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Review

Emotions in telephone calls to emergency medical services involving out-of-hospital cardiac arrest: A scoping review



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Abstract

Aims: The purpose of this scoping review was to identify and synthesise existing research evidence on emotions in the context of emergency phone calls to emergency medical services (EMS) involving out-of-hospital cardiac arrest (OHCA). The specific objectives were to identify studies that (1) described emotions during emergency OHCA calls; (2) specified an instrument or method for measuring/assessing emotions; and (3) examined the relationship between emotions and call outcomes or patient outcomes.

Methods/Data sources: Five databases were searched on 18 November 2021: Medline, Embase, PsycInfo, CINAHL, and the Cochrane Review Database. Included studies required the following three concepts to be addressed: *emotions* in the context of *EMS calls* that involved *OHCA*. Calls also needed to be made by a 'second-party' caller; and each study needed to address at least one of the three specific objectives, as outlined above. The review was conducted in accordance with the Joanna Briggs Institute guidelines for evidence synthesis for scoping reviews.

Results: Thirteen eligible studies were included for synthesis. All studies met Objective 1; six studies met Objective 2; and seven met Objective 3. One study reported patient fatality due to heightened emotions and ensuing ineffective communications between callers and call-takers.

Conclusion: The review highlights a significant gap in the evidence base of emotions in emergency OHCA-related calls, and the need for a more comprehensive and effective method in assessing and measuring emotions in this context. Relationships between emotions (their expressions and perceptions) and call outcomes (including patient outcomes) also need more rigorous investigation.

Keywords: Emotion, Emergency medical service, Emergency calls, Out-of-hospital cardiac arrest, OHCA, Emergency dispatch

Introduction

Rationale

Out-of-hospital cardiac arrest (OHCA) is a time-critical emergency.¹ As such, it is vital that communication during Emergency Medical Services (EMS) phone calls is optimised, so as to avoid unnecessary delays. Crucial information needs to be acquired to enable prompt ambulance dispatch and initiation of bystander cardiopulmonary resuscitation (CPR). This includes: the address of the incident (essential for ambulance dispatch) and ascertainment of the patient's state of consciousness and breathing status (to enable early

recognition of OHCA). Timely implementation of each of these actions has the potential to save lives.²

There is some research evidence to suggest that the caller's emotions and cooperation level during the emergency call may affect whether, and how promptly, bystander CPR was delivered.³⁻⁵ It is also recognized that the caller's emotions can be modified, for better or worse, by the call-taker's communication approach,^{6,7} in both OHCA and non-OHCA specific contexts.

A 2021 systematic review⁸ examined the facilitating and inhibiting features of EMS calls in relation to the call-taker's ability to recognize OHCA, and identified 'emotional distress' as a major theme emerging. However, there has not been a systematic review of the

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<https://doi.org/10.1016/j.resplu.2022.100264>

Received 12 April 2022; Received in revised form 25 May 2022; Accepted 15 June 2022

Available online xxxx

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published literature specifically examining emotions in emergency OHCA-related calls.

Objectives

This scoping review aims to identify the published research literature about the emotional content in OHCA emergency calls made to EMS. The specific objectives of this scoping review are to document, assess, and synthesize published studies that:

- (a) examined emotions during emergency calls that were made by a bystander on behalf of a patient experiencing an OHCA – this may include any, or all, of the following aspects: caller emotions, call-taker emotions, how emotions of one party are interpreted and/or handled by the other party; AND/OR
- (b) described a method, or an approach, to measuring or assessing the emotions in such calls; AND/OR
- (c) assessed the relationship between the emotions during such calls, and the outcomes of the call (including call process outcomes and/or patient outcomes).

Methods

Protocol and registration

This scoping review was conducted following the guidelines in the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis for Scoping Review.⁹ The protocol of the review has been registered with the Open Science Framework (OSF), registration DOI [10.17605/OSF.IO/3CJH8](https://doi.org/10.17605/OSF.IO/3CJH8). Read-only access is available via https://osf.io/ewhi3/?view_only=322a9bb5ad4a4b6e84fee312ddc52c38.

Eligibility criteria

Inclusion criteria

Participant/Population. Emergency calls made to EMS, involving any patient experiencing an OHCA at the time of the call. “OHCA” here includes both EMS-confirmed OHCA, and those events treated/suspected as OHCA during the emergency call.

Callers to EMS classified as ‘second-party’ callers (i.e. in close proximity with patient, such that CPR could theoretically be carried out by the caller, or another bystander in their presence).

Concepts. Any study reporting **emotions** in the context of **EMS calls** that involved **OHCA** would be considered for inclusion. All these three concepts would need to be present for each study to be included. Studies discussing or comparing emotions for OHCA-related versus non-OHCA related calls would also be considered for inclusion.

Context. Emergency calls to an EMS involving OHCA, made on behalf of the patient.

Types and sources of evidence. Evidence from published original studies or reviews that: explored the expression and/or effect of emotions during emergency calls relating to OHCA, and/or reported how emotions during the EMS calls were assessed or measured.

Exclusion criteria

Studies that did not meet the above stated inclusion criteria were considered not eligible for this scoping review. Additional specific exclusion criteria were: animal studies; simulation studies; studies solely limited to personal opinion; studies without an abstract in English language; and grey literature.

Information sources

Five databases – Medline, PsycInfo, CINAHL, Embase, and Cochrane Review Database – served as the main information sources for the literature search. There were no restrictions on the publication years for the included studies.

Search strategies

An initial search, primarily via online search engines and manual search, was conducted to confirm that no review was yet available for the topic. This warranted the necessity and appropriateness of the current scoping review.

The authors then followed the 3-step process, as recommended by the JBI manual for scoping reviews.⁹

The **first step** involved the first author conducting a preliminary search of the databases Medline(R) (via OVID search platform) and CINAHL (via EBSCO), using derivations and combinations of the following key words: “emotions”, “emotion assessment”, “cardiac arrest”, “heart arrest”, “OHCA”, “cardiopulmonary resuscitation”, “CPR”, “emergency”, “ambulance”, “emergency medical services”, “emergency medical dispatch”, “EMS”, and “dispatcher”.¹⁰ The key word selection was subsequently refined by analysis of text words in the keywords, titles and abstracts of the articles, identified in this first step.

The refined key words were then implemented in the **second step** of the search process, which utilized all the five aforementioned databases. This second step in the search process was executed on 18 November 2021. [Table 1](#) details the search strategy in PsycInfo.

The **third and final step** in the search process involved examining the reference lists of the identified search results from the second step, to identify any published articles that may have been missed, as well as other manual opportunistic/incidental searches, where applicable.

A Curtin University librarian was consulted during the planning of the search strategy and key words were refined and updated, as relevant and required, throughout the search process. Search results were uploaded to Rayyan¹¹ for the next stage – **Study selection**.

Study selection

The first author screened the search results in Rayyan for relevance via Title and Abstract, scoring each as either: Include, Exclude, or Maybe. The first two authors then conducted in-depth full text screening for all articles not initially excluded by the first author, leaning towards over-inclusion rather than under-inclusion. This in-depth full text screening adhered to the inclusion and exclusion criteria outlined above. Arbitration by another, independent review author would be required to resolve any disagreements or discordances between the first two authors, if existing. Final results were stored and managed in EndNote.

Table 1 – Example of search strategy (step 2) using PsycInfo database.

Step	APA PsycInfo < 1806 to November Week 2 2021>	Search Results
1	("cardiac arrest*" or "heart arrest*" or "cardiopulmonary arrest*" or "CPR*" or asystole* or OHCA*).mp. [mp = title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]	2576
2	exp heart disorders/	15,152
3	1 or 2	17,187
4	emotion*.mp. [mp = title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]	449,139
5	exp emotions/	385,599
6	4 or 5	639,497
7	((call* or phone* or cell*) adj5 (emergenc* or dispatch* or EMS or ambulance* or "911" or 9-1-1 or "000" or 0-0-0 or "999" or 9-9-9)).mp. [mp = title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]	1361
8	exp emergency services/ or telephone systems/ or mobile phones/ or smartphones/	17,493
9	7 or 8	18,554
10	3 and 6 and 9	17

exp: explode.

mp: multiple purpose.

Data extraction (Charting)

A template (draft charting table) was developed to assist the review authors (HN and TB) with the data extraction. The table contained the following fields: (i) authors; title; (ii) year of publication; (iii) origin/country of origin of the research; (iv) aims; (v) population and sample; (vi) interventions/methods, comparison group; (vii) outcomes; (viii) findings; and (ix) which review objectives were met.

Synthesis of results

The research evidence eligible for inclusion in this scoping review was synthesised according to the three specific objectives noted in the Introduction. Raw results of the review were first summarized and presented in a tabular format, similar to that of the charting table described above. Results were then synthesized textually and organized conceptually in accordance with how relevant they were to the three specific objectives of the review.

Results

Selection of sources of evidence

The search in the five databases yielded 183 records, with 160 remaining after removal of duplicates. Author HN screened these 160 records for relevance, via Title and Abstract, and retained 10 articles^{3-5,12-18} for full text review. A further four articles^{6,19-21} were identified via manual/ post-hoc search, and also included for full text review (Fig. 1). These four additional articles were not identified in the 'formal' database search, as each of them did not meet all the three required concepts, due to the way their keywords were listed, or how they were indexed in the databases. Specifically, Clark et al.¹⁹ did not have the concept of 'emotion' indexed; while the other three studies did not have the concept of 'cardiac arrest' listed in their key words.

Characteristics of sources of evidence

The first two authors were able to discuss and resolve their few differences/discordances during this screening process, thus arbitration by an additional author was not required. Table 2 summarizes key information on the 14 articles included for the full text review, with 13 agreed for final inclusion. The excluded study,¹⁹ while covering

the concepts of OHCA and emergency calls, only had a brief mentioning of 'hysterical' (emotions), and did not clearly meet any of the three review objectives. There was only one article identified for each included study.

The 13 included studies were published between 1986¹⁶ and 2021.¹⁴ Their countries of origin were the United States of America^{5,6,16,17}; Taiwan^{4,14,18}; Sweden^{13,21}; Australia³; Denmark¹²; Norway²⁰; and Switzerland.¹⁵

The included studies described emotions in OHCA calls in different levels of detail. Many of them had a broad focus on identifying factors that may affect OHCA recognition by call-takers and/or initiation of bystander CPR. Emotion was one such factor identified.^{3,5,12,17} However, few described and/or discussed the instruments used to assess emotions in the calls.^{6,14,21}

All studies involved review of audio recordings of the emergency calls to EMS regarding OHCA. Most of the included studies (except Chin et al.¹⁴ and Svensson and Pesämaa²¹) employed an opportunistic and consecutive sampling approach, within a certain time period chosen by the authors. On the other hand, Svensson and Pesämaa²¹ prospectively sampled and rated the first EMS call in every 30-minute block. Chin et al.¹⁴ reviewed the calls' recordings primarily for the purpose of calibration/validation of their new artificial intelligence (AI) models.

Specific Objective 1: Examination of emotions in emergency calls involving OHCA

All 13 included studies addressed this first objective (Table 3). Emotions in OHCA-related emergency calls were characterised with descriptors such as 'calm',^{3,12,13} 'hysteria',³ 'emotional distress',^{15,17} 'fear'/'sadness'/'anger',²¹ 'high emotional state',⁴ or 'emotional'.¹⁶ In several studies, emotion expressions were also 'blended' with, or described in conjunction with, the attitudes and/or behaviour (such as cooperation, reluctance, resignation, or hostility) of the 'expressor', as perceived by the other party, namely the call-taker in this case.^{3,4,6,18,20}

Using an instrument called the Emotional Contents and Cooperation Score (ECCS), developed by the United States' National Academy of Emergency Medical Dispatch, Clawson and Sinclair⁶ reported that callers of emergency OHCA calls in general were much calmer than expected, for example, in comparison to an early study by

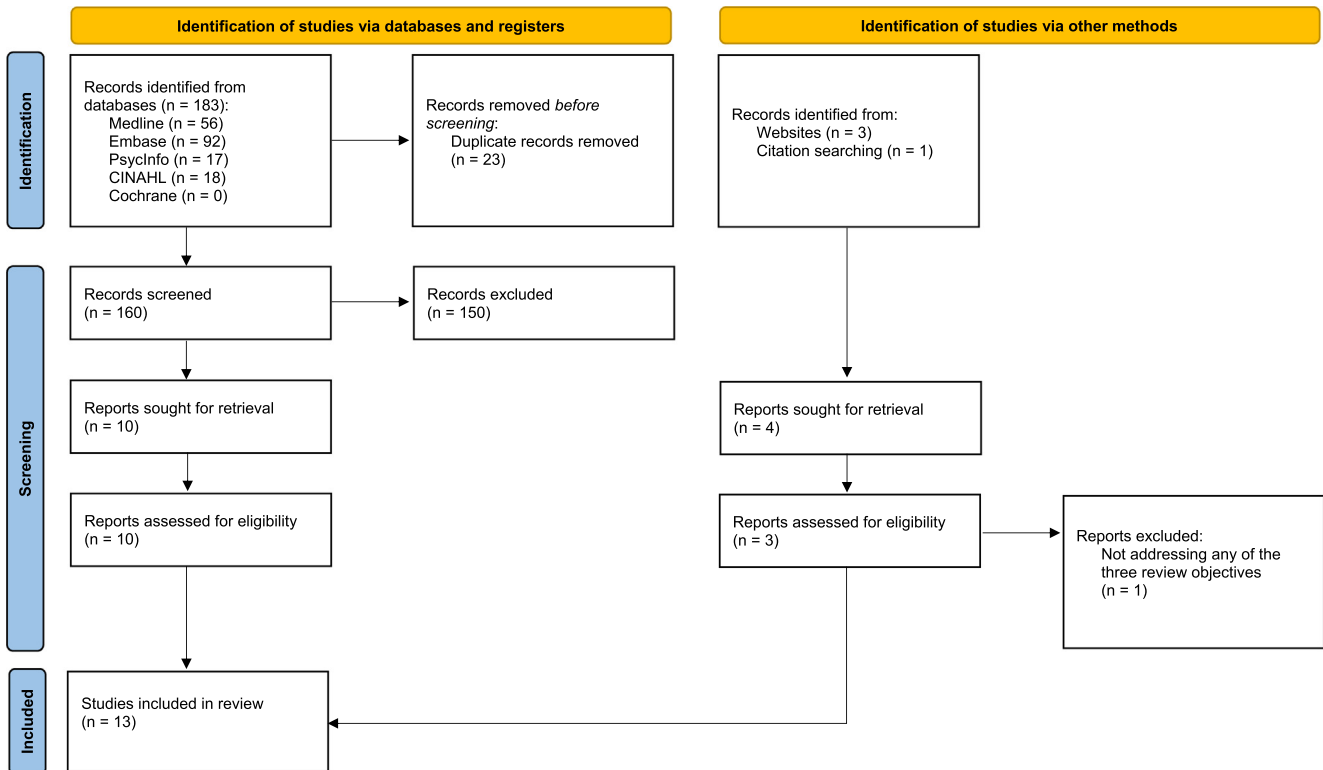


Fig. 1 – PRISMA 2020 flow diagram for literature search results. From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. <https://doi.org/10.1136/bmj.n71>. For more information, visit: <http://www.prisma-statement.org/>.

Eisenberg et al.¹⁶ Stating that the “demeanor, voice tone, empathy, and attitude of the dispatcher have an effect on the caller,”⁶ Clawson and Sinclair suggested that call-takers in the more recent years might have received improved training in the psychology of call interrogation, which could partly explain the increased level of calmness among callers, compared to the earlier years. More details on the ECCS instrument are provided in the results for Objective 2 below.

Specific Objective 2: Description of methods or approaches to measuring/ assessing emotions in emergency calls involving OHCA

Six (46%) of the included studies^{4,6,13,14,18,21} described in detail how emotions were assessed or measured.

Bang et al.,¹³ Clawson and Sinclair,⁶ Ma et al.,¹⁸ and Chien et al.,⁴ used the ECCS instrument,⁶ as mentioned above. The ECCS focusses specifically on the emotions and cooperation levels of the caller, not the call-taker. There are five levels on the ECCS ratings, with 1 representing normal conversation speech; 2 indicating the caller being anxious but cooperative; 3 caller moderately upset but cooperative; 4 caller uncooperative, yelling, and not listening; and 5 caller uncontrollable and hysterical.

Since there was variation in emotion during the course of a call, Chien et al.⁴ used the highest ECCS rating recorded in each call for analysis. These ECCS ratings were provided by a registered nurse and a paramedic, and reviewed by a medical doctor.⁴ Inter-rater reliability was reported to be ‘good’, with a kappa value of 0.63.⁴

In Bang et al.,¹³ caller emotion was assessed using the ECCS at the start and end of the call. Calls were evaluated by the medically responsible physician together with the operational leader at the dispatch centre.¹³ In Clawson and Sinclair,⁶ calls were reviewed by a “case review professional”, trained and certified by the (US) National Academy of Emergency Medical Dispatch; only the ECCS rating at the start of the call was obtained. Ma et al.,¹⁸ however, did not stipulate whether the ECCS rating applied to the entire call, or to certain segment(s) of the call. Two investigators performed the ECCS rating, with a good inter-rater reliability (kappa = 0.65).¹⁸

Chin et al.¹⁴ devised a novel approach, involving AI, to assess caller emotions in OHCA emergency calls. In their study, emotions were assessed in two separate stages. The first stage involved manual, human evaluations, and the second stage involved AI. Human ratings, based on the ECCS, were performed by two reviewers, with disparities subjected to a second round of review until a consensus was reached. The AI stage utilized mel-frequency cepstral coefficients and a support vector machine. According to Chin et al.,¹⁴ a mel-frequency cepstral coefficient “scales the frequency to match it more closely to the functioning of a human ear”, and is “a widely used feature in automatic speech recognition”. A support vector machine is “a robust supervised learning model” used for classification, to “identify emotionally unstable callers”.¹⁴ Validating against human ratings on the ECCS (i.e., the ‘gold standard’), their AI model had low sensitivity (39%) and moderate positive predictive value (73%), but high specificity (98%) and negative predictive value

Table 2 – Description of 14 studies retained after Title and Abstract screening, and included for full text review.

First Author & Year	Title	Country	Aims	Popn & Sample	Intervention/Method	Comparison
Alfsen 2015	Barriers to Recognition of out-of-hospital cardiac arrest during emergency medical calls: a qualitative inductive thematic analysis	Denmark	To identify factors affecting medical dispatchers' recognition of OHCA during emergency calls	EMS callers re OHCA	Qualitative. (Investigator triangulated) inductive thematic analysis	8 OHCA vs 13 nonOHCA
Bang 2003	Interaction between emergency medical dispatcher and caller in suspected out-of-hospital cardiac arrest calls with focus on agonal breathing. A review of 100 tape recordings of true cardiac arrest cases	Sweden	Primarily to assess call-takers' ability to elicit relevant information from callers, identify cardiac arrest, dispatch specialist ambulance, and deliver DA-CPR instructions. But also assess callers' description of breathing and interaction with call-takers.	100 EMS calls	Qualitative. Review of call recordings	Not stated/ NA
Case 2018	Identifying barriers to the provision of bystander cardiopulmonary resuscitation (CPR) in high-risk regions: A qualitative review of emergency calls	Australia	To identify barriers to providing bystander CPR in regions with low rates of bystander CPR	Total sample size 1423 adult OHCA calls, with 1253 identified as OHCA by call-takers. However, thematic analysis was performed on sub-sample size n = 139 calls only.	Qualitative. Thematic content analysis	None
Chien 2019	Impact of the caller's emotional state and cooperation on out-of-hospital cardiac arrest recognition and dispatcher-assisted cardiopulmonary resuscitation	Taiwan	To determine the impact of the caller's emotional state and cooperation on OHCA recognition and DA-CPR	367 EMS calls with non-traumatic OHCA	Review of audio recordings. Used ECCS (1–3 v 4–5)	n = 336 (92%) calmer (ECCS1-3) vs n = 31 (8%) uncooperative (ECCS 4–5)
Chin 2021	Early recognition of a caller's emotion in out-of-hospital cardiac arrest dispatching: An artificial intelligence approach	Taiwan	To determine caller emotional state in OHCA dispatching	337 EMS calls with OHCA	Manual v AI modelling/classification of sound features, based on ECCS ratings. Manual classification considered 'gold-standard'	Stable (ECCS1-3): n = 312, 93% v Unstable (ECCS4-5): n = 25, 7%
Clark 1994 †	Accuracy of Determining Cardiac Arrest by Emergency Medical Dispatchers	US	To identify & determine the rates of (appropriate or inappropriate) delivery & performance of DA-CPR in EMS calls that may involve cardiac arrests	Tot n = 358: 185 actual cardiac arrests, 154 potential cardiac arrests, 19 respiratory	Review of audio recordings	Actual vs 'potential' OHCA (ie those w symptoms resembling a cardiac arrest)

(continued on next page)

Table 2 (continued)

First Author & Year	Title	Country	Aims	Popn & Sample	Intervention/Method	Comparison
Clawson 2001 †	The Emotional Content and Cooperation Score in Emergency Medical Dispatching	US	To examine the ECCSs of callers in 6449 cases from 2 communication centres. To investigate the relationships btwn ECCS & caller party, incident nature, time of day, & geo locations.	n = 3019 from British Columbia (n = 358 suspected CA calls), n = 3430 from Monroe County (n = 681 suspected CA calls)	Used ECCS. Used descriptive statistics & correlation analysis	Across several different independent variables: relationships of callers with patients, types of incident, times of day, & geographical locations
Dami 2010	Why Bystanders Decline Telephone Cardiac Resuscitation Advice	Switzerland	To evaluate the rate and reason for bystander refusal of tCPR instruction	n = 264 with CPR proposed	Review of audio recordings. Descriptive statistics	NA?
Eisenberg 1986	Identification of Cardiac Arrest by Emergency Dispatchers	US	To identify features of a probable cardiac arrest call	n = 516 cardiac arrest calls vs n = 146 non-cardiac arrest calls	Review of audio recordings. Emotional distress measured with ECCS	cardiac arrest calls v non-cardiac arrest calls
Hauff 2003	Factors Impeding Dispatcher-Assisted Telephone Cardiopulmonary Resuscitation	US	To examine factors that may impede implementation of telephone CPR.	n = 404 cardiac arrest calls	Review of audio recordings	Not reported
Lerner 2008	Cardiac arrest patients rarely receive chest compressions before ambulance arrival despite the availability of pre-arrival CPR instructions	US	To determine the % of OHCA patients who received chest compressions from bystanders. To describe barriers to following DA-CPR instructions	N = 343 OHCA calls reviewed. n = 168 eligible for DA-CPR instructions	Retro case series of 3 dispatch centres	NA?
Ma 2007	Evaluation of emergency medical dispatch in out-of-hospital cardiac arrest in Taipei	Taiwan	To examine the ECCSs of callers for cardiac arrests. To evaluate the performances EMS dispatching system in Taipei.	n = 199 calls (131 2nd party callers (close relationship). 50 3rd party (close proximity). 18 4th party (public service agency)	Review of audio recs	NA? Different values/ levels/categories of the independent variables (e.g., ECCS vs different caller parties)
Svennevig 2012 †	On being heard in emergency calls. The development of hostility in a fatal emergency call	Norway	To analyze the development of conflict and hostility in a series of 3 calls related to one fatal incident	3 calls related to 1 same OHCA incident	Qualitative. Review of audio recordings	None

Table 2 (continued)

First Author & Year	Title	Country	Aims	Popn & Sample	Intervention/Method	Comparison
Svensson 2018†	How does a caller's anger, fear, and sadness affect operators' decisions in emergency calls?	Sweden	To study how emergency operators' interpretation of callers' anger, fear, and sadness influenced emergency assessment	n = 146 EMS calls, ratings by 7 EMS operators (41% identified as 'acute')	Call-takers simultaneously/prospectively rated 1st EMS call in every 30-minute interval → implicitly randomized. 11-point Likert scale for intensity (0==none – 10==very strong), for three emotions: fear, anger, sadness. 8-point Likert scale for perceived need of help (1==limited need – 8==intensive need).	Different emotion categories (Fear vs Anger & Sadness). Different emotion expression intensities.

DA-CPR: Dispatcher-Assisted Cardiopulmonary Resuscitation. EMS: Emergency Medical Service. NA: Not Applicable. OHCA: Out-of-Hospital Cardiac Arrest.
† indicates the four studies identified through 'manual' search. The remaining 10 studies were identified through the database search.

(93%). The model also performed similarly well, or slightly better in some respects, if only the first 10 seconds of the calls was assessed. Based on these two sets of results, the authors proposed that their AI model could be useful in helping to quickly identify 'emotionally unstable' callers, versus 'emotionally stable' callers.¹⁴

Svensson and Pesamaa²¹ classified caller emotions in emergency medical calls into three "basic emotions": fear, sadness, and anger. Participants (i.e., dispatchers) were asked to rate their perceived intensity of each emotion on an 11-point Likert scale (10: very clear emotional expression, 0: no expression), as well as what level of help they perceived the caller needed on an 8-point scale (1: no help needed, 8: severe help needed). Participating dispatchers were required to assess up to only the first minute of the call. See Objective 3 for more details.

Specific Objective 3: Relationships between emotions and call outcomes in emergency calls involving OHCA

Seven (54%)^{3-5,12,17,20,21} of the 13 included studies addressed this objective, with varying patient and call outcomes investigated and with mixed associated findings.

Chien et al.⁴ investigated the most comprehensive range of pre-specified call process and patient outcomes, in association with the caller emotions. They found different levels of emotion expression (ECCS levels 1–5, or 'calm' to 'yelling/hysteria') were not differentially associated with levels of accuracy in the caller's description of the patient's consciousness and breathing status. Similarly, emotional distress (i.e. higher ECCS score) was not identified as a barrier to OHCA recognition. Rather, higher ECCS scores were found to be 'facilitating' OHCA recognition by the call-taker, possibly because the caller's emotional distress communicated to the call-taker that the patient was in a dire situation. In contrast, emotional distress was associated with lower acceptance rate by the caller to perform DA-CPR on the patient. Yet, distressed callers took less time to initiate the first chest compressions following call-taker instructions, compared to 'calmer' callers (i.e. those with lower ECCS scores).⁴

Evidence on whether caller emotions were a factor affecting implementation of DA-CPR was mixed and inconclusive. Lerner et al.⁵ reported that caller emotions accounted for 14% of cases where DA-CPR instructions were not followed. Somewhat contradictory to these authors, Case et al.³ found both 'hysteria and panic' and 'calm resignation' among 20% and 39%, respectively, of calls where OHCA was identified but DA-CPR was not delivered. The findings from Case et al.³ appeared to suggest that both 'extremes' of emotions (panic versus resignation/indifference) impeded DA-CPR. Yet, Hauf et al.¹⁷ concluded that emotional distress was not a common factor impeding DA-CPR. These three studies^{3,5,17} examined reasons for DA-CPR not being performed, where emotions were, or were not, identified as a contributing factor. Nevertheless, the validity of their findings, and conclusions, are not verifiable, in the absence of a similar examination of a 'control' group, namely those with DA-CPR performed.

Conducting a qualitative inductive thematic analysis of two small samples of emergency calls where OHCA was not recognized ($n = 13$) and where OHCA was recognized ($n = 8$), Alfson et al.¹² found 'emotional distance' (i.e., when the caller was able to 'keep calm') to be a 'theme' in the latter sample. They reasoned that, when the caller was calm, they were able to cooperate with the call-taker, which in turn facilitated OHCA recognition.¹²

Svennevig²⁰ provided an in-depth conversation analysis of three emergency calls that led to a fatal OHCA incident, where hostility

Table 3 – Descriptions of 13 studies included for synthesis, with respect to the three objectives of the scoping review.

First Author & Year	Findings	Met Objective 1	Met Objective 2	Met Objective 3
		<i>Described Emotions</i>	<i>Described Approach to Assessing Emotions</i>	<i>Assessed Relationship between Emotions & Call Outcomes</i>
Alfsen 2015	In recognized OHCA: Call-takers' communication was calm, clear, direct. Callers followed instructions, assessed patients, & contributed to call success.	Yes	No	Yes
Bang 2003	Found most callers were calm, and even calmer @ end of call.	Yes	Yes	No
Case 2018	Found 3 types of barriers, one of them being 'personal factors', including emotional factors: can be hysteria & panic (20%) vs calm resignation & reluctance (39%)	Yes	No	Yes
Chien 2019	Found callers' high emotional state *not* a barrier to OHCA recognition, but possibly a barrier to DA-CPR delivery, in terms of lower rates, and possibly an enhancing factor for first chest compression.	Yes	Yes	Yes
Chin 2021	The artificial intelligence model had suboptimal sensitivity, but fair positive predictive value, & high specificity & negative predictive value.	Yes	Yes	No
Clawson 2001	ECCS remarkably low. (i) Overall 1.05 for British Columbia, 1.2 for Monroe County. (ii) In calls with cardiac arrest indicated: 1.22 for British Columbia (n = 358), 1.44 for Monroe County (n = 681). Nevertheless, ECCS statistically significant higher, but not substantially magnitude-wise, among calls with cardiac arrest, compared to non-cardiac arrest calls.	Yes	Yes	No
Dami 2010	Emotional distress cited as a reason in refusing or not performing DA-CPR. [DA-CPR acceptance rate 62% (163/264). 134 cases (51%) actually had DA-CPR performed.]	Yes	No	No
Eisenberg 1986	When patient older than 50 years & caller emotional → cardiac arrest more probable	Yes	No	No
Hauff 2003	Emotional distress *not* a common factor impeding DA-CPR	Yes	No	Yes
Lerner 2008	Emotional state of callers account for 14% of cases where DA-CPR instructions were not followed	Yes	No	Yes
Ma 2007	ECCS scores quite low (overall mean 1.42), consistent with Clawson2001 above	Yes	Yes	No
Svennevig 2012	The analysis shows "how problems of establishing intersubjective understanding lead the participants to mutually attribute each other an attitude of uncooperativeness & hostility".	Yes	No	Yes
Svensson 2018	Fear & Sadness were more (likely) associated with perceived higher levels of need, than Anger. Higher intensity of emotion expression (especially Fear, rather than Sadness) also associated with higher need level. Therefore, Fear comes out as the strongest indicator of need for help	Yes	Yes	Yes

DA-CPR: Dispatcher-Assisted Cardiopulmonary Resuscitation. ECCS: Emotional Content and Cooperation Score. EMS: Emergency Medical Service. OHCA: Out-of-Hospital Cardiac Arrest.

between the caller and the call-taker quickly developed and was sustained. Svennevig²⁰ concluded that this hostility resulted in no DA-CPR instructions being delivered by the call-takers, no DA-CPR attempted by the callers, and the EMS (ambulance) not dispatched in a timely manner.

Svensson and Pesamaa²¹ found that fear and sadness were more likely than anger, to be associated with a perception that the caller was in need of help. Additionally, fear was considered to be of higher intensity of expression than sadness, and was perceived to be associated with the highest level of need for help.²¹ It was suggested that the perceived level of need for help would affect the call-taker's actions in providing help (e.g., to dispatch an ambulance to the scene for the patient, to deliver DA-CPR instructions to the caller).²¹ It is also noted that this study, unlike other included studies, while addressing all the three objectives of the review, did not have a clear, pre-determined focus on emergency calls related to OHCA specifically. Instead, emergency OHCA calls were reported as part of the analysis of emotions in this study.²¹ Nevertheless, the study is included as it did provide a discussion on emotions in OHCA calls, which falls within this scoping review's inclusion criteria. Our review is also skewed towards over-inclusion, as previously stated.

Only one study²⁰ examined the effect of emotions on actual patient outcome, namely fatality. However, other patient outcomes, such as return of spontaneous circulation during chest compression or survival to hospital discharge, were not investigated in relation to emotions during calls, in any included study.

Discussion

Summary of evidence

This systematic scoping review has identified a small body of published research focussed on emotions in emergency OHCA-related calls, with few studies describing how emotions were measured in this setting. The relationship between emotions and call-process outcomes were examined in many of the included studies, with varying levels of detail. Specifically, according to Chien et al.⁴ and Hauff et al.,¹⁷ emotional distress was not found to be a barrier to OHCA recognition or DA-CPR, respectively. Yet, Case et al.,³ reported that both extremes of emotions (distress versus calm resignation) accounted for many cases without DA-CPR, whereas Alfson et al.¹² found emotional distance (i.e. calmness) facilitated the cooperation between the caller and the call-taker, hence helped improve OHCA recognition. Only one study²⁰ examined the relationship between heightened emotions during emergency OHCA calls and patient mortality, finding that suboptimal communication between callers and call-takers led to mutual perceptions of hostility, and in turn, help not being rendered in time, resulting in the patient's death. Other patient survival outcomes, such as return of spontaneous circulation during chest compression or survival to hospital discharge, were not addressed in the included studies.

This scoping review has identified considerable heterogeneity among the studies included. These differences included: methodology (qualitative versus quantitative versus mixed methods); study design (mostly retrospective, with no well-defined comparison group); sample sizes (ranging from $n = 3$ calls²⁰ to $n = 6449$ calls⁶); study objectives; and outcome measures.

Few studies described how emotions were measured in EMS calls involving OHCA. The Emotional Content and Cooperation Scale (ECCS)⁶ was the most commonly used instrument in this body of research to assess caller emotions. Other investigators¹⁴ capitalized on modern advances in artificial intelligence (AI) to develop a novel model to perform the same function. These investigators suggested that such a model could enable the accurate and efficient identification of the caller's emotional state earlier in the call, so that the call-taker might employ different techniques to assist 'emotionally unstable' callers more effectively.¹⁴

Due to their rich and 'nuanced' expressions and intensities, emotions are a complex concept to understand, investigate, predict, and manage, especially in the context of emergency calls related to OHCA, where every minute counts. This scoping review has highlighted how caller emotion expressions can be differentially perceived and received by the call-taker, which may in turn potentially influence the call-taker's recognition of OHCA and prompt initiation of DA-CPR.

Strengths and limitations of this scoping review

This is the first systematic scoping review on the topic of emotions in emergency OHCA-related calls. The three review objectives have effectively guided the conduct of this review. The ensuing synthesis of the evidence has helped consolidate the knowledge about this topic, as well as identified knowledge gaps that future research can attempt to address.

The review has limitations

First, our manual, post-hoc search identified three further included studies that had not been identified during the systematic search of the relevant databases. Similarly, an article by Lewis et al.,²² which reported a small percentage of cases where caller "emotional states" were associated with DA-CPR instructions not being delivered and/or delays in the initiation of first chest compression, was potentially missed by our review. This, however, is a rather common finding, and an acceptable practice in systematic (including scoping) literature reviews.

Second, the review did not include a critical appraisal of the 'quality' of evidence from each included study. However, this is not a common essential requirement of a scoping review.²³

Where to from here

Based on the results identified in this scoping review, there are three key suggestions for future research in this field. Future research assessing emotions in OHCA-related emergency calls, and their relationships with process / patient outcomes, should ensure that: the research question is clearly defined, with pre-specified outcome measures; an appropriate comparison group is included; and the sample size is adequate (if the research is quantitative).

As noted earlier, emotions are complex in nature, in terms of their range of expressions, 'nuances', and triggers. It has also been observed that sometimes descriptions of emotions were not well distinguished from those of perceptions, attitudes, and behaviours. These complexities are further compounded by the high-stakes situation of an emergency call that concerns an OHCA. Accordingly, a meaningful and useful instrument to assess emotions in this setting will need to be able to incorporate all these considerations. The

ECCS,⁶ while having been used most commonly, as evident from this scoping review, does not capture the 'dynamic' nature of emotions, and does not take into account any contextual factors for the emotions expressed. Further, as noted earlier, 'mix-up' of similar emotion expressions can occur, and needs to be addressed in a new instrument or method to accurately assess emotions in emergency OHCA calls.

The studies by Svennevig²⁰ and Svensson and Pesamaa²¹ have also shown the potential of applying linguistic analysis to examine how emotion unfolds during the call and can escalate interpersonally. Indeed, a recent editorial by some of the current review authors has highlighted such research endeavours.²⁴

Based on the findings and discussions from Chin et al.,¹⁴ Clawson and Sinclair,⁶ Svennevig,²⁰ and Svensson and Pesamaa²¹ we propose two further questions for future research and practice: 1) What training for EMS call staff is required to enable more effective management of caller emotions?; and 2) Is there value in educating the public about the emergency call-making process in general, such that callers are prepared for what questions they will be required to answer, with the ultimate outcome to save the patient's life?

Conclusion

This scoping review has demonstrated a small body of research relating to emotions in emergency OHCA-related calls, with only 13 studies identified as eligible for inclusion. Emotions were characterized to different extents across these studies, with only six studies providing a detailed description of how emotions were assessed or measured. Some of the included studies also examined the relationship between emotions during emergency OHCA calls and call outcomes, with mixed findings. Only one study reported the impact of emotion during the call on OHCA patient survival. The review highlights a significant gap in research that needs addressing, with important implications for both future research and practice.

Authors' contributions

HN, NP, SB, and JF conceptualized the study. HN conducted the literature search. HN and TB reviewed the search results for inclusion and synthesized the results. HN wrote the first draft of the manuscript and edited subsequent versions. All authors contributed to the intellectual content of the manuscript and approved the final, submitted version.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement of funding

All authors are employees of Curtin University of Technology, Perth, Australia. JF receives salary support and research funds from a NHMRC Investigator grant (#1174838). The authors gratefully acknowledge Ms Vanessar Varis, Faculty Librarian, Curtin Univer-

sity's Faculty of Health Sciences, for her help with the literature search strategy.

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