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| Question | |
| **Should Double Sequential Defibrillation vs. Standard defibrillation be used for Adult cardiac arrest patients with a shockable (VF/pVT) cardiac arrest rhythm?** | |
| **Population:** | Adult cardiac arrest patients with a shockable (VF/pVT) cardiac arrest rhythm |
| **Intervention:** | Double Sequential Defibrillation |
| **Comparison:** | Standard defibrillation |
| **Main outcomes:** | Good Neurological Outcome at Discharge; Survival to Hospital Discharge; Survival to Hospital Admission; Return of Spontaneous Circulation; Termination of VF; |
| **Setting:** | Any Setting |
| **Perspective:** |  |
| **Background:** |  |
| **Conflict of interests:** |  |

# 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 | Survival from sudden cardiac arrest is low. Patients who present in an initial cardiac rhythm of ventricular fibrillation (VF) have a higher rate of good outcome. Approximately 20% of VF patients, however, will remain in VF (after 5 shocks) despite standard resuscitation interventions. Patients in refractory VF have significantly lower rates of survival than patients who respond to standard resuscitation treatments. |  |
| Desirable Effects How substantial are the desirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial ○ Small ● Moderate ○ Large ○ Varies ○ Don't know | Earlier termination of VF, and restoration of spontaneous circulation is associated with better outcomes from cardiac arrest. |  |
| Undesirable Effects How substantial are the undesirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large ○ Moderate ○ Small ○ Trivial ○ Varies ● Don't know | It is not currently known if there are undesirable effects of double sequential defibrillation. Excess defibrillation energy may cause myocardial stunning and prevent return of organised rhythm post-defibrillation [Crampton 1980 167]. | There are possibly undesirable effects associated with double dispatching multiple units in order to perform DSED. including clinical risk to other patients |
| 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 certainty around the evidence for DSED compared to standard defibrillation is very low. The results across studies are inconsistent and there is a large degree of potential confounding within each study. The case reports of DSD effectiveness are likely to represent no more than publication bias. |  |
| 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 no clear evidence for either intervention, but current evidence is more in favour of comparator group (standard defibrillation). The current quality of evidence is very-low and is at high risk of confounding. |  |
| 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 | No research examined costs associated with the intervention. | There are most likely costs associated with double dispatching multiple units in order to perform DSED. The extent of the costs associated with this intervention will vary from service to service.  Documented defibrillator damage may also result in increased service/repair 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 | There are costs associated with the intervention as it requires multiple defibrillators to perform. The resource requirements to carry out the intervention will vary across EMS services. |
| 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 | Not known. No included studies |  |
| 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. | It is possible that in lower income communities it is not possible to perform DSED due to additional resource requirements. |
| 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.    The certainty around the level of evidence however is very low and there is no evidence that the intervention is beneficial in terms of our outcomes of interest (neurological outcome and survival to hospital discharge). |  |
| Feasibility Is the intervention feasible to implement? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes ○ Yes ● Varies ○ Don't know | There is no research examining the feasibility of this intervention. It is likely that the feasibility will be dependent on the setting that it is applied. | Feasibility will depend on dispatching procedures, availability of units with defibrillators and training of personnel.  Feasibility may also depend on the setting, rural vs. urban vs. remote settings.  May also depend on low vs high resource settings. |

# 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 suggest against routine use of dual (or double) sequential defibrillation strategy in comparison to standard defibrillation strategy for cardiac arrest with a shockable rhythm (weak recommendation, very low certainty of evidence). |
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| Justification |
| The evidence available (very-low-quality evidence) suggests lower rates of survival and neurological outcome for patients treated with DSED.  There is no evidence suggesting deviation from standard of care. |

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| Subgroup considerations |
| None |

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| Implementation considerations |
| Implementation of DSED would require training to frontline staff as well as ensuring that there were defibrillators that were available to provide the intervention. |

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| Monitoring and evaluation |
| It is important to monitor the intervention, not just to determine effectiveness but to track any adverse events such as harm to the patient, defibrillator damage, the increase in resource utilization etc. |

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| Research priorities |
| 1. High-quality study examining the effectiveness of DSED compared to standard defibrillation in terms of survival and neurological outcome at hospital discharge  2. What is the optimal timing of the intervention?  3. What is the optimal pad placement? |

**Reference**

Crampton R. Accepted, controversial, and speculative aspects of ventricular defibrillation. Progress in Cardiovascular Diseases. Volume 23, Issue 3, 1980, 167-186