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| Question |
| **Should self-directed digital vs. instructor-led training be used to teach adults and children basic life support skills?**  |
| **Population:** | Adults and children undertaking BLS training. |
| **Intervention:** | Self-directed digitally-based BLS training. |
| **Comparison:** | Instructor-led BLS training |
| **Main outcomes:** | Patient outcomes: Good neurological outcome at hospital discharge/30-days; Survival at hospital discharge/30-days; Return of spontaneous circulation (ROSC); Rates of bystander CPR; Bystander CPR quality during an OHCA (any available CPR metrics); Rates of automated external defibrillator (AED) use. Educational outcomes at the end of training and within 12 months: CPR quality (chest compression depth and rate; chest compression fraction; full chest recoil, ventilation rate, overall CPR competency) and AED competency; CPR and AED knowledge; Confidence and willingness to perform CPR. |
| **Setting:** | Lay person BLS training  |
| **Background:** | Bystander CPR and automated external defibrillator (AED) use in OHCA more than doubles OHCA survival. BLS training provides knowledge and skills to perform CPR and use an AED. BLS training is associated with increased confidence and willingness to perform BLS skills.  |
| **Conflict of interests:** | The following Task Force members declared an intellectual conflict of interest and this was acknowledged and managed by the Task Force Chairs and Conflict of Interest committees: Andrew Lockey, Joyce Yeung, Koen Monsieurs and Robert Greif. |

# Assessment

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| ProblemIs the problem a priority? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no○ Probably yes● Yes○ Varies○ Don't know | Out-of-hospital cardiac arrest (OHCA) is a significant cause of death. Given the current pandemic, with issues in attending training, the EIT Task Force considered this question a priority. Two related PICOS were performed as part of the 2015 ILCOR review: # 647 (CPR instruction methods: self-instruction versus traditional) and #651 (AED training methods). A significant number of RCTs on this topic have been conduced since that time.  | Access to digital self-directed training is important during pandemics because 1) more OHCA occur in the home and 2) access to instructor-led training may not be possible or is restricted. |
| Desirable EffectsHow substantial are the desirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial○ Small● Moderate○ Large○ Varies○ Don't know | **Subsequent use of skills and patient outcomes** Two RCTs reported results for subsequent use of BLS skills and patient outcomes following training. Only Dracup et al. (2000 3289) reported any OHCA events (n=13) where trainees used skills, however there were too few events (n=13) and outcomes of this study were of too low quality (very low certainty of evidence, downgraded for risk of bias and imprecision) to be confident in the findings. **Educational outcomes (CPR and AED skills immediate and to one year)**Testing of CPR and AED skills was conducted immediately to one-month after training in 36 studies (29 RCTs and 7 non-RCTs) and between two-months and one-year in 24 studies (20 RCTs and 4 non-RCTs: Barr 2013 538; Braslow 1997 207; Edwards 1987 492; Isbye 2006 435). Methods of measurement and the types of educational outcomes varied widely between studies, which precluded any pooling of data or meta-analysis. Moderate certainty of evidence (downgraded for risk of bias) from 28 studies, comparing instructor-led training and digital training using video or interactive computer programs with manikin practice, showed comparable educational outcomes for most CPR skills and knowledge gained immediately following training and to one-year. Low certainty of evidence (downgraded for risk of bias and imprecision) from 9 studies, comparing instructor-led training and digital training using video-only, showed comparable educational outcomes for most CPR skills and knowledge gained immediately following training and to one-year and overall CPR competency and knowledge immediately. Low certainty of evidence (downgraded for risk of bias and imprecision) from 11 RCTs testing methods of digital training for AED skills, suggests instructor-led training may be more effective immediately following training but not in the long-term. Insufficient (low quality, downgraded for risk of bias and inconsistency) evidence (3 studies) was found comparing gaming training to instructor-led training.  | Two excluded studies mailed out digital training kits and examined the impact on OHCA CPR and patient outcomes. No change was noted in bystander CPR or patients outcomes when compared to a period of time before or a region that did not receive BLS training kits. Compared to no training arms or before-and-after studies –both digital and instructor-led improved learning outcomes.Testing of educational outcomes varied in terms of duration of testing and methods of data collection (manikin and checklists). Varied use of manikin practice, feedback devices, and assessment of CPR performance was also noted. Manikins have different technical specifications with respect to delivery of CPR. Most currently available digital training allows free multiple viewings, viewing at the learners convenience, the potential for training others (e.g. kits trained >2 people), and free retraining.  |
| Undesirable EffectsHow substantial are the undesirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial○ Small○ Moderate○ Large● Varies○ Don't know | Some studies showed a statistical difference for chest compression depth favouring instructor-led training. However, it is difficult to know how clinically significant these differences were, because in some studies compression depth was low in both groups and most differences were marginal. Furthermore: * Studies with pre-testing or with a no training control groups showed improved compression depth outcomes in digital training arms.
* Use of feedback devices for compression depth varied widely.
* Manikins vary with respect to the maximum allowable depth (e.g. some allow compressions beyond depth guidelines, while others do not), force required to generate guideline compliant depth (i.e. resistance), and chest size.
* One study noted that although some video kit manikins contained feedback devices, the video did not always explained its use (Jones 2007 350). How widespread this issue was across other studies is unknown due to lack of reporting.
* One study suggested differences in achieving CPR skills may related to the different manikins used in practice and assessment, with only the instructor-led group training on the same manikins used in assessment (Jones 2007 350).

Video only training may not achieve acceptable education outcomes for all CPR and AED skills.  | Data suggests CPR and AED training must included skills practice –preferably with corrective feedback.One study suggested insufficient emphasis in AED use in digital training may explain worse AED educational outcomes (Doucet 2019 317). |
| Certainty of evidenceWhat is the overall certainty of the evidence of effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Very low○ Low● Moderate○ High○ No included studies |

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| **Outcome** | **Certainty of evidence** |
| Patient outcomes  | Very low | ⊕ |
| Educational outcomes immediate to one-month | Moderate | ⊕⊕⊕ |
| Educational outcomes to one-year | Low | ⊕⊕ |

 | Most studies were downgraded due to loss to follow-up (>95%) for both short and long term outcomes. Most non-RCTs did not adjust for differences in characteristics and confounders (e.g. prior CPR training) at baseline between groups.  |
| ValuesIs there important uncertainty about or variability in how much people value the main outcomes? |
| Judgement | Research evidence | Additional considerations |
| ○ Important uncertainty or variability○ Possibly important uncertainty or variability● Probably no important uncertainty or variability○ No important uncertainty or variability | Main outcome is survival, and neurologically intact survival. COSCA has confirmed importance of these outcomes. COSCA: Haywood K, Whitehead L, Nadkarni VM, Achana F, Beesems S, Bottiger BW, et al. COSCA (Core Outcome Set for Cardiac Arrest) in Adults: An Advisory Statement From the International Liaison Committee on Resuscitation. Resuscitation. 2018;127:147-63.Educational outcomes were decided and prioritised by the EIT Task Force.  |  |
| Balance of effectsDoes the balance between desirable and undesirable effects favor the intervention or the comparison? |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison○ Probably favors the comparison● Does not favor either the intervention or the comparison○ Probably favors the intervention○ Favors the intervention○ Varies○ Don't know | The systematic review found no difference for most CPR educational outcomes for video kits/ video with manikin practice.  | Self-directed digital training is already widespread and more convenient for learners |
| Resources requiredHow large are the resource requirements (costs)? |
| Judgement | Research evidence | Additional considerations |
| ○ Large costs○ Moderate costs○ Negligible costs and savings○ Moderate savings○ Large savings●  Varies○ Don't know | Most studies comparing cost of video kits (with manikin) to instructor-led training state digital self-training is cheaper (see cost-effectiveness below). Digital training requires viewing equipment and the cost of training materials. Video-kits with manikins are generally cheap and comparable in costs to instructor-led classes. Most currently available digital training allows free multiple viewings, viewing at the learners convenience, the potential for training others (e.g. kits trained 2.5 people), and free retraining.Instructor-led training resources include personnel, space and equipment. Learner’s time and travel costs to classes.  | One study (Chung 2010 165) compared costs to users and determined digital self-directed learning to be more expensive –but this included the costs of purchasing a separate manikin (which is now sold as part of video kits) and assessment.   |
| Certainty of evidence of required resourcesWhat is the certainty of the evidence of resource requirements (costs)? |
| Judgement | Research evidence | Additional considerations |
| ○ Very low● Low○ Moderate○ High○  No included studies | Low quality evidence.  |  |
| Cost effectivenessDoes the cost-effectiveness of the intervention favor the intervention or the comparison? |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison○ Probably favors the comparison○ Does not favor either the intervention or the comparison● Probably favors the intervention○ Favors the intervention○ Varies○  No included studies | Hasselager (2019 28) reported a cost-effectiveness analyses of video CPR training with an infant manikin (clicker feedback). They accounted for participant time costs, cleaning, equipment and instructor time) Each 10,000 USD spent: 233 laypersons trained using self-directed digital training 71 will be competent after training. For instructor-led training, 109 can be trained and will be 65 competent.  | Digital self-training is becoming cheaper and can allow for free re-training and provide opportunity to train others. Li (2011 357) reported a cost-effectiveness analyses of video only CPR training compared to interactive instructor-led BLS training and instructor-led lectures. They reported much higher cost/passed student (knowledge only), for instructor-led training 2.1 to 3.7 times higher than video only.  |
| EquityWhat would be the impact on health equity? |
| Judgement | Research evidence | Additional considerations |
| ○ Reduced○ Probably reduced○ Probably no impact○ Probably increased○ Increased● Varies○ Don't know | The convenience and accessibility of digital self-directed training is likely to be more equitable than instructor-led training. |  |
| AcceptabilityIs the intervention acceptable to key stakeholders? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no● Probably yes○ Yes○ Varies○ Don't know | Digital training methods scored higher by participants for acceptability (Assadi 2015 291; Ali 219 30; Barr 2013 538). |  |
| FeasibilityIs the intervention feasible to implement? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no● Probably yes○ Yes○ Varies○ Don't know | Most people have access to equipment to view digital training. Video kits can be mailed.  |  |

# Summary of judgements

|  | **Judgement** |
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| **Problem** | No | Probably no | Probably yes | **Yes** |  | Varies | Don't know |
| **Desirable Effects** | Trivial | Small | **Moderate** | Large |  | Varies | Don't know |
| **Undesirable Effects** | Large | Moderate | **Small** | Trivial |  | Varies | Don't know |
| **Certainty of evidence** | **Very low** | Low | **Moderate** | High |  |  | No included studies |
| **Values** | Important uncertainty or variability | Possibly important uncertainty or variability | **Probably no important uncertainty or variability** | No important uncertainty or variability |  |  |  |
| **Balance of effects** | Favors the comparison | Probably favors the comparison | **Does not favor either the intervention or the comparison** | Probably favors the intervention | Favors the intervention | Varies | Don't know |
| **Resources required** | Large costs | Moderate costs | Negligible costs and savings | **Moderate savings** | Large savings | Varies | **Don't know** |
| **Certainty of evidence of required resources** | Very low | **Low** | Moderate | High |  |  | **No included studies** |
| **Cost effectiveness** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | **Probably favors the intervention** | Favors the intervention | Varies | **No included studies** |
| **Equity** | Reduced | Probably reduced | Probably no impact | **Probably increased** | Increased | Varies | **Don't know** |
| **Acceptability** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |
| **Feasibility** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |

# Type of recommendation

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| --- | --- | --- | --- | --- |
| Strong recommendation against the intervention | Conditional recommendation against the intervention | Conditional recommendation for either the intervention or the comparison | Conditional recommendation for the intervention | Strong recommendation for the intervention |
| ○  | ○  | ●   | ○  | ○  |