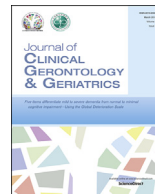




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## Original article

# The impact of the presence of systemic inflammatory response syndrome in the emergency department on the timing and outcomes of medical emergency team calls after admission: A retrospective audit

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## ABSTRACT

**Background/Purpose:** To investigate if systemic inflammatory response syndrome (SIRS), present on arrival to the emergency department, correlates with the timing of medical emergency team calls (MET calls), mortality, length of stay, and discharge destination.

**Methods:** A retrospective audit was performed on patients who had a MET call during their admission and were over the age of 75 years during a 6-month period. A total of 127 patients were included: 43 with SIRS and 84 without.

**Results:** There was a greater amount of MET calls within 48 hours for the SIRS group compared with the Non-SIRS group (48.8% vs. 27.4%), with an odds ratio of 2.54 (95% confidence interval: 1.18–5.45,  $p < 0.0175$ ). A MET call greater than 48 hours was associated with a longer length of stay (7.91 days vs. 15.49 days, mean,  $p < 0.0003$ ), and higher mortality rates, 28.9% versus 4.5%, with an odds ratio of 8.54 (95% confidence interval: 1.91–38.12,  $p < 0.0049$ ).

**Conclusion:** The presence of SIRS on admission may be considered in assessing early deterioration, prognosis, and treatment aims for older patients.

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## 1. Introduction

There is little evidence available regarding the use of systemic inflammatory response syndrome (SIRS), evident on emergency department (ED) presentation, as a prognostic indicator. Particularly regarding older individuals, who comprise an increasing proportion of hospitalized patients in Australia, an increase in presentation of 9% compared with 4% for the overall population, from the year 2011 to 2012.<sup>1</sup> Older patients who are likely to deteriorate clinically require accurate prognostication to improve investigation and management, which may include the recognition of SIRS.

SIRS was originally defined in 1992 as a means to identify a systemic inflammatory response to pathologies of both an infectious and noninfectious nature.<sup>2</sup> It has also been used conceptually and clinically to define the spectrum of infectious pathologies from a localized infection to severe septic shock with organ failure.<sup>3</sup> Since its conception the usefulness of SIRS has been much debated, especially its sensitivity and specificity in defining sepsis in a variety of clinical settings. In a large study of patients with infection and organ failure, one in eight patients did not fulfill the definition of SIRS.<sup>4</sup> Amongst ED presentations, one study found that only 26% of patients with SIRS had an infectious pathology.<sup>5</sup> In noninfectious pathologies, SIRS on admission has been shown to result in higher mortality rates and length of stay in trauma patients and a higher stroke severity score in patients with stroke.<sup>6,7</sup>

Amongst older patients, SIRS has been used with biochemical inflammatory markers to identify sepsis and as an indicator for

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**Table 1**

Criteria for systemic inflammatory response syndrome (SIRS) and medical emergency team (MET) calls.

	Standard MET criteria	SIRS criteria ( $\geq 2$ )
Airway Breathing	Difficulty breathing	
	RR < 8 or > 30	RR > 20
	SpO <sub>2</sub> < 90% despite O <sub>2</sub> 6 L/min via Hudson mask	PaCO <sub>2</sub> < 32 mmHg
Circulation	HR < 50 bpm or > 130 bpm	HR > 90 bpm
	SBP < 90	
Disability	New or unrelenting chest pain	
	Acute change in conscious level	
Other	Seizure	
	Worry about patient condition	Temperature < 36°C or > 38°C
		WCC > 12 or < 4, > 10% immature bands

HR = heart rate (beats/min); RR = respiratory rate (breaths/min); SBP = systolic blood pressure (mmHg); WCC = white cell count ( $\times 10^9/L$ ).

organ failure and mortality.<sup>8,9</sup> It has also been shown to be associated with increased in-hospital and 1-year mortality rates in this age group.<sup>10</sup> Given recent findings indicating that there has been an increase in the number of medical emergency team (MET) calls, similar to a rapid response team, since the introduction of the 4-hour rule (National Emergency Access Target) in the ED, detecting SIRS on admission may be helpful in predicting the timing of MET calls.<sup>11</sup> A relationship which has yet to be explored (Table 1).

Rates of cardiac arrest and overall in-hospital mortality decreased upon the introduction of MET calls, based on the evidence that cardiac arrest was preceded by unstable clinical and physiological signs.<sup>12,13</sup> Identifying these patients prone to clinical deterioration decreased the amount of unplanned intensive care unit (ICU) admissions and death.<sup>12</sup> Patients that trigger a MET call within 24 hours of admission have an increased risk of in-hospital mortality.<sup>14</sup> A recent study of patients who trigger a MET call response found a high proportion fulfill the criteria for SIRS, 77.4% out of 358 MET calls.<sup>15</sup> Therefore, exploring the relationship between SIRS and the timing of MET calls may be prognostic for mortality and in-hospital outcomes for older patients.

## 2. Methods

A retrospective audit of patients older than 75 years of age were selected using the ICU MET call database. Ethics approval was sought from the Eastern Health Research and Ethics Committee, Maroondah Hospital, VIC, Australia (Approval No. LR61-2014 on December 12, 2014). Patients who had a MET call during the period of January 2014 to June 2014 at Maroondah Hospital were included and 127 patients met these criteria. Data was collected from the electronic medical records and pathology results. SIRS was defined at presentation to the ED using the baseline observations recorded in the ED and the first blood samples taken, which was either in the department or once they arrived to the ward. Baseline characteristics were recorded for all patients including age, sex, admitting diagnosis, and home location to determine if there were baseline differences between the two groups being studied (Table 2).

The primary outcomes measured were time-to-MET call, discharge destination, length of stay, and mortality. The time-to-MET call was calculated from the time the patient left the ED until the time recorded on the MET call database entry form. Discharge destination was considered altered if the patient was discharged to a location different from where they were admitted from.

**Table 2**

Baseline characteristics.

	Population	SIRS	Non-SIRS	<i>p</i>
Patients ( <i>n</i> )	127	43	84	
Mean age (y)	83.9	83.7	84.1	0.7203
Male	57 (44.9)	18 (41.9)	25 (58.1)	0.7606
Female	70 (55.1)	39 (46.4)	45 (53.6)	
Principle diagnosis				
Cardiovascular	23 (18.1)	10 (23.4)	13 (15.5)	0.3957
Respiratory	18 (14.2)	9 (20.9)	9 (10.7)	0.1965
Gastrointestinal	5 (3.9)	1 (2.3)	4 (4.8)	0.8391
Orthopedic	17 (13.4)	1 (2.3)	16 (19.1)	0.0186
Malignancy	6 (4.7)	2 (4.7)	4 (4.8)	0.6781
Surgical	16 (12.6)	6 (14.0)	10 (11.9)	0.9562
Neurological	12 (9.5)	3 (7.0)	9 (10.7)	0.7233
Falls	10 (7.9)	2 (4.7)	8 (9.5)	0.5470
Sepsis	11 (8.7)	8 (18.6)	3 (3.6)	0.0121
Renal	2 (1.6)	0 (0)	2 (2.4)	0.7841
Other	7 (5.5)	1 (2.3)	6 (7.1)	0.4758
Home location				
Home alone	95 (74.8)	32 (74.4)	63 (75)	0.8869
Residential care	32 (25.2)	11 (25.6)	21 (25)	
Admitting unit				
GEM	30 (23.6)	8 (18.6)	22 (26.2)	0.4633
General medicine	66 (51.2)	25 (58.1)	41 (48.8)	0.4208
Surgical	11 (8.7)	3 (7.0)	8 (9.5)	0.8881
Oncology	4 (3.2)	2 (4.7)	2 (2.4)	0.8691
Plastics	2 (1.6)	0 (0)	2 (2.4)	0.7841
Gastroenterology	2 (1.6)	2 (4.7)	0 (0)	0.2099
Urology	1 (0.8)	0 (0)	1 (1.2)	0.7373
Cardiology	4 (3.2)	1 (2.3)	3 (3.6)	0.8889
Respiratory	2 (1.6)	1 (2.3)	1 (1.2)	0.7779
Orthopedic	5 (3.9)	1 (2.3)	4 (4.8)	0.8391
MET call criterion				
Respiratory	36 (28.4)	17 (39.5)	19 (22.6)	0.0731
Cardiovascular	48 (37.8)	19 (44.2)	29 (34.5)	0.3824
Neurological	28 (22.1)	6 (14.0)	22 (26.2)	0.1793
Concern	15 (11.8)	1 (2.3)	14 (16.7)	0.0368

Data are presented as *n* (%).

GEM = geriatric evaluation and management; MET = medical emergency team; SIRS = systemic inflammatory response syndrome.

Statistical analysis was conducted on the baseline characteristics of the two groups of patients. Results were quantified using univariate and bivariate analysis and tested with 95% confidence levels and *p* values utilizing the *t* test. The arbitrary cutoff to state statistical significance was defined as a *p* value < 0.05. Regression analysis was also conducted when comparing the number of SIRS criteria fulfilled and the timing of MET calls.

SIRS was defined as fulfilling two or more of the following criteria: (1) respiratory rate > 20 breaths/min or carbon dioxide partial pressure < 32 mmHg; (2) heart rate greater than 90 bpm; (3) temperature > 38°C or < 36°C; (4) white cell count >  $12 \times 10^9/L$  or <  $4 \times 10^9/L$  or > 10% immature bands.<sup>2</sup> The number of criteria fulfilled was recorded for all patients including those with only one criterion. Standard MET call criteria were used at Maroondah Hospital unless the patient's criteria were modified (Figure 1).

## 3. Results

A total of 426 MET calls occurred during the period of January 2014 to June 2014 at Maroondah Hospital, with a proportion of 29.8% attributed to patients older than 75 years.

Of the 127 patients who met the inclusion criteria, 43 fulfilled criteria for the presence of SIRS on admission in the ED and 84 did not fulfill the criteria. The mean age was 83.9 years, comprising 55.1% women and 44.9% men. The majority of patients were living at home prior to their admission (94 patients or 74%). A total of 33 (26%) patients lived in supported accommodation or residential

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