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Rapid response systems

The lay descriptors of out-of-hospital cardiac arrest in the Western Cape province, South Africa

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Abstract

Introduction: Out-of-Hospital Cardiac Arrest (OHCA) is a time-sensitive emergency requiring prompt identification and emergency care to reduce morbidity and mortality. The first step in managing OHCA is rapid identification by the emergency dispatch centre. Identification of these patients remains challenging in South Africa due to multiple languages and widely differing levels of education. This study aimed to identify the key descriptors (words and phrases) of OHCA used by callers in the Western Cape when contacting the provincial Emergency Medical Services' emergency call centre.

Methodology: Computer-aided dispatch data with a corresponding "*patient unresponsive*" incident type were drawn for a 12-month period (January −December 2018). Corresponding patient care records were extracted to verify OHCA. The original voice recordings between the caller and emergency call taker at the time of the emergency were extracted and transcribed verbatim. Transcriptions were subjected to inductive, qualitative content analysis to the manifest level. Descriptors of OHCA in isiXhosa, English and Afrikaans calls were coded, categorised, and quantified.

Results: A total of 729 confirmed OHCA cases were identified, of which 38 (5.2%) Afrikaans, 24 (3.3%) isiXhosa and a random sample of 50 (6.8%) English calls were transcribed. Following content analysis, five distinct categories were identified. The most prevalent categories were descriptors related to ill health (medical history and suspected diagnosis; 35.5%), level of consciousness (unresponsive; 18.6%) and cardiac activity (pulselessness and suspected death; 17.2%).

Conclusion: The vast majority of callers within the Western Cape province of South Africa use consistent descriptors across languages when requesting an ambulance for OHCA. Future studies should focus on the development and validation of OHCA recognition algorithms, based on these findings.

Keywords: Out-of-Hospital Cardiac Arrest, Emergency medical dispatch, Call centres, Emergency call taker, Telephonic cardiopulmonary resuscitation

Introduction

Out-of-Hospital Cardiac Arrest (OHCA) is a time-sensitive emergency. Globally, it is estimated that only 10% of OHCA patients survive and the time it takes before cardiopulmonary resuscitation (CPR) is administered to a victim, has the greatest impact on survival.[1] A recent scoping review seeking to determine the clinical outcomes following OHCA arrest in low resource settings reported return of spontaneous circulation rates as low as 0%.[2] They advocated for the development of minimum standards for the management of OHCA in low resource settings.[2]

The primary focus for the management of OHCA are summarised in the Chain of Survival, as presented by the American Heart Association (AHA). This chain consists of six vital links, namely: recognition and activation of the emergency response system, high

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quality (bystander) CPR early, rapid defibrillation, advanced resuscitation, post-cardiac arrest care, and recovery.[3] In OHCA, emergency care depends on the bystander recognition of OHCA and the initiation of bystander CPR.[4] About 90% of patients who experience OHCA die before reaching the hospital, which could be attributed to poor bystander CPR uptake.[5,6] In a Johannesburg-based study done by Stein et al. on OHCA, only 36% of patients who suffered witnessed cardiac arrest received bystander CPR.[7] Within SA, it is typical that an ambulance can take longer than five minutes to arrive at the scene of an emergency,[7] which again reiterates the critical role of the bystander. Literature has suggested that bystander CPR rates may be significantly increased if OHCA is recognised by the emergency call taker, who in turn guides the caller through telephonic CPR (tCPR).[9]

Yet again, the first step is recognition. In the call centre environment, recognition of OHCA is solely based on callers' descriptors when seeking emergency care.[10] Emergency call takers within South Africa are faced with unique challenges such as diverse cultures, different socioeconomic statuses, varying levels of education and literacy, and 11 official languages.[11,12] For these reasons, reliance on internationally published descriptors of OHCA may not be appropriate and may result in unrecognised or undiagnosed OHCA.

Within the Western Cape province of South Africa, 46.6% of the population speak Afrikaans, 31.1% isiXhosa and 19.6% English as their first language.[13] Currently, there is no published literature detailing the OHCA descriptors that residents of the Western Cape use to describe OHCA when calling the Western Cape emergency call centre. This study aimed to identify the key descriptors (words and phrases) of OHCA used by callers in the Western Cape when contacting the emergency call centre of the provincial Emergency Medical Services during a 1-year-period. Determining how callers in the Western Cape describe OHCA might aid in developing an algorithm for recognising OHCA when calling for an emergency ambulance.

Methodology

A descriptive, retrospective qualitative study was performed to identify unprompted OHCA descriptors (keywords and phrases) used by callers when calling for an emergency ambulance within the Western Cape. In this study, "*unprompted*" means a descriptor offered by the caller without being asked a direct question by the call taker. After verbatim transcription, inductive content analysis to the manifest level was performed. Descriptors of OHCA in isiXhosa, English and Afrikaans calls were coded, categorised and quantified.

Study setting

The study was conducted within the Western Cape Government (WCG) emergency medical services (EMS) emergency call centre. WCG EMS is a provincially funded service and renders emergency care to all Western Cape Province residents. The WCG EMS call centre handles approximately 2000 calls per day and 65 000 calls monthly. In the centre, emergency call takers receive an emergency call from residents of the Western Cape requiring an ambulance. Emergency call takers are most often the first point of contact between members of the public and emergency services. Call takers are mostly non-medically trained personnel whom, upon appointment, undergo orientation within EMS and receive in-house training on call-taking procedures and the computer systems utilised by WCG EMS. Calls taken at the call centre are unscripted and the call takers primarily focus on gathering geographical information pertaining to the call rather than the details of the condition through call-taking algorithms. Language mismatches within the call centre are mostly handled through code switching (either call-taker or caller changes speaks in a different language, often English)[14] or the call is transferred to a call taker with proficiency in the language.

Data collection

Computer-aided dispatch (CAD) data with the corresponding non-trauma, "*patient unresponsive*" incident types were drawn for a 12-month period (January–December 2018). Thereafter, the corresponding electronic patient care reports (ePCR) were extracted to verify for OHCA.

OHCA was verified in several ways. Firstly, the ePCR data were filtered according to their final prehospital triage code, namely "Red" (very urgent, time-critical patients) and "Blue" (expectant or deceased). The ePCRs of these cases were subjected to a retrospective chart review.

OHCA was verified in cases with a final red triage code where patients were initially unresponsive and pulseless, or CPR was initiated by emergency medical services upon arrival. Cases where cardiac arrest was not the presumed cause for unresponsiveness (e.g. stroke and hypoglycaemia) were excluded. For cases with a final blue triage code, OHCA was verified where a declaration of death accompanied the ePCR record. All other cases were excluded as these cases are highly unlikely to indicate OHCA. After screening, the original voice recordings of included cases were randomly selected using Microsoft Excel (Microsoft Corp. Washington, United States), extracted and transcribed verbatim by transcribers with the relevant language proficiency. A random sample of 50 cases were chosen per language, based on previous, similar studies in this field.[15–17] However, owing to the limited number of isiXhosa and Afrikaans calls, all occurrences in these languages were sampled.

Data analysis

After transcription, the calls were subjected to inductive, qualitative content analysis to the manifest level, noting the Afrikaans, isiXhosa and English descriptors used for OHCA within the Western Cape. Descriptors were sought across the duration of the entire call, if present. Analyses were completed through double coding using NVivo 12 (QSR International Pty Ltd, Australia), and completed through three steps: (1) Developing and Applying Codes; (2) Identifying categories; (3) Summarising and quantifying the data.[18]

As only one member of the study team was proficient in isiXhosa, analysis of these calls was through a process of consensus judgement.[19,20] Consensus judgement involves the agreement by all involved in the process that the identified terms were indeed used to describe the presentation of interest. In this study, consensus was achieved between the research team and an experienced contact centre call taker. The research team has prior experience in the use of consensus judgement for similar studies.[15] The contact centre call taker is considered a real-world expert in this data's content, due to the nature of their daily work. They are regularly exposed to keywords and phrases spoken by callers with various first languages and dispatch resources based on what they have interpreted the call's nature.

Qualitative rigour

Qualitative rigour and trustworthiness were ensured by using a well-defined study methodology and further addressed, as outlined by Guba:[21]

- *Credibility:* Credibility was ensured through prolonged engagement with the sampled data and investigator member checks during debriefing sessions, where all investigators reviewed, refined and verified the codes and categories across the different languages.[22] Only cases of true non-traumatic OHCA were selected. Cases were further selected at random, and until saturation across the languages. For Afrikaans and isiXhosa calls, all calls were sampled.
- *Transferability:* This study was set in the Western Cape province and according to the language profile there. Transferability is thus limited. This study has provided a detailed description of the setting to facilitate the reader to make judgements on whether these results may be applicable to their own setting.
- *Dependability:* Dependability was ensured by using an appropriate study design, data collection and analysis process. It enables readers to examine the methodology used to gather the data.[22] An audit trail between the investigators has been kept. Additionally, this study is reported in accordance with the consolidated criteria for reporting qualitative research (COREQ) checklist.[23]
- *Confirmability:* Verification of transcription was performed in order to ensure accuracy through the review of text with the audio recordings by investigators who were proficient in the language. Confirmability was further ensured through investigator triangulation by duplicate coding of transcriptions and the consensus judgement processes.

Results

A total of 15 678 cases with corresponding non-trauma, *"patient unresponsive"* incident type, were identified. After excluding 14 411 cases for a variety of reasons (Fig. 1), 729 OHCA patients

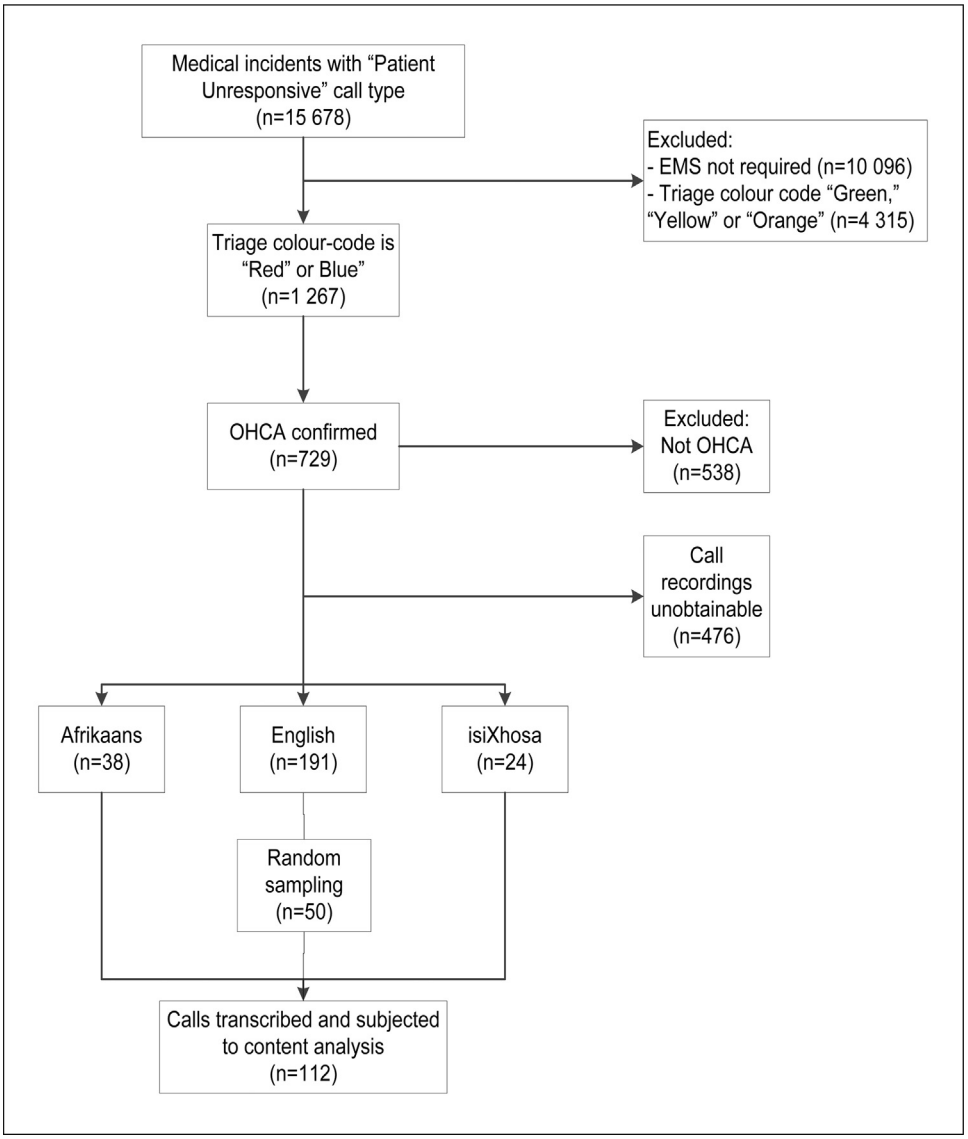

Fig. 1 – Data collection and extraction process.

Table 1 – Afrikaans, English and isiXhosa descriptors of Out-of-Hospital Cardiac arrest used by callers.

Category	Code	Meaning Unit	English Translation
Ill Health	Suspected diagnosis	*"Dink soos sy 'n stroke weg het"*	"Think she had a stroke"
		"Dit lyk soos sy 'n hartaanval gehad het"	"Looks like she had a heart attack"
		"Hy besig om 'n stroke te kry"	"He is busy having a stroke"
		"Lyk soos sy 'n stroke gehad het"	"Looks like she had a stroke"
		"Pain over his chest man"	
		"Told me he's got chest pains"	
		"Bakhwirisha ingathi uhlaselwe"	"Query heart attack"
	Medical History	*"Hy het verswak"*	"He's weakened"
		"Hy't nou heeltemal verswak"	"He's completely weak now"
		"Hy is 'n diabetic"	"He is a diabetic"
		"He had pneumonia"	
		"She's a known hypertensive"	
		"Looks like she vomited"	
		"He fell again"	
		"Utata uveske wawa"	"Daddy just fell"
Level of Consciousness	Unresponsive	*"Collapse reageer nie"*	"Collapse not responding"
		"Beweeg niks"	"Not moving"
		"Bewusteloos"	"Unconscious"
		"Daar's niks respons nie"	"There isn't any response"
		"She is not responding"	
		"Not getting any response"	
		"Trying to wake him up but he's not waking up"	
		"She's blackout now"	
		"Umntana akavuki"	"The baby does not wake up"
		"Patient ilele"	"Patient is sleeping"
		"Akarispondi xa emkhwaza"	"Did not respond when he cried out."
		"Yena ukholapsile"	"He collapsed"
Cardiac Activity	Pulselessness	*"Ek't gevoel daar's nie meer 'n pols nie."*	"I felt there is no more pulse"
		"Daar's nie meer 'n pols by hom nie"	"There is no pulse with him anymore"
		"Geen pols"	"No pulse"
		"Gevoel by sy arm ook, daar is ook nie' n pols nie"	"Felt at his arm as well, there isn't a pulse either"
		"Don't feel any heartbeat"	
		"Pulse I cannot feel"	
		"Trying to see if she's got a pulse, we can't pick it up"	
		"No heart beating"	
		"Ndiyendazama ukuva i-pulse, ndeva i-pulse ndeva kuthulekile"	"Tried to feel for the pulse, no pulse"
		"Ndizitshekhile pulse zakhe akho resipontsi"	"I have checked pulses and there are no responses"
	Suspected Death	*"Dood"*	"Dead"
		"Besig om dood te gaan"	"Busy dying"
		"Hy's klaar"	"He is finished"
		"Weet nou nie of hy lewe of wat nie"	"Not sure if he is alive or what"
		"Passed on"	
		"She passed away"	
		"Apparently he is dead"	
		"He is showing signs that he is not with us"	
		"Ingathi uswelekile"	"Seems like dead"
		"Akavuki uswelekile"	"Does not wake up, she is dead"
Clinical Features	Facial Descriptors	*"Sy oë is dood"*	"His eyes are dead"
		"Skuim kom al by sy mond uit"	"Foam is already coming from his mouth"
		"Skuim uit sy mond uit"	"Foam is coming out his mouth"
		"Daar kom skuim uit sy mond uit"	"There is foam coming out of his mouth"
		"Blood is coming out of her nose"	
		"Stuff coming out of his mouth"	
		"Eyes is a little bit open"	
		"Eyes and everything, it's dilated"	
		"ukhamisile"	"His mouth opened" also "He gasped"
	Body Temperature	*"Sy's yskoud"*	"She is ice cold"
		"Hy is yskoud"	"He's ice cold"

Table 1 *(continued)*

Category	Code	Meaning Unit	English Translation
		"Koudterig"	"Coldish"
		"Haar hande is yskoud"	"Her hands are ice cold"
		"His body is cold"	
		"She's getting cold."	
		"uyabanda"	"She is feeling cold"
Respiratory Effort	Apnoea	*"Blaas laaste asem uit"*	"Blowing out the last breath"
		"Blaas ook niks asem uit nie"	"Not exhaling"
		"Daar is niks asemhaling nie"	"There is no breathing"
		"Dit lyk nie hy haal asem nie"	"Does not seem like he is breathing"
		"She is not breathing"	
		"I don't think he's breathing"	
		"She stopped breathing"	
		"Doesn't seem as if he's breathing"	
		"Thina asazi asimani simphefumlisa"	"We do not know if she has stopped breathing"
		"So akaphefumli kengoku"	"He is not breathing right now"
		"akaphefumli"	"He is not breathing"
	Difficulty in breathing	*"Haal swaar asem"*	"Breathing heavily"
		"Bors toe getrek"	"Chest closed up"
		"Baie, baie vlak asemhaling"	"Very, very shallow breathing"
		"Ag, te vlak, baie vlak"	"Too shallow, very shallow"
		"She is getting a hard time to breathe"	
		"She is hardly breathing"	
		"There is slight breathing"	
		"She is breathing very slightly"	
		"Ingathi uyaphefumla kancinci kakhulu andimazi noba uyasweleka na andimazi"	"She seems to be breathing very slowly and I don't know if she is dying."
		"Kancinci"	"A bit" or shallow.

Languages are presented alphabetically: Afrikaans, English, isiXhosa.

were identified. A further 476 call recordings were not retrievable from the archiving system due to errors in archiving system upgrades. Of the remaining 191 calls, 38 (19.9%) calls were in Afrikaans, 24 (12.6%) calls were in isiXhosa, and 129 (67.5%) calls were in English. All Afrikaans and isiXhosa calls were transcribed and analysed, while a random sample of 50 English calls were selected for transcription and analysis. This yielded a final sample size of 112 (58% of those calls with recordings available, 15% of all) OHCA calls.

Demographic information for the patients included was obtained from the ePCR data. The mean (SD) age for the sample was 54.6 (19.1) years, and most patients were male (n = 66, 58%). A total of 291 meaning units (descriptors) were identified from the 112 calls transcribed. The meaning units were then condensed into codes and five categories during subsequent content analysis (Table 1). Herein, descriptors are presented by language, arranged alphabetically: Afrikaans, English and isiXhosa.

Fig. 2 shows the frequency with which descriptors were used. The most prevalent categories were descriptors related to ill-health (medical history and suspected diagnosis; 35.5%), level of consciousness (unresponsive; 18.6%) and cardiac activity (pulselessness and suspected death; 17.2%).

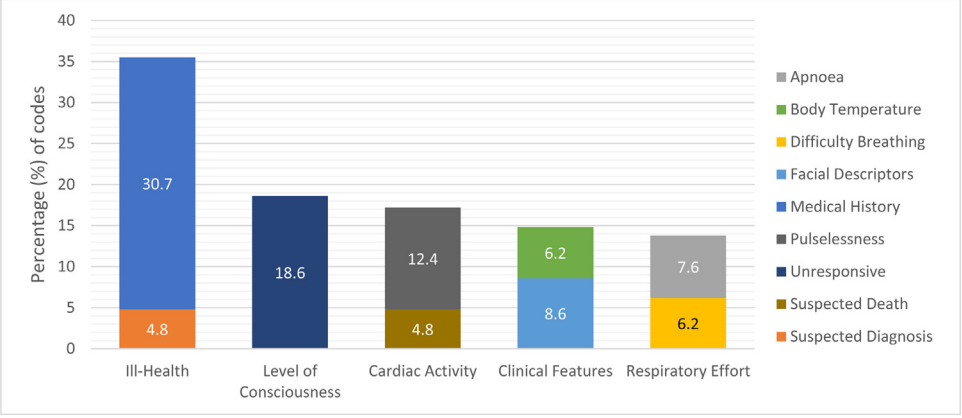

Fig. 2 – Frequency of Afrikaans, English and isiXhosa descriptors of Out-of-Hospital Cardiac arrest used by callers.

Discussion

The manner in which callers describe their emergency to the EMS call centre greatly impacts on the emergency call taker's ability to correctly prioritise the case and to ensure the right resources are allocated and sent to the scene.[24] OHCA requires prompt intervention from emergency call takers to facilitate bystander tCPR. This study aimed to identify the key descriptors (words and phrases) of OHCA used by callers seeking emergency medical assistance when calling into the emergency call centre of the WCG EMS in different languages. In this study, it was found that Afrikaans-, isiXhosa- and English-speaking callers described cardiac arrest most frequently in three ways using descriptors (words and phrases) linking to the following categories: ill-health (medical history and suspected diagnosis), level of consciousness (unresponsive) and cardiac activity (pulselessness and suspected death).

Despite Afrikaans being the home language of almost half of the Western Cape population,[13] Afrikaans calls accounted for but a fraction of the OHCA calls analysed. Non-English speakers, while communicating in their home language, regularly used English phrases while describing their emergency. This is known as code-switching and was previously described in this setting by Penn et al.[19] This is likely reflective of a predominantly English medium of language in public schools in South Africa and South African popular media.[12]

It was surprising that despite initial assumptions that different languages would describe OHCA differently (hence analysing each language separately and inductively) common categories across the languages still emerged. For this reason, perhaps the descriptions rather than the language in which they are made, become more important for future work in telephonic disease recognition. It is unclear whether the same may be observed in other nations where popular media and refugees and immigrants are largely anglicised or naturalised to the local language. This is also worth investigating in other settings and regions of South Africa. Following from this, the trigger to recognise OHCA in the Western Cape province should likely be in the categories that emerged, rather than the specific words used. This will allow for some universality in the application of the algorithm within the province. Yet, the specific terms would still be important in the application of the algorithm across languages. However, herein it is likely that such sociolinguistic elements may already be embedded in native speakers of each language. Put differently, by developing recognition algorithms based on the categories of descriptions that the native language speaking call-taker might recognise, the specific words that describe such categories may easily be identified by the call-taker owing to their language proficiency. This simplifies the algorithm and eliminates the need to have algorithms that are specific to each language.

Patients in our study were most frequently described as having a history of ill-health prior to experiencing OHCA. These descriptors came up spontaneously and unprompted, i.e. no history items were asked by the call taker. While some chronic diseases uncovered during history taking may be predictive of CVD and OHCA, it is unclear whether this will increase the accuracy of telephonic OHCA recognition. Furthermore, this should be offset by call-taking time, and delaying tCPR and EMS dispatch. Additionally, some history items may indicate the acuity of the events preceding the collapse and may be utilised for prognostication, e.g. progressive worsening of ill health versus sudden collapse. This may inform the EMS response and resource allocation, however, prospective studies should be undertaken to determine the predictive power of history items on the likelihood of OHCA and prognosis.[25]

Callers described the level of consciousness of OHCA patients in about a fifth of patients. While in-keeping with previous work, unconsciousness is a relatively non-specific complaint and is thus not pathognomonic of OHCA, especially in emergencies. [26] It is perhaps for this reason that it has been suggested that unconsciousness should be used to predict likelihood of OHCA along with other more specific descriptors such as apnoea, abnormal breathing or pulselessness, and may serve as an entry-point into an OHCA recognition algorithm.[26] It is, however, important to note that an unresponsive patient was the initial inclusion criteria for our study and might explain its frequency in our sample.

In this study, pulselessness was also used frequently to describe the patient with OHCA. Yet, literature from higher income settings has demonstrated that neither bystanders nor healthcare providers can reliably detect a pulse in unconscious victims.[6,27] The utility of bystander reported pulselessness in OHCA in our setting is thus drawn into question, and future work should investigate relevance in Africa. For these reasons, many international recognition algorithms rather recommend abnormal breathing or apnoea as a trigger for tCPR.[10] It is interesting that our study did not, in fact, recognise descriptors of abnormal breathing to frequently be offered by callers, when seeking an emergency response for OHCA.

While this study did not seek to determine why this deviated from international literature, some explanations may be offered. Firstly, descriptors of suspected death offered by callers might reflect a protracted time from actual cardiac arrest to discovery of the victim by family members, and therefore descriptors of respiratory effort become less critical. Additionally, such descriptors of "certain death" may have some prognostic value and similarly to "ill-health" or "history" descriptors might be helpful in guiding resource allocation in cases of futility, especially in resource-poor settings, such as South Africa.

Secondly, while international OHCA recognition algorithms are often prompted (through directed questioning) by the call-taker,[28] this study sought to describe *unprompted* descriptors by callers; and this might be why callers did not necessarily focus on abnormal breathing but rather ill health and level of consciousness. Literature has suggested that callers might interpret agonal breathing inappropriately as respiratory effort, and thus if not prompted by a call-taker, not as apnoea.[29] This does not discount respiratory effort as an important factor in OHCA recognition in our setting. Directed questioning according to a contextual OHCA recognition algorithm in this setting might still recognise abnormal breathing as important in instances of OHCA with good prognosis. Again, future studies should explore this. At the very least, this strengthens the argument for generating contextual recognition algorithms for each socio-linguistic setting, as emergency medical call-taking and dispatch is quite literally the intersection between language, communication and health.

In order to develop a telephonic OHCA recognition algorithm, the descriptors found in this study, which are embedded in the voice of the caller, may be used as the trigger for an emergency call-taker to initiate directed questioning for OHCA as opposed to other algorithms. This is particularly important in nascent settings where computer-aided dispatch is not universally used and the application of the algorithm is likely a manual process. When these descriptors are also interrogated for an association between prognosis, directed questions may be

developed that may also guide dispatch priority based on the probability of a good outcome.

Limitations and recommendations

The transferability of this study is limited by the geographic and socio-linguistic context, yet these findings may still be applicable to other areas in South Africa. Similarly, the methods that are described herein may be used to initiate the development of telephonic triage and recognition algorithms. Future studies may seek descriptors of other languages spoken in South Africa.

This study is further limited by selection bias, in that only patients with OHCA were eligible to be included. Thus, this work cannot be used to determine diagnostic accuracy in similar descriptions that do not relate to OHCA. Yet, the accuracy of these descriptors in isolation and in various combinations to recognise OHCA, should be determined next. Hereafter, and notwithstanding our limitations of transferability, these descriptors should then be combined in an OHCA recognition algorithm for implementation and testing. This is particularly important as the incidence of CVD and OHCA is expected to increase.

Conclusion

Callers within the Western Cape province of South Africa used consistent descriptors when requesting an ambulance for OHCA. Producing recognition algorithms based on these descriptors could bolster the accuracy with which OHCA is identified, and thus tCPR can be initiated. Interestingly, some of these descriptors might be explored to predict prognosis following OHCA. Future studies should seek to develop and validate telephonic OHCA recognition algorithms.

Author contribution

LvR: Study design, data collection, transcription, data analysis and interpretation, and manuscript preparation.

LR: Data collection, data analysis and interpretation, and manuscript approval.

SM: Data collection, data analysis and interpretation, and manuscript approval.

JC: Study design, data analysis, and critical review of manuscript.

CW: Data interpretation and preparation and critical review of manuscript.

WS: Conceptualisation of the study, study design, data analysis and interpretation, manuscript preparation, and critical review and final approval of manuscript.

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Conflict of interest

Authors in this study have no conflict of interest.

Patient consent

The study was conducted retrospectively, and a waiver of consent was approved by the Human Research Ethics Committee of the University of Cape Town. The ePCR's and transcriptions that were obtained were anonymised and stored in protected files.

Ethics approval

University of Cape Town Human Research Ethics Committee granted ethics approval for the study, with waiver of consent (Reference number 459/2019).

Data sharing statement

Data for this study was formally requested via the National Health Research Database (NHRD) of the South African National Department of Health, following ethics approval. Data can be made available upon request, subject to approval by the NHRD. Results were disseminated to the relevant Emergency Medical Service in accordance with ongoing collaborations.

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