Overview of the incidence, early identification and management of sepsis


Abstract
Sepsis is a potentially life-threatening condition that is triggered by an infection. Sepsis is an urgent public health issue globally, and is one of the leading causes of death in emergency departments and hospitals. However, consensus definitions of sepsis are imprecise and the incidence and costs of the condition are thought to be underestimated. This article discusses the incidence of sepsis globally and nationally, and the effects of the condition. It emphasises the early identification and effective management of sepsis, which remain crucial to improving patient outcomes such as morbidity and mortality. It also outlines the nurse’s role in providing sepsis care.

Keywords
global health, infection, public health, sepsis, sepsis identification, sepsis management

SEPSIS IS ONE of the most significant challenges that nurses experience when caring for patients. This article discusses the global effects of sepsis, and emphasises the importance of identifying sepsis early and managing the condition effectively. Daniels (2015) stated that sepsis is one of the most urgent public health issues globally, while the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) (2015a) in the UK stated that sepsis is a leading cause of avoidable death, causing more deaths than breast, bowel and prostate cancer combined each year.

Sepsis is a common and potentially life-threatening condition triggered by an infection (NHS England 2015). It can be caused by various infections, but the most common sources are generally considered to be infections of the lung, urinary tract and abdominal organs. Sepsis can be triggered by introducing bacteria into blood via medical devices (NHS England 2015). During sepsis, the body’s immune system has an unregulated response to infection, leading to a series of reactions, including widespread inflammation, swelling and blood-clotting (NHS England 2015). These reactions can lead to a significant decrease in blood pressure, reducing the blood supply to vital organs and depriving them of oxygen. If not treated quickly, sepsis can progress to septic shock, which can lead to multiple organ failure and/or fatality.

While sepsis can affect anyone, it is most common in older adults and children (Nasa et al 2012). Chronic co-morbidities, including diabetes mellitus, cancer and human immunodeficiency virus (HIV), increase the risk of sepsis (Nasa et al 2012), as do pregnancy and severe burns or physical injury (Young et al 2009).

Defining sepsis
Definitions of sepsis are under review and new international consensus definitions are imminent (National Institute for Health and Care Excellence (NICE) 2017). Bateson and Patton (2015) suggested that sepsis has a spectrum of severity that includes uncomplicated sepsis, severe sepsis (sepsis and sepsis-related organ dysfunction
or tissue hypoperfusion) and septic shock. Septic shock is the most severe form of sepsis, and is diagnosed in the presence of sepsis-related hypotension that persists despite sufficient fluid resuscitation.

These definitions have formed the basis of research and guidance by leading sepsis campaign groups, such as the Surviving Sepsis Campaign (SSC) and the Global Sepsis Alliance (McClelland and Moxon 2014). However, a review of the literature indicates there is general agreement that these definitions lack sensitivity in terms of the ability of the criteria to correctly identify sepsis, and specificity in terms of the ability to correctly identify people without sepsis (Levy et al 2003, Balk 2014, Cohen et al 2015, Kaukonen et al 2015). The SSC guidelines (Rhodes et al 2017) explain that sepsis involves the existence of infection together with systemic indications of infection.

NICE (2017) guidelines acknowledge that the terms ‘systemic inflammatory response syndrome’ (SIRS) and ‘severe sepsis’ should no longer be used, and suggest using only the terms ‘sepsis’ and ‘septic shock’. They recommend that actions are taken according to clinical parameters that stratify risk of severe illness or death from sepsis, rather than using the definitions of the various sepsis terms to identify those at risk (NICE 2017). Daniels (2015) suggested that it is necessary to develop both a pragmatic definition of sepsis aimed at its early identification and an epidemiological definition of sepsis designed for public health surveillance and clinical trial design.

Incidence of sepsis
A review of the literature demonstrates general agreement regarding the global burden of sepsis, including the growth in the number of cases, a high level of mortality but decreasing fatality rates, and the underestimation of the issue resulting from inconsistencies in the data collection methods used.

The first rough estimate of the worldwide incidence of sepsis was 15-19 million (Adhikari et al 2010). To provide a more precise estimate, Fleischmann et al (2015) identified 33 studies that provided population-level data incidence of hospital-treated sepsis. Based on these studies, they estimated the annual incidence was up to 31 million cases of sepsis, which is similar to the SSC estimate of 30 million people worldwide each year (Daniels 2011). Fleischmann et al (2015) also estimated there were 24 million cases of severe sepsis each year, with around six million deaths from the condition worldwide. In the UK, it has been estimated that sepsis causes 37,000 deaths each year (Daniels 2011), with the York Health Economics Consortium (2017) reporting that there could be up to 44,000 deaths annually from the condition.

Research indicates that sepsis becomes a growing health issue as the population ages (Hall et al 2011). Many studies in high income countries report the occurrence of rising incidence of sepsis and falling cases of death (Cohen et al 2015). Data for hospitalisations as a result of sepsis is available in countries including Australia, New Zealand, Taiwan and the US, which show that the number of cases has risen steadily (Shen et al 2010, Hall et al 2011, Lagu et al 2012, Kaukonen et al 2014). For example, information collected by the US National Centre for Health Statistics estimated that there was an increase in hospitalisations for sepsis in the US, from 621,000 in the year 2000 to 1,141,000 in 2008 (Hall et al 2011). Seymour et al (2012) found that there was up to a threefold increase in the number of hospital admissions in the US for severe sepsis between 2000 and 2009, while stroke and myocardial infarction admissions remained stable in comparison, resulting in the number of hospitalisations with severe sepsis overtaking those for myocardial infarction or stroke.

While the number of sepsis cases may be increasing, associated mortality rates appear to be decreasing, with one US-based study indicating this declined at a rate of 3-5% between 1991 and 2009 (Stevenson et al 2014). It could be suggested that this fall in mortality rate
is a result of improvements in care and increased early recognition of patients with the condition.

Globally, sepsis continues to be a significant cause of fatality resulting from infection, despite developments in medicine such as vaccines, antibiotics and acute care. Vincent et al (2014) undertook a worldwide appraisal of the mortality rate associated with sepsis, finding that one third of patients with sepsis treated in an intensive care unit (ICU) died in hospital, with mortality rates of up to 40-50% when septic shock was present. In addition, Liu et al (2014) stated that sepsis remains an outstanding cause of overall fatality worldwide, contributing to between one third and half of all hospital mortalities. This is supported by European research by Vincent et al (2006), which found that 36% of deaths in ICUs were caused by sepsis.

In the developing world, the review of 33 studies by Fleischmann et al (2015) noted the absence of population-based data on sepsis incidence from low and middle-income countries. However, it has been claimed that, overall, sepsis is the cause of 60-80% of fatalities per year in developing countries, affecting over six million babies and children each year, with over 100,000 woman acquiring sepsis through the course of pregnancy and childbirth (Kissoon et al 2011).

Say et al (2014) stated that an estimated 11% of maternal deaths globally are caused by sepsis, with most of these occurring in developing regions. Maternal sepsis is a life-threatening condition that causes organ dysfunction resulting from an infection during pregnancy, post-abortion, childbirth or the postpartum period (World Health Organization 2017). It is recognised as a challenge in both low-resource and high-resource settings, with figures indicating that one quarter of women who die within the six weeks after pregnancy in the UK die from sepsis (Knight et al 2014).

**Accuracy of sepsis estimates**

While the existing data indicates that sepsis is a significant global concern, there is agreement in the literature that these figures are underestimates. Cohen et al (2015) emphasised that sepsis does not have a single diagnostic test, therefore measurements of sepsis and its effects can differ across and within countries. There are three general approaches to data collection (Cohen et al 2015):

» Clinically defined sepsis in prospective clinical registries.

» Administrative coding of sepsis in hospital discharge databases.

» Causes of death from vital statistics records.

Each of these approaches is unique and has its limitations. For example, clinical registries cannot capture all ICUs, hospital discharge databases only capture people treated in hospital, and most death records assign infectious diseases to the underlying infection. While there is a significant amount of literature on sepsis, it is notable that much of the evidence is based on data collected in ICUs; Cohen et al (2015) noted that little is known about sepsis outside the context of clinical practice in critical care settings in developed countries.

Because of the limitations of the data collection methods, many researchers consider the available figures to be underestimates. Bateson and Patton (2015) emphasised that the estimate of 37,000 annual deaths from sepsis in the UK is conservative, since this includes only patients diagnosed with severe sepsis within 24 hours of admission to ICUs. McPherson et al’s (2013) study of the information recorded on death certificates in England from 2001-2010 revealed that one in 20 deaths were associated with sepsis. Importantly, McPherson et al (2013) found that these deaths occurred in a range of specialty areas and 15,000 (7%) of the deaths that were definitely associated with sepsis in this period did not occur in hospital. This finding suggests that estimates of sepsis are low, since much of the research has been based on data collected from ICUs, thus ignoring deaths occurring outside of hospital settings.

A NCEPOD (2015a) report claimed that the reported incidence in the UK is
likely to be an underestimate because the clinician coding system prioritises the source of infection, rather than considering all of the potential identifiable information that could be explored. NCEPOD (2015a) estimated that there could be up to 200,000 cases of sepsis in the UK and up to 60,000 deaths per year from the condition, while the York Health Economics Consortium (2017) approximated that there could be as many as 260,000 cases annually – significantly higher than the reported figures.

Effects of sepsis

Research on sepsis outcomes has traditionally focused on mortality as an end point (Bateson and Patton 2015). However, increasingly, the costs and long-term consequences of survival from sepsis are being documented, which are likely to be substantial (Iwashyna et al 2010, Winters et al 2010, McPherson et al 2013, NCEPOD 2015b). Daniels (2015) stated that patients with sepsis spend more time in hospital and in ICUs than patients admitted for other reasons. Around 65,000 people in the UK per year survive sepsis, and they often experience serious long-term effects that result in amputation, muscular contraction, irreversible lung damage, heart and kidney damage, and cognitive disorders (NCEPOD 2015b). When these factors are considered together with the statistics on death, Daniels (2015) suggested that the true human and fiscal costs of sepsis become ‘frightening’.

According to McPherson et al (2013), the average cost of treating a patient who had sepsis was six times the cost of treating a patient who did not have sepsis in a UK hospital in 1995-1996; however, it should be noted that recent figures for this are required. According to Frost et al (2010), the total cost of sepsis to the NHS is more than £2.5 billion per year, while more recently the York Health Economics Consortium (2017) estimated that the total cost could be as much as £15.6 billion. The Agency for Healthcare Research and Quality listed sepsis as the most costly condition treated in US hospitals, equating to more than $20 billion in 2011, with this cost increasing by 12% on average each year (Pfuntner et al 2013). It is generally agreed that early identification and management of sepsis have significant economic benefits, potentially saving up to £2.8 billion per year in the UK (University of York 2017).

NHS England (2015) reported that a typical medium-sized general hospital could save £1.25 million annually through improved management of sepsis, and that achieving 80% delivery of the basic standards of care is likely to save 10,000 lives per year and around £170 million annually for the NHS. The longer-term economic benefits are likely to be even greater. This suggests that early identification and management of sepsis is essential because it would lead to significant improvements in patient outcomes and economic benefits, reducing long-term costs for the NHS.

Identifying and managing sepsis

A review of the literature suggests that there is general agreement that, since 2000, increased identification and management of patients with sepsis have improved patient outcomes, such as mortality and morbidity (Cohen et al 2015, Daniels 2015, Yealy et al 2015). However, evidence indicates there is potential for significant improvements in the identification and management of the condition (Parliamentary and Health Service Ombudsman 2013, Cohen at al 2015, NCEPOD 2015a, NHS England 2015, Yealy et al 2015, Rhodes et al 2017), and it is thought that 14,000 deaths in the UK could be avoided each year through earlier recognition of sepsis (University of York 2017).

The UK Sepsis Trust (2017) SEPSIS acronym can be used to identify signs and symptoms:

- S – slurred speech or confusion.
- E – extreme shivering or muscle pain.
- P – passing no urine in a day.
- S – severe breathlessness.
- I – it feels like you’re going to die.
- S – skin mottled or discoloured.
McClelland and Moxon (2014) suggested that nurses have an important role in identifying patients who are unwell or deteriorating, and in initiating life-saving treatments. Therefore, it is essential that nurses develop a culture of suspicion of sepsis and respond quickly to identify, manage and escalate patients with sepsis. This is particularly important for patients in the community, where more than 70% of cases arise (NCEPOD 2015a), and early intervention can reduce harm and significantly reduce mortality. Developing this culture of suspicion accords with the assertion of Daniels (2015), who stated that without an understanding among healthcare practitioners of the symptoms indicating sepsis, opportunities to identify and treat this condition will continue to be missed. Nurses are often the first to suspect that a patient may have sepsis and are often the first to initiate treatment. Nurses should also assist in reducing sepsis by ensuring that infection prevention and control procedures are adhered to.

The SSC guidelines (Rhodes et al 2017) recommend the use of two care bundles in the management of sepsis. The first bundle must be completed within three hours and the second within six hours of presentation. While research demonstrates that staff adherence with these care bundles is associated with a reduction in hospital deaths (Levy et al 2015), it is clear that there is significant potential for improvements in staff adherence rates (NCEPOD 2015a) and the consistent delivery of the fundamentals of care (Daniels 2015).

In the UK, the Sepsis Six care bundle (Daniels 2011) is often used for the immediate management of sepsis. This is similar to the SSC three-hour care bundle, but should be completed within the first hour of sepsis being identified (Bateson and Patton 2015). It is comprised of six interventions (Daniels 2011):

- Administer oxygen to maintain saturation above 94%.
- Take blood cultures.
- Give intravenous antibiotics.
- Measure serum lactate and send full blood count.
- Commence intravenous fluid resuscitation.
- Undertake accurate measurement of urine output.

The Sepsis Six care bundle has been shown to reduce the relative risk of death by 47% (Daniels et al 2011) when delivered to patients with severe sepsis within one hour. Close monitoring and regular review can identify patients who do not improve after the use of the Sepsis Six care bundle, prompting urgent referral to critical care. It is also important to note that the NCEPOD (2015a) reported that many fundamental aspects of effective nursing practice, including hand-washing, recording basic vital signs, adhering to hospital protocols and completing documentation, are important remedial factors, which, if addressed effectively, would improve the care of patients with sepsis.

Healthcare practitioners should adhere to NICE (2017) guidelines and sepsis care bundle interventions to ensure that patients with sepsis receive the care they require. Many UK healthcare organisations have revised their protocols in accordance with the updated NICE (2017) guidelines, and as such nurses should ensure that they adhere to these in their practice. Nurses have a vital role in improving patient outcomes by implementing sepsis care bundles and improving rates of staff adherence with these interventions.

**Conclusion**

Sepsis has significant global effects and associated implications; therefore, it is crucial to identify the condition early and provide effective management. It is essential to raise nurses’ awareness of sepsis and their role in the care of patients with this condition. It is also crucial for nurses to adhere to and implement the NICE (2017) guidelines and sepsis care bundles in their practice, to preserve patient safety and reduce morbidity and mortality.

**KEY POINT**

The Sepsis Six care bundle has been shown to reduce the relative risk of death by 47% (Daniels et al 2011) when delivered to patients with severe sepsis within one hour.
References


Daniels R (2011) Surviving the first hours in sepsis: getting the basics right (an intensivist’s perspective). Journal of Antimicrobial Chemotherapy. 66, Suppl 2, iii1-iii3.


