ORIGINAL ARTICLE

Limited public ability to recognise and understand the universal sign for automated external defibrillators

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ABSTRACT

Objective To study if the public is able to recognise and understand the International Liaison Committee on Resuscitation (ILCOR) sign for automated external defibrillators (AEDs), and to explore how national resuscitation councils have adopted the sign.

Methods A survey was conducted among travellers in an international airport serving 21 million passengers annually. Participants were asked to state the meaning of six international safety signs, one of which was the ILCOR AED sign. Also, all national resuscitation councils forming ILCOR were contacted to determine whether they recommend the ILCOR AED sign and the existence of national legislation regarding AED signage.

Results In total, 493 travellers (42 nationalities) were included. Correct identification of the ILCOR AED sign was achieved by 39% (95% CI 35% to 43%). Information on AED signage was obtained from 41 of 44 (93%) national resuscitation councils; 26 councils (63%) recommended the use of the ILCOR AED sign. In two countries, the ILCOR AED sign was mandatory by law.

Conclusions There is limited public recognition and understanding of the ILCOR AED sign. The ILCOR AED sign is not unanimously recommended by national resuscitation councils worldwide. Initiatives promoting public awareness of AEDs are warranted.

INTRODUCTION

Out-of-hospital cardiac arrest is a leading cause of death.[1–3] Cardiopulmonary resuscitation (CPR) and early defibrillation improves survival. In out-of-hospital cardiac arrest with a shockable rhythm, the chances of survival are reduced by 10%–12% for every minute defibrillation is delayed when CPR is not being performed and 3%–4% when CPR is being performed.[2 4] International guidelines recommend that defibrillation in the out-of-hospital setting is performed as fast as possible.[5]

Public access defibrillation programmes implemented in public areas, such as airports, have resulted in survival rates of 59%–75% from cardiac arrest with shockable rhythms.[6 7] Survival rates in areas with high quality emergency medicine services but without automated external defibrillators (AEDs) are only about half of survival rates observed in areas with public access defibrillation programmes.[8–10] However, AEDs are rarely used outside specific public access defibrillation programmes and, consequently, save very few lives.[11 12] This missed opportunity to save lives may be attributed to inappropriate device deployment[13] and/or to a lack of public knowledge and inability to locate a nearby AED.[14]

In June 2008, the International Liaison Committee on Resuscitation (ILCOR) introduced a sign to identify the location of public access AEDs (figure 1).[15] The sign is designed in accordance with the International Organization for Standardization (ISO) 7010 standard for safety signs. ISO is an independent, non-governmental membership organisation that develop voluntary international standards. Colours and symbols are in accordance with ISO 3864-3 standard and has been tested in accordance with the ISO 9186-1 standard.[16 17]

Importantly, no previous studies have investigated the public awareness of this sign. Accordingly, the aim of this study was to investigate if laypersons were able to recognise and understand the ILCOR AED sign and to explore how well national resuscitation councils under ILCOR have adopted the sign.

METHOD

This study was conducted in two parts: (1) a convenience sample from travellers in an international airport and (2) a cross-sectional study among the resuscitation councils that together form ILCOR.

Substudy 1: public awareness of the ILCOR AED sign

The aim was to evaluate public knowledge of the ILCOR AED sign. The study was conducted in Copenhagen Airport, an international airport that serves about 21 million passengers annually and has direct flight connections to about 140 destinations worldwide.[18]

Participants and ethics

All travellers waiting in the international terminal were eligible for inclusion in the study. Participants who failed to provide information about gender, age, nationality or interpretation of the AED sign were excluded from further analysis.

In accordance with the Danish National Committee on Biomedical Research Ethics, no ethical review committee approval was required. Permission to conduct the study was obtained from

Figure 1 The International Liaison Committee on Resuscitation automated external defibrillator (AED) sign. The sign was issued in June 2008 to indicate the presence of an AED.

the airport after completing a mandatory safety course. All participants gave oral consent.

Questionnaire

We developed a questionnaire (see online supplement) including basic demographics (age, gender, nationality, country of residence and occupation) and six different safety signs, one of which was the ILCOR AED sign. The five other signs were: fire extinguisher, high voltage, emergency exit, danger of explosion and no smoking. The reason for including five other safety signs was to avoid revealing the main purpose of the study and to enable us to compare recognition of the AED sign to other safety signs. A pilot study was conducted in order to test the comprehensibility of the questionnaire, which was modified based on the results of this pilot study. The questionnaire was printed in colour on cardboard paper. Travellers seated in the international terminal of Copenhagen Airport were approached during the course of 1 day by one of four study authors and asked to fill out the questionnaire in writing. Participants were all approached in English but answers in any language were accepted. The questionnaire was handed directly back to the author after completion.

Data analysis and statistics

This was a convenience sample obtained during the course of 1 day in the international terminal of Copenhagen Airport. The airport dictated the time limit of 1 day for security reasons. Data from the questionnaires were entered into a spreadsheet. Answers were reviewed and rated: correct or incorrect. If no answer was given or the answer was 'don't know', it was rated incorrect. In case of difficulties interpreting a response on a questionnaire, answers were reviewed and discussed with a coinvestigator to reach consensus. Questionnaires answered in Danish, Swedish, Norwegian and English were interpreted by the lead author (RA). Questionnaires in other languages were translated into Danish, either by full time language students at Aarhus University, Denmark or other students who were native speakers of the particular language.

For binomial variables, an assumption of approximation to the normal distribution was made and 95% CIs were calculated. Statistical analyses were performed using GraphPad Prism V.5 for Windows (GraphPad Software, La Jolla, California, USA).

Substudy 2: resuscitation councils and the ILCOR AED sign

The aim was to evaluate how national resuscitation councils have adopted the ILCOR sign for AEDs. The study was conducted among 44 national resuscitation councils (see online supplement). An electronic questionnaire concerning the ILCOR AED sign was designed using the www.surveymonkey.com (Palo Alto, California, USA). A link to the questionnaire was sent to national resuscitation councils. Where possible, the questionnaire was sent directly to the person responsible for basic life support and AEDs. In cases where such a person could not be identified, an email was addressed to the chairman of the resuscitation council. If no answer was received after the initial contact, two additional requests were emailed with approximately 2 weeks interval. Resuscitation councils that did not respond by email were contacted by phone 2 months after the initial request.

We obtained information about: (1) whether national resuscitation councils were aware that ILCOR has issued an official AED sign intended to be adopted worldwide, (2) whether they recommended the use of this sign, (3) whether they recommend the use of a different sign, (4) what actions the councils had taken to promote public awareness of the AED sign they recommend and (5) whether there was any legislation in their country regarding AED signage (see online supplement). Responses were collected from 28 May 2010 to 6 September 2010.

Data analysis and statistics

Data were extracted from the www.surveymonkey.com (Palo Alto) and percentages were calculated using Excel (Microsoft, Washington, USA). No further statistical analysis was performed.

RESULTS

Substudy 1: public awareness of the ILCOR AED sign

In total, 514 travellers accepted to participate and, of these, 21 were excluded because they failed to provide information on nationality, age or sex. Accordingly, 493 participants were included in the study. Most participants were Scandinavian, but in total, 42 different nationalities were represented. Demographics are reported in table 1.

The questionnaires were answered in 13 different languages: English (n=231), Danish (n=180), Swedish (n=35), Norwegian (n=11), German (n=15), Spanish (n=5), Basque (n=1), Turkish (n=1), Japanese (n=1), Russian (n=1), Czech (n=1), Finnish (n=3) and French (n=8).

Of all participants, 39% (95% CI 35% to 43%) correctly identified the ILCOR AED sign. Overall, correct identification of the other safety signs were: 99% (98% to 100%) for the no smoking sign, 84% (81% to 88%) for fire extinguisher sign, 75% (72% to 79%) for the emergency exit sign, 65% (61% to 69%) for the high voltage sign and 52% (47% to 56%) for the danger of explosion sign (figure 2). Table 2 presents data for different demographic groups.

Substudy 2: resuscitation councils and the ILCOR AED sign

Forty-four national resuscitation councils were asked to participate. Thirty-five councils completed the electronic survey. In

Table 1 Demographics

Category	N (percentage of total)
Overall	493 (100)
Sex	
Female	206 (42)
Male	287 (58)
Nationality, grouped according to geographical area	
European	445 (90)
North American	25 (5)
Asian	10 (2)
African	7 (1)
Middle Eastern	2 (0.4)
Australian	2 (0.4)
South American	2 (0.4)
Country of residence, grouped according to geographical area*	
European	408 (83)
North American	20 (4)
Asian	5 (1)
African	5 (1)
Middle Eastern	2 (0.4)
Australian	1 (0.2)
South American	0 (0)
Age group	
<19	29 (6)
20–39	190 (39)
40–59	206 (42)
>60	68 (14)
Occupation†	
Healthcare professional	26 (5)
Non-healthcare professional	408 (83)

*Fifty-two participants did not state their country of residence.
†Fifty-nine participants did not state their occupation.

Table 2 Correct interpretation of ILCOR AED sign—percentage of total

Participants	Correct % (95% CI)
Overall	39 (35 to 43)
Sex	
Female (n=206)	33 (26 to 39)
Male (n=287)	44 (38 to 49)
Nationality, grouped according to geographical area	
European (n=445)	40 (35 to 44)
North American (n=25)	44 (27 to 63)
Others (n=23)	17 (7 to 37)
Country of residence, grouped according to geographical area*	
European (n=408)	41 (36 to 46)
North American (n=20)	50 (28 to 72)
Other (n=13)	23 (0 to 46)
Age group	
<19 (n=29)	21 (6 to 35)
20–39 (n=190)	42 (35 to 49)
40–59 (n=206)	40 (33 to 46)
>60 (n=68)	37 (25 to 48)
Occupation†	
Healthcare professional (n=26)	46 (29 to 65)
Non-healthcare professional (n=408)	39 (34 to 44)

*Fifty-two participants did not state their country of residence.
†Fifty-nine participants did not state their occupation.
AED, automated external defibrillator; ILCOR, International Liaison Committee on Resuscitation.

addition, six councils not completing the survey provided answers by email; four councils sent us a copy of the AED sign they recommended, one council stated that they did not recommend a specific AED sign and, lastly, one council had published the sign they recommended on their website, allowing us to obtain a copy of the sign. It was not possible to obtain information about AED signage from three national resuscitation councils.

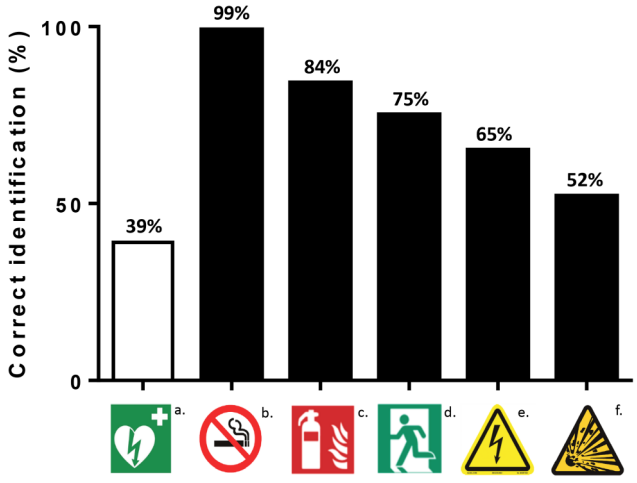

Figure 2 Correct interpretation of safety signs. Numbers above bars indicate correct interpretation as percentage of total. (a) International Liaison Committee on Resuscitation automated external defibrillator sign, (b) no smoking, (c) fire extinguisher, (d) emergency exit, (e) high voltage and (f) danger of explosion.

Recommendation of the ILCOR AED sign

Of the 41 national resuscitation councils, a total of 26 (63%) councils recommended the use of the ILCOR AED sign. Additionally, four resuscitation councils indicated that they intended to recommend the ILCOR sign in the future. Of the 15 councils that did not recommend the use of the ILCOR AED sign, seven indicated that they did not recommend any specific sign at all and eight recommended the use of a different sign. Figure 3 depicts the alternative AED signs recommended by these resuscitation councils. When asked why the ILCOR AED sign was not recommended, three councils indicated that they

Figure 3 Alternative automated external defibrillator (AED) signs. Alternative AED signs. *This sign is also commonly used in the USA.

were not aware that ILCOR had issued a universal sign. Measures taken by national resuscitation councils to promote public awareness of AED signage are shown in table 3.

Legislation on AED signage

Information concerning national legislation on AED signage was obtained from 35 councils. Of these, 32 indicated that no legislation on this subject existed in their country. Three councils confirmed that there is national legislation regarding AED signage in their country (Portugal, Belgium and Cyprus). Cyprus and Portugal both stated that it is determined by law that the presence of an AED must be indicated by the ILCOR AED sign. In Belgium, it is determined by law that a similar sign, but still different to the ILCOR sign, must be used.

DISCUSSION

The main finding of this study is a limited public ability to recognise and understand the universal ILCOR sign for AED. Less than half of a selected public is able to recognise and understand the ILCOR AED sign. In addition, not all national resuscitation councils that form ILCOR recommend the use of the sign and very few countries have legislation on AED signage.

Survival from cardiac arrest is dependent on early defibrillation. AEDs can be used safely by laypersons[7] and have the potential to save lives, yet very few lives are actually saved by AEDs.[11] This could be due to inappropriate deployment of AEDs with the consequence that an AED is not available to bystanders[13] or that bystanders are not using the AEDs available to them.[14] In order to use an AED, bystanders must be aware of their existence, be able and willing to use them and, importantly, to locate AEDs in case of cardiac arrest. A universal sign that is easily recognisable and understandable by the public may facilitate the latter.

Less than half of travellers were able to recognise and understand the ILCOR AED sign. Being a pictogram, the sign should be self-explanatory. The sign has been tested according to the ISO 9186-1 standard (test methods—part 1—Methods for testing comprehensibility) where it was found superior to other suggested signs. However, very few pictograms are in fact universally understood and most often some form of learning is required in order for pictograms to be understood.[19] Familiarity with a pictogram, however, improves comprehension.[19] Lack of awareness of AEDs in the general public may contribute to the poor recognition of the ILCOR AED sign.

A study reported that only 6% of travellers in a central Dutch railway station mentioned defibrillation when being asked what should be done as quickly as possible in case of suspected cardiac arrest.[20] Importantly, more than half of these travellers were unable to recognise an AED when it was shown to them. Likewise, a recent study from England reported that an AED was successfully deployed in only approximately 40% of cases where a first responder was aware that an AED was readily available. The first responder was aware of the presence of an AED in only 4.25% of cases (the actual rate of AED availability is unknown), meaning that an AED was deployed in only 1.74% of out-of-hospital cardiac arrests.[12] This low rate of deployment is consistent with other reports.[9]

In our study, only 46% of medical professionals correctly identified the ILCOR AED sign. Medical professionals, who are present at the scene of an out-of-hospital cardiac arrest, are expected to provide basic life support and use an AED, if present. Consequently, it is of great importance that medical professionals recognise signage indicating the presence of an AED. In the aforementioned Dutch study, only 6% of medical professionals mentioned defibrillation when being asked what should be done as quickly as possible in case of suspected cardiac arrest.[20] Even though 74% of medical professionals in the Dutch study were able to identify an AED when they were pointed directly to one, these data are consistent with the current study results and suggest a lack of awareness of AEDs among medical professionals.

In our study, along with the ILCOR AED sign, participants were asked to interpret five other safety signs that conform to ISO standards. The reason was no to reveal the objective of the study and to be able to compare the interpretation of the signs. Importantly, the proportion of correct sign identification was lower for the ILCOR AED sign compared with all the remaining signs. It should be noted that almost all participants correctly identified the no smoking sign, indicating that it is possible for a safety sign to be universally understood by the general public.

It is the intention of ILCOR that the ILCOR AED sign should be adopted by all resuscitation councils that form ILCOR.[16] At the time of our investigation, only 26 (63%) national councils were recommending the use of the sign. Some councils specifically recommended signs different from the ILCOR sign and other councils had no recommendations on AED signage. Only a few councils provided specific reasons for not recommending the ILCOR AED sign. Whatever the reason, this lack of endorsement by national resuscitation councils seems to be an obstacle for the ILCOR AED sign to become universal. Despite the obvious reasons for having a universal sign, cultural differences could entail that a different sign is more comprehensible in some countries.

It is also the intention of ILCOR that public organisations and governments should encourage the use of the ILCOR AED sign.[16] Governmental endorsement of the ILCOR sign and national legislation would probably increase the use of the sign. At the time of our study there was very little legislation on the subject of AED signage. In two countries, however, the ILCOR AED sign was mandatory by law.

Table 3 Methods to promote public awareness of AED signage

	Number of councils
Homepages/internet	19
Newsletters/journals for medical professionals	18
First aid manuals/pamphlets	13
Advertisements/newspapers/magazines	9
Public information posters	6
Advertisements in television	5

Twenty-eight national resuscitation councils provided information on this topic; some council gave more than one answer.
AED, automated external defibrillator.

LIMITATIONS

The study was based on voluntary participation with the inherent risk of selection bias. We tried to reduce this by only informing potential participants that we were doing a study on safety signs. The study was performed in an airport and

extrapolation to the public in general might be unjust as the socioeconomic profile of a frequent traveller likely differs from an average citizen. Our results only relate to recognition and understanding of the ILCOR AED sign. They do not reflect if people would actually be able or willing to use an AED, but the ability to locate an AED is a prerequisite for using one. Data were collected in 2010, 2 years after publication of the ILCOR AED sign.[16] As the majority of national resuscitation councils recommend using the sign, its use might have increased since 2010. This possible increased public exposure might in turn have increase public recognition of the sign. We collected data during one single day. There may be temporal differences in the composition of travellers in the international terminal of Copenhagen Airport, which could influence results. Collecting data over multiple days would counter this possible bias. However, for security reasons we were only allowed access to the international terminal for one day and the study was a convenience sample with no formal sample size estimation.

CONCLUSION

There is limited public ability to recognise and understand the universal ILCOR sign for locating the presence of an AED. Importantly, less than half of a selected public is able to recognise and understand the ILCOR AED sign and only two-thirds of the national resuscitation councils that form ILCOR recommend the use of the sign. Only very few countries have legislation on AED signage. Initiatives promoting public awareness of AEDs are warranted.

Key messages

What is already known on this subject?
Automated external defibrillators (AED) can save lives, but outside specific public access defibrillation programmes, they are seldom used, leaving an unfulfilled potential.

What might this study add?
This study demonstrates that a selected public has poor knowledge of the meaning of the International Liaison Committee on Resuscitation (ILCOR) AED sign, which is intended for global use. This implies that the public is either unaware of AEDs in general or unable to interpret the ILCOR AED sign.

How might this impact on clinical practice?
The study findings imply that, in our effort to promote increased use of AEDs, we should focus on promoting public awareness of AED signage and AEDs in general.

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Contributors BL conceived the study. BL, RA, AW, RM and KWI designed the trial. RA, AW, RM and KWI collected the data. RA, BL and ELG analysed the data. RA drafted the manuscript, and all authors contributed substantially to its revision. RA and BL take responsibility for the paper as a whole.

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