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First aid knowledge retention in school children: A review of the literature

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Review

First aid knowledge retention in school children:

A review of the literature

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Abstract

Introduction

First aid training for lay people is recognised as an important capacity building component of pre-hospital care in communities. In countries such as Australia, this training is increasingly targeted to school children, but relatively little attention is directed to knowledge retention or optimal training methods for this population. This literature review aimed to determine whether the published literature demonstrates that first aid knowledge is retained by school children who have learnt first aid from professional first aid providers.

Methods

A search of the peer-reviewed and grey literature was conducted for narrative review. Journal articles were retrieved from three databases (MEDLINE, CINAHL, ERIC) using the search terms 'first aid'; 'resuscitation'; 'training'; 'child*'; and 'school'. Inclusion and exclusion criteria were applied and review findings organised thematically.

Results

The search yielded four primary studies of European school children aged 4–12 years trained by professional first aid providers. Subsequent review identified emergent themes of resuscitative first aid and non-resuscitative first aid. Heterogeneity was apparent in training and evaluation methods, and study quality varied. Reported first aid knowledge retention was mixed.

Conclusion

There is a lack of quality evidence to guide optimal training methods and maximise first aid knowledge retention in school children. To date, research in this area has been limited to Europe. Further research is therefore recommended. Formal evaluation of professional first aid training can help guide training methods and maximise first aid knowledge retention in school children, thereby building more robust first aid capacity in the community.

Keywords:

first aid training; knowledge retention; school children

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Introduction

First aid is the 'immediate help provided to a sick or injured person until professional help arrives' (1). It has long been recognised that young children can, and do, play an important role in the provision of first aid; but consideration must be given to how and when they are trained.

First aid training has been a mandatory part of the school curriculum in countries such as Norway since the early 1960s (2). Since then, there has been widespread calls for other countries to adopt similar policies, however, uptake is far from universal (3), despite feasibility studies to support it (4). Eisenburger and Safar (5) argue that school children learn quickly and are easy to motivate, citing research that suggests school children are able to learn life saving first aid (including cardiopulmonary resuscitation [CPR] – basic life support) as readily as adults. Indeed, research has, to varying degrees, supported the efficacy of first aid training for school children when provided by physicians and medical students (4); nursing students (6); and trained school teachers (7-9). While systematic reviews have investigated the literature on first aid training for children in general (10,11), the specific contribution of professional first aid training providers to school children's learning of first aid appears an under-researched area. This is despite an increasing trend where first aid training is mostly provided to school children by professional trainers. For example, Red Cross and St John Ambulance Australia increasingly provide first aid training to Australian school children. St John Ambulance Australia (12), through its First Aid in Schools Program, report having trained over 70,000 primary school children in 2013 and plan to increase this annual number to 200,000 by 2017. This training has been developed and targeted to a range of levels from kindergarten through to year 6, and is delivered through various topics; however, the utility of this training and knowledge retention among trained school children remains unclear in this context. Further investigation is therefore warranted.

The objective of this literature review was to determine whether the published literature demonstrates that first aid knowledge is retained by school children who have undertaken first aid training from professional providers.

Methods

A search of peer-reviewed and grey literature was conducted in December 2014 to facilitate a narrative review. This narrative review of the literature was carried out according to the review principles and methods outlined by Coughlan and colleagues (13,14) to provide transparency and minimise potential bias in the selection and review process.

Search strategy

Table 1 outlines the search strategy used, comprising a combination of electronic searches and hand searching of bibliographies. The MEDLINE, Cumulative Index of Nursing and Allied Health Literature (CINAHL) and Education Resource Information Centre (ERIC) databases were searched to retrieve articles from key words, title and abstract, using combinations of Boolean operator and the search terms 'first aid'; 'resuscitation'; 'training'; 'child*'; and 'school'. Full-text articles were subsequently reviewed after initial screening of abstracts found to be of relevance. A World Wide Web search for grey literature using these terms was also conducted, using the Google internet search engine.

Table 1. Databases and search terms

Database	Search terms
MEDLINE	'first aid' OR
	'resuscitation' AND
CINAHL	'training' AND
	'child*' OR
ERIC	'school'

Inclusion/exclusion criteria, quality appraisal and synthesis

Articles were included only if they were peer-reviewed, published in English and relevant to the stated review objective. No date restrictions were applied. Articles were excluded where their focus was specifically on mental health first aid, or first aid training provided by school teachers or medical/nursing students. An appraisal of overall quality was conducted for primary studies according to guidelines for the critique of both quantitative (15) and qualitative research (16). While these guidelines do not formulate a quality ranking, they do provide a sound and reliable framework from which to gauge the rigor, believability and robustness of empirical studies. All papers were analysed thematically to synthesise and summarise the current body of knowledge, identifying gaps in the literature.

Results

Table 2 outlines the four primary studies that were included and reviewed. A range of training methodologies and evaluation strategies were reported across the studies – originating from Norway (n=2), Italy (n=1) and the United Kingdom (UK) (n=1); they encompassed both quantitative and qualitative research designs. The quality of studies also varied considerably, though none were assessed to be inadequate. The age of school children represented in study samples ranged from 4–12 years. The studies differed largely in their context and objectives. They also varied with respect to whether the first aid training involved CPR or whether it was non-resuscitative in nature, focusing on treatment of injuries or emergency helping behaviours. The two themes 'resuscitative first aid training' and 'non-resuscitative first aid training' were identified.

Authors	Country	Study design/methods	Sample	Results	Theme	Comments
Bollig et al (2011)	Norway	Pilot evaluation study Mixed methods First aid scenario test at 2 months Observation over 7 months	10 kindergarten children aged 4-5 years	70% assessed consciousness correctly and knew the correct emergency telephone number 60% showed correct assessment of breathing and 40% were successful with recovery position and airway management	Non-resuscitative first aid training	Glove puppet used as teaching aid Qualitative data were limited to field notes taken by school teachers
Bollig et al (2009)	Norway	RCT with first aid training intervention (n=117) and control groups (n=111), comprising 6-item scenario test and retest at 6 months	228 primary school children aged 5-7 years	Statistically significant difference (p<0.001) between intervention and control groups for all six items tested. Similar results were obtained at 6 months follow-up in five out of the six items	Non-resuscitative first aid training	Glove puppet used as teaching aid Risk of bias
Connolly et al (2007)	Northern Ireland	22-item multiple choice questionnaire administered to training group (n=46) and control group (n=43) at baseline and immediately after basic life support training, and at 6 month follow-up	79 students from a rural primary school aged 10-12 years	Significant improvement in knowledge in the majority of questions (p<0.05), but there was no change observed in over 30% of the questions. At 6 month follow-up, knowledge had decreased considerably since training but remained significantly higher than baseline	Resuscitative first aid training	Randomised not used Lacks details of selection into training and control groups
Lubrano et al (2005)	Italy	13-item multiple-choice test and semi-structured test administered after training to (a) theory-only group (n=271) and (b) combined theory/practical group (n=189)	469 primary school students aged 8-11 years	Older students demonstrated significantly higher levels of knowledge and skills retention than younger students Practical training enhanced theoretical learning	Resuscitative first aid training	Some discrepancies apparent in reported sample sizes Risk of bias

Table 2. Studies of professional first aid training for school children

Non-resuscitative first aid training

In a randomised controlled trial, Bollig and colleagues (17) set out to determine whether a combined theoretical and practical first aid training program can influence the performance of school children in a first aid scenario. From a total sample of 228 primary school children (102 girls and 126 boys) aged 5–7 years from nine different primary schools, a control group of 111 children did not receive any training, while an intervention group comprising 117 children received basic first aid training. The structure and duration of this training consisted of five, once-weekly 45-minute lessons taught by a Red Cross first aid instructor with the aid of a glove puppet to engage the children. The training was designed to introduce elementary knowledge of first aid, with its content delivered across the following five lessons:

- Lesson 1: The body and its functions, assessment of consciousness and breathing
- Lesson 2: Wound treatment, bleeding
- Lesson 3: Unconsciousness, open airway and recovery position
- Lesson 4: Behaviour in emergency situations, emergency call
- Lesson 5: First aid scenarios.

Test scenario: Test of performance in a mock first aid scenario
The same scenario was used to test both the control and intervention group, which involved the children managing a child who had fallen from a bicycle. The specific directions '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?' were given, and the children made decisions and acted alone, without the aid of questions being answered by an instructor. The performance criteria for assessment comprised:

1. Correct assessment of consciousness
2. Correct assessment of breathing
3. Knowledge of the correct emergency telephone number
4. Providing correct information during the emergency call
5. Performance of correct recovery position
6. Correct airway management with open airway.

Both groups were tested after completion of the training program, and only the intervention group was re-tested at a 6-month follow-up time point. The study authors reported that their results demonstrated large and statistically significant differences between the groups. While the 6-month follow-up test showed a lack of retention, the re-test group still scored significantly higher ($p < 0.001$) than the group that did not receive the training. However, as previously outlined by He, Wynn and Kendrick (10), although studies such as this report significant increases in first aid knowledge and skills, they are also at significant risk of bias, specifically performance and detection bias or selection bias in non-randomised studies. This has made it difficult for researchers to draw conclusions with regard to the type and efficacy of first aid training programs or an optimal age for first aid training.

Bollig et al (18) later conducted a pilot study that combined the collection of quantitative and qualitative data from a small sample of kindergarten children aged 4–5 years. To investigate the effects of first aid training, a sample of 10 was tested in a first aid scenario – 2 months post-training intervention. This was followed by 7 months of participant observation. This observation entailed the taking of field notes by school teachers to record the demonstration of first aid knowledge and skills by the school children in play situations and everyday life, in contrast to the formal test scenarios taken at the 2 month time point post-training intervention. The study findings concluded that children in this age range are able to learn and apply basic first aid, and recommended that first aid training should commence at this age. It should be noted, however, that the study protocol did not include pre-intervention testing, and that the small sample size and lack of control group in this pilot study mean that these findings and conclusions should be interpreted with caution.

Resuscitative first aid training

Lubrano and colleagues (19) conducted a study of over 460 Italian students aged 8-11 years across primary school grades 3, 4 and 5 (the highest levels in the Italian primary school system). This study aimed to evaluate the benefit of teaching emergency procedures that include practical sessions for this population. Accordingly, the training program 'How to become an under 11 rescuer' was designed to comprise a combination of theoretical and practical sessions that involve simulated scenarios. Across 17 modules, this training program addressed three core issues relevant to school children through the use of imaginary cartoon characters: (a) 'The broken tooth', (b) 'The bleeding nose' and (c) 'Paediatric basic life support'.

The training design explicitly identified knowledge retention as a consideration and based its delivery on information from an American Heart Association basic life support instructor's manual (20). According to Lubrano et al, 'students retain 10% of what they read, 20% of what they listen to, 30% of what they watch, 50% of what they listen to and watch, and 80% of what they listen to, watch and do' (19). However, it is unclear if these claims are informed by research findings and whether the stated figures apply to first aid students generally, or if they are age-specific, considering that the subjects of this study were aged 12 years or younger. The study reported that a combination of multiple-choice tests and open-ended question responses given at 30 days post-training indicated retention of knowledge to be 'good'. In general, older children (school years 5 and over) demonstrated better retention than younger children (school years 3 and 4). The findings also suggested that the inclusion of practical training for these school children was more effective than the provision of theoretical training alone. However, some discrepancy is apparent in the reporting of samples and the study findings should be interpreted with caution, as this study involved a high risk for selection, performance and detection biases (10).

Connolly et al (21) conducted a study in Northern Ireland that involved a sample of 79 students aged 10-12 years. An intervention group (n=46) received a 4-stage stepped CPR training, while a control group (n=33) received no training. A 22-point basic life support questionnaire was administered to both groups before and after training. The results showed a significant increase ($p < 0.05$) in first aid knowledge after training, and while this knowledge decreased over time (6 months), it remained higher than those who had not been trained. A potential limitation of this study can be found in the research design, which suggests a risk of selection bias and/or detection bias. Nonetheless, taken together, both these studies provide some evidence that CPR training – delivered in a variety of ways - is effective in a range of school children aged 4–12 years.

Discussion

This review sought to determine to what extent the literature demonstrates that first aid knowledge is retained by school children who have undertaken first aid training from professional providers. Overall, it is apparent that different approaches have yielded different results within a variety of samples. There is some evidence to support the delivery of resuscitative and non-resuscitative first aid training to school children, however, this evidence-base appears very limited both in research design and population reach. It remains unclear as to what age is optimal for training in specific first aid techniques, and which methods of training and evaluation are most effective or reliable. What becomes clear is that there is a growing need for formal evaluation of first aid training for school children. This is especially the case in countries such as Australia, where there has been a significant increase in first aid training for school children provided by professional organisations such as St John Ambulance Australia.

The use of evaluation can be seen in the example of the St John Ambulance Senior First Aid recertification training in South Australia. In his evaluation, Snewin (22) highlighted that poor knowledge retention was a significant issue in adult first aid training, with 73% of participants failing resuscitation testing and 68% failing the 'stable side position' at 12 months post-completion of initial training. However, a formal research evaluation of this type is yet to be undertaken for first aid training knowledge retention in Australian school children. It has been argued that school children learn quickly and are easy to motivate (5), but only a handful of European studies have sought to address the important issues of knowledge retention and instruction technique. According to the Australian Resuscitation Council Guidelines for Training in Basic Life Support (23), children of primary school age are 'able to perform age appropriate basic life support skills effectively when attention is given to the context in which these skills are introduced and how the skills are taught'. The training guidelines go on to state that 'comparable knowledge and psychomotor

skills are taught to children of this age and retained, with subsequent demonstration of effective performance'. However, these statements are based on the consensus of expert opinion rather than empirical evidence, and no specific recommendations relating to children's first aid training are made in the guidelines. Further research is needed in this area to support the ARC guidelines and inform the development of recommendations for first aid training for school children.

Although pedagogies are not explicitly named within the reporting of these studies, various pedagogical approaches are implied within the various strategies used to facilitate the teaching and learning of first aid. For example, the capacity of students to 'learn by doing' is an important pedagogical consideration for first aid training (24), as is an understanding of various learning theories that are both relevant and effective in the teaching of first aid for school children. Kirschner, Sweller and Clark (25) argue a compelling case for guided instruction pedagogies that draw on cognitive learning theories. In doing so, they draw on evidence to suggest that instructional learning with little or no guidance is less effective and less efficient. This means that, according to their hypothesis, learning theories incorporating any of the constructivist, discovery, problem- or inquiry-based teaching approaches are flawed in comparison to those favouring cognitive-based guided instruction (25). In the case of pedagogy for the acquisition of first aid knowledge and skills in school children, the work of cognitive learning theorists such as Jean Piaget appears relevant. In outlining distinct stages of children's cognitive development, Piaget's theory of cognitive development has been highly influential in curriculum development in primary schools (26). Essentially, according to cognitive learning theory, a first aid instructor must tailor his or her learning content and teaching methods to match appropriately the developmental stage of the children.

These pedagogical considerations were reflected in the studies reviewed here, where it was apparent that first aid learning and retention of knowledge and skills generally increased with age and the inclusion of practical training. First aid teaching methods were tailored to the age and developmental stage of students, and their learning was greater when they had opportunities to 'learn by doing'. What appears to have been lacking within these studies, is a consistent theoretical framework to scaffold the approaches to the teaching and learning intervention, as well its evaluation. Buckley and colleagues (27) applied a theoretical framework to an Australian school context, proposing an integration of cognitive behavioural therapy and theory of planned behaviour in order to effect a more lasting change in secondary school students from an intervention that included first aid training. There may be merit in building a similar theoretical framework to guide first aid training for children in both primary and secondary school settings. Beyond the rudiments of first aid knowledge and skill acquisition or retention, future applied theory could usefully address the issue of whether students' helping behaviours change such that they will actually put the knowledge and skills into practice.

Limitations of this study

This review of the literature was limited to the research and grey literature published in English. Therefore, it is possible that other studies have been conducted on this topic and reported in a language other than English. Furthermore, cultural factors may need to be considered as the reported studies involved only samples of school children from Europe. Thus there is scope for investigation into sub-populations not represented in the literature to date. For example, future research might usefully explore potential considerations for the provision of first aid training to minority groups such as people with disabilities, or those from Indigenous or culturally and linguistically diverse backgrounds.

Conclusion

This review has highlighted a paucity of evidence demonstrating first aid training knowledge retention in school children. Due to the heterogeneity of training programs and study designs reported in the research literature, there is an overall lack of definitive evidence. While there is evidence to suggest that some first aid knowledge is retained, and that knowledge retention generally increases with age and the inclusion of practical training, the variation in research design, methodological rigour and overall quality of studies prevents sound conclusions from being drawn with regards to optimal age for targeting specific first aid training interventions. Except for a small number of European studies, and despite a significant and ongoing increase in first aid training across Australian schools, to date, the knowledge retention and utility of first aid training for school children in this region remains largely unknown. Further longitudinal research is needed to evaluate and inform the growing provision of first aid training both in this context and for sub-populations who may present unique considerations.

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Conflict of interest

Shane Lenson holds a voluntary director role within St John Ambulance Australia (ACT). The role has no direct relationship to this work or the seed funding provided. Each author of this paper has completed the ICMJE conflict of interest statement.

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