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| Question |
| **EMS career experience and exposure to OHCA** |
| **Population:** | Adults and children who have a cardiac arrest  |
| **Intervention:** | Resuscitation by experienced EMS practitioners or EMS practitioners with higher exposure to resuscitation |
| **Comparison:** | Resuscitation by inexperienced EMS practitioners or EMS practitioners with lower exposure to resuscitation |
| **Main outcomes:** | Good neurological outcome at discharge/30-days; Survival to hospital discharge/30-days; Survival to hospital (event survival); ROSC |
| **Setting:** | out-of-hospital  |
| **Perspective:** |  |
| **Background:** | Definitions:Exposure – EMS personnel attendance at an attempted resuscitation. Experience – Years of career experience.  |
| **Conflict of interests:** | Janet Bray and Judith Finn are co-authors on an included paper (Dyson 2016). Neither performed the risk of bias or data extraction for this study.  |

# 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 | There are no current ILCOR recommendations on EMS experience and exposure to resuscitation. A systematic review published in 2016 (Dyson 2014, 1134) found very little evidence, however there have been several large, subsequent studies published.  | This PICO was recently ranked #7 by EIT TF.Resuscitation knowledge and skills are likely to degrade with time if not refreshed with regular use or training.  |
| Desirable EffectsHow substantial are the desirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial○ Small● Moderate○ Large○ Varies○ Don't know | The EIT Task Force places high value on ensuring EMS teams attending OHCA patients are appropriately skilled and experienced to perform resuscitation.  |  |
| Undesirable EffectsHow substantial are the undesirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Large○ Moderate○ Small● Trivial○ Varies○ Don't know | Some studies reported decreased rates of attempted resuscitation with higher exposure of attending EMS (Dyson 2016, 154). The appropriateness of this finding is unknown. This may have confounded the evidence of exposure; as EMS personnel with more exposure may have identified OHCA cases more likely to survive. |  |
| 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 |  All evidence is from observational studies. Very low certainty of evidence for all outcomes (downgraded for risk of bias and imprecision).  | Exposure to resuscitation in the out-of-hospital setting doesn’t necessary reflect skill level or experience. The finding of an association between exposure and outcomes aligns with the association of OHCA case-volume and survival seen in emergency departments and hospitals (e.g. Amagasa 2019, 161; Ro 2012, 855; Shin 2011, 32). Exposure to resuscitation varies widely both within and between EMS (Dyson 2015, 93). Exposure to rare OHCA cases in whom specific skills are needed (e.g. neonates, pediatrics, traumatic OHCAs) is likely to be very low in all EMS personnel (Dyson 2015, 93).  |
| 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 | Improved survival and neurologic recovery are outcomes valued by patients and their caregivers (Haywood 2018, e783).  |  |
| 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 current limited evidence suggests improved short-term survival with increased exposure to attempted resuscitation by EMS personell. The two largest and highest quality observational studies both report improved outcomes with higher preceding exposure after adjustment for factors known to predict survival (Dyson 2016 154; Tuttle 2018 654). The current evidence suggests no relationship between years of career experience and patient outcomes.  |  |
| 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 | No studies have reported the resources required to monitor and report EMS exposure to attempted resuscitation. Existing studies have relied on registries and employment databases.  | Required resources include: the ability to identify and capture of EMS at the scene of all OHCA with attempted resuscitation; systems to identify the number and time since attempted resuscitation was performed for each clinical EMS employee that attends OHCA cases; alert systems for low or gaps in exposure; and educational resources for supplementation if needed.  |
| 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 | No evidence.  | Costs are likely to vary between different health care settings.  |
| 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 | No evidence on cost-effectiveness.  |  |
| 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 | Exposure is likely to be lower in rural regions.The associated resources and costs may prohibit the monitoring exposure in some health care settings.  |  |
| AcceptabilityIs the intervention acceptable to key stakeholders? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no● Probably yes○ Yes○ Varies○ Don't know | There is an expectation from the public and health care systems that EMS employees will be equipped with the knowledge and skills to treat this important critical condition. |  |
| FeasibilityIs the intervention feasible to implement? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no○ Probably yes● Yes○ Varies○ Don't know | Some studies used existing data to measure exposure (e.g. OHCA registries).  | Feasibility of monitoring and increasing exposure to resuscitation is likely to be dependent on the size of the EMS and existing resources. Self-reporting may be needed in some 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 that EMS systems: 1) monitor their clinical personnel’s exposure to resuscitation and 2) implement strategies, where possible, to address low exposure or ensure that treating teams have members with recent exposure (weak recommendation, very-low certainty of evidence).* |
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| Justification |
| *In making this recommendation the EIT Task Force prioritized the potential for improved patient outcomes through increased exposure, and with the understanding that knowledge and skills degrade over time and without use. We recognize that the evidence in support of this recommendation comes from observational studies of very low quality.* *Potential strategies to improve exposure include the rotation of EMS personnel through higher OHCA volume areas and ensuring treating teams include EMS personnel with recent exposure. However, the strategies employed are likely to vary between EMS systems.* *The EIT Task Force discussed the maintenance of resuscitation skills through team simulation. Team simulation has found to be effective for maintaining ALS skills in hospital settings, and are associated with improved patient outcomes (Andreatta 2011 33; Knight 2014 243). Such training may be a useful proxy for exposure in low exposure settings and for rare OHCA cases (e.g. pediatrics and neonates).* *The EIT Task Force also discussed the possibility of providing a target level for “ideal exposure”. However, it was decided more evidence is needed before exposure can be more accurately defined as the existing studies are conflicting. Dyson (2016, 154) report a linear relationship between survival and exposure, whereas Tuttle (2018, 654) report a levelling of survival at >15 exposure in the preceding 5 years.* |

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| Subgroup considerations |
| Rare cases (e.g. neonates and paediatrics) may require frequent high-fidelity simulation.  |

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| Implementation considerations |
| Different strategies may be needed depending on the EMS service, available resources and the size of the population serviced.  |

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| Monitoring and evaluation |
| Will require a database to monitor exposure to attempted resuscitation.  |

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| Research priorities |
| Limited evidence to define low exposure to OHCA resuscitation. Limited evidence of exposure to OHCA rare cases. Interventional studies implementing strategies to improve EMS exposure to resuscitation.  |