first aid to the public. We also would like to thank all children, their parents and teachers for participation in the study and their support.

References


Fig. 3. Four step model of first aid education.

In conclusion the present study demonstrates that 6–7-year-old first graders can give basic first aid measures as checking respon-