Barriers to implementation of the Sepsis Six guidelines in an acute hospital setting – a questionnaire survey

**ABSTRACT**

**Aim:** To identify the barriers to implementation of the Sepsis Six pathway.

**Background:** Research has suggested that compliance with the Sepsis Six pathway remains low.

**Design:** Survey questionnaire.

**Methods:** Convenience sample of doctors and nurses from one Emergency Department, two medical wards and two surgical wards.

**Results**: Data from 108 respondents were available for analysis. Doctors and nurses agreed that lack of sepsis recognition during observation rounds and failure to associate sepsis with deranged temperature and blood results acted as barriers to the identification of sepsis. Doctors and nurses agreed that nursing delays and knowledge deficits were the top barriers leading to delay in sepsis treatment.

**Conclusion:** Knowledge deficits, lack of resources and practical issues were barriers identified in this survey. This will inform the educational and process needs of both doctors and nurses in order to improve sepsis care.

**Keywords:** sepsis, Sepsis Six, guidelines, barriers,nurses, doctors, compliance

**INTRODUCTION**

Sepsis is a clinical syndrome that occurs as a result of infection. Bacteria are the most common pathogens, but viral, fungal and parasitic organisms can also lead to sepsis. Sepsis occurs when an inflammatory response is triggered after chemicals are released into the bloodstream to combat infection. This results in a cascade of changes that can lead to multi-organ failure and death. A number of resuscitation bundles (such as the Surviving Sepsis Campaign bundle) have been produced to combat the high mortality and morbidity associated with sepsis, however many have tended to be complex or dependant on specialist skills. To overcome this, the Survive Sepsis Organisation developed the Sepsis Six pathway which became widely adopted in 2009 when it was recommended by the College of Emergency Medicine (CEM). The simplified Sepsis Six pathway consists of three diagnostic and three therapeutic interventions to be delivered within one hour of sepsis recognition (Robson and Daniels, 2008). It can be completed by doctors or nurses. It includes four of the basic elements of the Surviving Sepsis Campaign bundle – serum lactate measurement, blood cultures, broad-spectrum antibiotics, intravenous fluids – as well as adding high flow oxygen and urine output measurement as essential components.

**Background**

The Sepsis Six pathway has been shown to reduce mortality by 50% (Robson and Daniels, 2008). Despite this, a UK national audit revealed that compliance with the pathway was low, ranging from 27-47% for individual interventions (CEM, 2012). Previous research has identified several barriers to the implementation of sepsis bundles, with different opinions being identified between medical and nursing staff. This discordance was the main driver behind comparing professional groups in our survey.

The study by Carlbom and Rubenfeld (2007) identified early recognition of sepsis as the most commonly cited barrier to implementation of sepsis bundles. Both doctors (42%) and nurses (38%) ranked ‘identifying the septic patient’ as the second most common barrier. Both agreed that a shortage of nursing staff to perform the bundle was also a frequent barrier.

Bentley and colleagues (2016) found that only 55% of patients with three Systemic Inflammatory Response Syndrome (SIRS) markers (two or more are considered sufficient to activate the Sepsis Six pathway) received the Sepsis Six pathway within the required timeframe. Such results demonstrate the difficulties in diagnosing and treating septic patients.

Clearly, both perceived and practical issues relating to sepsis bundles appear to interfere with their implementation. This study aimed to gain further insights into the barriers towards the Sepsis Six pathway in clinical practice by gauging the opinions of the staff who apply it. The intention was to develop solutions in the future to overcome the barriers to sepsis guideline implementation (including educational interventions).

**THE STUDY**

**Aim**

The aim of this study was to identify the perceived barriers to implementation of the Sepsis Six pathway in an acute hospital setting amongst doctors and nurses.

**Design**

The study adopted a cross-sectional descriptive design using a self-completed questionnaire. A paper survey questionnaire was devised which consisted of 25 closed questions divided into four domains: demographics (four questions); identification of sepsis (eight questions); principles of the Sepsis Six pathway (two questions); and resources, skills and education (11 questions).

**Rigour and validity**

Leading questions were avoided by giving ‘not sure’ options. Careful wording was used to optimise content validity so that the participants understood exactly what they are being asked. Once written approval and ethical clearance were obtained from the Trust and University, the questionnaire was piloted to test how long it took staff to complete, as well as to ensure that all questions were clear and likely to provide clinically meaningful data. Asking a panel of sepsis experts (Sepsis Steering Group) to assess the instrument also tested its content validity by ensuring the survey adequately covered the domains it was designed to assess.

**Participants**

The study was performed in an acute teaching hospital in the UK serving a population of 750,000 residents. Rather than sampling all medical and surgical wards, a convenience sample of doctors and nurses was taken from the Emergency Department (ED), two medical wards and two surgical wards. The total target population was 280 (200 nurses and 80 doctors), in whom the timing, type and frequency of previous sepsis training was unknown.

**Data collection**

Data collection was carried out between 4th January 2016 and 29th January 2016. Nominal scales were used to collect data on demographics, resources and skills. Ordinal scales were used to identify perceived barriers in sepsis identification and treatment. Likert scales and combined Likert scales/grid questions were used to understand doctors’ and nurses’ attitudes towards identification of sepsis and the principles of the Sepsis Six pathway.

**Ethical considerations**

Ethical approval from the University was obtained prior to data collection. Written confirmation was obtained to confirm that NHS Research Ethics Committee approval was not required. Implied consent was obtained by virtue of completion and return of the questionnaire.

**Data analysis**

Statistical analysis was undertaken using Statistical Package for Social Sciences (SPSS) version 21, which required the data to be coded into numbers for the purposes of analysis. Descriptive statistics regarding job role, years of experience, ability to identify sepsis, and attitudes towards resources and skills were performed. Fisher’s Exact Test was used to compare responses between nurses and doctors, as well as between ED and ward nurses. A two-sided p-value of <0.05 was considered statistically significant.

**RESULTS**

**Respondent characteristics**

Overall, 114 individuals returned the questionnaire (response rate of 40%). Six of these questionnaires did not meet the inclusion criteria due to 10-20% of incomplete data, leaving 108 questionnaires suitable for the final analysis. 50 completed questionnaires (46%) were from medical staff (n=41 from ward and n=9 from ED). 58 questionnaires (54%) were from nursing staff (n=25 from ward and n=33 from ED).

**Identification of sepsis**

103 staff (95%) asserted that they could reliably identify sepsis. Of the five respondents that did not, all were of a junior grade (three Band 5 nurses and two Foundation Doctors).

83 respondents (77%) reported that they were more likely to apply the Sepsis Six pathway to patients with clinically recognisable signs of septic shock rather than biochemical evidence of septic shock. Within the entire cohort, 78 respondents (72%) reported that they knew how serum lactate measurement could be used to manage a septic patient. ED nurses were statistically more likely to appreciate the utility of serum lactate measurement compared to ward nurses (36% vs. 6%; Fisher’s Exact test, P=0.007). 84 respondents (78%) ‘agreed’ or ‘strongly agreed’ that a patient with a temperature greater than 38.3 degrees was more likely to be assessed and treated for sepsis than a patient with a temperature less than 36.0 degrees.

Respondents were asked to rank (from 1 to 5) their perceived causes of delay in the identification of sepsis. ‘Lack of sepsis recognition during observation rounds’ was considered the most significant cause of delay amongst both doctors (n=13; 26%) and nurses (n=16; 28%). On the other hand, ‘unfamiliarity with the early warning score’ was the least likely barrier identified by both doctors (n=6; 12%) and nurses (n=4; 7%).

**Treatment of sepsis**

When asked about the perceived causes of delay in the treatment of sepsis, the most salient barrier was ‘nursing delays’, with 39 doctors (78%) and 37 nurses (63%) ranking this as their top perceived delay. Table 1 shows the percentage of respondents who included each perceived barrier amongst their top three causes of treatment delay.

**Table 1. Top three ranked barriers considered greatest cause of delay in sepsis treatment**

|  |  |  |  |
| --- | --- | --- | --- |
| **Barrier** | **Doctors**  **(n=50)** | **Nurses**  **(n=58)** | **P-value** |
| Nursing delays | 39 (78%) | 37 (63%) | 0.140 |
| Pharmacy delays | 15 (30%) | 20 (34%) | 0.683 |
| Lack of necessary equipment | 11 (22%) | 25 (43%) | **0.025** |
| Prescription delays | 23 (46%) | 32 (55%) | 0.441 |
| Laboratory delays | 31 (62%) | 26 (45%) | 0.085 |
| Knowledge deficit regarding appropriate management | 33 (66%) | 34 (59%) | 0.551 |

Table shows the number of doctors and nurses (with percentages) who cited each barrier in their top three for the greatest cause of delay in the treatment of sepsis. P-values refer to the differences between doctors and nurses as assessed by the Fisher Exact test.

**Principals of the Sepsis Six pathway**

66 respondents (61%) agreed that the Sepsis Six pathway could be completed within one hour of sepsis identification, whilst 14 respondents (13%) were ‘not sure’ and 28 respondents (26%) ‘did not agree’. Table 2 shows the percentage of respondents who included each perceived barrier amongst their top three causes of non-completion of the Sepsis Six pathway within one hour. Both doctors and nurses reported that ‘lack of available nursing staff’ was the top barrier.

**Table 2. Top three ranked barriers to non-completion of Sepsis Six within one hour**

|  |  |  |  |
| --- | --- | --- | --- |
| **Barrier** | **Doctors**  **(n=10)** | **Nurses**  **(n=18)** | **P-value** |
| Lack of available nursing staff | 7 (70%) | 14 (78%) | 0.674 |
| Lack of medical staff | 3 (30%) | 11 (61%) | 0.236 |
| Treatment & investigations not available at the point of care | 7 (70%) | 8 (44%) | 0.254 |
| Difficult access to protocol medication | 3 (30%) | 4 (22%) | 0.674 |
| Delay in prescribing | 5 (50%) | 7 (39%) | 0.698 |
| Handover between medical and nursing staff | 3 (30%) | 7 (39%) | 0.703 |
| Difficult access to equipment | 2 (20%) | 3 (17%) | 1.000 |

Table shows the number of doctors and nurses (with percentages) who cited each barrier in their top three for failure to complete the Sepsis Six pathway within one hour. Only those who ‘did not agree’ that Sepsis Six could be completed within one hour of sepsis identification were included. P-values refer to the differences between doctors and nurses as assessed by the Fisher Exact test.

**Resources and skills**

When ward and ED nurses were compared, the resources and skills required for Sepsis Six completion varied significantly. 22 ward nurses (88%) did not have personal access to a blood gas analyser (including password) in order to measure serum lactate compared with only three (9%) ED nurses (Fisher’s Exact test, P<0.001). Routine review of septic patients’ blood results differed significantly between ED nursing staff and ward nursing staff (39.3% vs. 20%; Fisher’s Exact test, P=0.015). Venepuncture and intravenous skills also differed significantly, with 26 (79%) ED nurses possessing these skills compared with only 12 (48%) ward nurses (Fisher Exact test, P=0.025).

The majority of ED and ward doctors felt that they had the resources and skills to complete the Sepsis Six pathway. However, when ED and ward doctors were compared, there were some differences. White blood cell count in septic patients was more likely to form part of the ED handover than the ward handover (100% vs. 61%; Fisher’s Exact test, P=0.043). There was also a trend towards ED doctors being more likely to obtain personal access to measure serum lactate compared to ward doctors (89% vs 54%), although this difference was not statistically significant (Fisher’s Exact test, P=0.067).

**Education**

When doctors and nurses were compared, the area that nurses felt needed the most improvement differed significantly from doctors (Figure 1). 33 nurses (57%) felt that practical skills needed most improvement, whilst only 14 doctors (28%) recognised this as a training deficiency (Fisher’s Exact test, P=0.003). 32 doctors (64%) considered further training in ‘applying the sepsis pathway’ to be the most important educational need, which was also cited by 30 nurses (52%). 29 nurses (50%) felt that the ‘theory underpinning sepsis’ needed improvement compared with 14 doctors (28%) (Fisher’s Exact test, P=0.03).

**Figure 1. Areas requiring improvement in the sepsis education programme**

Figure shows the number of doctors and nurses (and percentage) who identified specific areas in the sepsis education programme that required improvement.

**DISCUSSION**

This questionnaire survey revealed some important findings regarding perceptions towards sepsis management, which sometimes differed depending on professional background. Lack of sepsis recognition during observation rounds was considered the biggest barrier to sepsis identification amongst doctors and nurses. This is despite the fact that both groups felt that unfamiliarity with the early warning score was not a major barrier. This may suggest that other clinical and laboratory factors are necessary to make a diagnosis of sepsis. Future research should explore other explanations for these apparently conflicting views (such as time and workload factors, lack of written prompts on observation charts, and inadequate training).

Both doctors and nurses stated that they were more likely to apply the sepsis bundle to a patient with a high temperature rather than a low temperature, as well as to patients with clinical signs of septic shock rather than deranged biochemical markers. Consistent with these findings, Kakebeeke and colleagues (2013) found that septic patients with clinically recognisable signs of organ failure (such as hypotension) were more likely to receive the sepsis bundle and early antibiotics rather than laboratory parameters (elevated lactate). Similarly, Bentley et al (2016) found that a septic patient with high temperature (38 degrees or over) was more likely to receive treatment than a septic patient with a temperature less than 38 degrees. Despite the Society of Critical Care Medicine finding that the SIRS criteria was unhelpful in the identification of sepsis, the society still believes that non-specific aspects of the SIRS criteria such as pyrexia and neutrophil count will continue to help with the diagnosis of infection (Singer et al, 2016).

In line with previous research, nursing delays were identified as the most common barrier for delayed sepsis treatment (Carlbom and Rubenfeld, 2007). It is unlikely that this purely reflects an underlying blame culture since it was identified as the main barrier by both doctors and nurses. Further research is required to clarify whether this reflects the time demands placed on nurses, lack of practical skills (such as venepuncture and urinary catheterisation), or administrative factors (such as laboratory delays).

26% of respondents disagreed that the Sepsis Six pathway could be delivered within the required a one-hour timeframe. The main reason identified was lack of available nursing staff. This result suggests that doctors may be waiting for nursing staff to initiate urgent treatment. This is consistent with the findings of Carlbom and Rubenfeld (2007) and Burney and colleagues (2012) who identified nursing shortages as a barrier to implementation of the sepsis bundle. Sepsis education needs to reflect that both doctors and nurses can deliver treatment.

A significant number of ward nurses compared to ED nurses in our cohort responded that they did not have access to equipment to measure lactate. This is potentially important because it has been shown that elevated lactate levels prompt appropriate fluid resuscitation in normotensive septic patients who may otherwise have not received this (Daniels et al 2011). This barrier could be rectified by ensuring that staff are adequately trained and supplied with an operational password for arterial blood gas machines and that lactate measurements are available on all machines.

Ward nurses were significantly more likely to lack venepuncture and cannulation skills compared to ED nurses in this study. This may leave patients who develop sepsis on the ward at a disadvantage if waiting for intravenous access before starting treatment. Indeed, each hour that antimicrobials are delayed in septic shock is associated with a 7.6% increase in mortality rate (Kumar et al 2006). Although training more nurses to cannulate is important, consideration should also be given how to ensure timely medication prescribing as well.

Overall, respondents felt that they received sufficient sepsis education, although the majority (85%) remained keen for more in-depth training. It has been previously demonstrated that providing educational sessions on the Sepsis Six pathway to nurses and junior doctors increases the number of interventions implemented within one hour (Kumar et al, 2015).Our study also found that nurses would like to see an improvement in the teaching relating to the theory underpinning sepsis. Bentley et al (2016) found that focusing nurse education on the pathophysiology of sepsis improved nurses’ identification of sepsis. In addition to sepsis identification, the other area in our study which was felt to benefit from improvement was ‘applying the sepsis pathway’

**Limitations of this study**

Overall, the response rate within this convenience sample was 40%, which is acceptable in terms of ensuring good quality data. It was notable that the response rate from ED medical staff was poor (only nine respondents in total), thus making comparisons between ED and ward doctors less reliable. Non-respondent bias may have been introduced by surveying specific wards where staff were regularly exposed to septic patients. Therefore, information may have been missed by not sampling wards where septic cases were less common.

**CONCLUSION**

This survey has identified new barriers to implementation of the Sepsis Six pathway such as lack of practical skills, lack of available resources, and failure to use routinely available blood results to help identify sepsis. By providing nurses and doctors with a sepsis education programme tailored to their needs, the expectation is that they will be better able to identify sepsis in the future, and therefore more capable of implementing the Sepsis Six pathway. Further research will be required to evaluate the impact of these recommendations on Sepsis Six compliance.

**IMPLICATIONS FOR PRACTICE**

* Sepsis education programmes should revise their teaching contents and ensure that presentations are tailored to suit their audience. Improved teaching on the theory underpinning sepsis and the importance of serum lactate measurement in the management of sepsis should be included in nurses’ education. Sepsis teaching should be delivered to subgroups separately.
* Hospital induction programmes for nursing and medical staff should include sepsis training. Measurement of serum lactate should be considered a key skill in certain clinical environments (assuming that staff are adequately trained and machines are adequately serviced).
* More nurses should be taught venepuncture and cannulation skills to help ensure that septic patients have blood cultures taken and antibiotics administrated within the required timeframe.

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