Full title:

Commence, continue, withhold or terminate? A systematic review of decision-making in out-of-hospital cardiac arrest

Running head:

Out-of-hospital cardiac arrest decision-making

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Abstract

When faced with an out-of-hospital cardiac arrest patient, prehospital and emergency resuscitation providers have to decide when to commence, continue, withhold or terminate resuscitation efforts. Such decisions may be made difficult by incomplete information, clinical, resourcing or scene challenges and ethical dilemmas. This systematic integrative review identifies all research papers examining resuscitation providers' perspectives on resuscitation decision-making for out-of-hospital cardiac arrest patients. Fourteen studies met inclusion criteria: nine quantitative, four qualitative and one mixed-methods design. Five themes were identified, describing factors informing resuscitation provider decision-making: *the arrest event; patient characteristics; the resuscitation scene; resuscitation provider perspectives* and *medico-legal concerns.* Established prognostic factors are generally considered important, but there is a lack of resuscitation provider consensus on other factors indicating that decision-making is influenced by the perspective of resuscitation providers themselves. Resuscitation decision-making research typically draws conclusions from evaluation of cardiac arrest registry data or clinical notes but these may not capture all salient factors. Future research should explore resuscitation provider perspectives, to better understand these important decisions and the clinical, ethical, emotional and cognitive demands placed on resuscitation providers.

Keywords

Cardiopulmonary resuscitation; Decision-making; Heart arrest; Out-of-hospital cardiac arrest; Ethics, Medical; Medical futility; Health professional attitudes; Systematic Review

Introduction

Every year thousands of people have an Out-of-hospital Cardiac Arrest (OHCA).[1] For some, cardiac arrest may be anticipated; the inevitable conclusion of a progressive illness. For others cardiac arrest may come as a sudden, unexpected and potentially catastrophic event interrupting their everyday lives [2].

Survival from cardiac arrest is dependent on prompt recognition of the emergency and initiation of the Chain of Survival [3] and recognising the potential to save many lives, the international resuscitation community continues to work hard to strengthen all links of the chain. Although incremental gains have been made [4, 5] and reported incidence and survival rates vary internationally and inter-regionally [5, 6] OHCA survival remains very low – with aggregated studies reporting fewer than 8% of patients survive to discharge. [1, 7]. In reality, for the vast majority of cardiac arrest patients the event heralds their imminent death [8].

For decades, researchers have attempted to validate criteria for withholding and/or terminating resuscitation. [9-11]. However, even where termination of resuscitation protocols have been implemented, research evidence indicates that there is limited compliance with these protocols [12-14]. The latest international resuscitation consensus statements remain cautious about intra-arrest prognostication [15, 16] and the American Heart Association recommends withholding of CPR only where an advance directive is legally documented, death is clearly irreversible or the resuscitation provider safety is threatened [17]. Compounding the clinical and ethical challenges of establishing medical futility [18] prehospital resuscitation providers may find themselves in situations where very little verifiable patient information is available [16].

Out-of-hospital cardiac arrests are potentially distressing emergency events which may be witnessed by friends or family or other members of the public. In the vast majority of cases efforts to resuscitate the patient will fail. Resuscitation providers must contend with significant clinical and ethical challenges when deciding to commence, continue, withhold or terminate cardiopulmonary resuscitation (CPR). Greater understanding of factors informing these decisions has the potential to facilitate on-scene assessment, improve handover between health professionals and assist in preparation and support of those tasked with such decisions.

Objectives

The purpose of this review was to synthesise international research addressing the following research question:

Which factors as identified by resuscitation providers inform their decisions to commence, continue, withhold or terminate cardiopulmonary resuscitation efforts for out-of-hospital cardiac arrest patients?

In this systematic review, the term *resuscitation provider* is used to collectively describe those professionally tasked with initiating, withholding, continuing or terminating resuscitation.

Methods

An integrative systematic review typology was chosen to answer the review question. As scoping searches revealed relatively few relevant studies this inclusive approach enabled synthesis of diverse data from different study designs into a systematic knowledge base [19]. An integrative systematic review establishes what is known and what remains unknown, as well as identifying where uncertainty lies and thereby informing future research [20].

Careful development of an effective search strategy was required as capture of qualitative studies can be particularly challenging when conducting a mixed-method review [21, 22]. Search strategy piloting and review of optimised pre-hospital search filters [23] revealed variation in relevant MeSH terms and keywords both internationally and historically. Accordingly, a large number of synonyms and wildcards were used for each key concept (see Table 1). Medline, the Cumulative Index to Nursing and Allied Health Literature (CINAHL Plus) and Science Direct databases were searched from earliest records. Manual searches of key articles' reference lists, and cited reference searches through Scopus, were undertaken. Resuscitation, the Journal of the European Resuscitation Council was hand-searched from first edition (1972).

Table 1: Search terms

Resuscitation provider	Resuscitation provider; Allied health personnel; Paramedic*; Ambulance*; Health professional; Physician; Emergency Med*; EMT; First aid; Military medicine; First responder
Decision-making	Decision*; Withholding Treatment; Medical Futility; Ethics, Medical; Resuscitation Orders; terminat*/attempt*/contin*/start/stop ADJ resus*
Cardiopulmonary resuscitation	Cardiopulmonary Resuscitation; CPR; Resus*; Basic life support; BLS; Advanced cardiac life support; A$LS
Out-of-hospital cardiac arrest	Heart arrest; Outofhospital; Cardiac arrest; Cardiorespiratory arrest; Sudden death; Pre$hospital

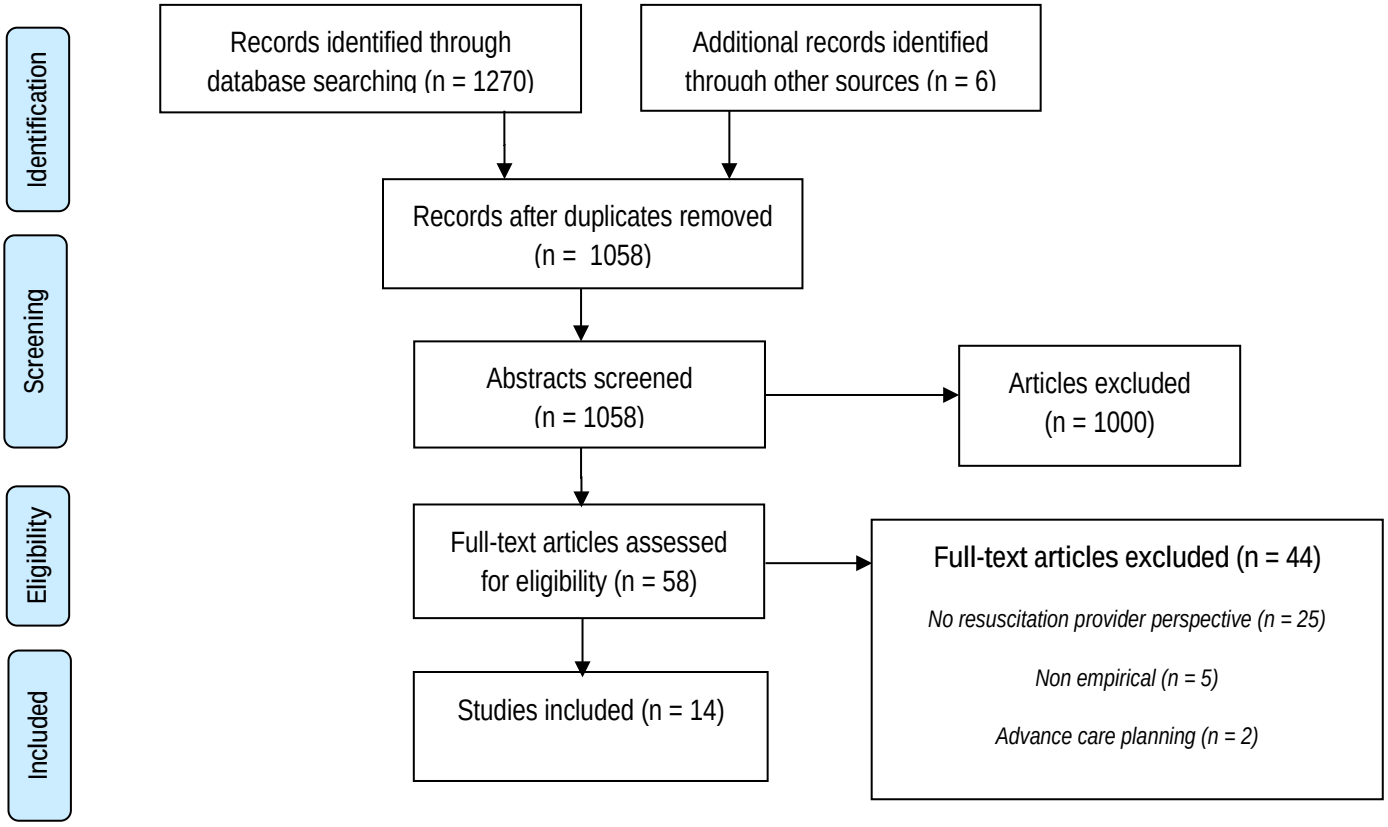
Inclusion criteria:

- All English language research papers which sought resuscitation providers' perspectives on decision-making for adult (>18 years) OHCA patients, with no restrictions on methodology, country or time of publication
- **P**articipants: Providers professionally tasked with initiating, withholding, continuing or terminating Basic Life Support or Advanced Life Support
- **I**nterventions: Descriptive studies of out-of-hospital resuscitation decision-making, implementation trials
- **O**utcome measures: Decision-making factors, importance of these factors
- **S**tudy design: All study designs

Exclusion criteria

- Non-empirical articles, including policy statements and opinion pieces
- Papers which related specifically to advance care planning, paediatric cardiac arrest or in-hospital cardiac arrest
- Unpublished manuscripts, conference abstracts and posters
- Foreign language papers with no translation

Figure 1: Study selection flow diagram



Quality Assessment

Most valid and reliable critical appraisal tools have been designed to assess specific, experimental methods [24]. However, studies included in this review were typically descriptive: exploring a process rather than evaluating an intervention. The use of critical appraisal tools in integrative reviews has been debated, [25, 26] but a transparent, methodical assessment of study quality is a preferred feature of the systematic review process [27]. A validated, widely used critical appraisal tool designed to assess studies from diverse paradigms was adopted to assess methodological quality of studies included in this review [28] Two further assessments were made: the relevance of each study's method to the review question (methodological relevance) and the relevance of each study's focus to the review question (topic relevance). Assessment of methodological and topic relevance was independently conducted by NA and MG and where any inter-rater disagreement occurred, this was resolved by JS. The contribution that each study made to answer the research question was then

determined by the combined, overall Weighting of Evidence score [29, 30]. No study data were excluded based on quality assessment alone.

Data Extraction and Thematic Synthesis

In order to extract all relevant data, each study was interrogated with the review question. Numerical, categorical and narrative data addressing the review question were then extracted. Where provided, contextual information such as response rates and author interpretations were noted. The characteristics and quality assessment of each study were also tabulated: a summary of this information is provided in Table 2.

Thematic synthesis is a method which facilitates identification of shared concepts across divergent studies and is well-suited to informing hypotheses for future research [31]. Thematic headings are used to summarise ideas which occur repeatedly or prominently [32]. Concepts can be seen as related to one another even if data from diverse research designs is being synthesised [33, 34].

In this systematic review all data describing factors informing decision making were arranged in an Excel spreadsheet with each decision-making factor on a separate row. In a second column, codes were assigned to each data point. In a third column, codes were grouped in clusters. This process was iterative, with frequent return to individual studies to re-examine findings for convergence and divergence. Codes were initially grouped into eight themes, but with further analysis these groups were reduced and renamed providing the final five descriptive themes.

Results

As depicted in Figure 1,14 studies met the inclusion criteria for this review: nine quantitative studies,[14, 35-42] four qualitative studies [43-46] and one mixed-methods study [47]. The earliest study was published in 1981[35] and the most recent in 2014.[14] Studies were set in the USA [35, 38-42, 47], UK [36, 44], Norway [45, 48], Canada [14], Germany [37] and Sweden [46]. Participant sample sizes ranged from n=7 [46] to n=1546 [39] and included emergency physicians [14, 35, 37, 38, 40, 44], junior and senior medical staff [36, 43], emergency medical technicians [14, 39, 42, 47], paramedics [41, 43, 45] and ambulance nurses [46].

Table 2: Included studies

Authors (Year) *Aims "verbatim"*	*Study design* *Setting & sample*	*Quality appraisal*	*Relevant findings*	*Themes identified*
Chipman, Adelman, and Sexton (1981) "To determine whether there is uniformity of approach to the question of when to cease CPR"	Quantitative: Questionnaire collecting demographic data and using hypothetical case studies to test seven criteria for ceasing CPR, derived from the literature: lack of success after 30 mins of ACLS; 10min 'down time'; no success after 10 min of asystole; acute traumatic brain death; cardiac arrest secondary to hemorrhage; age of patient and prognosis/functional status of patient. Responses also used to calculate indicies of tendency to cease CPR for each respondent. Circa. 1979 Oregon, USA 78 physicians practicing emergency medicine in Oregon. Questionnaire handed out during selected business meetings, where emergency physicians were attendance	High Weight of Evidence (Medium Methodological Quality, High Methodological Relevance, High Topic Relevance) Convenience sampling of physicians practicing emergency medicine, within Portland and surrounding areas. Response rate not reported. Limited sample demographics described. Proposed criteria for cessation of CPR taken from review of (limited) outcome data available in that time period. Allowed for cease, continue or 'cease, only if…' responses, allowing communication of additional factors deemed salient by respondents, although limited reporting of this data. Comparable scenarios used to check for internal validity.	Results indicated there was significant variability in criteria used for cessation of CPR. Criteria for cessation of CPR: 1. Unsuccessful after 30 minutes of ACLS 29% with profound acidosis 25% with severe hypoxia 40% with hypothermia 0% 2. Time before CPR commenced - 10 minutes 44% 5 minutes 5% 3. Unsuccessful after 10 minutes of ACLS patient with asystole 13% patient with ventricular fibrillation 3% 4. Arrest due to traumatic brain death 44% 5. Arrest due to hemorrhage 16% 6. Age 65 or older 4% 75 or older 9% 7, Functional status/prognosis nursing home 18% mental impairment 54% Terminal disease, as per (source unspecified) 87% Source= medical record 81% Source = patient's physician 97% Source = spouse 65% Source = EMT 18% ANOVA found significant correlations between 'tendency to cease CPR' indicies and some demographic factors.Information regarding the patient is important, but so was the source of that information	The arrest event Resuscitation provider perspective Patient characteristics
Brown, Jones, and Glucksman (1996) "To determine which factors are perceived by senior house officers, consultants and medical registrars in accident and emergency medicine as being important in decision making"	Quantitative: Survey given to convenience sample of inducting UK SHOs, 'randomly selected' medical registrars and A&E consultants from one UK hospital. Questionnaire gave 20 factors and asked which were important in the decision to continue resuscitation from OHCA. Circa 1995 UK 132 A&E SHOs, 10 medical registrars and 31 A&E consultants.. Repeated measures achieved with SHOs six weeks (73 participants) and six months (55 participants).	Medium Weight of Evidence (Medium Methodological Quality, Medium Methodological Relevance, High Topic Relevance) Limited description of derivation of 20 factors which form questionnaire. Limited response options (Important / Not important / Unsure). Unclear how repeated-measures data were analysed. Limited reporting of descriptive statistics; responses for some factors not reported, results grouped and presented comparatively, some apparent assumption about interpretation, and re-wording of factors.	Several factors associated with prognostic significance identified as important by participants, but considerable variation in perceived importance of other decision-making factors. Factors deemed important by 90% of respondents: CPR started immediately after arrest; Short interval between arrest, ambulance response and arrival in A&E; Rhythm on arrival at hospital; Presence of pulse and/or respiratory effort Factors deemed important by 70-89% of respondents: Age of patient; History of previous cardiac illness; Knowledge of other chronic illness; Defibrillation performed by ambulance crew; Rhythm on arrival of ambulance crew Factors yielding mixed responses: Fixed dilated pupils; Any obvious trauma; Advice of nursing staff/ambulance crew to continue resuscitation; Advice of nursing staff/ambulance crew not to continue resuscitation Factors most commonly deemed unimportant: Body shape; Unkempt appearance; Presence of relatives; IV access established by ambulance crew with or without drugs administered	The arrest event Patient characteristics The resuscitation scene Resuscitation provider perspective

Authors (Year) *Aims "verbatim"*	*Study design* *Setting & sample*	*Quality appraisal*	*Relevant findings*	*Themes identified*
Naess, Steen, and Steen (1997) To elicit the criteria actually used by paramedics when making decisions about CPR; to find out whether these criteria differed from those used by doctors on physician manned ambulances; to determine if they were affected by length of experience.	Qualitative: Semi-structured, in-depth interviews conducted after each of 70 OHCA cases 1992-1993 Oslo, Norway 9 doctors and 35 paramedics, working within a single EMS system, who attended a total of 70 OHCA cases	High Weight of Evidence (Medium Methodological Quality, High Methodological Relevance, High Topic Relevance) Participants questioned after real OHCA cases, about these cases, to minimise socially desirable responses and maximise validity. Interview guide shows structured approach with prompts for numerous pre-determined factors, but also including open-ended questions, allowing for additional salient points to emerge. Limited description of data analysis. Response 'counts' reported, descriptive statistics and analysis of variance used.	Of 70 OHCA cases: 21 CPR not attempted, 28 CPR TOR in field, 15 ROSC in field, 6 transported to hospital with CPR. Identified "similar and limited' criteria, used by both doctors and paramedics, for treatment decisions. Criteria are grouped under thematic headings. The patient perspective. Prognostic criteria :Ventricular fibrillation registered on ECG; Gasps or small movements; Contracted pupils or normal skin colour; = 100% continue/commence CPR Age (not sufficient criterion for cessation); Time intervals ("If I don't start CPR, time will run out and I can never make up for the time I have lost"); Cardiac arrest witnessed by the ambulance personnel; Bystander CPR ("It's a way of saying thank you for starting"). Ethical criteria: 'The patient's right to live or right to die (death with dignity, avoiding medico-technical dying); Age The bystander perspective. Expectations from bystanders (Bystander CPR) ; Forced to start CPR by bystanders The MD/paramedic perspective EMS-system reputation (for paramedics, not physicians); Burden of responsibility ("We're working in a 'grey zone' all the time. The relatives say: how can you decide not to start CPR when you are only paramedics?"); Experiences from previous cases (Once…I was in doubt whether to start CPR or not. I started and the patient walked out of the hospital three days later. So if I am in doubt I always start"); Need for practice The community perspective Social status of the patient (potential, unacceptable, source of bias); Attempted suicide; Ongoing CPR during transport	The arrest event Patient characteristics The resuscitation scene Resuscitation provider perspectives Medico-legal concerns
Mohr, Bahr, Schmid, Panzer & Kettler (1997) To determine when resuscitative efforts are usually terminated abd which factors are considered important in the decision to abandon CPR attempts in the prehospital setting.	Quantitative: Questionnaire mailed to Association of Emergency Physicians in Northern Germany (AGNN) members Circa. 1994, Germany 409 members of the Association of Emergency Physicians in Northern Germany (36.9% of the AGNN)	Medium Weight of Evidence (Medium Methodological Quality, Medium Methodological Relevance, High Topic Relevance) Large sample size, moderate response rate. Multiple choice 'checklist' approach to identify criteria, without clear rationale for inclusions. Option for free text entries. Some sample demographics provided. Data supports findings.	Multiple choice criteria for termination of CPR chosen by 75% or more of respondents: ECG (asystole, persistent EMD) 83% Pupillary status (fixed & dilated) 78% Age 89% Pre-existing diseases 92% Response time 92% Duration of CPR 90% Low response rate factors: Missing brain stem reflexes (31%); Body temperature (12%); Suspected drug intoxication (8%) 'Typical' time frames for TOR sought – response rates quite widely and evenly spread - most commonly within 30-45 minutes.	The arrest event Patient characteristics The resuscitation scene Resuscitation provider perspective

Authors (Year) *Aims "verbatim"*	*Study design* *Setting & sample*	*Quality appraisal*	*Relevant findings*	*Themes identified*
Marco, Bessman Schoenfeld & Kelen (1997) Assess current resuscitation practice, as reported by survey respondents, and to determine factors influencing decisions to initiate, continue, or terminate resuscitative efforts.	Quantitative: Mailed survey sent to randomly selected members of the American emergency physicians. 1252 respondents 1997, USA 1252 American emergency physicians (25% response rate)	High Weight of Evidence (High Methodological Quality, High Methodological Relevance, High Topic Relevance) 25% response rate, but evidence sample demographically representative of ACEP membership. Survey questionnaire (including pre-determined list of decision-making factors) developed by an expert panel. Survey also solicited additional comments.	Nb. Data reported again in study comparing results (repeated measures 10 years later) Factors rated important or very important in resuscitation decision making by: > 90% of respondents – Witnessed arrest in ED; Down time; Advance directive 60-80% of respondents - Family wishes; Pre-arrest health; Rhythm; Age Impact of legal concerns – 94% of respondents indicated that legal concerns do influence practice, although 78% indicated that, ideally, they should not. Fear of litigation or criticism outweighed assessment of medical utility/futility, for many respondents.	The arrest event Patient characteristics The resuscitation scene Medico-legal concerns
Hick, Mahoney, and Lappe (1998) To determine medical and nonmedical factors resulting in transport, to hospital, of patients in continuing cardiac arrest.	Quantitative: Prospective survey completed by attending paramedic, shortly after attending every unsuccessful resuscitation of a nontraumatic adult OHCA patient. Ranked, in order of importance, the factors informing their decision to transport. 1996-1997, USA 68 OHCA patients attended by Hennepin County Ambulance Service and transported while in cardiac arrest.	Medium Weight of Evidence (Medium Methodological Quality, High Methodological Relevance, Medium Topic Relevance) Ranking of pre-determined decision-making. Result reporting focuses on primary factors – other data lost. Authors note that there were system-related logistical barriers to TOR in the ambulance, during the study, as hospital would not accept a dead-on-arrival patient, and transport of body to medical examiner was problematic. This was not cited as a decision-making factor, but it is unclear if such a response option was available.	Paper results report 'primary' factors cited, with some mention of secondary factors. Factors (number of cases where this was primary factor, of 68 cases where patients were transported in continuing cardiac arrest): Transport ordered by on-line physician (13); Transport ordered by EMS physician on scene (1); Public place (17); Traffic hazard (1); Potential hypothermia for patient and paramedics outdoors in winter (6); Arrest in ambulance or en route to ambulance (6); Possible correctable cause (4); Persistent VT/VF arrest (5); Unable to gain intravenous access (5); Airway problems (5); Non–English-speaking family or cultural barrier (1); Family stated unable to accept field termination (2); Family perceived by paramedics unable to accept field termination (1); Extreme obesity (1);	The arrest event Patient characteristics The resuscitation scene Medico-legal concerns

Authors (Year) *Aims "verbatim"*	*Study design* *Setting & sample*	*Quality appraisal*	*Relevant findings*	*Themes identified*
Lockey and Hardern (2001)To investigate the factors which influence decision making by experienced emergency physicians when they decide whether to (a) pronounce 'life extinct' in adult patients with non-traumatic cardiac arrest while in the ambulance, or (b) bring them into the resuscitation room for further assessment /management.	Qualitative :Nine semi-structured interviews and one focus group. Non-traumatic OHCA patients arriving via ambulance, with CPR in progress Circa 1999, UK Purposive sampling A total of 15 emergency physicians (Interviews: 1 clinical fellow, 5 specialist registrars, 3 consultants; Focus group: 1 clinical fellow, 4 specialist registrars, 1 consultant)	Medium Weight of Evidence (Medium Methodological Quality, Medium Methodological Relevance, High Topic Relevance) Small qualitative study. Interview guide shows mix of prompts and open-ended questions. Used focus group to clarify and validate themes, with no new themes emerging. Limited description of data analysis. Limited description of sample demographics.	Multifactorial decision-making process with individual variation in importance attached to decision making factors. Six main themes emerged: 1. Doctor's past experience – more experienced were more likely to continue CPR in ED 2. Ambulance service issues ("Any patient who has had a non-paramedic crew will always be brought in because we can do advanced life support") 3. Prehospital care (witnessed arrest, time intervals, resuscitation duration) 4. Patient characteristics (shockable rhythm, <u>not</u> age) 5. Presence and views of relatives (presumed expectation of ongoing resuscitation) 6. Organisational issues (limitations of assessing in ambulance setting, staff culture)	The arrest event Patient characteristics The resuscitation scene Resuscitation provider perspective Medico-legal concerns
Marco and Schears (2003) To determine the current pre-hospital practices regarding withholding and termination of resuscitation and the impact of advance directives.	Quantitative: Cross-sectional mailed questionnaire with 1546 respondents (41% response rate) 1999 USA 1546 members of America's National Association of Emergency Medical Technicians	High Weight of Evidence (High Methodological Quality, High Methodological Relevance, High Topic Relevance) Moderate response rate, sample demographics provided. Questionnaire provided and clear data analysis and reporting of results.	Pre-hospital providers who would withhold resuscitation efforts: 1. With state approved advance directive = 89% 2. With verbal report of advance directive = 10% 3. With unofficial document = 4% Providers with > 10 years' experience reported more perceived futile (low likelihood of success) resuscitation attempts per year than less experienced staff (p=0.01) Have local EMS guidelines for TOR = 73% Consider guidelines inadequate = 22.5%	Resuscitation provider perspective Medico-legal concerns

Authors (Year) *Aims "verbatim"*	*Study design* *Setting & sample*	*Quality appraisal*	*Relevant findings*	*Themes identified*
Feder, Matheny, Loveless, and Rea (2006) To determine if EMS personnel working under newly implemented guidelines were more likely to withhold resuscitation from OHCA patients than those working where the guidelines had not been implemented.	Quantitative : Repeated measures programme evaluation, examining the clinical circumstances of 2770 patients with EMS-attended cardiac arrest. Comparisons made pre (1997) and post-guideline implementation (1999) between participating and nonparticipating agencies. 1997 – 1999 Washington, USA 2770 patients with EMS-attended cardiac arrest excluding trauma, suicide or drug overdose Structured interviews with EMS only conducted for 51/99 cases where resuscitation was withheld in the post-guideline participating group.	Low Weight of Evidence (Medium Methodological Quality, Low Methodological Relevance, Low Topic Relevance) Programme evaluation - two of the authors were also main instigators of guideline implementation (potential bias). Focus on patient/clinical characteristics. Comparing pre and post implementation of guideline allowing EMS staff to withhold CPR efforts if patients were known to have a terminal condition and a written or verbal DNR request was expressed. Withholding of CPR based on medical futility criteria not discussed, TOR not discussed. Unclear if participants could discuss non-clinical factors.	New guidelines for withholding CPR made EMTs more than twice as likely to withhold CPR, primarily when honoring verbal DNR requests: "Emergency medical services personnel indicated that the guidelines affected their decision to withhold resuscitation. Thirty-two of 51 said they would have initiated or continued a resuscitation effort in a similar situation before guideline implementation, particularly in cases in which there was a verbal request only." (p. 638)	Resuscitation provider perspectives Medico-legal concerns
Marco, Bessman, and Kelen (2009) Determine the current practice of CPR initiation and termination among emergency physicians. Compare results with 1995 study.	Quantitative: Repeated measures design. Mailed survey sent to a random selection of American emergency physicians with 18% response rate. 1995 & 2007, USA 928 American emergency physicians	High Weight of Evidence (High Methodological Quality, High Methodological Relevance, High Topic Relevance) Method comparable to original research, but lower response rate (18%). Table of comparisons given, but some reporting of results from two surveys differs, so further direct comparisons difficult.	Nb. Data from 1995 study reported in Marco, Bessman Schoenfeld & Kelen (1997) Overall, responses did not differ substantially. Statistically significant difference in responses to "Always honors legal advance directives" (1995 = 78% cf. 2007 86%) and "Always honors verbal reports of advance directives" (1995 = 6% cf. 2007 = 12%) 2007 study data: Factors rated " very important" in resuscitation decision making (% of respondents): Advance directives (78%); witnessed arrest (77%); downtime (73%); family wishes (40%); presenting rhythm (38%); age (28%) and pre-arrest state of health (25%). Impact of legal concerns – 92% of respondents indicated that legal concerns do influence practice, although 80% indicated that, ideally, they should not.	The arrest event Patient characteristics The resuscitation scene Resuscitation provider perspective Medico-legal concerns
Grudzen et al. (2009) Assess paramedic and EMT comfort with withholding or terminating resuscitation in the field, in accordance with a newly implemented guideline.	Mixed methods: Brief written survey and five focus groups conducted on-site with on-duty EMTs and paramedics. Grounded theory used to analyse data. Circa. 2007, USA Convenience sample of 36 Los Angeles County EMS service paramedics and EMTs with $\geq$ 12 months' experience in that service.	Medium Weight of Evidence (High Methodological Quality, Medium Methodological Relevance, Medium Topic Relevance) Small convenience sample, not well-described. Research conducted on-duty/on-site. Group discussion guide provided. Data collection and analysis well described.	Provider factors important in resuscitation decision-making Provider knowledge of, comfort with and attitude towards policy: Policy benefits outweigh harm for patients. Paramedics feel empowered by policy: Group dynamics Tension between EMS, police and ED staff, regarding resource utilisation Arrest characteristics important in decision-making: Patient factors Paramedic confidence in identifying patients with poor chance of survival Family dynamics: Family emotional preparedness Logistics: Location of arrest; presence of onlookers; space for resuscitation	The arrest event Patient characteristics The resuscitation scene Resuscitation provider perspective Medico-legal concerns

Authors (Year) *Aims "verbatim"*	*Study design* *Setting & sample*	*Quality appraisal*	*Relevant findings*	*Themes identified*
Nordby and Nohr (2012) Explore the experiences of paramedics faced with ethical dilemmas regarding resuscitation of cancer patients	Qualitative: Semi-structured interviews 2009, Norway 15 Norwegian paramedics 'randomly' selected from a group of volunteers	Medium Weight of Evidence (Medium Methodological Quality , Medium Methodological Relevance , Medium Topic Relevance) Limited description of small sample, 'randomly' selected volunteers who had already participated in a larger study. Some details of data collection provided. Data analysis not clearly described.	Ethical decision-making process in the context of resuscitation of cancer patients is characterised by 'double-pressure situations' with conflicts existing between personal beliefs and procedures. Typical reasons for resuscitating: system-related guidelines, uncertainty ("it is better to make one trip too many than one too few"), the value of human life Typical reasons for not resuscitating: clinical judgment, individual caring frameworks, quality of life issues	The arrest event Patient characteristics Resuscitation provider perspective Medico-legal concerns
Larsson and Engström (2013) To describe ambulance nurses' experiences of nursing patients suffering OHCA	Qualitative Thematic content analysis of interview texts 2011, Sweden Seven Swedish ambulance nurses	Medium Weight of Evidence (Low Methodological Quality, Medium Methodological Relevance, Medium Topic Relevance) Volunteer recruitment process unclear. Small homogenous sample. Limited description of data collection and data analysis. Findings linked to quotes but limited explanation/interpretation provided.	Over-arching theme: "Striving to save people's lives and make the right decisions" Six subthemes: 1. Preparations for the unknown situation 2. Carrying out CPR 3. Getting help with chest compressions 4. Taking care of the relatives 5. Ending up in ethically demanding situations 6. Reflection and follow-up	Patient characteristics The resuscitation scene Resuscitation provider perspective
Morrison et al. (2014) Implementation trial to evaluate compliance, transport rate and provider comfort with a BLS TOR rule.	Quantitative Multi-centre implementation trial. Discretionary rationale for TOR non-compliance was a secondary outcome measure. All OHCA patients treated by EMT-Ds excluding: under 18 year olds, obviously dead , suffered arrest from an obvious cause (drowning, hanging, trauma), written or verbal DNRs 2006-2008 Canada 2421 OHCA cases attended by EMT-Ds (emergency medical technicians trained to use BLS and defibrillate).	Medium Weight of Evidence (High Methodological Quality, Low Methodological Relevance, Medium Topic Relevance) High-quality method for evaluation of implementation. Provider perspective data, relevant to review, was lost by categorising results and it is unclear if data was obtained from pre-determined categories – e.g. around 55 reasons fall collectively into "other" and "paramedic discretion".	Discretionary rationales for TOR non-compliance, in descending order of frequency cited: (241 reasons cited in 198 cases) 1. Family distress 2. Unable to establish phone contact with on-line physician 3. Short time of arrest 4. On-line physician chose to transport 5. Paramedic discretion 6. Other 7. Short transport to hospital 8. Patient's age 9. Public location	The arrest event Patient characteristics The resuscitation scene Resuscitation provider perspective Medico-legal concerns

Five themes describing factors informing resuscitation provider decision-making were identified. These were:

- The arrest event
- Patient characteristics
- The resuscitation scene
- Resuscitation provider perspective and
- Medico-legal concerns

The arrest event

Important decision-making factors derived from clinical features of the arrest itself included; electrocardiogram (ECG) findings, presumed aetiology, the presence or absence of signs of life, whether the arrest was witnessed; downtime and duration of resuscitative efforts.

Several studies suggested ECG findings are significant in resuscitation decision-making. A questionnaire study completed by a large sample of American emergency physicians in 1995 [40], then repeated in 2007 [38] reported that a majority of respondents in both samples considered the presenting rhythm important or very important in decision-making. Another questionnaire study of UK doctors also demonstrated that the presenting rhythm was important – both on arrival of ambulance crew (70-89% of respondents) and arrival to hospital (>90% of respondents) [36]. A shockable rhythm (ventricular tachycardia or ventricular fibrillation) provided justification for commencing or continuing resuscitation [35, 41, 43, 44]. Persistent asystole or electro-mechanical disassociation was reported as a key justification for termination of resuscitation by 83% of German emergency physician respondents [37] but was deemed less important in an earlier study of US emergency physicians[35].

Included studies following-up on real OHCA cases all excluded traumatic arrests [14, 41, 42, 44] and few studies in this review included probes or response categories on the cause of an arrest. However, traumatic and hypoxic aetiologies were mentioned as influential, in decision-making, in three studies [35, 36, 43].

Signs of life including small movements, gasping or presence of a pulse [36, 43] were considered pertinent in resuscitation decision-making, but pupil reactivity yielded mixed responses. Fixed, dilated pupils was deemed an important criterion for termination of resuscitation by 78% of responding emergency physicians in a German questionnaire study [37]. In a questionnaire study set in the UK around the same time period, 87% of senior house officers believed fixed, dilated pupils were important, but fewer than half of surveyed registrars and consultants agreed [36]. A Norwegian interview study found contracted pupils in combination with normal skin colour, constituted sufficient reason to commence or continue resuscitation [43].

Importance was given to the established prognostic factor of 'downtime' - the time elapsed between arrest and onset of BLS [35-38, 40]. A related factor - whether an arrest was witnessed - was also deemed important [38, 44], particularly where an OHCA was witnessed by prehospital resuscitation providers [43] or emergency department staff [40]. Overall time spent on resuscitation also featured as a consideration in termination of resuscitation, although there was a lack of consensus regarding what length of time constituted a sufficient duration attempt [35-37, 44].

Patient characteristics

Most studies identified that patient-specific variables, including age, co-morbidities and quality of life, were often considered important in resuscitation decision-making.

In a Norwegian study exploring 70 real OHCA events, age was often mentioned by attending doctors and paramedics, who were interviewed after each event. Older age alone was not considered sufficient reason to withhold or terminate CPR, but youth was given as a reason to commence CPR and appeared to make termination of resuscitation efforts more difficult [43]. In four other studies, a majority of participants considered the patient's age when making resuscitation decisions [14, 36, 37, 40]. Contrasting findings were identified in three studies exploring emergency physicians' decision-making, where patient age was not a chief criterion [35, 38, 44].

Patient co-morbidities appeared to be a key consideration [36-38, 40, 43] as were evaluations of pre-arrest quality of life [45, 46]. Ascertaining health status and quality of life, and the uncertainty around these evaluations was a particularly dominant theme in a recent study exploring OHCA of patients known to have a cancer diagnosis [45]. The perceived reliability of information about a patient's medical history may also be important. An early US study showed where a patient's own physician described the patient as having a 'terminal illness' or this was outlined in medical records, it was given significant weighting. If the patient's health status was reported by a spouse or emergency medical technician, this was less likely to impact on resuscitation-decisions [35].

The resuscitation scene

Several aspects of the resuscitation scene appeared to be influential in decision-making, including: the imperative of commencing resuscitation, availability of resources, handover of resuscitation efforts, presence of bystanders and scene safety.

With resuscitation providers cognisant of the time-critical nature of cardiac arrest survival and their own vital, role, participants in three interview studies emphasised the importance of avoiding delays and 'getting on with CPR' [43, 45, 46]. Where resuscitation efforts were already initiated – by professional or lay providers - this also appeared to influence decisions to continue efforts. Respondents in an interview study exploring real OHCA cases stated that resuscitation efforts were always continued where bystanders had commenced CPR [43]. This seemed to be in response to the bystander, rather than impact on patient outcome, as the effectiveness of bystander CPR did not influence the decision to continue.

Bystander and/or family expectations, [38, 40, 41, 43, 44, 46] perceived distress of bystanders and/or family [14, 41, 47] and cardiac arrest in a public place [14, 41] were also influential decision-making factors. Practical concerns about resource availability [40, 46, 47] and scene safety [41, 43] also exerted an influence on decisions. In a retrospective analysis of decisions to transport patients in ongoing cardiac arrest, six cases involved outdoor resuscitation scenes in sub-zero temperatures and the decision continue CPR and transport the patient was primarily motivated by the need to avoid hypothermia [41].

Resuscitation provider perspective

The most frequently-reported finding in included studies was a lack of consensus between resuscitation providers. Wherever comparisons between participants were made, studies reported significant variability in the criteria considered for decision-making and/or the relative importance given to each criterion [14, 35-40, 43-47]. This is perhaps best illustrated by a series of quotes from the conclusions of included papers.

> *"… there is wide variation between the responses to all other factors, even among more experienced doctors" [36]*
>
> *"Strict guidelines would be difficult to construct since individuals vary in the importance they attach to different factors" [44]*
>
> *"The physicians in this survey made choices to cease or continue CPR that are not consistent with any criteria which might guide them in clinical decision-making" [35]*

Two studies reported a positive association between length of resuscitation providers' experience and tendency to commence or continue CPR [35, 44] with participants apparently influenced by 'critical cases' where prolonged resuscitative efforts had been rewarded with favourable outcomes. The results of a large questionnaire-based study of US Emergency Medical Technicians (EMTs) [39] were somewhat at odds with this finding. It found those EMTs who have worked for more than 10 years reported a greater number of perceived futile resuscitation attempts per year than less experienced staff (p=0.01).

Organisational and medico-legal concerns

Organisational and medico-legal factors considered important in resuscitation decision-making included; provider knowledge and perception of guidelines, organisational issues, advance directives and fear of litigation.

Three included studies were primarily evaluating the influence and acceptability of newly-implemented guidelines for withholding or terminating resuscitation [14, 42, 47]. Although new guidelines appeared to be influencing prehospital resuscitation providers' decision-making, each of these studies concluded there was some non-compliance. Other included studies also demonstrated there was variable health

professional knowledge and perception of guidelines [39, 41] including ethical conflicts between guidelines and resuscitation providers' beliefs [45].

Three studies also highlighted significant logistical and bureaucratic barriers to termination of resuscitation within ambulances [41, 44, 47]. These barriers centred ongoing responsibility of care for the deceased and bereaved. Organisational issues cited by physicians in a study exploring decision-making for OHCA patients arriving at hospital, included the suboptimal assessment environment of an ambulance interior and demand on resources within the receiving department [44].

Investigating the influence of advance directives was a key objective of one of the included studies. An American study conducted in 1999 reported that 89% of prehospital resuscitation providers would withhold resuscitation efforts where a state approved advance directive was sighted. Fewer than 10% would withhold resuscitation with verbal report or unofficial documentation of an advance directive. [39]. Results from the repeated American questionnaire studies also indicated emergency physicians would usually (but not always) follow legally-binding advance directives whilst informal documents and verbal reports of patient wishes were less influential [38, 40].

Results from US studies indicated that fear of litigation outweighed assessment of medical utility or futility, in some contexts. A large survey of US emergency physicians conducted in 1995, demonstrated that 94% of respondents felt legal concerns influenced their resuscitation decisions, though 78% felt they should not.[40] Fear of litigation was cited by 92% of respondents, when the questionnaire was repeated in 2007.[38]

Discussion

This review is the first to synthesise research ascertaining factors identified by resuscitation providers which inform their decisions to commence, continue, withhold or terminate OHCA resuscitation efforts. Although there are relatively few studies in this area, the 14 included studies sought the perspectives of a range of prehospital and emergency resuscitation providers and spanned across four decades and six countries. Bearing in mind the proliferation of published research examining OHCA it is surprising that so few studies have sought the perspective of the resuscitation providers themselves.

Decisions to commence, continue, withhold or terminate resuscitation in out-of-hospital cardiac arrest are complex and multi-factorial. Resuscitation providers aspire to minimise delays and achieve 'best-practice' according to internationally accepted, evidence-based resuscitation guidelines. On-scene information-gathering may be hampered by prioritisation of resuscitation efforts, task-focus, lack of bystanders, emotional distress or communication barriers.

Findings from this review support simulation studies, exploratory research and retrospective analyses which indicate that the presence, behaviour and perceptions of bystanders may influence resuscitation provider cognitive and emotional responses including decision-making. [49-52] Indeed, significant efforts have been made to increase bystander initiation of CPR and it is plausible that increased public awareness of the time-critical nature of resuscitation and proliferation of digital recording devices may also have increased potential bystander impact over time. Further research in this area is warranted.

Methodological challenges and limitations of included studies

Exploring clinical and ethical decision-making is a difficult task and studies in this review were all subject to limitations in design, sampling, analysis and reporting of data. Wherever clinicians are asked to disclose their clinical and ethical decision-making, a sensitive approach must be adopted, and the risk of response bias acknowledged. Almost all studies used convenience samples and were susceptible to volunteer response biases. This is a notable limitation of the included interview-based studies, [43-46] where participant samples were mostly homogenous and/or poorly-described.

Three included studies followed-up on specific, real decisions to terminate, withhold, commence or continue resuscitation.[14, 41, 43] Eight studies included checklists or questionnaires. [14, 36-41, 47] However, little information was provided about questionnaire development processes and there was little or no discussion of internal reliability or validity. Measures of decision-making factors were sometimes limited to clinical or established prognostic factors and responses were often reported as categorised data, with a bias towards significant findings. Free-text results and responses to open-ended questions were often combined into a single, nondescript 'other' category. In undertaking a thematic synthesis, further data reduction has occurred, and it is possible that salient decision-making factors have been lost, to these processes.

Although there is a wealth of literature providing commentary on resuscitation ethics and the complexity of resuscitation decision-making, only fourteen studies seeking resuscitation provider

perspectives were located. With a major international move towards standardised recording and reporting of cardiac arrest outcome data [53] conclusions about resuscitation decision-making may be increasingly drawn through retrospective analysis of registry data. Findings from this reviewer suggest a number of idiosyncratic, situational and scene-related variables have been captured, where resuscitation provider perspectives have been sought.

Conclusion and future directions

This review provides a synthesis of research seeking a resuscitation provider perspective on factors informing OHCA decision-making. Decisions are clearly multi-factorial as resuscitation providers may take into account the arrest event, patient characteristics, the resuscitation scene and medico-legal concerns. Established prognostic factors are generally considered important but there is a notable lack of resuscitation provider consensus on other factors indicating that decision-making is significantly influenced by the perspective of resuscitation providers themselves.

Whilst it is important to continue to strengthen evidence for resuscitation decision-making guideline criteria, it should also be recognised that OHCA decision-making is idiosyncratic and dynamic. Rather than beginning with a reductionist approach, creating a checklist of known or prognostic decision-making factors, future research should aim to more inclusively explore all clinical and non-clinical decision-making factors. Future studies could explore what characterises challenging OHCA decision-making and what can help to make decisions more straight-forward. Greater understanding of the way resuscitation providers use their education, mentoring and experiences to inform decisions would help to inform teaching and support. Little is known about how resuscitation providers balance the physical and cognitive demands of resuscitation with a systematic approach to information-gathering and ethical decision-making. The influence of bystander behaviour, resuscitation provider beliefs and organisational guidelines also warrants closer examination.

The resuscitation provider perspective is missing from the resuscitation decision-making literature. A greater understanding of OHCA resuscitation decision-making will help future resuscitation providers to meet the clinical, ethical, emotional and cognitive demands of these situations.

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