QUESTION

Should a clinical decision rule be used to diagnose chance of surviving a cardiac arrest among hospitalized patients at risk of cardiac arrest?	
POPULATION:	Hospitalized adults and children experiencing an in-hospital cardiac arrest.
INTERVENTION:	Any pre-arrest clinical prediction rule.
PURPOSE OF THE TEST:	Predict survival or survival with favorable neurological outcome following in-hospital cardiac arrest.
ROLE OF THE TEST:	Facilitate do-not-attempt cardiopulmonary resuscitation (DNACPR) discussions with patients/ families and inform decisions on which patients who should not be resuscitated.
LINKED TREATMENTS:	Cardiopulmonary resuscitation
ANTICIPATED OUTCOMES:	Prediction of survival to hospital discharge and survival with favorable neurological outcome.
SETTING:	In-hospital cardiac arrest.
PERSPECTIVE:	A reliable test can predict survival outcomes and could be implemented in clinical practice to facilitate DNACPR discussions with patients and decide which patients that should not be attempted resuscitated.
BACKGROUND:	CPR is started in only 6-12% of all hospital deaths in some settings, this is mainly to a pre-existing DNACPR at the time of the cardiac arrest. In cases where CPR is initiated for in-hospital cardiac arrest, only 15-30 % will survive to hospital discharge and some of these patients will survive in a state of health they would not have desired. Thus, the ability to predict which patients that are likely, or unlikely, to achieve a meaningful survival outcome from CPR is important to patients, their families, and caregivers.
SUBGROUPS:	Adults and children.
CONFLICT OF INTERESTS:	Theresa Djärv has published studies on pre-arrest prediction scores and was excluded from bias assessment.

ASSESSMENT

Problem Is the problem a priority?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**

○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	Only 15-30 % of in-hospital cardiac arrest patients will survive to hospital discharge and some of these patients will survive with unfavorable neurological outcome with a cerebral performance category of 3 or 4. Thus, the ability to predict which patients that are likely, or unlikely, to benefit from CPR is important to patients and caregivers.	• Hospitalized patients are normally at risk of physiological deterioration and cardiac arrest. For these patients, a key decision is whether CPR should be attempted if they experience a cardiac arrest. • Decisions regarding resuscitation have important implications. If CPR is attempted in a patient in whom it would be futile or does not align with their values and preferences, the individual will be subjected to a medical intervention that would not be in their best interests. If resuscitation is not attempted where it might be in the patient's best interests, the patient will inevitably die. • Identifying patients in whom CPR is appropriate is clinically challenging and requires careful discussion with the patient or their family to elicit their values and preferences. A key concern is that such discussions and linked decisions may be unduly influenced by the healthcare provider's and patient's subjective assessment of the likely success of CPR. Prediction scores provide an attractive solution to inform these challenging discussions. However, current scores are rarely used in practice and there is a need to synthesize evidence on their test performance.

Test accuracy

How accurate is the test?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very inaccurate ○ Inaccurate ○ Accurate ○ Very accurate ● Varies	We identified 23 studies investigating 13 different pre-arrest prediction rules of survival following in-hospital cardiac arrest. • For the outcome of predicting survival to hospital discharge, we identified very low certainty evidence from seven historical cohort studies {Ebell 1997 171, O'Keeffe 1994 21, Bowker 1999 89, Ohlsson 2014 294, Limpawattana 2018 1231, George 1989 28, Cohn 1993 347} investigating the pre-arrest morbidity (PAM) score (downgraded for risk of bias, indirectness, imprecision, and inconsistency) and four of these studies investigated the	All studies predicted survival outcomes for cardiac arrest patients only. All studies were based on historical cohorts and there were no prospective validation or prospective

○ Don't know	prognosis after resuscitation (PAR) score (downgraded for risk of bias, indirectness, imprecision, and inconsistency), Table 2. The studies identified various cut-off values for the score to predict no chance of survival to hospital discharge. Due to clinical heterogeneity in study cohorts, no meta-analysis was conducted. The outcomes of the PAM score and PAR score are presented in Table 1 and Table 2 respectively. Limpawattana et al., {Limpawattana 2018 1231} did not report data to calculate sensitivity, specificity, NPV, and PPV with 95% confidence intervals (CI). However, they reported an area under the curve (AUC) of 0.65 (95% CI: 0.56-0.74) for the PAM score and self-calculated outcome measures without confidence intervals for the prediction of death (as opposed to survival) with a PPV of 92.2, a specificity of 87.8, a sensitivity of 39.2, and a NPV of 28.1. For the PAR score, they reported an AUC of PAR 0.6 (95% CI: 0.52-0.70).	implementation of the scores. Use of historical cohorts may introduce the risk of creating 'self-fulfilling prophesies' as resuscitative efforts may have been terminated early on some patients due to clinician bias.

Study	Cut-off	Sensitivity	Specificity	NPV	PPV
Ebell 1997	PAM >8	100 (90.0-100)	1.8 (0.9-3.1)	100 (71.5-100)	5.4 (3.8-7.5)
O'Keeffe 1994	PAM >8	100 (86.3-100)	2.0 (0.6-4.5)	100 (47.8-100)	9.1 (6.0-13.2)
Bowker 1999	PAM >6	100 (92.5-100)	12.9 (8.7-18.1)	100 (87.7-100)	19.9 (15.0-25.6)
Ohlsson 2014	PAM >7	96.6 (88.1-99.6)	10.9 (7.2-15.7)	92.6 (75.7-99.1)	21.5 (16.7-27.0)
George 1989	PAM >8	100 (89.7-100)	22.6 (15.1-31.8)	100 (85.8-100)	29.3 (21.2-38.5)
Cohn 1993	PAM >8	100 (92.0-100)	25.0 (12.7-41.2)	100 (69.2-100)	59.5 (47.4-70.4)

Table 1: Predictive values of historical cohort studies using the pre-arrest morbidity (PAM) score to predict survival to hospital discharge (presented with 95% CI). NPV negative predictive value; PPV positive predictive value.

Study	Cut-off	Sensitivity	Specificity	NPV	PPV
Ebell 1997	PAR >8	97.6 (94.8-99.1)	30.6 (26.2-35.4)	95.4 (90.3-98.3)	46.1 (41.8-50.5)
O'Keeffe 1994	PAR >5	100 (86.3-100)	22.8 (17.8-28.4)	100 (93.9-100)	11.1 (7.3-16.0)
Bowker 1999	PAR >7	100 (87.7-100)	28.8 (23.1-35.0)	100 (94.7-100)	14.3 (9.7-20.0)
Ohlsson 2014	PAR >10	98.3 (90.8-100)	10.5 (6.8-15.2)	96.0 (79.6-99.9)	21.8 (16.9-27.2)

Table 2: Predictive values of historical cohort studies using the prognosis after resuscitation (PAR) score to predict survival to hospital discharge (presented with 95% CI)

- For the outcome of predicting survival to hospital discharge, we identified very low certainty evidence from two historical cohort studies {Bowker 1999 89, Limpawattana 2018 1231} investigating the modified pre-arrest morbidity (MPI) score (downgraded for risk of bias, indirectness, imprecision, and inconcistency). Bowker et al. showed a sensitivity of 100 (95% CI: 87.7-100), a specificity 22.5 (95% CI: 17.3-28.3), a NPV of 100 (95% CI: 93.3-100), and a PPV of 13.3 (95% CI: 9.0-18.6) for a MPI score >6. Limpawattana et al. did not report data to calculate sensitivity, specificity, NPV, and PPV with 95% CIs. However, they reported self-calculated outcome measures without confidence intervals for the prediction of death (as opposed to survival) with a PPV of 92.2, a specificity of 87.8, a sensitivity of 39.2, and a NPV of 28.1 for a MPI score >5.
- For the outcome of predicting survival to hospital discharge, we identified very low certainty evidence from one historical cohort study investigating the modified early warning score (MEWS) {Stark 2015 916}, two historical cohort studies investigating the National Early Warning Score (NEWS) {Haegdorens 2020 4594, Roberts 2017 1601}, one historical cohort study investigating the Clinical Frailty Scale {Ibitoye 2021 147}, and one historical cohort study investigating the APACHE III score {Ebell 1997 171}. The level of evidence for all scores was downgraded for downgraded for risk of

bias, indirectness, imprecision, and inconsistency. Ibitoye et al. showed a sensitivity of 100 (95% CI: 75.3-100), a specificity of 51.9 (95% CI: 40.3-63.5), a NPV of 100 (95% CI: 91.2-100), and a PPV of 26.0 (95% CI: 14.6-40.3) for a Clinical Frailty Scale >4. Haegdorens et al. showed a sensitivity of 57.9 (95% CI: 33.5-79.7), a specificity of 71.4 (95% CI: 41.9-91.6), a NPV of 55.6 (95% CI: 30.8-78.5), and a PPV of 73.3 (95% CI: 44.9-92.2) for a NEWS ≥5 and Roberts et al. showed a sensitivity of 89.3 (95%CI: 80.1-95.3), a specificity of 31.7 (95% CI: 25.6-38.2), a NPV of 89.7 (95% CI: 80.8-95.5), and a PPV of 30.7 (95%CI: 24.7-37.3) for a NEWS ≥7. Stark et al. did not report data to calculate sensitivity, specificity, NPV, and PPV with 95% CIs. However, they reported self-calculated outcome measures without confidence intervals for the prediction of death (as opposed to survival) with a PPV of 76, a specificity of 80, a sensitivity of 47, and a NPV of 53 for a Modified Early Warning Score of 7. Ebell et al. did not report data to calculate sensitivity, specificity, NPV, and PPV with 95% CIs. However, they reported an area under the curve of 0.59 for the APACHE III score to predict survival to hospital discharge.

- For the outcome of predicting survival to hospital discharge with favorable neurological outcome, we identified low certainty evidence from seven historical cohort studies {Ebell 2013 1872, Piscator 2018 63, Rubins 2019 2530, Cho 2020 36, Thai 2019 140, Ohlsson 2016 294, Hong 2021 10631} investigating the Good Outcome Following Attempted Resuscitation (GO-FAR) score to predict survival with a cerebral performance category (CPC) of 1 (downgraded for risk of bias, indirectness, and imprecision). The outcomes are presented in Table 3. Hong et al. did not report data on survival with CPC of 1 but the authors provided data showing a sensitivity of 94.1 (95% CI: 87.6-97.8), a specificity of 11.7 (95% CI: 8.5-15.6), a NPV of 87.0 (95% CI: 73.7-95.1), and a PPV of 24.1 (95% CI: 20.0-28.6) for the GO-FAR score to predict survival to hospital discharge.

Study	Cut-off	Sensitivity	Specificity	NPV	PPV
Ebell 2013	≥24	99.3 (99.0-99.5)	10.4 (10.1-10.7)	99.2 (98.9-99.5)	11.4 (11.1-11.7)
Piscator 2018	≥24	99.3 (96.1-100.)	9.7 (6.9-13.1)	97.4 (86.2-99.4)	28.9 (24.9-33.1)
Rubins 2019	≥24	95.7 (88.0-99.1)	17..1 (13.2-21.6)	95.0 (86.1-99.0)	19.5 (15.5-24.1)
Cho 2020	≥24	99.4 (96.6-100)	11.4 (9.4-13.8)	99.0 (94.4-100)	17.6 (15.2-20.3)
Thai 2019	≥24	99.2 (99.0-99.4)	8.2 (7.9-8.4)	98.4 (97.9-98.7)	16.1 (15.8-16.4)
Ohlsson 2016	≥24	97.8 (88.2-99.9)	10.3 (6.8-14.9)	96.2 (80.4-99.9)	16.9 (12.5-22.0)

Table 3: Predictive values of historical cohort studies using the good outcome following attempted resuscitation (GO-FAR) score to predict survival to hospital discharge with a cerebral performance category (CPC) of 1 (presented with 95% CIs). NPV negative predictive value; PPV positive predictive value.

- For the outcome of predicting survival to hospital discharge with favorable neurological outcome, we identified low certainty evidence from one historical cohort study {George 2020 162} investigating the Good Outcome Following Attempted Resuscitation 2 (GO-FAR 2) score, one historical cohort study {Piscator 2019 92} investigating the Prediction of Outcome for In-hospital Cardiac Arrest (PIHCA) score, and two classification and regression tree models (CART 1, CART 2) {Ebell 2013 2688 , Guilbault 2017 333}. The CART models {Ebell 2013 2688, Guilbault 2017 333} aimed to predict survival with a CPC=1 whereas the GO-FAR 2 score and the PIHCA score investigated survival with CPC ≤2. The outcomes are summarized in Table 4. All scores were downgraded for risk of bias and imprecision.

Study	Model	Sensitivity	Specificity	NPV	PPV
Ebell 2013	CART 1	96.0 (94.9-96.9)	24.1 (23.3-24.8)	97.8 (97.2-98.3)	14.6 (13.9-15.2)
Guilbault 2017	CART 1	95.6 (84.9-99.5)	28.5 (22.9-34.6)	97.2 (90.2-99.7)	19.9 (14.8-25.9)
Ebell 2013	CART 2	94.1 (92.9-95.2)	29.5 (28.8-30.3)	97.5 (97.0-98.0)	14.7 (14.1-15.4)
Guilbault 2017	CART 2	95.6 (84.9-99.5)	36.4 (30.3-42.8)	97.8 (92.2-99.7)	21.8 (16.3-28.3)
George 2020	GO-FAR 2	98.9 (98.6-99.1)	6.7 (6.4-6.9)	95.7 (94.9-96.4)	21.8 (21.4-22.2)
Piscator 2019	PIHCA	99.4 (96.8-100)	8.4 (6.0-11.3)	97.4 (86.5-99.9)	29.4 (25.7-33.2)

	Table 4: Predictive values of historical cohort studies using different scores than the GO-FAR score to predict survival to hospital discharge with favorable neurological outcome (presented with 95% CIs).	

Desirable Effects

How substantial are the desirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ○ Small ○ Moderate ● Large ○ Varies ○ Don't know	We identified no evidence on the desirable effects of using a pre-arrest clinical decision rule.	There are many potentially beneficial effects of a reliable pre-arrest clinical decision rule: A) The tool can be used to aid DNACPR discussions with patients and next of kin, B) Use of the tool may result in fewer patients receiving CPR when it is futile or does not align with their values and preferences, C) A reliable tool may also result in fewer patients that do not receive CPR when it is an appropriate clinical intervention (i.e. realistic chance of patient achieving outcome that is valued by them) D) Patients that should be resuscitated will be resuscitated

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Large ○ Moderate ○ Small ○ Trivial ○ Varies ○ Don't know	We identified no evidence on the undesirable effects of using a pre-arrest clinical decision rule. However, implementation of a clinical decision rule that does not have a perfect negative predictive value could result in patients not being resuscitated following cardiac arrest where they may have achieved an outcome that is valued by them.	

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 evidence was very low for all the identified clinical decision rules. We found no prospective studies applying a clinical decision rule in clinical practice. There were serious concerns regarding risk of bias and imprecision for all of the scores. Moreover, there were applicability concerns regarding most of the scores and many studies were based on selected patient cohorts, single center studies, and/ or cohorts from the 1980'ies and 1990'ies that cannot be directly compared to contemporary resuscitation practices. Thus, there were concerns regarding indirectness for several of the studies.	The task force valued narrow confidence intervals not crossing 99% for the negative predictive value as it is important not to miss potential survivors when applying a clinical decision rule.

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	As there were no prospective studies implementing any of the pre-arrest clinical decision rules, there is no direct evidence regarding the direct benefits, adverse effects or burdens of the tests.	

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 are no studies on the management's effects.	

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	There are no studies on the link between the test results and the management decisions.	It is likely that a reliable test implemented in clinical practice would be used to facilitate DNACPR discussions with the patients.

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	No prospective studies and no randomized studies were identified. Thus, the effect of clinical implementation of a pre-arrest decision rule is unknown.	The evidence suggests that none of the decision rules can reliably predict no chance of surviving or surviving with favorable neurological outcome. Thus, implementation may result in patients not being resuscitated although they could have survived.

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 or provider values. However, the value placed on different outcomes (e.g. survival, survival with good neurological outcome, health related quality of life) will likely vary across individuals, communities, and cultures.	

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 clinical decision rules misclassified several patients as non-survivors/ not surviving with favorable neurological outcome even though they did survive. Thus, implementation could lead to an unacceptable number of patients not being offered resuscitation even though they could have survived.	The EIT Task Force values a very high negative predictive value over the positive predictive value as the most important thing would be not to miss potential survivors.

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 implementing a pre-arrest clinical decision rule.	Correct use of the clinical decision rule may require training of all healthcare providers of unknown duration and frequency. It is unknown how implementation of a pre-arrest clinical decision rule would affect the number of DNACPR discussions and number of patients being resuscitated/ attempted resuscitated.

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 evaluated cost and/or resource requirements. There may be concerns that some of the scores may be difficult to calculate for the clinicians without technological aid, although the increasing use of electronic health records may facilitate integration of a score within that system	

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 evaluated cost and/or resource requirements. There may be concerns that some of the scores may be difficult to calculate for the clinicians without technological aid and that training would be required. It is unknown whether implementation would affect rates of resuscitation attempts.	

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 examined health equity. However, implementation of a successful pre-arrest prediction rule may result in more patients receiving the same chance of resuscitation without e.g. racial bias.	

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 investigated acceptability.	Implementing a clinical decision rule with a high likelihood of misidentifying patients as non-survivors will likely not be accepted by key stake holders, such as clinicians and patients/ relatives.

Feasibility

Is the intervention feasible to implement?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ○ Probably yes ○ Yes ○ Varies ● Don't know	No studies investigated implementation or feasibility of pre-arrest clinical decision rules. There may be concerns that some of the scores may be difficult to calculate for the clinicians without technological aid which may be of particular concern in low-resource settings.	

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**

	JUDGEMENT						
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

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
	○	○	○	○

Deleted: •

CONCLUSIONS

Recommendation

We recommend against using any currently available pre-arrest prediction rule as a sole reason to not resuscitate an adult with in-hospital cardiac arrest (strong recommendation, very low certainty evidence).

We are unable to make a recommendation about using pre-arrest prediction rules to facilitate do-not-attempt CPR discussions with adult patients, pediatric patients, or their substitute decision maker as there are no studies investigating the clinical implementation of such a score for this indication.

We are unable to provide any recommendation for pediatric patients as no studies on children were identified.

Justification

In making this recommendation, the task force valued a perfect negative predictive value (i.e. no chance of classifying a survivor as a non-survivor). None of the existing pre-arrest prediction rules were able to reliably predict no chance of survival to hospital discharge or survival with favorable functional outcome. The task force also noted that most studies on the PAM, PAR, APACHE III and MPI scores were based on cohorts before 2000, when survival rates were lower. The PAM score and the PAR scores did not perform consistently across cohorts.

Some studies were based on selected patient cohorts or patients from a single center, raising concerns about generalizability. All studies were based on historical cohorts, and concern for bias and unaccounted for confounding was high. As there were no prospective studies identified on clinical implementation of a pre-arrest prediction model to facilitate do-not-attempt cardiopulmonary resuscitation (DNACPR) discussions, it is unknown whether the clinical implementation of such a score would influence the rate of DNACPR discussions, the rate of DNACPR orders, survival outcomes, or patient perspectives.

- All scores predicting survival with favorable neurological outcome included variables such as hypotension, respiratory insufficiency, or sepsis before the arrest that may change during the hospital admission. Thus, there are concerns regarding applicability of these models.
- The GO-FAR score identifies the chance of survival with good neurological outcome (i.e. CPC of 1) although patients and relatives may value survival with a CPC > 1.

- Scores that can predict a very low chance of survival with favorable functional outcome may be used to facilitate DNACPR discussions with patients, although the score may not be able to predict no chance of survival or survival with favorable neurological outcome.

Subgroup considerations

We found no evidence concerning the pediatric population.

Implementation considerations

We found no clinical evaluation of any implementation strategies of such pre-arrest clinical decision rule.

Monitoring and evaluation

It is important to measure compliance and survival rates and continuously reassess the criteria if considering implementation of any pre-arrest clinical decision rule.

Research priorities

We identified several knowledge gaps in the published literature.

- There are no clinical decision tools to predict return of spontaneous circulation and several scores did not predict survival to hospital discharge.
- We found no studies assessing long term outcomes beyond hospital discharge or outcomes assessing quality of life.
- No studies were found on in-hospital pre-arrest clinical prediction of survival for pediatric patients.
- No studies were found on in-hospital pre-arrest clinical prediction of survival in low-resource settings.
- No studies were found on in-hospital pre-arrest clinical prediction of survival on patient values of survival outcomes, either among at-risk patients or cardiac arrest survivors
- We did not identify any score predicting survival with favorable neurological outcome that did not include physiological deterioration before cardiac arrest.
- There is a lack of prospective clinical validation studies and randomized trials investigating the use of a in hospital pre-arrest clinical prediction rule to be used for do-not-attempt cardiopulmonary resuscitation discussions and/ or making DNACPR orders.
- How the use of clinical decision tools affects resuscitation practices, cost-benefit, or survival outcomes.
- It is unknown how the use of a clinical decision tool affects resuscitation practices, cost-benefit, or how it affects survival outcomes.