Simulation and education

Knowledge and willingness to teach cardiopulmonary resuscitation: A survey amongst 4273 teachers∗

Nicolas Mpotosa,∗, Eva Vekemanb, Koenraad Monsieurg,hd, Anselm Derese, Martin Valkeb

a Emergency Department, Ghent University Hospital, De Pintelaan 185, B-9000 Ghent, Belgium
b Department of Educational Studies, Ghent University, H. Dunantlaan 2, B-9000 Ghent, Belgium
c Emergency Department, Antwerp University Hospital, Wilrijkstraat 10, B-2650 Edegem, Belgium
d Faculty of Medicine and Health Sciences, University of Antwerp, Universiteitsplein 1, B-2610 Wilrijk, Belgium
e Faculty of Medicine and Health Sciences, Ghent University, De Pintelaan 185, B-9000 Ghent, Belgium

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A B S T R A C T

Introduction: Schoolteachers are expected to play a role in teaching cardiopulmonary resuscitation (CPR) to schoolchildren, but little is known about their attitudes, actual knowledge and willingness to do so. We conducted a survey about CPR knowledge, preparedness to perform and teach CPR as well as attitude towards an alternative self-learning strategy amongst Flemish teachers.

Methods: A questionnaire was developed consisting of four distinct parts: (1) Demographics; (2) CPR knowledge and skills level; (3) Attitude towards training and (4) Resuscitation experience. Content experts screened the questionnaire in view of content validity. One hundred and seventy-one students in Educational Sciences were each asked to interview 25 different teachers.

Results: A total of 4273 teachers participated in the study (primary school n = 856; secondary school n = 2562; higher education n = 855). Of all respondents, 59% (2539/4273) had received previous CPR training with the highest proportion observed in primary schoolteachers (69%) and in the age group 21–30 years (68%). Mandatory CPR training at school was supported by 41% (1751/4273) of the teachers and only 36% was aware that CPR is now formally included in the secondary education curriculum. Sixty-one percent (2621/4273) did not feel capable and was not willing to teach CPR, mainly because of a perceived lack of knowledge in 50% (2151/2621). In addition 69% (2927/4273) felt incompetent to perform correct CPR and 73% (3137/4273) wished more training. Feeling incompetent and not willing to teach was related to the absence of previous training. Primary schoolteachers and the age group 21–30 years were most willing to teach CPR.

Conclusions: Although many teachers mentioned previous CPR training, only a minority of mostly young and primary schoolteachers felt competent in CPR and was willing to teach it to their students.

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1. Introduction

Bystander cardiopulmonary resuscitation (CPR) can double or triple survival rates after cardiac arrest.1,2 Lack of CPR knowledge, however, is one of the main reasons contributing to the fact that the actual bystander rate is fewer than 50%, usually only 30% and at times <10%.3–7 Schoolteachers take a special position in the general public. First, they play a critical role in educating future citizens. Second, they are relatively more often involved in larger social settings and may be more likely to witness a cardiac arrest. Schoolchildren may not be in the latter position, but they have a role as future citizens capable of performing CPR.8,9 Teaching CPR to schoolchildren is recommended by the European Resuscitation Council (ERC)10 and several studies have already shown this approach to be feasible.5,9,11–20 The latter stresses the importance of all teachers being trained in CPR. In Flanders, a province of Belgium, CPR is included in the secondary school curriculum as a formal general attainment goal since September 2010. Schoolteachers could therefore play an important role in training the children.17,18 However, finding time in a busy curriculum, funding the necessary equipment, as well as scheduling the teachers/training are often considerable barriers.16 There are only few studies reporting the effectiveness of teachers instructing CPR and there is no general agreement on the CPR training teachers require.9 Moreover, in the Flemish educational context, no solid information is available as to schoolteachers and CPR.
We conducted a survey about CPR knowledge, preparedness to perform and teach CPR as well as attitude towards an alternative self-learning strategy amongst Flemish teachers.

2. Methods

One hundred seventy-one students in Educational Sciences (Ghent University, Flanders, Belgium) carried out a survey about CPR-AED (automated external defibrillation) knowledge in schoolteachers. These students received CPR training in the previous semester and were introduced in a systematic way to the study and protocol to be followed.

The purpose of the study was explained to school principals and teachers through an explanatory letter. All participants were asked to sign an informed consent and were assured that participation was anonymous, voluntary and that they were free to withdraw at any time. Data were collected between March and June 2012. Approval of the ethics committee was not required.

A balanced sampling approach was adopted to select schools and teachers to be involved in the study. As a primary sampling unit, schools were randomly selected from the number of primary schools \( n = 2321 \), secondary schools \( n = 964 \) and higher education institutes \( n = 29 \) in Flanders. The sample design aimed at recruiting 20% primary schoolteachers, 60% secondary schoolteachers and 20% higher education teachers in the research sample. The oversampling of secondary schoolteachers is based on the fact that since September 2010, in contrast to primary and higher education, the secondary education curriculum in Flanders explicitly includes CPR training as one of the final attainment goals. Since teaching CPR skills is feasible starting at age 10, only primary schoolteachers from the last educational cycle (3th and 6th year; age 10–12) were involved.21 Secondary schools compost three educational cycles of two years each (first, second and third grade) and higher education was considered as one educational cycle. This resulted in a sampling framework consisting of five educational cycles of which each student had to contact five teachers, resulting in a total of 25 teachers per student.

The questionnaire consisted of four distinct parts.

(1) Demographics: three questions (educational cycle, sex, age); (2) CPR knowledge level: three questions about previous training and 12 theoretical or skills questions which surveyed familiarity with the current CPR-AED guidelines (these question included issues regarding survival, recognition of cardiac arrest, activation of the emergency medical services, hand placement on a life-size torso picture, compression-ventilation ratio, compression depth and rate, AED); (3) Attitude towards CPR training: 8 questions investigating the reasons for schoolteachers’ to attend CPR courses, willingness to teach CPR and attitude towards alternative training strategies; (4) Resuscitation experience: three questions about the respondents’ former experience in helping a cardiac arrest patient. The 12 knowledge questions, included in the questionnaire, were derived from the 2010 guidelines on adult BLS/AED and a number of questions were developed in analogy with the ‘ABC for life’ questionnaire published by Toner et al.20 Moreover, content experts checked the accuracy, potential item ambiguity and completeness of an initial version of the questionnaire, which helped to guarantee the content validity of the research instrument. The administration of the questionnaire was carried out following a detailed protocol, determining the order and pacing of the questions/tasks, the wording of the questions/tasks and the coding of the individual answers. This guaranteed the controlled and systematic execution of the study. During the entire research period an online help-provision was made available to the interviewees in case of problems.

The completed research instruments were transferred to SPSS (version 19, SPSS Inc., Chicago, USA) in view of data analysis. To measure the teachers’ actual CPR knowledge and skills level, a scoring system was created. One point was given for each correct answer to the 8 knowledge questions and to the four basic CPR skills performed on the torso (with no negative marking) allowing the calculation of a mean score. We considered the difference to be statistically significant when the \( P \)-value was \( <0.05 \). Chi Square test and the contingency coefficient test were used to determine relationships between responses to knowledge questions and the respondents’ demographic information.

3. Results

A total of 4320 questionnaires were returned. After screening 47 were judged incomplete, resulting in 4273 questionnaires to be included in the analysis. The participants constituted 28% of all schoolteachers in Flanders.22 The cluster with demographic characteristics of the respondents is shown in Table 1. The three other clusters of items in the questionnaire focused on CPR related topics: (1) training status and attitudes towards CPR training, (2) CPR knowledge and skills assessment and (3) willingness to teach CPR. All questions and full results are provided as Appendix A.

3.1. Training status and attitude towards training

CPR is to be considered a critical skill of citizens in general and of every single teacher in particular. The latter is especially the case in secondary education schoolteachers, since CPR is one of the general attainment goals to be pursued at this educational level. Of all respondents, 59% received previous CPR training (Table 1).

Significant differences were observed between the different educational cycles \( (\chi^2 = 45.61; P < 0.01) \), with the highest proportion of previous training in primary schoolteachers (69%) and the lowest proportion in second grade secondary schoolteachers (56%) (Fig. 1).

Furthermore there was a significant age difference in teachers having received previous CPR training \( (\chi^2 = 82.71; P < 0.01) \), with the highest proportion (68%) in the age group 21–30 years and the lowest proportion (44%) in the age group 60 years or older. A consistent decline in the proportion of teachers mentioning previous CPR training was observed with increasing age (Fig. 1).

Almost all formerly trained respondents (75%), finished this training more than two years ago and more than half of them (58%) attended CPR courses through the Red Cross, first aid at work or other course providers. Importantly, a majority of teachers (73%) stated they would like to receive more CPR training (Table 2). Their predominant motivation to get additional training was to prevent avoidable death (67%). Reasons for not having followed training

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Demographic characteristics of the respondents.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>n/N(%)</td>
</tr>
<tr>
<td>Female</td>
<td>2534/4273 (59%)</td>
</tr>
<tr>
<td>Male</td>
<td>1739/4273 (41%)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>&lt;20 y</td>
<td>27/4273 (1%)</td>
</tr>
<tr>
<td>21–30 y</td>
<td>1153/4273 (27%)</td>
</tr>
<tr>
<td>31–40 y</td>
<td>1201/4273 (28%)</td>
</tr>
<tr>
<td>41–50 y</td>
<td>1140/4273 (27%)</td>
</tr>
<tr>
<td>51–60 y</td>
<td>704/4273 (17%)</td>
</tr>
<tr>
<td>≥61 y</td>
<td>48/4273 (1%)</td>
</tr>
<tr>
<td>Education cycles</td>
<td></td>
</tr>
<tr>
<td>Primary education</td>
<td>856/4273 (20%)</td>
</tr>
<tr>
<td>Secondary education</td>
<td>2562/4273 (60%)</td>
</tr>
<tr>
<td>1st grade</td>
<td>845/4273 (20%)</td>
</tr>
<tr>
<td>2nd grade</td>
<td>861/4273 (20%)</td>
</tr>
<tr>
<td>3rd grade</td>
<td>856/4273 (20%)</td>
</tr>
<tr>
<td>Higher education</td>
<td>855/4273 (20%)</td>
</tr>
<tr>
<td>Previous CPR training</td>
<td>2539/4273 (59%)</td>
</tr>
</tbody>
</table>
previously were: ‘lack of time’ (37%), ‘limited interest’ (17%), do not know where to follow training’ (13%) and ‘costs’ (1%) (Table 2). While the vast majority (84%) supported compulsory CPR training at school, at work or linked to driving licence courses, only 41% stated that it should be at school and only 36% was aware of the fact that CPR is explicitly incorporated in the secondary education curriculum in Flanders since 2010 (Table 2).

3.2. CPR knowledge and skills assessment

A minority of teachers (34%) felt they were capable to provide CPR in a cardiac arrest situation. Significant differences between teachers were observed: 47% of the teachers with previous CPR training felt capable to provide CPR compared to 8% in the group without previous training ($\chi^2 = 724.05; P < 0.01$) (Fig. 2).

Concerning the use of an AED only 48% of the teachers answered they would use it in a cardiac arrest situation. No differences were observed in relation to previous training. Besides fear of injuring someone (19%) and having no reason (4%), the most frequent reason for not willing to use the AED was lack of knowledge (77%).

The percentage of correct answers to the knowledge questions and for skills demonstration are provided in Table 3. Previous CPR training had a significant effect on knowledge ($P < 0.005$) and skills ($P < 0.005$). Teachers with previous training performed better on the knowledge and skills assessment, with no differences between teachers of different educational cycles. Significant differences, however, were observed for knowledge between the different age groups ($P < 0.005$) and skills level ($P < 0.005$). Teachers between 21 and 30 years old differed significantly from teachers between 30 and 40 years old, 41–50 years old and 51–61 years old.

3.3. Willingness to teach CPR

Sixty-one percent of the teachers answered that they did not feel capable and that they were not willing to teach CPR. As the main reason for this, lack of knowledge was mentioned in 50% (Fig. 3). In the group willing to teach CPR at school the majority was younger than or 21 years old (48%), a primary school teacher (45%), had followed previous CPR training (49%) and perceived themselves as

![Fig. 1. Proportion of teachers with previous CPR training for each education cycle and age group.](image1)

![Fig. 2. Influence of training status on self-esteemed capability to provide CPR.](image2)
Table 3  
Percentages of correct answers to the knowledge questions and for the skills demonstration.

<table>
<thead>
<tr>
<th>Knowledge questions</th>
<th>Correct answer, n/N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival rate after bystander CPR</td>
<td>1927/4273 (45%)</td>
</tr>
<tr>
<td>Knowledge of emergency phone number</td>
<td>2819/4273 (66%)</td>
</tr>
<tr>
<td>Check for responsiveness, airway management and assessment of breathing</td>
<td>3351/4273 (78%)</td>
</tr>
<tr>
<td>Calling emergency services</td>
<td>3702/4273 (87%)</td>
</tr>
<tr>
<td>Correct ratio chest compression–rescue breathing</td>
<td>14/27 (52%)</td>
</tr>
<tr>
<td>Correct chest compression depth and rate</td>
<td>1420/4273 (33%)</td>
</tr>
<tr>
<td>Purpose of using AED in cardiac arrest patients</td>
<td>3494/4273 (82%)</td>
</tr>
<tr>
<td>Would use an AED in cardiac arrest patients</td>
<td>2054/4273 (48%)</td>
</tr>
<tr>
<td>Skills demonstration</td>
<td></td>
</tr>
<tr>
<td>Kneeling next to the torso</td>
<td>3695/4273 (87%)</td>
</tr>
<tr>
<td>Correct hand placement</td>
<td>3697/4273 (87%)</td>
</tr>
<tr>
<td>Correct chest compression rate</td>
<td>1450/4273 (34%)</td>
</tr>
</tbody>
</table>

capable to act in a cardiac arrest situation (64%). The use of a computerised self-learning station as an alternative to instructor-led training was supported by 76% of all teachers.

4. Discussion

CPR training is recommended as part of the secondary school curriculum by the European Resuscitation Council. Norway was the first country that implemented CPR as a mandatory part of the school curriculum since 1961. Later on, many other European countries have developed school CPR training programmes. In Flanders, Belgium, CPR became part of the secondary school curriculum since September 2010. Surprisingly only 36% of the teachers were aware of this. Since teachers are accustomed to adhere to local and national guidelines, to monitor performance and to carry out standard assessments, they are best placed to teach CPR to their students. Therefore they should at least be aware of a curriculum’s content. Two studies published in 2007 reported the effectiveness of instructors instructing CPR to schoolchildren, however, there is no general agreement on the training in CPR teachers would require.

A recent German study from Bohn and colleagues reported a group of students (10–13 years old) being trained by two different types of instructors (school teachers and emergency physicians) and found no differences between both groups. The latter teachers had previously attended a 12-h first aid course as part of their teachers’ studies and received a 1-h CPR theoretical and practical update before the trial. In our survey the majority of teachers (61%) felt not capable to teach CPR at school with as the main reason a perceived lack of knowledge. A recent study by Patsaki and colleagues reported that the number of incorrect answers to knowledge questions was directly related to the absence of a previous course and also correlated with teachers’ increasing age, which may be attributed to the fact that teachers received inadequate CPR training or failed to update previously acquired knowledge. This is similar to our findings except that in their study the percentage of previous training was much lower (21%) than in our study (59%). Attending a CPR course in the past has a positive effect on knowledge and also increased self-confidence, which may comport an important motivational factor to teach CPR to others.

Kanstad and colleagues found that secondary school students are an important target to increase survival from cardiac arrest. In our study, the teachers most willing to teach CPR were those from primary schools. Several trials report the feasibility of starting CPR training at primary school age and in particular Toner and colleagues concluded that primary schoolteachers, previously trained by medical students, can effectively teach the principles of CPR to 10–12-year-old schoolchildren. Eventually, training schoolchildren should result in a high proportion of the population with useful CPR skills.

Since most teachers were in favour of training via a self-learning station, this type of learning might assist teachers in achieving this target. A self-learning station could be considered stand-alone or as a part of a blended learning programme in combination with an instructor-led course. In our survey the number of schoolteachers interested in teaching CPR (39%) may not seem very large but might be sufficient, considering the option of the teacher being a facilitator for self-learning or blended learning. Only minimal changes in the curriculum would then be required to implement CPR training. Once students have been instructed in CPR at school, they will not continue to perform adequately without retraining at regular intervals, and is doubtful whether a large proportion would do so voluntarily. After the implementation of a single CPR course, curriculum planners should be convinced of the benefits of regular revision, at least once in each school year.

The feasibility of automated CPR skills assessment was reported previously by our group and could be used for a yearly skills assessment. Charlier and colleagues reported the usefulness of game-based assessment of CPR skills, and combining this principle with self-learning could lead to the development of a self-learning CPR game for school children. The approach of training schoolchildren through self-learning or blended learning and the development of “CPR gaming” is an interesting venue for future research.

Our study has several limitations. The study did not take into account which kind of teacher was surveyed (e.g. physical education versus a language teacher). CPR could have been the responsibility of one specialised teacher, being responsible for setting up all CPR classes in the school; though our respondents never explicitly mentioned this. Self-reported data may also produce bias and, although anonymity was guaranteed, some respondents may have given socially desirable responses. In addition previous knowledge of CPR may also have biased some of the answers.

5. Conclusions

Although a majority of teachers received previous CPR training, awareness of CPR as a mandatory part of the secondary school’s curriculum was poor. Only a minority, mostly primary schoolteachers, felt competent in CPR and was willing to teach it to their students. Most teachers were in favour of a self-learning station as an alternative to instructor-led courses. These findings should urge policy
makers to reconsider the competency level of teachers and think about a regular (re)training of critical knowledge and skills of teachers in this curriculum area.

**Conflicts of interest statement**

The authors have received a grant from the Laerdal Foundation. Laerdal has taken no part in neither designing the study, analysing data nor writing of the manuscript.

The authors developed a training strategy to acquire and retrain CPR skills in a self-learning station.

**Acknowledgements**

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**Appendix A. Supplementary data**

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.resuscitation.2013.01.023.

**References**