# QUESTION

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| **TITLE** | |
| **POPULATION:** | Adults and children suffering an out-of-hospital cardiac arrest |
| **INTERVENTION:** | having a citizen CPR responder notified of the event via technology or social media |
| **COMPARISON:** | no such notification |
| **MAIN OUTCOMES:** | survival to hospital discharge with good neurological outcome, survival to hospital discharge/30-day survival, hospital admission, ROSC, bystander CPR rate, time to first compressions/shock delivery |
| **SETTING:** | OHCA |
| **PERSPECTIVE:** | Community perspective |
| **BACKGROUND:** | Cardiac arrest is one of the most common causes of death, most of which take place outside the hospital as sudden cardiac death. However, with immediate actions such as bystander-initiated cardiopulmonary resuscitation (CPR) and defibrillation many lives could be saved. Chances of survival after out‐of‐hospital cardiac arrest decrease 12% per minute from collapse until defibrillation. Bystander cardiopulmonary resuscitation (CPR) improves survival from out-of-hospital cardiac arrest, but rates and performance quality remain low. Engaging volunteer citizens through different social media/technologies could potentially increase rates of bystander CPR/defibrillation and survival. |
| **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 | Cardiac arrest is one of the most common causes of death, most of which take place outside the hospital as sudden cardiac death. However, with immediate actions such as bystander-initiated cardiopulmonary resuscitation (CPR) and defibrillation many lives could be saved. Chances of survival after out‐of‐hospital cardiac arrest decrease 12% per minute from collapse until defibrillation. Bystander cardiopulmonary resuscitation (CPR) improves survival from out-of-hospital cardiac arrest, but rates and performance quality remain low. Engaging volunteer citizens through different social media/technologies could potentially increase rates of bystander CPR/defibrillation and survival. |  |
| **Desirable Effects**  How substantial are the desirable anticipated effects? | | |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * Trivial * Small * Moderate * Large * Varies * Don't know | Notifying a citizen CPR responder by a smartphone’s app with mobile positioning system (MPS) or Text Message (TM)-alert system to attend Out-Of-Hospital Cardiac Arrest (OHCA) events and could increase early CPR and defibrillation improving survival. |  |

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| **Undesirable Effects**  How substantial are the undesirable anticipated effects? | | |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * Large * Moderate * Small * Trivial * Varies * Don't know | There is a knowledge gap regarding:  Safety of notifying CPR responders by a smartphone’s app with mobile positioning system (MPS) or Text Message (TM)-alert system to attend Out-Of-Hospital Cardiac Arrest (OHCA) events  The psychological or emotional impact imposed on responders by potential or actual engagement in a call to rescue. |  |
| **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 comes from one randomized controlled trial, which was reported to be of a high quality. The one before-after study was also of a high-moderate quality (depending on the outcome assessed). The rest were cohort studies which were of a very low or low quality, downgraded for the risk of bias, inconsistency and imprecision as well as the study design. |  |
| **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 | Different initiatives, including the use of technology, to improve the outcomes of OHCAs are a priority for patients and clinicians. |  |

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| uncertainty or variability   * No important uncertainty or variability |  |  |
| **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 | The general direction of effect across most studies favours the intervention. Survival to hospital discharge, which was a critical outcome assessed in 4 studies was reported to be better in the intervention group.  Bystander CPR, an important outcome, was reported to be better in the intervention group in all studies.  Survival to hospital discharge with good neurological outcome, critical outcome, was assessed in two studies (NRS and cohort) and there was no statistically significant difference between the intervention and the comparison groups. ROSC, another critical outcome, was assessed in 4 studies (1 RCT and 3 observational) and there was not a statistically significant difference in the two groups.  Time to first compression/shock was assessed in 4 observational studies of very low quality and was better in the intervention group in all the studies. |  |
| **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 | None of the studies reported the costs of first responders engaged by technology in cases of out of hospital cardiac arrest. |  |
| **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 studies examined the costs of first responders engaged by technology in cases of out of hospital cardiac arrest. |  |
| **Cost effectiveness**  Does the cost-effectiveness of the intervention favor the intervention or the comparison? | | |

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| **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 studies examined the cost-effectiveness of first responders engaged by technology in cases of out of hospital cardiac arrest. |  |
| **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 | No studies examined health equity of first responders engaged by technology in cases of out of hospital cardiac arrest. However, it is reasonable to assume that increasing access to bystander CPR will increase access to potentially life-saving interventions for all OHCAs (and thereby probably increasing health equity). |  |
| **Acceptability**  Is the intervention acceptable to key stakeholders? | | |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * No * Probably no * Probably yes * Yes * Varies * Don't know | No studies examined acceptability |  |
| **Feasibility**  Is the intervention feasible to implement?  **Is the intervention feasible to implement?** | | |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * No * Probably no * Probably yes * Yes * Varies * Don't know | No studies examined the feasibility of engaging first responders by technology in cases of out of hospital cardiac arrest. |  |

# SUMMARY OF JUDGEMENTS

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|  | **JUDGEMENT** | | | | | | |
| **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**

## Recommendation

We recommend that citizen/individuals who are in close proximity to a suspected Out-Of-Hospital Cardiac Arrest (OHCA) event and willing to be engaged/notified by a smartphone app with mobile positioning system (MPS) or Text Message (TM)-alert system should be notified (strong recommendation, very low-certainty evidence).

## Justification

We make these suggestions considering the following:

We considered the improved outcomes in OHCA patients when a citizen CPR responder was notified by a smartphone app or text message for the event and started CPR or delivered defibrillation across most studies. Our treatment recommendation is based on the totality of evidence for the outcomes we designated as critical: survival to hospital discharge with good neurological outcome, survival to hospital discharge, and hospital admission.

Even though the certainty of the evidence is very low/low among the observational cohort studies, there was one RCT and one before-after study of a high quality, reporting improved outcomes when first responders were notified by an smartphone’s app with mobile positioning system (MPS) or Text Message (TM)-alert system for the OHCA event and started CPR or delivered defibrillation.

For the critical outcome «survival with favourable neurologic outcome at discharge», the meta-analysis of adjusted data included 2905 OHCAs (4 studies) and showed benefit in survival to hospital discharge when having a citizen CPR responder notified of the event by smartphone’s app with mobile positioning system (MPS) or Text Message (TM)-alert system [Adj. pooled RR 1.70 (95% CI 1.16-2.48) (I2=69%, P=0.02)]. Pooled RR were estimated using a random effect model, as it takes into account the between studies variability. Heterogeneity between studies was assessed using the I2 statistics. The heterogeneity across the four studies included in the meta-analysis that assessed the outcome “survival to hospital discharge” was moderate (I2=69%, p=0.021). Sensitivity analyses were conducted to investigate the impact each study had on the overall estimate. The heterogeneity decreased from I2=69% p=0.021 to I2=0.0% p=0.5 after omitting the study by Lee et al (Lee 2019 198). In fact, this is the only study that reports a non-significant result and has a different study design (before-after) compared to the other three studies. The presence of the statistical heterogeneity suggests the presence of variability among the clinical characteristics of the studies’ populations (ie comorbidities, cause of cardiac arrest, time and location of the arrest, arrival time of lay persons or first responders at the location) as well as methodological heterogeneity (ie study design, data collection).

## oup considerations

## Implementation considerations

Technology is being increasingly utilized to engage bystander assistance in cardiac arrest events. The use of mobile technology including social media, cellular networks and smartphone applications could be of great impact in the next future. We recommend integrating technology that enables dispatchers to alert citizen responders near cardiac arrest victims. As these technologies become more ubiquitous, they will likely continue to play a larger role in the chain of survival. A causative relationship between application-initiated citizen responses and survival has not been made, and systems utilizing such technology should continue to develop quality data to further demonstrate the benefit of integrating such technologies into EMS. Privacy legislation, which has been cited as a barrier to implement such technologies, may require modernization.

## Monitoring and evaluation

## Research priorities

There is the need for more high-evidence quality prospective studies including long term survival assessment. Especially risk of bias is a predominant issue, with studies controlling for confounding factors only for a few outcomes. More RCT studies are needed for more robust evidence.

There is no evidence of the cost-effectiveness of notifying laypersons through a smartphone’s app with mobile positioning system (MPS) or Text Message (TM)-alert system in the case of OHCAs.

There was only one study assessing which of the technologies used could be more beneficial in order to improve the outcomes of OHCAs (APP vs SMS). There is the need for more high-quality evidence to determine the best technology to use in terms of OHCAs outcomes.

There is the need for the extension of these studies in different social, cultural, ethnic and geographical contexts.

The results of the included studies apply only on OHCAs of cardiac origin, hence the need for more evidence regarding OHCAs in cases trauma, drowning, intoxication, or suicide.

There is the need for more consistent high-quality evidence on the impact of engaged/notified versus unnotified bystander responses on survival with favourable neurologic outcome at hospital discharge, ROSC and survival to hospital admission?

What is the impact of engaged/notified versus unnotified bystander responses on bystander CPR rates and time to first compressions/shock delivery?

Safety of notifying CPR responders by a smartphone’s app with mobile positioning system (MPS) or Text Message (TM)-alert system to attend Out-Of-Hospital Cardiac Arrest (OHCA) events.

The psychological or emotional impact imposed on responders by potential or actual engagement in a call to rescue.