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| Question | |
| **Should public access AED vs. traditional EMS response be used for out-of-hospital cardiac arrest patients?** | |
| **Population:** | out-of-hospital cardiac arrest patients |
| **Intervention:** | public access AED |
| **Comparison:** | traditional EMS response |
| **Main outcomes:** | Survival 1-year favorable neurological outcome; Survival discharge favorable neurological outcome; Survival 30 day favorable neurological outcome; [RCT] Survival discharge; Survival discharge; Survival 30day; Survival to admission; any ROSC; |
| **Setting:** | out of hospital setting |
| **Perspective:** |  |
| **Background:** | Early defibrillation is an important component in the chain of survival. There is a growing body of evidence that increased use of public-access defibrillation by bystanders is associated with an increase in the number of survivors with a favorable neurologic outcome after out-of-hospital ventricular-fibrillation cardiac arrest.  The 2015 International Liaison Committee on Resuscitation (ILCOR) review, comparing implementation of public access AED program to traditional EMS response, found low quality evidence and concluded with a strong recommendation. |
| **Conflict of interests:** | None |

# Assessment

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| Problem Is the problem a priority? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know | Important determinants of survival in OHCA are early CPR and rapid defibrillation to restore spontaneous circulation. Delayed response time of EMS have been associated with poor survival. AEDs permit bystanders not trained in rhythm interpretation to provide early defibrillation prior to EMS arrival. Many countries already implemented public access AED program to increase survival of the cardiac arrest.  The ILCOR Basic Life Support (BLS) Task Forces have prioritized an updated review of this evidence following the publication of several large registry studies on this topic since the 2015 ILCOR review (Kiguchi 2019, 1682; Hansen 2017, 507; Kitamura 2016, 1649; Nakahara 2015, 247). |  |
| Desirable Effects How substantial are the desirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial ○ Small ○ Moderate ● Large ○ Varies ○ Don't know | AED is usually considered as safe equipment. There are many countries to have an experience of implementing PAD program successfully. But, some observational studies showed negative results (Kuisma 2003, Gianotto-Oliveira 2015, Nas 2018, Tay 2019). |  |
| Undesirable Effects How substantial are the undesirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large ○ Moderate ● Small ○ Trivial ○ Varies ○ Don't know | AED is usually considered as safe equipment. There are many countries to have an experience of implementing PAD program successfully. But, some observational studies showed negative results (Kuisma 2003, Gianotto-Oliveira 2015, Nas 2018, Tay 2019). |  |
| Certainty of evidence What is the overall certainty of the evidence of effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very low ● Low ○ Moderate ○ High ○ No included studies | The evidence is mainly from non-randomized observational studies or registry based cohort studies. | There are some elements that needs downgrade a certainty of evidence, however reviewers agree that there are also elements considering upgrade. Many recent studies used data from national registry with large sample size. Most studies showed consistent results that an implementation of PAD improved survival. There are also magnitude of effect and dose (time from cardiac arrest to shock) response (survival) effect. |
| Values Is 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 | There is little uncertainty around the value that people put on the main outcome of neurological survival and/or survival to hospital discharge. |  |
| Balance of effects Does 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 | There is large desirable effect of PAD while small undesirable effect. |  |
| Resources required How 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 | PAD program requires to deploy many AEDS in the public locations where there is a high likelihood of cardiac arrest. The cost may be various among countries, but would be higher than moderate costs. |  |
| Certainty of evidence of required resources What is the certainty of the evidence of resource requirements (costs)? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very low ○ Low ○ Moderate ○ High ● No included studies | No research examined the resource requirements for the intervention. |  |
| Cost effectiveness Does 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 | Cost-effectiveness of PAD program may be various according to country. An overview of cost-effectiveness studies reported the cost-effectiveness ratio of 37,200~1,152,400 USD/QALY [Holmberg 2017]. Recent study [Andersen, 2019] about cost-effectiveness of public AED reported that public AEDs are a cost-effective public health intervention in the United States. |  |
| Equity What 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 intervention would be utilized equally across different subgroups of patients. |  |
| Acceptability Is the intervention acceptable to key stakeholders? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know | Stakeholders are likely to accept the benefit vs risk. If effective, the benefit is high, while the relative risks would be low. |  |
| Feasibility Is the intervention feasible to implement? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes ○ Yes ● Varies ○ Don't know | It is likely that the feasibility will be dependent on the setting that it is applied. |  |

# 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** |
| ○ | ○ | ○ | ○ | **🞆** |

# Conclusions

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| Recommendation |
| We recommend the implementation of public-access defibrillation programs for patients with OHCAs. (Strong recommendation, low-quality evidence) |
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| Justification |
| In making these recommendations [in support for PAD programs], we recognize there are barriers to the implementation of PAD programs. The ILCOR Scientific Statement on Public Access Defibrillation addresses key interventions (early detection, optimizing availability, signage, novel delivery methods, public awareness, device registration, mobile apps for AED retrieval and personal access defibrillation) which should be considered as part of all public access defibrillation programmes [Brooks 2020 TBC].  In making these recommendations, we put high value on consistency with 2015 recommendation of strong recommendation and low quality evidence. Among 31 included studies, only one was randomized controlled trial which showed improved survival to discharge in CPR plus AED group compared with CPR only group. Observational studies were mostly retrospective analysis from large registry data and showed improved survival outcomes associated with public access defibrillation. However, some observational studies showed no significant differences in outcomes [Kuisma 2003, Gianotto-Oliveira 2015, Nas 2018, Tay 2019]. Although most of the evidence comes from observational studies, we decided to maintain evidence level for consistency.  There were heterogeneity among studies in this meta-analysis. The location of cardiac arrest was various including airports [Garcia 2017], subway [Gianotto-Oliveira 2015], and sports facility [Aschieri 2018]). The population of some studies was only pediatric patients [Fukuda 2017, Matsui 2019]. The control group was various among studies from the patients not defibrillated (only received CPR) to patients received defibrillated by paramedics or first responders. Some studies compared before and after period of PAD implementation, but their comparators were also various from historic control [Fleischhackl 2008, Nas 2018] to before period [Tay 2019] or initial period of implementation [Gianotto-Oliveira 2015]. Despite such heterogeneity, all patients in those studies had OHCA and most studies consistently showed that implementation of PAD improved survival. Many studies used data from big national registry. |

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| Subgroup considerations |
| Subgroup analyses may be required including adult vs pediatric population, public vs residential arrest locations, shockable vs non-shockable rhythm, layperson vs first responder AED use, dispatched vs non-dispatched AED use, etc. |

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| Implementation considerations |
| The public deployment of AED may be expensive. Therefore, the most probable location of sudden cardiac arrest in the community should be evaluation for cost effective implementation. Effective AED training for layperson in the community is also required. An overview of cost effectiveness for public access AED program reported the cost-effectiveness ratio of 37,200~1,152,400 USD/QALY [Holmberg 2017]. However, recent study [Andersen, 2019] about cost-effectiveness of public AED reported that public AEDs are a cost-effective public health intervention. |

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| Monitoring and evaluation |
| It is important for the implementing authority to maintain and monitor use of public AED. |

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| Research priorities |
| * Optimal placement/location of AEDs? * Optimal role of emergency medical dispatchers in identifying nearest AED and alerting callers to their location? * How AEDs could be most effectively integrated into citizen responder programs? |

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