



## ORIGINAL ARTICLE

# The epidemiology of sepsis in a district hospital emergency centre in Durban, KwaZulu natal

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## ARTICLE INFO

## Keywords:

Sepsis  
Emergency department  
Developing countries

## ABSTRACT

**Introduction:** Sepsis is one of the leading causes of death worldwide. There is a paucity of data describing the epidemiology of sepsis in emergency centres in developing countries. This study aims to describe the clinical profile and management of patients presenting with sepsis in this setting.

**Methods:** A retrospective chart review was conducted in an Emergency Centre (EC) of a district hospital in Durban from December 2015 to February 2016. All patients with a diagnosis of an infection that met the Surviving Sepsis Campaign criteria for sepsis syndrome were included in the study.

**Results:** A total of 1195 patients who were diagnosed with an infection were screened. Of these, 52 of them met the inclusion criteria for the study. The criteria for severe sepsis was met in 40.3% (n 23) and 1.9% (n 1) met the criteria for septic shock. More than half of the patients were HIV positive and 30.7% did not know their HIV status. The most common sites of infection were respiratory tract, gastrointestinal and central nervous system respectively. Most patients were admitted to the general medical ward. The inpatient mortality rate was 15% for general medical ward admissions.

**Conclusion:** A better understanding of the demographic and clinical profile of sepsis syndrome in South African ECs is required to guide clinical and operational policy development.

## African relevance

- Sepsis has a high mortality rate globally
- African emergency care staff need to recognise sepsis early and implement the initial management once recognised
- HIV, tuberculosis and malnutrition are likely to increase the burden of sepsis in Africa

## Introduction

Sepsis is a clinical syndrome that occurs when a localised infection becomes systemic and produces a dysregulated inflammatory immune response [1]. It is one of the leading causes of death worldwide with a mortality rate ranging from 17.9% to 59% and the incidence of sepsis syndrome continues to increase every decade [2]. Globally sepsis syndrome accounts for approximately 5.3 million deaths annually [3]. Sepsis mortality & morbidity data from developing countries is not well documented. A study in an Emergency Centre (EC) in a developing country reported a hospital mortality rate of 43% in patients presenting with severe sepsis [4]. A recent study describing the spectrum and outcomes of patients with surgical sepsis reported an overall mortality

rate of 12.7% [5]. With the high prevalence of Human Immunodeficiency Virus (HIV) and other infections in Africa, it is likely that the burden of sepsis syndrome is equal or even higher than that estimated from developed countries.

Studies from the first world countries indicate that sepsis syndrome occurs most commonly in the elderly [6,7]. There is a male predominance although the likelihood of dying from sepsis is the same in both sexes [8,9]. Most of these infections are community acquired and are mainly due to gram negative bacteria [6]. The most common types of infections causing sepsis in developed nations are pneumonia, urinary tract infections and intra-abdominal infections respectively [4,6–9]. Pre-existing co-morbidities such as diabetes, hypertension and malignancies increased the mortality from sepsis [6].

Early recognition and management of sepsis syndrome can translate to lower morbidity and mortality. The Surviving Sepsis Guidelines have introduced bundles of care to improve the management of patients with sepsis syndrome [10]. These include early administration of antibiotics, early initiation of fluids, inotropes and ventilation. These bundles of care have been incorporated into emergency centre (EC) protocols in developed countries. The sub-Saharan African region has resource limitations and finds challenges in implementing the internationally

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<https://doi.org/10.1016/j.afjem.2019.02.001>

Received 9 January 2018; Received in revised form 2 July 2018; Accepted 1 February 2019

Available online 02 March 2019

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recommended guidelines. It is therefore important to quantify the burden of sepsis to aid policy makers in allocation of resources towards sepsis management [7,11].

The aim of this study was to describe the clinical profile and initial management of patients with sepsis syndrome in a South African district hospital EC.

## Methods

A retrospective chart review was conducted in an Emergency Centre of a district hospital in Durban from December 2015 to February 2016. All patients with a diagnosis of infection or infectious illness that met the Surviving Sepsis Campaign (SSC) criteria for sepsis; severe sepsis and septic shock were included. A patient was deemed to have sepsis syndrome if two or more of the following criteria were present with either an identifiable source of infection or presumed infection: a temperature  $> 38^{\circ}\text{C}$  or  $< 36^{\circ}\text{C}$ ; a heart rate  $> 90$  beats/min or more than two standard deviations above the normal value for age; tachypnoea (respiratory rate  $> 20$  breaths/min or  $\text{PCO}_2 < 32$  mmHg); and an abnormal white cell count (WCC,  $> 12,000/\mu\text{L}$  or  $< 4000/\mu\text{L}$  or  $> 10\%$  immature band cells). Patients under the age of 11 with sepsis syndrome secondary to a nonsurgical cause were excluded as they presented directly to the paediatric department.

Charts of patients with any infection as a diagnosis were evaluated, and if they met the criteria for sepsis syndrome they were included in the study. The required data was extracted onto a standardised data collection sheet. Missing data were collected from the National Health Laboratory Service (NHLS) tracking systems and from the hospital electronic data base (Meditech). The following data were collected and analysed: Patient demographics, co-morbidities, clinical presentation, initial management in the EC and disposition of patient from the EC. Data was analysed using Microsoft Excel (Microsoft, Richmond, USA) and SPSS version 24 software (Windows, Armonk, NY). Descriptive statistics such as percentages and frequencies were used to summarize demographics and investigative findings.

Ethics approval was granted by the University of KwaZulu Natal Biostatistics Research Ethics Committee (BREC reference: BE236/16) and KwaZulu Natal Department of Health (KZ\_2016RP19\_753).

## Results

Fig. 1 provides a breakdown of sampling.

Table 1 depicts the patient demographics and common co-morbidities of patients presenting with sepsis syndrome. The mean sample age was 40.9 years (standard deviation  $\pm 15.8$  years).

Table 2 shows the vital signs and haematological parameters obtained on presentation to the EC.

Using the South African Triage Scale, the majority of patients were triaged as yellow priorities ( $n = 18$ , 34.6%), followed by orange ( $n = 4$ , 7.7%) and red ( $n = 3$ , 5.8%) priorities. The common sources of infections identified were lower respiratory tract infections, acute gastroenteritis, meningitis, and soft tissue and urinary tract infections, respectively. In four (7.7%) patients the site of infection was unclear.

Table 3 summarises the initial management in the EC. The mean time to antibiotic was 3.3 h (standard deviation  $\pm 4.5$  h).

The majority ( $n = 40$ , 76.9%) of patients were admitted into the general medical ward with an inpatient mortality rate of six (15%). Of the remaining patients, two (3.8%) were transferred to a tertiary institution's high care facility, five (9.6%) were discharged from the EC after receiving treatment, and disposition plan was not documented in five (9.6%).

## Discussion

In this study, we found that 4.35% of patients presenting to the EC with an infection or presumed infection met the criteria for sepsis

syndrome, similar to studies done at district hospitals in the UK and Brazil [8,12].

Most of the patients presenting with sepsis syndrome were  $< 60$  years old. This was similar to a recent local study profiling surgical sepsis, which reported a mean age of 46 years [5]. This is in contrast to first world countries where sepsis syndrome is prevalent in the elderly [6]. Some of the factors contributing to sepsis syndrome in the younger population could be the high burden of infectious diseases, especially HIV, in this age group [13,14]. HIV and TB were common co-morbidities found in this study cohort. Furthermore, non-communicable diseases (NCDs) are becoming more prevalent in the younger South African population and are significant risk factors for the development of sepsis syndrome [6,15].

Lower respiratory tract infections are the most common source of sepsis [4,6–9]. This was the same in our patient cohort as well. Of note, meningitis was more commonly diagnosed in this patient cohort compared to other studies. HIV co-infection with opportunistic central nervous system infections may have contributed to a rise in meningitis.

In the management of sepsis syndrome, early administration of empirical antibiotics within 1 h of recognition of septic syndrome has been recommended by the SSC in order to reduce mortality and progression to septic shock [10]. The mean hang time for antibiotic administration was longer than that recommended by sepsis guidelines. A large patient load, short staffed EC, delays in triage, the lack of training in early identification and treatment of sepsis and poor documentation may have contributed to delays in administering antibiotics. More than half of the patients were initiated on fluid therapy in the EC. The majority received crystalloids as the initial fluid of choice, in keeping with current guidelines [10]. A higher systolic blood pressure may have influenced doctors not to start intravenous fluids on presentation. The study showed a low blood culture yield which was a similar problem reported in another study from a developing country [4]. Poor sampling technique and pre-treatment with antibiotics may have contributed to poor culture yield.

The majority of patients were treated as inpatients at the district hospital. This included patients diagnosed with severe sepsis. Hospital overcrowding, lack of intensive care unit beds and lack of awareness of the severity of sepsis syndrome often lead to patients being managed outside of a high/intensive care setting. Access block to inpatient beds may have also contributed to patients being treated in the EC as inpatients and subsequently discharged directly from the EC.

This was a retrospective chart review that relied on the accuracy of the data recorded. Missing data could have influenced the accuracy of our findings. The study had poor paediatric representation. Times recorded were dependent on the attending nurse or doctor and may have influenced the accuracy of our findings.

Sepsis syndrome poses a significant burden to the health care system worldwide. There is a need to quantify the impact of sepsis syndrome in the South African setting and implement local protocols to manage sepsis.

## Acknowledgements

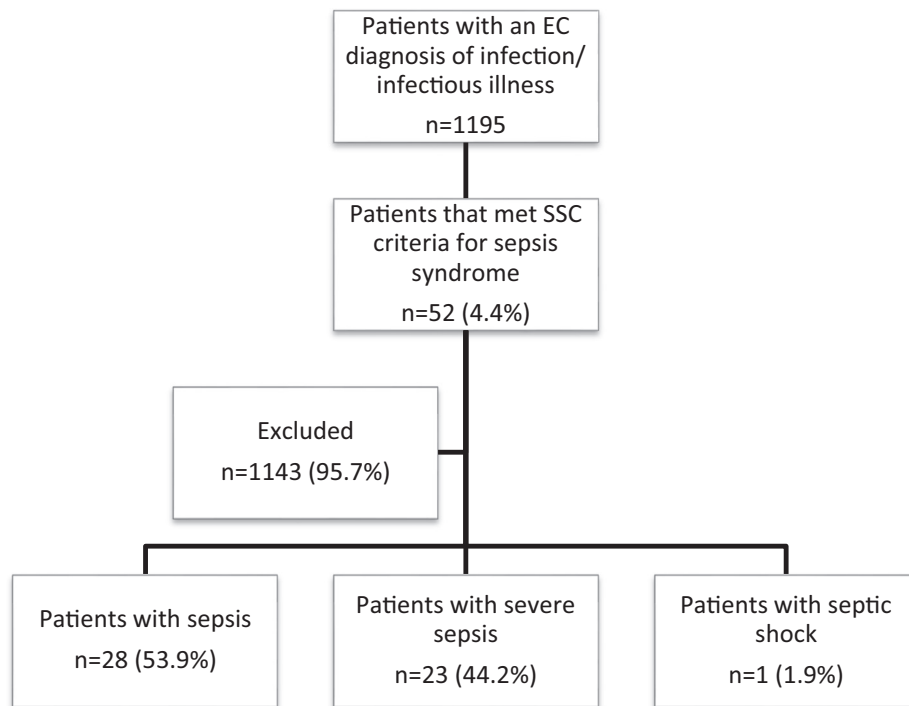
Successful conduct of this study was made possible by the KwaZulu Natal Department of Health and the King Dinuzulu Hospital Complex Emergency Centre staff.

## Conflicts of interest

The authors declare no conflicts of interest.

## Dissemination of results

The findings from this paper have not been disseminated beyond this publication.



EC, emergency centre; SSC, Surviving Sepsis Campaign

Fig. 1. Breakdown of study sampling.

EC, emergency centre; SSC, Surviving Sepsis Campaign.

Table 1  
Sample demographic data.

Variable	n (%)
Male/female	18 (34.6)/34 (65.4)
11–18 years	1 (1.9)
19–35 years	20 (38.5)
36–59 years	24 (46.1)
> 60 years	7 (13.5)
HIV positive/negative/unknown	32 (61.5)/4 (7.7)/16 (30.8)
HIV positive on ARVs	16 (50)
Diabetes	6 (11.5)
Tuberculosis	10 (19.2)
Hypertension	8 (15.0)
Epilepsy	1 (1.9)
Stroke	3 (5.7)
Asthma	3 (5.7)

HIV, human immunodeficiency virus; ARVs, anti-retroviral drugs.

Table 2  
Clinical presentation and laboratory results.

Variable	Mean ( ± standard deviation)	Sample range
Respiratory rate (breaths/min)	23.30 ± 4.89	16–38
Pulse (beats/min)	117.02 ± 19.78	62–150
Systolic blood pressure (mmHg)	106.70 ± 22.74	67–157
Temp (°C)	36.07 ± 2.46	35–39
White cell count (cells/mL <sup>3</sup> )	12.96 ± 8.53	3–44
Total Bilirubin (µmol/L)	16.33 ± 13.83	2–70
Creatinine (µmol/L)	200.3 ± 315.47	28–1405
Platelets (10 <sup>9</sup> /L)	289.04 ± 154.05	18–734

Table 3  
Initial emergency centre management.

Variable	n (%)
Received antibiotics in the EC	46 (88.5)
Ceftriaxone	28 (56.0)
Co-Amoxiclav	14 (28.0)
Cloxacillin	1 (2.0)
Metronidazole	3 (6.0)
Gentamycin	1 (2.0)
Rifafour	2 (4.0)
Cotrimoxazole	1 (2.0)
Time taken to administer antibiotic	
0–1 h	11 (24.0)
1–2 h	6 (13.0)
> 2 h	7 (15.2)
Missing administration time data	22 (47.8)
Cultures performed	35 (67.3)
Blood	14 (40.0)
Sputum	10 (28.6)
Cerebrospinal fluid	6 (17.1)
Swabs	1 (2.8)
Urine	3 (8.6)
Pleural fluid	1 (2.8)
Cultures positive	8 (22.9)
Staphylococcus species	2 (25.0)
Streptococcus group D	1 (12.5)
Corynebacterium species	1 (12.5)
Proteus species	1 (12.5)
<i>Mycobacterium tuberculosis</i>	3 (37.5)
Fluid administered	30 (57.7)
Crystalloid	17 (56.0)
Colloid	0
Freeze dried plasma	0
Blood	0
Not documented	13 (43.4)
Vasopressor/inotropic support	1 (1.9)

### Authors' contributions

Authors contributed as follow to the work: NN conceived of the original study idea, designed the data collection tool and collected the data, and analysed the data. NN and RM drafted, revised, and approved the final version of the submitted manuscript.

### References

1. Singer M, Deutchman CS, Seymour CW, et al. The third international consensus definitions for sepsis and septic shock (sepsis 3.0). *JAMA* 2016;315(8):801–10.
2. Angus DC, Pereira CA, Silva E. Epidemiology of severe sepsis around the world. *Endocr Metab Immune Disord Drug Targets* 2006;6(2):207–12.
3. Fleischmann C, Cheraf A, Adhikari NK, 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.
4. Jacob ST, Moore CC, Banura P, et al. Severe sepsis in two Ugandan hospitals: a prospective Ugandan observational study of management and outcomes in a predominantly HIV-1infected population. *PLoS One* 2009;4(11):e7782.
5. Green S, Kong VY, Clarke DL. The spectrum and outcome of surgical sepsis in Pietermaritzburg, South Africa. *S Afr Med J* 2017;107(2):134–6.
6. Martin S, Mannino DM, Moss M, et al. The effect of age on the development and outcome of adult sepsis. *Crit Care Med* 2006;34(1):15–21.
7. Tanriover MD, Guven GS, Sen D, et al. Epidemiology and outcome of sepsis in a tertiary care hospital in a developing country. *Epidemiol Infect* 2006;134(2):315–22.
8. Rezende E, Silva Junior JM, Isola AM, et al. Epidemiology of severe sepsis in the emergency department and difficulties in the initial assistance. *Clinics (Sao Paulo)* 2008;63(4):457–64.
9. Strehlow MC, Emond D, Shapiro NI, et al. National study of emergency department visits for sepsis. *Ann Emerg Med* 2006;48(3):326–31.
10. Rhodes A, Evans LE, Alhazzani W, et al. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock. *Intensive Care Med* 2017;43(3):304–77.
11. Green RS. Reflections from a Canadian visiting South Africa: advancing sepsis care in Africa with the development of local sepsis guidelines. *Afr J Emerg Med* 2012;2(2):90–4.
12. Cowan SL, Holland AA, Kane A, et al. The burden of sepsis in the emergency department: an observational snapshot. *Eur J Emerg Med* 2015;22(5):363–5.
13. Millennium Development Goals 6: Combat HIV/AIDS, Malaria and Other Diseases. *Statistics South Africa; 2015* [statssa.gov.za](http://statssa.gov.za), Accessed date: 12 May 2018.
14. Naicker B, Maharaj RC. HIV in acute care: a review of the burden of HIV associated presentation to an emergency department. *S Afr Fam Pract* 2016;58(1):13–7.
15. Hofman K. Non communicable diseases in South Africa: a challenge to economic development. *S Afr Med J* 2014;104(10):647.