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Development of Evidence-Based First Aid Guidelines for Laypeople in Flanders, Belgium

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Abstract

Introduction: First aid training of laypeople is important to make people self-reliant in emergency situations or disasters and to strengthen community resilience.

Aim: The aim of this project was to develop a First Aid manual '*Help! First aid for everyone*' according to the Evidence-Based Practice methodology, including several first aid and preventive topics as well as risk factors.

Methods: Evidence-based guidelines were developed according to our methodological charter and the AGREE II checklist for guideline development. Three databases (MEDLINE, using the PubMed Interface; Embase using the Embase.com interface and the Cochrane Library) were searched for the best available evidence. The quality of identified evidence was assessed using the GRADE methodology. Draft recommendations were formulated and presented to a panel of medical experts.

Results: 319 topic-specific searches were performed. A total of 118716 references were screened out of which finally 533 studies were included as a basis for the guidelines. Two examples of effective interventions, keeping burn blisters intact and the use of hand sanitizers, are provided in detail.

Conclusion: Evidence-Based first aid and prevention guidelines were developed for Flanders. This manual will be used as a basis for the first aid courses provided by the Belgian Red Cross-Flanders.

Keywords: First aid; Prevention; Evidence-Based Practice; Laypeople

Introduction

The Red Cross/Red Crescent is the reference for first aid education worldwide. First aid is a core activity of the 190 Red Cross and Red Crescent Societies and they are the major first aid educators and providers in the world. It is their mission to make people self-reliant in emergency situations or disasters and to strengthen community resilience. Millions of people are hurt or killed by injuries every year due to inadequate response or lack of timely assistance. Taking immediate action and applying the appropriate first aid techniques can considerably reduce deaths and injuries, and the impact of disasters and everyday emergencies. The Red Cross therefore provides training courses in first aid, which are based on first aid guidelines.

According to the International Federation of Red Cross and Red Crescent Societies (IFRC), first aid is defined as "Immediate help provided to a sick and injured person until professional help arrives. It is concerned not only with physical injury or illness but also with other initial care, including psychosocial support for people suffering emotional distress from experiencing or witnessing a traumatic event. First aid interventions seek to preserve life, alleviate suffering, prevent further illness or injury and promote recovery" [1].

Qualitative guidelines should be based on solid scientific evidence, or in the absence of evidence, on expert consensus [2-4]. This can be accomplished by working according to the triad of Evidence-Based Practice, in which scientific literature is combined with the preferences of the target population and expert opinion [4]. This approach contributes to the harmonization of first aid guidelines for the general public.

Providing evidence-based first aid is an important pillar of the strategy of Belgian Red Cross-Flanders (BRC-F). We already developed several evidence-based guidelines and materials for Europe, Sub-Sahara Africa and India [5-7]. For each of these guidelines, evidence was searched to specifically support local first aid interventions (e.g. honey for burn wounds in the African guidelines), in addition to "basic first aid interventions" which are included in each of the guidelines. Furthermore, an evidence-based educational pathway was developed to include first aid in the school curriculum [8], and together with the Flemish government, guidelines concerning first aid for sports injuries were developed.

Five years ago, a first step was taken to publish a first aid manual for Flanders based on scientific evidence. Since guidelines need to be updated every five years, the aim of this project was to develop a first aid manual '*Help! First aid for everyone*' according to the latest methodology and scientific literature [4]. Furthermore, additional topics were reviewed so that not only first aid topics, but also preventive interventions and risk factors are now included. This handbook will be used as a basis for the first aid training courses provided by the BRC-F.

Methods

The evidence-based guidelines were developed according to our methodological charter and the AGREE II checklist for guideline development [4,9].

Selection of topics

The selection of relevant topics was based on the topics included in the previous version of the handbook. New topics were added based on input of the First Aid services of the BRC-F following feedback of first aid teachers. Topics included bleeding, skin wounds, burn wounds, animal bites and stings, injuries of the head and neck, chest, limbs, poisoning, accidents in the water, electrical and lightning injuries, problems with heat and cold, travel illnesses, allergies, pregnancy and delivery and infections. Evidence from the recently published first aid and resuscitation guidelines of the European Resuscitation Council (ERC) were incorporated for topics concerning resuscitation and choking, and from the first aid guidelines of the International Liaison Committee on Resuscitation (ILCOR) [2,3,10]. Consistency of our guidelines with the IFRC guidelines, which we co-developed, was revised.

Search strategy

For each first aid/preventive intervention or risk factor, a PICO (Population, Intervention, Comparison, and Outcome) question was defined and a search strategy was composed. Three databases (MEDLINE, using the Pub Med Interface; Embase, using the Embase.com interface, and the Cochrane Library) were searched for the best available evidence between the dates of inception until the search date (2015). Study selection was performed by one reviewer (VB, HVR or EDB). A first selection of studies was made by screening title and abstract. Full texts were retrieved for relevant studies and checked if they met the in- or exclusion criteria. The reference lists of included articles were scanned for other potentially relevant studies, as well as the first 20 related citations in Pub Med. For each PICO question an "evidence summary" was developed, in which the search strategies were documented.

Selection criteria

The following in- and exclusion criteria were applicable for all first aid or preventive interventions or risk factors:

Population: Sick or injured people or healthy volunteers of all ages.

Intervention/Risk factor: Inclusion of interventions provided by lay people (i.e. basic first responders, lay caregivers and/or community health workers). When the intervention is feasible to be performed by lay people but performed by a healthcare professional, the study is included in case no other evidence with laypeople is available (but considered as indirect evidence). Interventions that require special equipment or competences were excluded, as well as interventions that do not take place during the acute phase which can be considered as aftercare. For risk factors, we included modifiable, proximal risk factors with a potential immediate implication for practice that results in primary prevention at the household or community level and risk factors related to healthy persons. Risk factors that lead to interventions with already proven effectiveness were excluded. Furthermore, risk factors that do not precede the outcome and risk factors that are common sense were excluded.

Outcome: Studies describing health-related outcome measures including survival, functional recovery, pain, complications, and time to resumption of usual activity, restoration to the pre-exposure condition, time to resolution of symptoms or adverse effects were included. Studies measuring performance by basic first responders or lay caregivers and/or community health workers were excluded.

Study design: Systematic reviews: inclusion of the studies of the systematic review if the search strategy and selection criteria are clearly described and if at least the Cochrane Library, MEDLINE and Embase are searched. Experimental studies: inclusion in case of one of the following study types: (quasi or non-) randomized controlled trial, controlled before and after study or controlled interrupted time series, and the data are available. Observational studies: inclusion in case of one of the following study types: cohort and case-control study, controlled before and after study or controlled interrupted time series, and the data are available. Following study types were excluded: case series, cross-sectional studies, animal studies, *ex vivo* or *in vitro* studies, conference abstracts, studies reporting no quantitative data, studies reporting only means, but no standard deviations, effect sizes or p-values.

Language: Only articles in English were included.

Publication year: We searched the databases from time of inception until the search date in 2015.

In addition to these general selection criteria, specific in- and exclusion criteria were formulated for each PICO question.

No PICO question was formulated if the intervention concerned (1) a 'Good Practice Point' ("Good Practice Points are intended to assist guideline users by providing short pieces of advice which may not have an evidence base, but which are seen as essential to good clinical practice", according to the definition of the Scottish Intercollegiate Guidelines Network [11]) or common sense, (2) the responsibility of professionals (such as a medical doctor or pharmacist), (3) interventions with only a long-term effect (e.g. lifestyle interventions such as healthy diet, smoking cessation), (4) the practical organization of activities, (5) medico-legal aspects (e.g. use of EpiPen) or (6) anatomy or physiology. For risk factors, no PICO question was formulated if the risk factor did not precede the outcome, was common sense, a fixed marker (e.g. race, gender), a distal risk factor (e.g. smoking as a risk factor for lung cancer) or not valid for healthy people.

Data extraction

Data concerning study design, population, outcome measures, effect sizes and quality of the study were collected. Review Manager 5 [12] was used to calculate effect sizes (risk ratios (with 95% confidence intervals) for dichotomous variables and mean differences (with 95% confidence intervals) for continuous outcomes) if these were not reported in the study and raw data were available. A p-value <0.05 was considered as statistically significant.

Quality assessment

The GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach was used to assess limitations of study design for each individual study, followed by a quality rating for the body of evidence, which depends on study limitations, imprecision, inconsistency, indirectness and publication bias and ranges from high to very low. The initial level for experimental studies is 'high-quality' whereas observational studies start from a 'low-quality' level. A high level of the body of evidence means that "further research is very unlikely to change our confidence in the estimate of effect" whereas a low level of evidence indicates that "further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate" [12].

Formulation of evidence-based recommendations

Based on the evidence identified and taking into account practice considerations, the First Aid Service of BRC-F formulated draft recommendations. The evidence summaries and draft recommendations were presented at the Medical Committee of BRC-F which is composed

of all provincial chief physicians of BRC-F, a physician of the Flemish Government and physicians of the department of Defense of the Belgian Government. They evaluated the recommendations and the evidence during six expert meetings. The experts decided whether or not to recommend certain interventions, taking into account the quality of the evidence, the feasibility, the benefits and harms of the intervention, and the costs. Then they formulated final recommendations, decided on the strength of the recommendation (weak or strong) and when appropriate, they also formulated 'Good Practice Points'.

The draft recommendations were also reviewed by a reading group consisting of staff members of the First Aid Services, the Relief Services and the Centre for Evidence-Based Practice of BRC-F as well as first aid teachers and laypeople.

Results

Characteristics of studies

We performed 319 topic specific searches. For each topic, a PICO (Population, Intervention, Comparison, and Outcome) question was defined (see below for 2 examples). 181 PICOs concerned first aid, 76 were about prevention, 6 PICOs defined a combination of first aid and prevention, 46 were about risk factors and 10 diagnostic PICOs were formulated. The searches resulted in a total of 118716 references. Title and abstract screening resulted in 2586 references of which the full texts were evaluated. 2009 studies were not eligible according to our in- and exclusion criteria. Finally, 533 studies or systematic reviews were included for data extraction. The flowchart in figure 1 shows an overview of the study selection for all PICO questions together. For 128 PICO questions (100 first aid interventions, 14 on prevention, 11 on risk factors and 3 diagnostic PICOs) no evidence was found. When searching for evidence we always first searched for existing systematic reviews. Of the 191 PICOs for which evidence was found, the evidence for 72 PICOs was based on systematic reviews, of which 41 included Cochrane reviews. 24 evidence summaries were based on Cochrane reviews as a whole, whilst for 4 PICOs a Cochrane review was used but an update was also performed because the review was out-of-date (more than 5 years old). For 13 PICOs, Cochrane reviews were used as a source of individual studies. If no existing systematic reviews were available, a search for individual studies was performed.

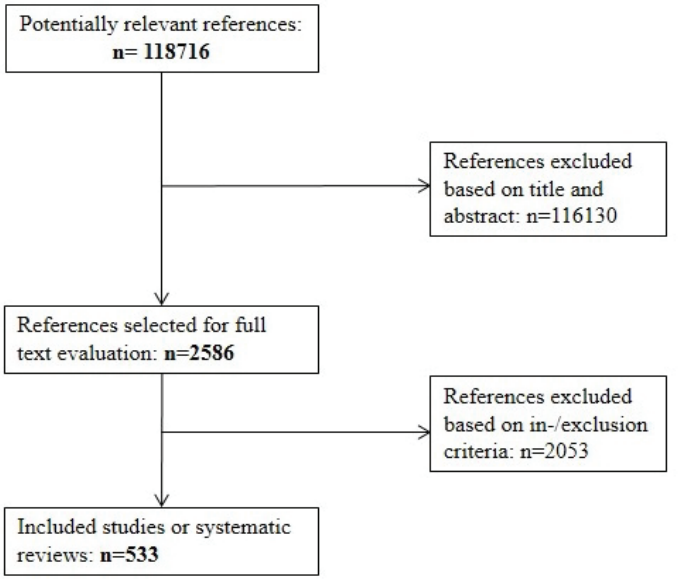

Figure 1: Overview of study selection for all 319 PICO questions together.

From evidence to recommendations: two detailed examples

An example of an effective first aid intervention is keeping burn blisters intact. An example of an effective preventive intervention is the use of hand alcohol as prevention of diarrhea. These two examples are described in detail below.

Example 1: Deroofing or aspiration of burn blisters: The following PICO question was formulated: In humans with burns (P), is deroofing or aspiration of blisters (I) compared to leaving the blisters intact (C) effective to change tissue healing, functional recovery, pain, complications, time to resumption of usual activities, restoration to the pre-exposure condition, time to resolution of symptoms (O)?

A total of 910 studies were identified with the search strategy which can be found in supplemental file 1. Finally, only one study was included [13]. This study includes 202 patients with 316 minor burns. Only thermal burns of the arms and legs that could be treated with paraffin gauze dressings were included. Burn blisters were aspirated after one day, deroofed after one day or kept intact for 10 days (table 1).

It was shown that keeping the blister intact resulted in a statistically significant lower number of blisters colonized with any bacterium or with *Staphylococcus aureus* specifically compared to aspirating or deroofing the blister (table 2) [13]. The level of evidence is low due to limitations in study design (no information on randomization or blinding) and imprecision due to limited sample size (n<400). This means that further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate [14].

Finally, based on the identified evidence, draft recommendations were formulated and discussed/reviewed by the expert panel. The final recommendation was formulated as follows: "Do not puncture burn blisters. This will increase the risk of infection. Because of the burn, the protective effect of the skin is compromised, which allows micro-organisms to penetrate the body. This could slow down the recovery."

Example 2: Hand sanitizers as preventive measure for diarrhea: In our first aid manual, it is recommended to wash hands with water and soap before and after providing first aid. However, what if no water is available? Is the use of hand alcohol a good alternative? To answer this question, the following PICO question was formulated: In humans (P), is the use of hand sanitizers (I) compared to no intervention (C) effective to prevent diarrhea (O)?

A total of 390 studies were identified with the search strategy which can be found in supplemental file 2. After title and abstract screening, 18 studies were assessed based on the full text. Finally, 2 randomized controlled trials were included [15,16] One study was performed among 134 administrative officers in Germany who did not already apply hand hygiene at work. They were randomized into an intervention or a control group. The second study was performed among 1364 students in six schools in Nairobi, Kenya. The schools were randomly assigned to receive one of the interventions (hand washing with soap or hand sanitizer) or the control (no intervention) (table 3).

Author	Study Design	Population	Comparison
Swain et al. [13]	Experimental: Non-randomized controlled trial	202 patients with 316 minor burns. Only thermal burns of the arms and legs that could be treated with paraffin gauze dressings were included.	Intervention 1: Aspiration after 1 day Intervention 2: Deroofing after 1 day Control: keeping blister intact for 10 days

Table 1: Characteristics of included studies for evidence review concerning deroofing or aspiration of burn blisters.

It was shown that the use of alcohol-based hand sanitizers resulted in a statistically significant decrease of absenteeism due to diarrhea, compared to the usual unchanged hand hygiene practices [15]. Furthermore, it was shown that alcohol-based hand sanitizers resulted in a statistically significant decrease of the number of watery stools in 24 hours compared to hand washing with soap [16]. However, a statistically significant decrease of diarrhea, using alcohol-based hand rubs compared to unchanged hand hygiene, no intervention or hand washing with soap, could not be demonstrated [15,16]. Furthermore, a statistically significant decrease of any loose/watery stools in 24 hours, using alcohol-based hand sanitizer compared to no intervention, could not be demonstrated (table 4) [16].

Evidence is of low quality due to imprecision (limited sample size and large variability of results) and possible publication bias, since in one study one author is employed by the manufacturer of the hand gels and 2 authors received financial support for research from the manufacturer.

Outcome	Comparison	Effect Size	#Studies, # Participants	Reference
Number of blisters colonized with bacteria	Deroofing *vs* Keeping blister intact	Statistically significant: 78/102 *vs* 15/110 § RR: 5.61, 95%CI [3.46; 9.08] (p<0.00001)* *In favor of keeping blister intact*	1, 102 *vs* 110 blisters	Swain et al. [13]
Number of blisters colonized with *Staphylococcus aureus*		Statistically significant: 45/102 *vs* 2/110 § RR: 24.26, 95%CI [6.04; 97.47] (p<0.00001)* *In favor of keeping blister intact*		
Number of blisters colonized with bacteria	Aspiration *vs* keeping blister intact	Statistically significant: 73/104 vs 15/110 § RR: 5.15, 95%CI [3.16; 8.37] (p<0.00001)* *In favor of keeping blister intact*	1, 104 *vs* 110 blisters	
Number of blisters colonized with *Staphylococcus aureus*		Statistically significant: 19/104 *vs* 2/110 § RR: 10.05, 95%CI [2.40; 42.08] (p=0.004)* *In favor of keeping blister intact*		

Table 2: Synthesis of findings for evidence review concerning deroofing or aspiration of burn blisters.
*Calculations done by the reviewer (s) using Review Manager software, § Imprecision (low number of events)

Author	Study Design	Population	Comparison
Hübner et al. [15]	Experimental: Randomized controlled trial	134 administrative officers who do not already apply hand disinfection at work were randomized in control (n=67, mean age 45.6 years) and intervention (n=67, mean age 43.6 years) group.	Intervention: Alcohol-based hand rubs. Participants were advised to use it at least five times daily, especially after toilet use, blowing nose, before eating and after contact with ill colleagues, customers and archive material. Control: Unchanged daily hand hygiene.
Pickering et al. [16]	Experimental: Randomized controlled trial	1364 students (ages 5-13) in 6 schools in Nairobi, Kenya. Schools were randomly assigned to receive a hand washing with soap intervention (n=460), an alcohol-based hand sanitizer intervention (n=435) or no intervention (n=469)	Interventions: (1) Hand washing with soap or (2) Alcohol-based hand sanitizer: an initial teacher training session followed by the installation of soap or sanitizer wall dispensers. Control: no intervention

Table 3: Characteristics of findings for evidence review concerning the use of hand sanitizers as a preventive measure for diarrhea.

Outcome	Comparison	Effect Size	#Studies, #Participants	Reference
Absenteeism due to diarrhea	Alcohol based hand rubs *vs* unchanged hand hygiene	Statistically significant: 1/64 *vs* 8/65 § OR: 0.11, 95%CI [0.01;0.93] (p<0.05) *In favor of alcohol-based hand rubs*	1, 64 *vs* 65	Hubner et al. [15]
Diarrhea		Not statistically significant: 8/64 *vs* 15/65 § OR: 0.48, 95%CI [0.19;1.22] (p ≥ 0.05)		
	Alcohol-based hand sanitizer *vs* no intervention	Not statistically significant: RR: 0.75, 95%CI [0.52; 1.10] (p=0.14) ¥	1, 460 *vs* 435 *vs* 469	Pickering et al. [16]
	Alcohol-based hand sanitizer *vs* hand washing with soap	Not statistically significant: RR: 0.89, 95%CI [0.61; 1.30] (p=0.56) ¥		
Any loose/watery stool in 24 hours	Alcohol-based hand sanitizer *vs* no intervention	Not statistically significant: RR: 0.87, 95%CI [0.72; 1.04] (p=0.12) ¥		
	Alcohol-based hand sanitizer *vs* hand washing with soap	Statistically significant: RR: 0.80, 95%CI [0.67; 0.95] (p=0.01) *In favor of alcohol-based hand sanitizer*		

Table 4: Synthesis of findings for evidence review concerning the use of hand alcohol as a preventive measure for diarrhea
*Calculations done by the reviewer (s) using Review Manager software, § Imprecision (low number of events); ¥ Imprecision (large variability of results)

In the first aid manual, it is recommended to wash the hands with water and soap before and after providing first aid and if the hands are visibly dirty. However, if no water is available, hand sanitizers can be recommended based on the evidence described above. The recommendation was formulated as follows: "If no water is available, or your hands are not visibly dirty, decontaminate your hands with a hand sanitizer before and after taking care of a casualty."

Discussion

An evidence-based first aid handbook was developed for the Belgian context. For this project, a total of 118716 references were screened and 533 studies were finally included. Based on the evidence, draft recommendations were formulated which were presented to an expert panel.

The strengths of this project are that no search limits such as geographical filters or time constraints were used. The evidence was searched according to a strict methodology and the AGREE II checklist for guideline development was followed [4,9]. For 23% of the topics, a systematic review was identified and included, either as a whole or as a source of individual studies, of which 13% were Cochrane reviews. Furthermore, evidence from recently published international first aid and resuscitation guidelines of ILCOR and the ERC were also incorporated in the manual [2,3,10,17,18]. In addition, for some topics our evidence summaries were incorporated in the IFRC first aid guidelines which will be published soon. All steps of the methodology of Evidence-Based Practice were followed. The best available scientific evidence was combined with the preferences of the target population and the expert opinion of the Medical Committee of BRC-F.

However, this project also has some limitations. For this version of the manual, the focus was on first aid and prevention interventions and possible risk factors. Only 10 diagnostic PICOs were formulated. However, in the manual each topic starts with a section explaining the signs and symptoms of the injury or illness. During the next update of the manual in 5 years, it is planned to include these diagnostic topics to fully support the signs and symptoms sections with scientific evidence. Another limitation is the lack of evidence for 40% of the topics. Recommendations for these topics were therefore based on 'Good Practice Points' and expert opinion. This big lack of evidence indicates that more primary research is definitely needed in first aid settings and pre-hospital care.

In conclusion, an evidence-based manual for first aid was developed. This manual will be used as guidance for the first aid courses provided by the Belgian Red Cross-Flanders. The 762 volunteer first aid teachers will be retrained so they can teach first aid to more than 20000 people each year according to the latest scientific evidence. Furthermore, the handbook will also be broadly available for anyone with an interest in first aid. In addition, all evidence summaries will be made available upon request. In this way we try to promote first aid knowledge and skills and helping behavior among the general population as much as possible.

Authors Contribution

All authors contributed significantly to this work. PV proposed the guideline project. AV coordinated the project. VB wrote the manuscript. VB, HVR and EDB performed the evidence reviews. All authors have critically reviewed the manuscript.

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Competing Interest

All authors are employees at Belgian Red Cross-Flanders and receive no other funding. One of the activities of Belgian Red Cross-Flanders is providing first aid training to laypeople.

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