THE IMPACT OF EVIDENCE BASED SEPSIS GUIDELINES ON EMERGENCY DEPARTMENT CLINICAL PRACTICE: A PRE-POST MEDICAL RECORD AUDIT

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ABSTRACT

Aims and objectives

The aim of this study was to explore the number of patients presenting with sepsis before and after guideline implementation; the impact of sepsis guidelines on triage assessment, Emergency Department management and the impact of guideline implementation on time to antibiotic.

Background

Sepsis remains one of the leading causes of mortality and morbidity within hospitals. Globally, strategies have been implemented to reduce morbidity and mortality rates, which rely on the early recognition and management of sepsis. To improve patient outcomes the New South Wales government in Australia introduced sepsis guidelines into Emergency Departments. To date the impact and translation of the guidelines into practice remains unclear.

Design/Methods

A 12 month pre-post retrospective randomised medical record audit of adult patients with a sepsis diagnosis. Data were extracted from the Emergency Department database and paper medical record. Data included patient demographic (age, gender); clinical information (time of arrival, triage code, seen by time, disposition); patient assessment data (heart rate, respiratory rate, blood pressure, temperature, oxygen saturations, medication) and clinical information (time to antibiotic, pathology, time to intravenous fluids).

Results

This study demonstrated a statistically significant 230 minute reduction in time to antibiotics post implementation of the guidelines. The post group (n=165) received more urgent triage categories (n=81; 49.1%), a 758 minute reduction in mean time to second litre of intravenous fluids and an improvement in collection of baseline lactate (n=112, 67.9%), also statistically significant.

Conclusions

The findings highlight the impact guidelines can have on clinician decision making and behaviour that support best practice and positive patient outcomes. The sepsis guidelines improved the early assessment, recognition and management of patients presenting with sepsis in one tertiary referral Emergency Department.

Relevance to clinical practice

The use of evidenced based guidelines can impact on clinical decision making and behaviour, resulting in the translation and support of best practice and improving patient care.

Keywords

Assessment, Clinical Guidelines, Emergency Care, Emergency, Sepsis

INTRODUCTION

Sepsis remains one of the leading causes of mortality and morbidity within hospitals, with higher mortality rates noted for severe sepsis and septic shock (Shapiro et al. 2005). Sepsis is often difficult to assess, diagnose and treat. Globally, strategies have been implemented to reduce sepsis morbidity and mortality rates, which rely on the early recognition and ongoing management of sepsis. Yet, early recognition and management varies between countries, specialties and clinicians (Gao et al. 2005, Reade et al. 2010). Similarly, across Australian Emergency Departments (ED) assessment and management of sepsis is not standardised.

Often the lack of recognition of sepsis, by clinicians, can delay management and treatment options. There is evidence to suggest that mortality rate increases by 7 6% with every hour of delay before antibiotic therapy begins (ACI 2010). Consequently, early and effective administration of antimicrobial agents within the first hour has been associated with increased survival rates (Kumar et al. 2006, Guimont et al. 2009, Gaieski et al. 2010).

The New South Wales (NSW) government identified that the recognition, assessment and management of sepsis as a major challenge for ED clinicians. Consequently, in 2011, sepsis guidelines were introduced across NSW EDs to reduce sepsis hospital mortality and morbidity rates. The guidelines sought to standardise the recognition, assessment and management of patients presenting with sepsis by emergency clinicians and in particular triage nurses (Box 1) (Burrell et al. 2016).

Therefore, the aim of this study was to explore (1) the number of patients presenting with sepsis before and after guideline implementation; (2) the impact of guideline implementation on triage assessment and ED management; and (3) the impact of guideline implementation on time to antibiotic.

BACKGROUND

Across the healthcare sector, sepsis is recognised as one of the leading cause of avoidable mortality and morbidity. A recent multicentre study identified that 11 8 per hundred admissions to intensive care units (ICU) were associated with severe sepsis, with an in-hospital mortality rate of 37 5% increasing to 60% mortality in patients with septic shock (ARISE 2007). Similarly, Sundarajan et al. (2005) conducted a four-year ICU study, in Australia, and identified a sepsis rate of 1 1% in overnight hospital admissions with a mortality rate of 18 4%. Of these patients, 23 8% required ICU admission and treatment.

Sepsis can develop from minor injuries or conditions. Indeed, local infections can result in the development of sepsis and septic shock. Sepsis has been defined as the activation, by microbacterial organisms, of the body's inflammatory responses; and, for severe sepsis, signs of hypoperfusion and organ dysfunction are present. When septic shock is present profound, hypotension is evident and patients usually require vasopressors and fluid resuscitation (Lever & Mackenzie 2007, Dellinger et al. 2013). For people with sepsis, the ED commonly is the entry portal into the healthcare system.

Emergency nurses undertaking the triage role are usually the first to assess, monitor and manage the septic patient. Hence, triage nurses play a critical role in the early identification of this vulnerable patient group. To ensure positive outcomes for patients presenting with sepsis, early identification and

aggressive treatment is essential (Gao et al. 2005, Shapiro et al. 2005, Dellinger et al. 2008, Reade et al. 2010). Given that sepsis is potentially life threatening, the NSW sepsis guidelines were developed to assist early recognition and clinical decision-making (Clinical Excellence Commission 2009; Fry et al. 2012, Jeffery et al. 2014).

The guidelines assist in the early recognition through the identification of risk factors, signs and symptoms and vital signs (Box 1). If the patient is deemed as potentially having sepsis, the patient continues through the guideline. This involves early intervention which includes intravenous antibiotics within 60 minutes; fluid resuscitation at 20 ml/kg; collection of blood cultures; serum lactate and early referral to intensive care (Burrell et al. 2016). However, to date, the impact of the guidelines on everyday ED practice remains unclear.

Design and Method

This was a pre-post retrospective randomised medical record audit of adult patients with a diagnosis of sepsis. Data were audited for a 12-month period before the implementation of the sepsis guidelines, followed by a 12-month post medical record audit after allowing for a two-month implementation phase.

SITE

This study was conducted in one metropolitan Australian tertiary referral centre ED. The annual ED presentation rate is over 70,000 (79% adult; 21% paediatric) with an admission rate of 35 6%. The ED serves as an adult major trauma centre (SESLHD 2010). Tertiary referral centres provide 24-hour services and access to all surgical specialties, intensive care, radiology, pathology and pharmacy (ACEM 2012; NSW Ministry of Health 2016).

SAMPLE

A random sample was selected of ED patients with a sepsis diagnosis. The inclusion criteria included: patients over 16 years and with a sepsis related ED discharge diagnosis (sepsis, bacteraemia, septicaemia, urosepsis, febrile neutropenia and septic shock).

Patients with a sepsis diagnosis were identified from data obtained from the ED patient information system FirstNet^{TM}. A sample size of 157 patients was identified for both the pre-post groups. The sample size calculation to permit tests of differences pre-post groups was undertaken using a clinically estimated medium effect size (10% reduction in time to antibiotics), power of 0.80, and significance 0.05 (Gpower3.1.0). This indicated that a minimum of 157 patients were required in each group. Given the potential for missing data and availability of medical records 165 records per group were requested and reviewed.

SEPSIS GUIDELINE TOOL

All NSW EDs were to implement the sepsis guidelines by 2011. The guidelines required the triage nurse, if a decision of suspected sepsis was determined at the time of assessment, to allocate a triage category as per the Australasian Triage Scale (ATS; Box 2). The ATS is a clinical tool that is designed to ensure patients presenting to the ED are seen in a timely manner. The ATS is used to describe clinical urgency by assigning patients with a category from one to five, one being urgent to five which is classified as non

urgent (ACEM 2013). Once a triage category is assigned, the patient is transferred to a clinical area where appropriate resources would be assembled. In addition, the triage nurse was to alert senior medical and nursing staff through the activation of an electronic 'sepsis bomb' icon embedded within the ED patient information system (FirstNetTM).

IMPLEMENTATION OF THE GUIDELINES

The NSW Clinical Excellence Commission (CEC) is one of the health pillars of the NSW government. The CEC implemented the sepsis guidelines across all NSW EDs in 2011 using a top-down bottom up approach. The implementation of sepsis guidelines was reliant on the support and leadership from local clinical governance units. EDs were provided with tools to assist in the implementation process, which included education packages, audits, workshops and teleconferences (Burrell et al. 2016). However, implementation strategies were developed at each site to suit the contextual needs of the EDs.

The sepsis guideline implementation strategy used by the study ED involved the development of a multidisciplinary sepsis working party and a targeted education programme. The ED working party included nursing clinical leaders; medical clinical leaders; a pharmacist and infectious diseases staff specialist.

MEDICAL RECORD AUDIT

The pre-post medical record audit compared a randomised sample of pre sepsis guideline ED patients (12 months) with post sepsis guideline patients (12 months). The pre-post audit compared triage, assessment, ED management and treatment practices. Randomisation of medical records was performed using a computerised randomisation programme. Data were extracted from FirstNetTM and included patient demographic (age, gender) and clinical information (time of arrival to the ED, triage code, doctor seen by time, disposition).

The patient's paper medical record was identified by Medical Record Number from the FirstNetTM data and audited to obtain assessment data (heart rate, respiratory rate, blood pressure, temperature, oxygen saturations) and clinical information (time to antibiotic, pathology and time to intravenous fluids).

A predetermined data collection protocol was used to review the medical records. Data collection and inter-rater checking was undertaken by two of the investigators. To strengthen inter-rater reliability, a random sample of protocol data collected from the medical records was checked by two lead investigators, followed by the review of 10% of the Excel database against the paper data collection sheets.

DATA ANALYSIS

Descriptive analysis was conducted to summarise patient demographics and ED characteristics (age, gender, triage code, time of arrival, time seen, diagnosis and disposition). Categorical variables were represented in frequency and percentages. Continuous variables were represented using mean and standard deviation. Vital signs were coded as categorical data (normal or abnormal if they met the sepsis guideline, for example respiratory rate ≤10 or ≥25 breaths per minute or heart rate ≤50 or ≥120 beats per minute). Nonparametric analysis was undertaken using Pearson's chi-squared test or Mann–Whitney U-

test, with statistical significance determined by p-values ≤0 05. Data were analysed using IBM SPSS v22 (IBM Corp., Armonk, NY).

Ethical Considerations

All participant data were de-identified following audit of the paper record. The study was approved by the hospital's Human Research Ethics Committee (HREC13/141) and ratified by the University (HREC-ETH15-0112).

RESULTS

The number of adult ED patient presentations in the pre-and post group was 47,307 and 52,354, respectively. Of these patients, there were 486 with a sepsis-related diagnosis in pre group (1 0%) and 828 (1 6%) in the post group. The total sample (n = 329) included 164 (pre group) and 165 patients in the post sepsis guideline group. Due to one incomplete file, 164 patients comprised the pre group. There were no differences between the pre and post groups in relation to age, gender or arrival mode (Table 1).

On arrival to the ED, just over half of patients received a triage category 3. There was a difference in triage categorisation before and after guideline implementation which was statistically significant. There was a lower proportion of patients allocated a category 3 and a higher proportion of category 2 in the post group compared to the pre group (Table 1). There were no patients who received a category 5 in the post group.

Of the pre group (n = 164) patients, the majority were admitted to hospital (n = 159; 97 0%) with 39 admitted to a critical care ward. The admission rate in the post group was similar to the pre group (n = 165) with 161 (97 6%) patients admitted to hospital. When comparing the pre and post groups, the admission rate to a critical care ward had halved post guideline implementation; this was statistically significant (Table 1).

There was a 19-minute significant difference in the pre and post group for patients to be seen by a nurse or doctor after triage: from 39 minutes before guideline implementation, to 20 minutes afterwards (Table 2). When comparing triage categories and time seen, patients allocated a triage category 3 had a mean time of 45 minutes (pre group) compared to 28 minutes (post group). Conversely, patients allocated a triage category 4 had a mean seen by time (pre group) of 55 minutes compared to 182 minutes (post group) (Table 2). The mean time to decision to admit was 4 hours and 43 minutes (pre group) compared to 3 hours and 45 minutes (post group) which was statistically significant (U = 10,432 0,p = 0 01).

Of the patients in the pre group, 86 6% (n = 142) received intravenous (IV) antibiotics compared with 100% (n = 165) in the post group. When comparing the mean time to IV antibiotics (pre and post group), the results demonstrated a 230-minute reduction in time to IV antibiotics for patients in the post group, this was statistically significant (Table 2).

When comparing triage category and time to antibiotic for the pre group allocated a triage category 3, they had a mean time of 325 minutes compared to 368 minutes for triage category 4. However, in the post implementation group, the mean time to IV antibiotics for triage category 3 was 88 minutes

compared to 65 minutes for triage category 4 patients. When comparing pre-post groups, triage category 2 and 3 were significant (Table 2).

Pre-post group data were explored by age and time to IV antibiotics. Patients over the age of 65 years were compared in the pre and post groups, which identified 322 and 80 minutes, respectively. Both pre-post groups had longer mean time to antibiotic when compared to those under the age of 65 years (Table 2), although this was not statistically significant.

There was a 758-minute (mean) reduction in time to second litre of intravenous fluids (IVF) when comparing the pre and post group. The mean time to second litre of IVF for the pre and post group was 1128 minutes (SD 2669) and 370 minutes (SD 393), respectively (U =3346 0, p =<0 001). The number of patients who received IVF in the pre and post group were similar 66 5% (n =109) and 63 6% (n =105), respectively.

A baseline lactate pathology test was taken for 60 (36 6%) pre group patients compared to 112 (67 9%) for post group patients. There was a statistical difference (v 2 =32 285, df 1, p =<0 001) when comparing the number of lactate tests conducted in the pre and post group.

For the patients in the pre group (n = 164), the diagnosis included the following: febrile neutropenia (n = 49; 29 9%); sepsis (n = 88; 53 7%); and urosepsis (n = 27; 16 5%). Diagnosis for the post group (n = 165) included febrile neutropenia (n = 14; 8 5%); sepsis (n = 145; 87 9%) and urosepsis (n = 6; 3 6%). Urinary infections accounted for the main source of infection in the pre implementation group (n = 42; 25 6%) while respiratory infections were the main source in the post implementation group (n = 66; 40 0%).

In the pre group, the most frequent triage vital sign recorded was heart rate and temperature. Systolic blood pressure was the most frequent triage vital sign recorded for the post group (Table 3). Although there was some variation for specific vital signs, the total number recorded in the post group was less than the pre group. This was a result of a substantial decrease in the documentation of Glasgow Coma Scale in the post group. While the reduction in vital sign documentation decreased, abnormal vital signs increased from an average of 1 4–2 2. Viewed as a proportion of total vital signs recorded, this represents a change from 24 6% of observations in the pre group to 47 3% in the post group. Both the change in the documentation of overall and abnormal vital signs were found to be statistically significant (Table 3).

DISCUSSION

The study has identified that the implementation of the NSW sepsis guidelines significantly changed clinician assessment and management practices within the ED. Most importantly, the time to antibiotics within 60 minutes had significantly improved in the post sepsis guideline group.

The early administration of antibiotics within one hour of identifying patients with severe sepsis and septic shock can reduce mortality and morbidity rates (Dellinger et al. 2013). This study has shown that the NSW sepsis guidelines have had a significant impact on the time of antibiotics in one ED. There was a 230-minute improvement in time to antibiotics compared with the pre sepsis group. However, there is room for further improvement given that patients were seen quickly (mean time 20 minutes) and yet a

target of 60 minutes for time to antibiotics was still not achieved. Prospective, observational studies are needed to gain a clearer understanding of the barriers to timely administration of antibiotics.

When the patient group was explored by age, patients >65 years of age in both the pre and post group took longer to receive antibiotics, although this was not statistically significant. Patients over 65 years of age are considered a vulnerable group and have been identified as high risk in the sepsis guideline. It is unclear why it takes longer for this group of patients to receive antibiotics. The complexity of comorbidities often associated with ageing may complicate the recognition and assessment process and contribute to antibiotic delay compared to the younger adult group. The challenges of an ageing population, comorbidities and declining cognitive function may challenge clinicians' assessment practices and decision-making processes. Further research needs to be conducted in this patient group to better understand these phenomena.

While the results demonstrated a difference in diagnosis and source of infection between the pre and post groups, this did not influence the implementation of sepsis guidelines by triage nurses. The sepsis guidelines provide the triage nurse with a range of risk factors to consider when undertaking the initial assessment. The source of infection is only one risk factor and during the triage assessment may not be evident and the focus of activating and implementing the sepsis guideline. Therefore, despite the pre-post difference in diagnosis and source of infection, it is unlikely that the time to antibiotic demonstrated in the results was influenced by these factors. However, further research is needed into whether different diagnostic groups or source of infection influence triage decision-making when implementing the sepsis guideline.

This study has shown that the implementation of sepsis guidelines had changed triage practices. Specifically, septic patients post sepsis guideline implementation were allocated more urgent triage codes. While the NSW sepsis guidelines do not specify a triage category, if vital sign parameters were abnormal, a triage nurse could not allocate a triage category 4 or 5.

The ATS indicators have been well validated for different diagnostic groups including sepsis. A study conducted by Chamberlain et al. (2015) explored the accuracy and validity of the ATS in identifying severe sepsis. They found clinical descriptor accuracy and validity was demonstrated in triage category 3 and 2, respectively. The authors demonstrated that the ATS had a 71% sensitivity for identifying severe sepsis. Within the ATS, the clinical descriptors associated with severe sepsis were embedded in triage category 2 and 3 and aligned with the NSW guidelines. However, while the ATS has been validated another study conducted by Fry et al. (2012) found that patients presenting with infections were allocated less urgent triage categories compared to patients with non-infective presentations. This finding was supported by the results of this study in the pre sepsis group and suggests that other contextual factors operate in clinical decision-making and that the implementation of a tool will not always result in clinician behaviour change.

The study identified that while there was an increase in urgent triage category allocation, there was an overall decrease in the total vital signs recorded in the post group. These findings suggest that the sepsis guideline criteria appears to have assisted with knowledge generation, whereby decision making by triage nurses now requires fewer vital signs to make a determination of sepsis. Further research is

needed to be conducted to better understand how sepsis guidelines have influenced triage nurse decision making and altered behaviour.

The collection of serum lactate blood test is required as part of the sepsis guideline. A lactate test is indicative of tissue hypoperfusion and is used to identify the severe septic patient. If a patient has septic shock, a lactate test can be used as a prognostic tool for mortality and morbidity (Del-linger et al. 2013, Bhat et al. 2015). Evidence has shown that patients with a lactate level >4 mmol/l with or without hypotension have an increased in-hospital mortality (Dellinger et al. 2013, Casserly et al. 2015, Eccleston et al. 2016). According to Bhat et al. (2015), mortality rates are significantly increased in patients who do not have an improvement in their lactate level prior to ED discharge. Lactate testing is therefore an important component of the medical assessment and in the ongoing management and evaluation of patients. However, the findings of this study showed that a large proportion of the post group patients did not have a lactate test recorded which demonstrated poor compliance with the guidelines. It remains unclear why there was poor compliance with certain components of the guidelines.

The administration of IVF is recommended to improve the haemodynamics of patients with severe sepsis and septic shock. Initial fluid bolus should be administered at 30 ml/ kg with ongoing fluid resuscitation until haemodynamic improvement is achieved (Dellinger et al. 2013). However, despite the evidence supporting early administration of fluids for patients with sepsis, the findings demonstrated that there was almost no change in the number of patients who received a second litre of IVF in the post group. The age range of the study (mean age of 69 years) may have contributed to the delay in fluid administration. Clinicians may be more reluctant to provide aggressive fluid resuscitation in older patients due to the complexity of ageing, comorbidities and potential risk of fluid overload.

Limitations

There are several limitations with this study. The study was conducted in one Australian mixed metropolitan tertiary referral ED, and therefore, the results may not be representative of other EDs or those in different geographical settings. The collection of data for the retrospective 12-month pre-post medical record audit was reliant on clinicians' willingness to complete all the required documentation fields correctly. Patients may have had sepsis, but their diagnosis was not entered as a sepsis related diagnosis and therefore were not included as part of the sample.

For the purposes of the study patients with a Glasgow Coma Score (GCS) equal to or <14 was coded as abnormal. However, some patients such as those with dementia may have had a baseline GCS of 14 which would be considered normal for this particular patient group. Normal baseline GCS was not documented in the medical record for all patients therefore any patient with GCS equal to or <14 was coded as abnormal.

Due to the small sample size when examining subgroups, some comparisons did not identify statistically significant differences. Future studies should consider multiple sites to reach appropriately large sample sizes for detailed examination of subgroups.

CONCLUSION

This study has identified that there has been significant behaviour change in the management of patients with sepsis. For patients arriving in the ED, post sepsis guideline implementation, they were allocated higher triage urgency codes, seen more quickly and received their antibiotics much earlier compared to the pre sepsis guideline group. The study findings highlight the impact that a guideline can have on clinician decision making and behaviour in ways that better support best practice and positive patient outcomes. The NSW sepsis guidelines improved the early assessment, recognition and management of patients presenting with sepsis in one tertiary referral ED.

Despite the significant improvements demonstrated in this study in ED sepsis management, further research needs to be conducted to gain a better understanding of sepsis guideline adherence, impact on the older person and how it has informed clinical practice and decision making.

Contributions

Study design: BR, MF, MR; data collection and analysis: BR, MF, MR; manuscript preparation: BR, MF, MR.

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TABLE 1. Characteristics of Pre and Post Sepsis Guideline Groups

Group	Pre (n=164)	Post (n=165)	*M-W U*	*p*	Total (n=329)
Age					
Years (Mean(SD))	68.4(17.2)	69.6 (18.5)	141411.000	.307	69.0 (17.9)
Group	**Pre (n=164)**	**Post (n=165)**	***X^2(df)***	***P***	**Total (n=329)**
Gender			.885(1)	.347	
Male	91 (47.6%)	100 (52.4%)			191 (58.1%)
Female	73 (52.9%)	65 (47.1%)			138 (41.9%)
Arrival mode			.694(1)	.405	
State Ambulance	95(48.0%)	103 (52.0%)			198 (60.2%)
Private transport	69(52.7%)	62 (47.3%)			131 (39.8%)
Triage code			35.284(4)	≤.001	
1	9(5.5%)	8 (4.85%)			17 (5.2%)
2	37(22.6%)	81(49.1%)			118 (35.9%)
3	97(59.1%)	74 (44.85%)			171 (51.9%)
4	20(12.2%)	2 (1.2%)			22 (6.7%)
5	1(0.6%)	0 (0%)			1 (0.3%)
ED Disposition			8.805(3)	.032	
Admitted to Ward	120(73.2%)	141(85.5%)			261(79.3%)
Admitted to Critical care	39(23.8%)	20(12.1%)			59(17.9%)
Discharged from ED	4(2.4%)	2(1.2%)			6(1.8%)
Death in ED	1(0.6%)	2(1.2%)			3(1.0%)

TABLE 2 Time seen and Time to Antibiotics for the Pre and Post Sepsis Guideline Group

Group	Pre (n=164) Mean (SD)	Post (n=165) Mean (SD)	*M-W U*	*p*	Total (n=329) Mean (SD)
Mean Time (minutes) from triage to seen by Australasian Triage Scale					
Overall	39(47.9)	20(34.8)	7799.500	≤.001	29(42.6)
By Triage Code					
1	0(0)	1(0.9)	3.500	.667	1(0.8)
2	9(10.3)	9(10.3)	1090.000	.766	9(10.2)
3	45(47.3)	28(33.5)	2804.000	.019	38(42.6)
4	55(65.2)	182(173.2)	34.000	.139	66(81.8)
5	6(0)	0(0)		N/A	6(0)
Mean Time (minutes) to IVABs by Australasian Triage Scale					
Overall	308(499.4)	78(52.6)	5052.000	≤.001	184(359.9)
By Triage Code					
1	186(216.8)	44(24.5)	14.000	.435	99(145.5)
2	245(720.6)	73(53.4)	918.000	.028	121(385.2)
3	325(441.3)	88(52.3)	1194.000	≤.001	216(347.1)
4	368(357.4)	65(49.5)	4.000	.095	337(350.8)
5	0	0		N/A	0
Mean Time (minutes) to IVABs by Age Group					
<65 years	288(459.0)	74(46.4)	8.125	≤.001	185(347)
>65 years	322(528.5)	80(55.5)	655.000	≤.001	184(368)

TABLE 3. Vital Signs for Pre and Post Sepsis Guideline Group

Group	Pre (n=164)	Post (n=165)	*M-W U*	*p*	Total (n=329)
Total Vital Signs Recorded (Mean(SD))	5.8(.64)	4.7(.71)	2627.500	≤.001	5.3(.86)
By type (N(%))*	N=948	N=778			N=1726
Heart Rate	163(17.2%)	149(19.15%)			312(18.1%)
Systolic Blood Pressure	162(17.1%)	165(21.2%)			327(18.9%)
Oxygen Saturations	161(17.0%)	138(17.7%)			299(17.3%)
Respiratory Rate	149(15.7%)	149(19.15%)			298(17.3%)
Temperature	163(17.2%)	163(21.0%)			326(18.9%)
Glasgow Coma Scale	150(15.8%)	14(1.8%)			164(9.5%)
Abnormal Vital Signs Recorded (Mean(SD))	1.4(1.33)	2.2(1.10)	18722.000	≤.001	1.8(1.28)
By type (N(%))*	N=233(24.6%)§	N=368(47.3%)§			N=601
Heart Rate	37(15.9%)	62(16.8%)			99(16.5%)
Systolic Blood Pressure	22(9.4%)	26(7.1%)			48(8.0%)
Oxygen Saturations	36(15.5%)	61(16.6%)			97(16.1%)
Respiratory Rate	44(18.9%)	82(22.3%)			126(21.0%)
Temperature	49(21.0 %)	126(34.2%)			175(29.1%)
Glasgow Coma Scale	45(19.3%)	11(3.0%)			56(9.3%)

** Multiple response variable*

§ Abnormal vital signs as a percent of total vital signs recorded

BOX 1 Sepsis Guidelines

The patient must have a risk factor PLUS at least 2 yellow zone criteria or 1 red zone criteria to be placed on the sepsis guideline.

Risk Factors

- Any signs of Infection
- Immunocompromised
- History of fever/rigors

Yellow zone criteria

- Respiratory Rate ≤10 or ≥25 per minute
- Oxygen Saturations <95%
- Systolic Blood Pressure ≤100mmHg
- Pulse ≤50 or ≥120 per minute
- Altered level of consciousness or change in cognitive status
- Temperature ≤35.5 or ≥38.5

Red zone Criteria

- Systolic Blood Pressure ≤ 90mmHg
- Age >65 years
- Immunocompromised
- Lactate ≥4mmol/L

Clinical Excellence Commission, Sepsis Pathway (2011)

BOX 2 Australasian Triage Scale (ATS)

Category	Treatment Acuity (Maximum waiting time for medical assessment and treatment)
ATS 1	Immediate
ATS 2	10 minutes
ATS 3	30 minutes
ATS 4	60 minutes
ATS 5	120 minutes

(ACEM, 2013)