African Journal of Emergency Medicine 10 (2020) 64–67

Contents lists available at ScienceDirect

African Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/afjem

Original article

Telephonic description of sepsis among callers to an emergency dispatch centre in South Africa

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ARTICLE INFO

Keywords:
Emergency medical services
Emergency medical dispatch
Sepsis

ABSTRACT

Introduction: Sepsis is an acute, life-threatening condition caused by a dysregulated systemic response to infection. Early medical intervention such as antibiotics and fluid resuscitation can be life-saving. Diagnosis or suspicion of sepsis by an emergency call-taker could potentially improve patient outcome. Therefore, the aim was to determine the keywords used by callers to describe septic patients in South Africa when calling a national private emergency dispatch centre.

Methods: A retrospective review of prehospital patient records was completed to identify patients with sepsis in the prehospital environment. A mixed-methods design was employed in two-sequential phases. The first phase was qualitative. Thirty cases of sepsis were randomly selected, and the original call recording was extracted. These recordings were transcribed verbatim and subjected to content analysis to determine keywords of signs and symptoms telephonically. Once keywords were identified, an additional sample of sepsis cases that met inclusion and exclusion criteria were extracted and listened to. The frequency of each of the keywords was quantified.

Results: Eleven distinct categories were identified. The most prevalent categories that were used to describe sepsis telephonically were: gastrointestinal symptoms (40%), acute altered mental status (35%), weakness of the legs (33%) and malaise (31%). At least one of these four categories of keywords appeared in 86% of all call recordings.

Conclusion: It was found that certain categories appeared in higher frequencies than others so that a pattern could be recognised. Utilising these categories, telephonic recognition algorithms for sepsis could be developed to aid in predicting sepsis over the phone. This would allow for dispatching of the correct level of care immediately and could subsequently have positive effects on patient outcome.

African relevance

- The burden of sepsis is large across the African continent.
- Early identification of sepsis may expedite care and improve outcome.
- Prehospital suspicion of sepsis has been found to improve in-hospital time to care and guideline adherence.
- Suspicion at the dispatch level can assist with resource allocation and priority setting.
- By recognising the sickest patients, limited EMS resources in Africa can be directed to the most appropriate cases.

Introduction

Sepsis is a life-threatening condition caused by a dysregulated host response to infection, [1] and carries a high mortality [2,3]. In higher-income countries, the incidence of sepsis is reported to be 334–571 per 100,000 for sepsis and 176–410 per 100,000 for severe sepsis [4]. Despite a paucity of epidemiological data on sepsis in low- to middle income countries (LMICs) [4,5], e.g. South Africa, the incidence of sepsis is anticipated to be higher than this owing, in part, to a high rate of infectious and retroviral diseases, and poor healthcare access secondary to socioeconomic disparities.

Sepsis is a time-critical emergency. Although robust evidence is lacking, it is widely accepted that early treatment in sepsis leads to

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https://doi.org/10.1016/j.afjem.2020.01.002
Received 18 September 2019; Received in revised form 3 December 2019; Accepted 6 January 2020
Available online 05 February 2020

improved clinical outcome [6]. One of the most important first steps to initiating early treatment, is the early recognition of the septic patient [6]. It has been found that prehospital recognition of sepsis leads to decreased delays in in-hospital treatment and might lead to improved mortality [7–9]. Prehospital recognition of sepsis is difficult however, due to a non-specific disease presentation [10] and the inaccuracy of prehospital sepsis screening tools [11]. Utilising the description of the patient's symptomatology has been suggested to improve prehospital diagnosis [12].

The emergency call-taker plays an important role as the first contact for individuals seeking emergency care. Understanding the communication processes in the call itself is the first step to enhancing the quality of the prehospital chain of emergency care. Early recognition of time-sensitive emergencies by call-takers has been shown to decrease response-times and expedite emergency care [13]. To this end, call-taker recognition of sepsis could provide prehospital providers with an early suspicion for sepsis and further decrease dispatch and response-times. Barring one Swedish study [14], to our knowledge, there are currently no published literature related to the telephonic description of sepsis presentations by callers to a South African or African emergency dispatch centre. The aim of the current study was therefore to determine the keywords used by callers to describe septic patients in South Africa when calling a national private emergency dispatch centre. We further sought to determine the prevalence with which these keywords are used.

Methods

Study design and setting

This was a mixed methods study on emergency calls to a private South African emergency dispatch centre during a fifteen month period, using a sequential exploratory design [15].

The current study was set in a national private ambulance service's dispatch centre, in South Africa. This service mainly receives calls and transports patients with medical insurance but does not refuse care to patients in need of emergency assistance who do not possess insurance. Approximately, 1500 calls are handled in this dispatch centre per day. The ambulance service transports approximately 13,000 patients per month.

Sample

A retrospective review of ambulance patient records between the periods of 1 January 2016 and 31 March 2017 was completed to identify patients with sepsis in the out-of-hospital environment. Patients were first identified using ambulance-diagnosed ICD10 codes compatible with infection (A00-B99). Hereafter, patient records were screened for sepsis by applying a standard definition of sepsis.

Sepsis was defined as fulfilment of one or more of the following criteria, in the presence of suspected infection, during prehospital care: "*systolic blood pressure < 90 mm Hg or an EMS statement of a non-measurable blood pressure, oxygen saturation of ≤86% if the lung was not the focus of infection or oxygen saturation ≤78% if the lung was focus of infection, acute altered mental status, mottling or cardiopulmonary arrest due to sepsis during EMS transport (but admitted alive to in-hospital care)*". This specific definition of sepsis was chosen as numerous screening tools fall short on accuracy, and has been applied in previous similar studies [11,12].

Using the unique patient case reference number, a random sample of sepsis cases was selected for the content analysis. The original call to the emergency dispatch centre was extracted. Calls were limited to adult (>18 years old) English speaking callers. Interfacility transfers and calls made by healthcare providers to the dispatch centre were excluded. Calls were also excluded if poor audio quality precluded meaningful analysis. Randomisation was repeated until a sample of thirty cases were included. This sample size is in line with previous studies using a similar methodology [14]. Demographic information is not routinely collected during the original call but was extracted from the ambulance patient record where possible.

Table 1
Categorical development.

Meaning unit	Code	Category
"He's passed out and we don't know what's happening…"	Decreased level of consciousness	Altered mental status
"…her stomach's running but…"	Diarrhea	Gastrointestinal
"We think she's maybe dehydrated"	Dehydration	Dehydration

Content analysis

After verbatim transcription, data was subjected to inductive content analysis to the manifest level by one coder, to determine telephonic keywords of signs and symptoms of sepsis. Content analysis was done using Atlas.ti (Scientific Software Development GmbH; Berlin, Germany), by following five steps: 1. organising and preparing the data; 2. reading through all the available data; 3. coding the data; 4. generating a description and category from the information; 5. identifying categories [15]. The content analysis development is exemplified in Table 1.

Quantification of keywords

Once keywords were identified by content analysis, the original call recordings of the remaining sepsis cases that met inclusion and exclusion criteria were extracted and listened to, but not transcribed. The frequency of each of the keywords was then quantified. The frequency is presented as number and proportion and ranked according to prevalence.

Methodological rigour

Validity and credibility were ensured by randomly selecting patient records for the original content analysis and quantifying the keywords in a different cohort, through frequent debriefing sessions between the authors during the content analysis and quantification processes, and researcher triangulation of results. Confirmability was further ensured through meticulous checks of transcriptions. Dependability and reliability were ensured by agreement of codes and keywords between the authors, description of the data collection methods and transparent disclosure of the categorical development (Table 1). Inter-rater reliability was not measured.

Approvals

Ethical approval for each phase of the study was obtained from the Human Research Ethics Committee of the University of Johannesburg (HREC Ref nrs: REC01762017, REC241112035). Studies were specifically approved for waiver of consent. Organisational approval was obtained from the emergency medical service.

Results

A total of 2789 ambulance patient records were identified by ICD10 coding as potential sepsis. After applying the inclusion and exclusion criteria, a total of 165 cases of sepsis were included in the study: 30 cases for the content analysis and identification of keywords and 135 for the quantification of keywords.

Demographic information was available for 143 (87%) cases. The majority of patients (n = 74, 51.7%) were female with a median

Table 2
Descriptor categories and frequencies.

Rank	Keyword category	Prevalence n (%)
1	Gastrointestinal keywords	54 (40%)
	Diarrhea	35 (26%)
	Vomiting	29 (22%)
	Other GI-symptoms (anal incontinence, haematemesis)	7 (5%)
2	Altered mental status	47 (35%)
	Descriptions containing: loss of/altered level of consciousness, unresponsiveness, suspicion of stroke, confusion, disorientation, delirium, unable to speak, agitation	
3	Weakness, legs	45 (33%)
	Descriptions containing: unable to stand, unable to walk, unable to move, bedridden/is lying down, need assistance standing/walking	
4	Malaise	42 (31%)
	Descriptions containing: unwell, sick, ill, turn for the worse, deteriorated condition	
5	Pain	21 (16%)
	Abdominal, back, chest, general, head, legs	
6	Dehydration	19 (14%)
	Described as such.	
7	Abnormal body temperature	16 (12%)
	Description of fever or elevated temperature	11 (8%)
	Hypothermia, or patient is cold	4 (3%)
	Shivering	2 (2%)
8	Respiratory keywords	16 (12%)
	Description containing: shortness of breath, difficulties breathing, coughing, suspicion of respiratory infection	
11	Loss of energy	13 (10%)
	Descriptions containing: weakness, lethargic or similar expressions	
11	Reduced oral intake of food, fluid or medicine	13 (10%)
11	Cardiovascular keywords	13 (10%)
	Hypotension, or low blood pressure	12 (9%)
	Tachycardia, or fast heart rate	1 (1%)
	Weak pulse	1 (1%)

(range) age of 75 (1–98) years of age. For the male population (n = 69, 48.3%) the median (range) age was 72 years (13–93) years of age.

A total of eleven distinct categories were identified. Table 2 outlines the categories identified, as well as the ranked prevalence of each. The most prevalent categories that were used to describe sepsis over the phone were: gastrointestinal symptoms (40%), acute altered mental status (35%), weakness of the legs (33%) and malaise (31%). At least one of these four categories of keywords appeared in 86% of all call recordings with suspected sepsis.

Discussion

English speaking callers to a South African emergency dispatching centre described sepsis using eleven distinct categories. In nearly all sepsis cases, at least one of the four most prevalent descriptor categories were used: gastrointestinal symptoms, acute altered mental status, weakness of the legs and malaise.

Gastro-intestinal keywords occurred most commonly in this South African cohort and not respiratory keywords. This is in contrast to studies conducted in the United States, where sepsis of respiratory focus is most prevalent [16], and could further explain the high reliance on respiratory signs and symptoms in prehospital sepsis screening tools developed in higher income nations [11,17]. Alternatively, dyspnoea could be part of the sepsis presentation itself, regardless of the actual septic focus. This was also demonstrated in a Swedish study of emergency calls [14]. The high incidence of diarrhoeal illness in South Africa (and other LMICs) [18], may be the underlying explanation that gastrointestinal keywords are the most prevalent. The inclusion of gastro-intestinal presentations in contextual prehospital screening algorithms should be considered. This is supported by the current findings.

Similar to the previous study [12], weakness of the legs and altered mental status were demonstrated in the current study. Although the cause of leg weakness in particular is currently not known, it could be explained as the symptomatic presentation of sepsis-induced myopathy, that has previously been described [19]. The diagnostic and prognostic value of this category is further yet to be determined however, it appears as though it occurs more commonly in the elderly [12].

Altered mental status is likely explained by sepsis-associated encephalopathy [20] or as a consequence of decreased cerebral perfusion secondary to hypotension. Indeed, cardiovascular keywords suggestive of hypotension were given in one tenth of sepsis patients in the current study. Regardless of the underlying cause, altered mental status is a common presentation in sepsis and has been incorporated into prehospital sepsis screening tools [11,17]. Altered mental status has further been associated with a higher mortality in sepsis [12,20], and these patients should therefore be given particular consideration.

In approximately one third of patients, non-specific keywords of general malaise (or illness) were provided. Such general descriptions could be explained by the non-specificity of the signs and symptoms of sepsis [10] or, potentially, due to the relative poor command of the English language within South Africa and level of education [21]. This is unlikely the only explanation however, as international guidelines include general phrases such as "*feeling unwell*" in recognition algorithms owing to the non-specific nature of sepsis [22].

With eleven official languages, poor English language proficiency and a substantial variation in level of education, the telephonic recognition of high acuity conditions such as sepsis is particularly challenging in the South African setting. With freedom of movement, and increased immigration and asylum seekers, language discordance between a caller and an emergency call-taker may not be isolated to the South African setting and is likely to become more common internationally. Discordance between language and cultural understanding has been shown to be consistent barriers to accessing healthcare for refugees [23,24]. Healthcare workers often do not have command of the vernacular of the populous and therefore further complicates communication even between citizens of a country [25]. Language proficiency together with the non-specific presentation of septic patients portray challenges to the telephonic recognition of sepsis.

By using telephonic recognition algorithms based on the phraseology used by a local resident of a country to describe disease, emergency call-takers can assist in the early recognition of high acuity emergencies. Considering that four keywords were consistently used when describing sepsis in this sample, future prospective research is required to determine the diagnostic accuracy of these. This may further be bolstered by the application of machine-learning.

Our study was modelled from a similar study undertaken in Sweden, where the most common keywords were abnormal body temperature, pain, altered mental status and weakness of the legs [12]. Some important differences between the two studies could explain variance in the observed sepsis keywords between the Swedish and South African settings.

Whereas the current study interrogated sepsis keywords in emergency calls made by lay-people, the Swedish study analysed ambulance care records where body temperature could routinely be recorded by prehospital providers. South Africans may not have access to thermometers in households, owing to poor socio-economic status or level of education. Although pyrexia does not occur commonly in sepsis [26], a dated study found that patients in Africa may not be able to detect fever accurately, leaving this sign unreliable in any event [27].

Most importantly, the current study was limited to calls in English of a single private emergency medical service only and may infer a selection bias. Although calls received are not received and selected based on insurance status, individuals that would make use of private EMS are likely of higher socio-economic status and therefore are more likely to have improved English proficiency. This detracts from the applicability to other settings in South Africa. We therefore recommend a larger scale

study that takes all language and socio-economic profiles into consideration.

The presence of sepsis was determined based on a retrospective assessment of prehospital patient report forms, and hospital diagnosis was therefore not confirmed. Despite this, clear patterns were observable in the data. Future studies could instead determine the presence of sepsis through in-hospital diagnosis, where more diagnostic testing is available.

Owing to these limitations and the exploratory nature of this study, these findings should not be applied as telephonic diagnostic criteria. It is recommended that future research aims at generating telephonic recognition algorithms to be tested prospectively and refined according to the cultural and language profile of a nation.

Conclusion

English speaking callers in South Africa describe sepsis using eleven distinct categories. In the majority of the sepsis cases, at least one of the four most prevalent categories were used: gastrointestinal symptoms, acute altered mental status, weakness of the legs and malaise. Utilising these categories, telephonic recognition algorithms for sepsis could be developed to aid in predicting sepsis over the phone. This may allow for dispatching of the correct level of care immediately and could subsequently have positive effects on patient outcome.

Dissemination of results

The results of this study have been shared with the service where the data was sourced from. The study will further be presented at conferences in South Africa and internationally.

Authors' contribution

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: WS contributed 35%; CW contributed 20%; EL contributed 20%; and LK contributed 25%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Conflicts of interest

Dr Willem Stassen is and editor of the African Journal of Emergency Medicine. Dr Stassen was not involved in the editorial workflow for this manuscript. The African Journal of Emergency Medicine applies a double blinded process for all manuscript peer reviews. The authors declared no conflicts of interest.

References

[1] Singer M, Deutschman CS, Seymour C, Shankar-Hari M, Annane D, Bauer M, et al. The third international consensus definitions for sepsis and septic shock (sepsis-3). JAMA - J Am Med Assoc 2016;315(8):801–10.
[2] ARISE Investigators, ANZICS Clinical Trials Group, Peake SL, Delaney A, Bailey M, Bellomo R, et al. Goal-directed resuscitation for patients with early septic shock. N Engl J Med 2014;371(16):1496–506.
[3] Mouncey PR, Osborn TM, Power GS, Harrison DA, Sadique MZ, Grieve RD, et al. Trial of early, goal-directed resuscitation for septic shock. N Engl J Med 2015;372(14):1301–11.
[4] Fleischmann C, Scherag A, Adhikari NKJ, Hartog CS, Tsaganos T, Schlattmann P, et al. Assessment of global incidence and mortality of hospital-treated sepsis. Current estimates and limitations. Am J Respir Crit Care Med 2016;193(3):259–72.
[5] Jawad I, Lukšić I, Rafnsson SB. Assessing available information on the burden of sepsis: global estimates of incidence, prevalence and mortality. J Glob Health 2012;2(1):010404.
[6] Rhodes A, Evans LE, Alhazzani W, Levy MM, Antonelli M, Ferrer R, et al. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock: 2016. Crit Care Med 2017;45:486–552.
[7] Seymour CW, Kahn JM, Martin-Gill C, Callaway CW, Yealy DM, Scales D, et al. Delays from first medical contact to antibiotic administration for sepsis. Crit Care Med 2017;45(5):759–65.
[8] Seymour CW, Gesten F, Prescott HC, Friedrich ME, Iwashyna TJ, Phillips GS, et al. Time to treatment and mortality during mandated emergency care for sepsis. N Engl J Med 2017;376(23):2235–44.
[9] Smyth M, Brace-McDonnell S, Perkins G. Impact of prehospital care on outcomes in sepsis: a systematic review. West J Emerg Med 2016;17(4):427–37.
[10] Bayer O, Schwarzkopf D, Stumme C, Stacke A, Hartog CS, Hohenstein C, et al. An early warning scoring system to identify septic patients in the prehospital setting: the PRESEP score. Acad Emerg Med 2015 Jul;22(7):868–71.
[11] Wallgren UM, Castrén M, Svensson AEV, Kurland L. Identification of adult septic patients in the prehospital setting: a comparison of two screening tools and clinical judgment. Eur J Emerg Med 2014;21(4):260–5.
[12] Wallgren UM, Bohm KEM, Kurland L. Presentations of adult septic patients in the prehospital setting as recorded by emergency medical services: a mixed methods analysis. Scand J Trauma Resusc Emerg Med 2017;25(1):23.
[13] Berdowski J, Beekhuis F, Zwinderman AH, Tijssen JGP, Koster RW. Importance of the first link. Circulation. 2009;119(15):2096–102.
[14] Bohm K, Kurland L, Bartholdson S, Castrèn M. Descriptions and presentations of sepsis - a qualitative content analysis of emergency calls. Int Emerg Nurs 2015;23(4):294–8.
[15] Creswell J. Research design: qualitative, quantitative and mixed methods approaches. 3rd ed California: SAGE Publications; 2009. Sage UK: London, England.
[16] Mayr FB, Yende S, Angus DC. Epidemiology of severe sepsis. Virulence. 2014;5(1):4–11.
[17] Smyth MA, Brace-Mcdonnell SJ, Perkins GD. Identification of adults with sepsis in the prehospital environment: a systematic review. BMJ Open 2016;6(8):e011218.
[18] Pillay-van Wyk V, Msemburi W, Laubscher R, Dorrington RE, Groenewald P, Glass T, et al. Mortality trends and differentials in South Africa from 1997 to 2012: second National Burden of Disease Study. Lancet Glob Health 2016;4(9):e642–53.
[19] Callahan LA, Supinski GS. Sepsis-induced myopathy. Crit Care Med 2009;37(10 Suppl):S354–67.
[20] Consales G, De Gaudio AR. Sepsis associated encephalopathy. Minerva Anestesiol 2005;71(1–2):39–52.
[21] Coovadia H, Jewkes R, Barron P, Sanders D, McIntyre D. The health and health system of South Africa: historical roots of current public health challenges. Lancet 2009;374(9692):817–34. [Internet].
[22] Tavaré A, O'Flynn N. Recognition, diagnosis, and early management of sepsis: NICE guideline. Br J Gen Pract 2017;67(657):185–6.
[23] Robertshaw L, Dhesi S, Jones LL. Challenges and facilitators for health professionals providing primary healthcare for refugees and asylum seekers in high-income countries: a systematic review and thematic synthesis of qualitative research. BMJ Open 2017;7(8):e015981.
[24] Chuah FLH, Tan ST, Yeo J, Legido-Quigley H. The health needs and access barriers among refugees and asylum-seekers in Malaysia: a qualitative study. Int J Equity Health 2018;17(1):120.
[25] Penn C, Watermeyer J, Nattrass R. Managing language mismatches in emergency calls. J Health Psychol 2017;22(14):1769–79.
[26] Lindvig K, Henriksen D, Nielsen S, Jensen T, Kolmos H, Pedersen C, et al. How do bacteraemic patients present to the emergency department and what is the diagnostic validity of the clinical parameters; temperature, C-reactive protein and systemic inflammatory response syndrome? Scand J Trauma Resusc Emerg Med 2014;22(1):39.
[27] Einterz EM, Bates ME. Fever in Africa: do patients know when they are hot? Lancet. 1997;350(9080):781.