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| Question | |
| **Should characteristics of the call process (these might include the specific words by the caller, langauge or idioms spoken by the caller and understood by the call taker, perceptions of the call receiver, emotional state of the caller, other caller characteristics, type of personnel receiving the call, background noises etc.) be used to diagnose cardiac arrest in adult and children in any setting (in-hospital or out-of-hospital)?** | |
| **Population:** | Adult and children in any setting (in-hospital or out-of-hospital) |
| **Intervention:** | Characteristics of the call process (these might include the specific words by the caller, language or idioms spoken by the caller and understood by the call taker, perceptions of the call receiver, emotional state of the caller, other caller characteristics, type of personnel receiving the call, background noises etc.) |
| **Purpose of the test:** | Increase the likelihood of the performance of bystander CPR and facilitate dispatching of appropriate resources |
| **Role of the test:** | Increase the likelihood of the dispatcher diagnosing cardiac arrest when it is present |
| **Linked treatments:** | Bystander CPR |
| **Anticipated outcomes:** | Provision of bystander CPR; dispatch of appropriate support |
| **Setting:** | Any setting (in-hospital or out-of-hospital) |
| **Perspective:** | Community; dispatcher; patient |
| **Background:** | Out-of-hospital cardiac arrest is associated with high morbidity and mortality. The treatment of cardiac arrest is time-sensitive and begins with recognition of the clinical problem at the time an emergency call is placed. Previous studies have shown that dispatcher recognition leads to increased rates of bystander CPR and improved outcomes. |
| **Subgroups:** | OHCA and IHCA.  Sub-groups of studies that utilized similar dispatching algorithms or criteria for diagnosis of cardiac arrest and studies that had similar backgrounds/training for emergency dispatchers. |
| **Conflict of interests:** | None identified |

# 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 | Out-of-hospital cardiac arrest is associated with high morbidity and mortality. The treatment of cardiac arrest is time-sensitive and begins with recognition of the clinical problem at the time an emergency call is placed. Previous studies have shown that dispatcher recognition leads to increased rates of bystander CPR (Rea 2001 2513) and improved outcomes.(Rea 2001 2513) | Emergency dispatchers need to be as accurate as possible in their diagnosis of cardiac arrest, prioritizing sensitivity (identifying all patients who are in cardiac arrest at the time of emergency call). |
| Test accuracy How accurate is the test? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very inaccurate ○ Inaccurate ○ Accurate ○ Very accurate ● Varies ○ Don't know | The accuracy of the diagnostic test statistics vary across the included studies. Sensitivities ranged from 0.46 to 0.98 and specificities from 0.32 to 1.00.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | | Sensitivity | 0.46 to 0.98 | | Specificity | 0.32 to 1.00 | |  | |  |  |  |  | | --- | --- | --- | --- | | Prevalences | 1%d | 15%d |  | |  |  | Outcome | № of studies (№ of patients) | Study design | Factors that may decrease certainty of evidence | | | | | Effect per 1,000 patients tested | | Test accuracy CoE | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Risk of bias | Indirectness | Inconsistency | Imprecision | Publication bias | pre-test probability of 1% | pre-test probability of 15% | | **True positives** (patients with cardiac arrest) | 47 studies 84656 patients | cohort & case-control type studies | serious a | not serious | serious b | serious c | none | 5 to 10 | 69 to 147 | ⨁◯◯◯ VERY LOW | | **False negatives** (patients incorrectly classified as not having cardiac arrest) | 0 to 5 | 3 to 81 | | **True negatives** (patients without cardiac arrest) | 12 studies 842093 patients | cohort & case-control type studies | serious a | not serious | serious b | not serious | none | 317 to 990 | 272 to 850 | ◯⨁◯◯ LOW | | **False positives** (patients incorrectly classified as having cardiac arrest) | 0 to 673 | 0 to 578 |  Explanations a. High or unclear risk of bias for a number of included studies  b. Diagnostic statistics ranges significantly across studies  c. Significant imprecision within individual studies (large 95% CI). Pooled data not available.  d. 1% is the prevalence of cardiac arrests for all emergency calls. 15% is the prevalence of cardiac arrests using unconsciousness as the denominator. | The variation in accuracy is most likely confounded by differences in algorithms/criteria used to diagnose cardiac arrest, the training and experience of personnel in the dispatch centres, and the denominator of patients included across the different studies. There may also be additional, unmeasured characteristics (e.g. language barriers) that impact the diagnosis of cardiac arrest by dispatchers |
| Desirable Effects How substantial are the desirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial ○ Small ○ Moderate ● Large ○ Varies ○ Don't know | Recognition of cardiac arrest results in appropriate resources being dispatched at the time of the emergency call. It also allows dispatchers to provide bystander CPR instructions. Both of these actions result in earlier treatment of cardiac arrest improving the patient's probability of survival. |  |
| Undesirable Effects How substantial are the undesirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large ○ Moderate ● Small ○ Trivial ○ Varies ○ Don't know | From an individual patient perspective, the undesirable effects of overly sensitive (decreased specificity) dispatch algorithms for cardiac arrest recognition can result in bystander CPR being performed on patients who are not in cardiac arrest. This can lead to injuries such as rib fractures (Haley 2011 282, Moriwaki 2012 3).  From a system perspective overly sensitive cardiac arrest recognition can result in ambulances responding to calls unnecessarily with “lights and sirens” which is the leading cause of motor vehicle accidents involving emergency vehicles (Watanabe 2019 101). Dispatching resources to a potential cardiac arrest also ties up valuable resources in the field that are then unavailable to respond to subsequent emergency calls. | In order to properly assess the degree of undesirable effects it also needs to be taken into account that while emergency responders may be dispatched incorrectly for a cardiac arrest that prompts the use of “lights and siren” response, it is likely that the patient condition would dictate use of “lights and siren” and so this response level would not be considered inappropriate. We did not examine research that indicated the proportion of responses for cardiac arrest that would result in a patient condition that was “non-emergent”. |
| Certainty of the evidence of test accuracy What is the overall certainty of the evidence of test accuracy? | | |
| Judgement | Research evidence | Additional considerations |
| ● Very low ○ Low ○ Moderate ○ High ○ No included studies | The certainty of the evidence regarding the accuracy of dispatcher recognition was inconsistent across included studies and the level of evidence was very-low. Additional evidence may increase the certainty around the true accuracy of dispatcher recognition of cardiac arrest. | Comparisons between different dispatching algorithms and across different systems resulted in significant variation in diagnostic accuracy making comparisons between systems complicated. Due to these differences between systems and reporting of studies there may not be a single measure of test accuracy. |
| Certainty of the evidence of test's effects What is the overall certainty of the evidence for any critical or important direct benefits, adverse effects or burden of the test? | | |
| Judgement | Research evidence | Additional considerations |
| ● Very low ○ Low ○ Moderate ○ High ○ No included studies | The certainty of evidence is very low regarding the accuracy of dispatcher recognition, however recognition leads to treatments which are shown to improve patient outcomes from cardiac arrest. There are minor adverse effects related to over-diagnosis of cardiac arrest such as the potential for injury when CPR is provided to patients not in cardiac arrest. The incidence of injury is low from bystander CPR. There is no information on the burden of the test. |  |
| Certainty of the evidence of management's effects What is the overall certainty of the evidence of effects of the management that is guided by the test results? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very low ○ Low ○ Moderate ● High ○ No included studies | There is evidence that bystander CPR, including dispatcher-assisted bystander CPR can improve a patient's chance of survival and neurological outcome after cardiac arrest.(Song 2014 101, Besnier 2015, 590 Nikolaou 2019 82) Dispatcher recognition of cardiac arrest is an important initial step that has been shown to increase overall rates of bystander CPR.(Goto 2014 1, Song 2014 101)  Appropriate dispatch of emergency resources and rapid EMS response times are also associated with significant improvements in survival from cardiac arrest. |  |
| Certainty of the evidence of test result/management How certain is the link between test results and management decisions? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very low ○ Low ○ Moderate ● High ○ No included studies | Recognition of cardiac arrest is required for dispatchers to initiate dispatcher-assisted CPR instructions to bystanders at the scene. Dispatcher-assisted telephone CPR has been previously shown to significantly increase overall rates of bystander CPR.(Goto 2014 1, Song 2014 101, Fukushima 2017 1)  Dispatcher recognition of cardiac arrest would also result in appropriate and timely response of emergency personnel. It is not known however, if recognition of cardiac arrest is required for timely dispatch of EMS resources. The difference in response for a patient determined to be in cardiac arrest and a patient determined to be unconscious but breathing, or breathing abnormally would not be expected to significantly differ. |  |
| Certainty of effects What is the overall certainty of the evidence of effects of the test? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very low ● Low ○ Moderate ○ High ○ No included studies | Current evidence of the accuracy of the diagnostic test is variable. New evidence could provide further information which could improve our understanding of the diagnostic accuracy of dispatch recognition of cardiac arrest. |  |
| 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 | No included research examining patient values. Dispatcher recognition is key to implementing timely care to cardiac arrest patients, as such we feel there would be little variability in the value placed by patients, the general public, or medical practitioners in early, accurate recognition by dispatchers over the phone. |  |
| 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 | Recognizing cardiac arrest has the ability to improve patient survival. Any possible negative consequences of false positive rates (e.g. providing bystander CPR to a patient not in cardiac arrest) would be considered minor in comparison.  Any negative systemic impact through increased false activation of emergency resources would also be considered minor compared to ensuring that all patients in cardiac arrest receive early treatment and rapid emergency response. | Value should be placed on increased sensitivity (i.e. recognizing all patients in cardiac arrest) which would most likely lead to an increased number of false positives (i.e. providing CPR to a patient not in cardiac arrest). |
| 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 studies evaluated the cost associated with training, implementing algorithms into dispatch centres, or monitoring diagnostic accuracy for recognition of cardiac arrest | There are costs and resources associated with training emergency medical dispatchers, and implementing algorithms into dispatching centres protocols for the recognition of 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 were identified that evaluated cost and/or resource requirements. |  |
| 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 | No studies were identified that evaluated cost and/or resource requirements. |  |
| 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 included studies specifically examined this question. Previous research has shown that bystander CPR rates are not consistent and that specific neighbourhoods, and socio-economic status are associated with decreased rates of bystander CPR (Sasson 2012 1607), ultimately contributing to lower probability of survival. Dispatcher recognition, and dispatcher-assisted CPR (DA-CPR) could improve rates of bystander CPR, which would have a larger effect in areas with lower initial bystander CPR rates.  Further, as dispatchers do not have access to information about race, socio-economic status, etc. there is no discrimination on the part of the dispatcher when offering CPR instructions. |  |
| Acceptability Is the intervention acceptable to key stakeholders? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know | Yes, dispatcher recognition of cardiac arrest at the time of emergency call is an acceptable intervention. The benefits of recognition far outweigh the risks associated with lack of recognition. Any undesirable consequences of providing CPR to patients who are not in cardiac arrest would also be outweighed by the need to ensure high sensitivity to recognize all potential cardiac arrest patients. | High accuracy in recognition is important to ensure that false positives and false negatives are minimized. |
| Feasibility Is the intervention feasible to implement? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know | It is feasible to implement algorithms or criteria into dispatch centres to identify potential cardiac arrests and dispatch appropriate resources. | We cannot make recommendations on which is the most accurate algorithm or criteria to identify cardiac arrest. Dispatch centres should continue to work to improve the diagnostic accuracy of their recognition of cardiac arrest. |

# Summary of judgements

|  | **Judgement** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Problem** | No | Probably no | Probably yes | **Yes** |  | Varies | Don't know |
| **Test accuracy** | Very inaccurate | Inaccurate | Accurate | Very accurate |  | **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 the evidence of test accuracy** | **Very low** | Low | Moderate | High |  |  | No included studies |
| **Certainty of the evidence of test's effects** | **Very low** | Low | Moderate | High |  |  | No included studies |
| **Certainty of the evidence of management's effects** | Very low | Low | Moderate | **High** |  |  | No included studies |
| **Certainty of the evidence of test result/management** | Very low | Low | **Moderate** | High |  |  | No included studies |
| **Certainty of effects** | 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 dispatch centres implement a standardized algorithm and/or cardiac arrest criteria to immediately determine if a patient is in cardiac arrest at the time of emergency call. (Strong Recommendation, Very low quality of evidence). |
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| Justification |
| In making this recommendation we prioritized the desirable benefits of increase in potential life-saving treatment that would result from immediate dispatcher recognition of cardiac arrest, such as increased bystander CPR rates through dispatcher-assisted bystander CPR and dispatching of appropriate and timely emergency resources, compared to any negative consequences of providing CPR to a patient who is not in cardiac arrest or any system-level impact of inappropriate emergency response. |

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| Subgroup considerations |
| We were unable to identify any specific algorithms/criteria that were more accurate in diagnosing cardiac arrest at the time of emergency call. We were further unable to identify any education or training for emergency medical dispatchers that improves diagnosis. |

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| Implementation considerations |
| Implementation of dispatching algorithms requires initial training for dispatch personnel and ongoing monitoring and evaluation to ensure diagnostic accuracy. Implementation of specific algorithms / criteria have been shown to improve recognition of cardiac arrest over dispatch intuition [Besnier 2015]. Further, multiple studies have shown that training programs can improve dispatcher performance. [Hardeland 2017; Meischke 2017] |

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| Monitoring and evaluation |
| As there is considerable variability in the literature with regards to dispatch diagnostic accuracy and there are a large number of factors that can impact cardiac arrest recognition it is important that dispatch centres have a method to monitor and evaluate their ability to recognize cardiac arrest cases at the time of emergency call. Dispatch centres should look for potential areas of improvement if it is determined that recognition rates are low. |

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| Research priorities |
| 1. Are there other potentially important criteria that would improve dispatcher recognition of cardiac arrest in addition to standard algorithms?  2. What are potential barriers that decrease the accuracy of dispatcher recognition (e.g. language barriers, caller characteristics, patient characteristics)?  3. Dose the use of artificial intelligence and machine learning improve recognition of cardiac arrest compared to emergency medical dispatcher recognition?  4. What is the cost associated with implementing and monitoring dispatcher recognition programs?  5. What is the most accurate algorithm, or criteria to recognize cardiac arrest?  6. What is the relationship between dispatch algorithms and time to recognition? Time to initiation of dispatcher-assisted CPR? |

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