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## Original Article

# Mortality of severe septic patients between physician's high and low care volumes



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## ABSTRACT

**Background:** Patients with severe sepsis frequently require intensive care unit (ICU) admission and different ICU care models may influence their outcomes. The mortality of severe septic patients between physician's high and low care volume remains unclear.

**Methods:** We analyzed the data from a three-year prospective observation study, which was performed in an adult medical ICU of Chung Gung Memorial Hospital, Keelung. The data included initial bundle therapies based on the Surviving Sepsis Campaign (SSC) guidelines for patients with severe sepsis.

**Results:** Clinical data of total 484 patients with severe sepsis were recorded. Cox regression model showed that physician's care volume was an independent factor for lowering mortality in ICU patients with severe sepsis (hazard ratio 0.708; 95% confidence interval 0.514–0.974;  $p = 0.034$ ). Patients treated by high care volume physician had four out of nine bundle therapies that were significantly higher in percentage following the SSC guidelines. These four therapies were renal replacement therapy, administration of low-dose steroids for septic shock, prophylaxis of gastro-intestinal bleeding, and control of hyperglycemia.

**Conclusion:** High care volume physician may decrease mortality in ICU patients with severe sepsis through fitting bundle therapies for sepsis.

Severe sepsis or septic shock are a lethal critical illness resulting in multiple organ dysfunction and high overall hospital mortality rate of 17.9–50.0% in different populations [1,2]. The complicated physical states in patients with severe sepsis frequently require intensive and critical care, which leads to high intensive care unit (ICU) admissions [3]. Such patients remain a major challenge in modern medicine. The “Surviving Sepsis Campaign (SSC)” guidelines provide evidence-based recommendations for managing patients with sepsis and

improving their outcomes [4,5]. But while better medical treatment can alter a patient's outcome, more extensive considerations should not only focus on medical treatment. An ever-increasing number of discussions about ICU care models and physician staffing has also been mentioned.

A study by Reynolds et al. concluded that critical care medicine (CCM) physicians may decrease mortality of ICU patients with septic shock [6]. A study by Brown et al. had similar results, showing that a full-time, trained critical care

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### At a glance commentary

#### Scientific background on the subject

The ICU physician care volume may affect ICU pneumonia patient's mortality. The difference between physician's high and low care volume may also impact on the outcome of ICU severe septic patients.

#### What this study adds to the field

We proved that ICU care by high care volume physicians may be better than that by low care volume physicians in patients with severe sepsis. The benefit provided by high care volume may relate to higher complete rate of bundle therapy.

specialist may reduce ICU morbidity and mortality [7]. A systemic review demonstrated that high intensity ICU physician staffing is associated with a reduction in ICU mortality and length of stay [8]. In their study, the high intensity care group was mandatory intensivist consultation, or all-care directed by the intensivist. Now, it is generally accepted that the care model managed by a trained CCM physician leading a multi-disciplinary team improves the outcome of ICU patients [9].

Most medical ICUs in Taiwan are staffed with full-time CCM physicians to be qualified by hospital accreditation. However, these CCM physicians may not be permanently located in ICU to be an ICU physician. In Taiwan, a pulmonologist is trained to not only be a pulmonary specialist but also a CCM specialist. The pulmonologist can join the ICU team to be a full-time CCM physician, also called an intensivist, or simply manage patients with pulmonary disease in the wards. Therefore, patients may be treated by high ICU care volume physician with more experience in critical care or by low ICU care volume physician with less experience in critical care. From a analysis of Taiwan's National Health Insurance, physician's care volume significantly predicted inpatient mortality in ICU pneumonia patients [10]. Since the ICU physician care volume may affect ICU pneumonia patient's mortality, the difference between physician's high and low care volume may also impact on the outcome of ICU severe septic patients. We analyzed the data from a three-year prospective observation study to examine whether physicians with higher care volume offer ICU severe septic patients better outcomes.

## Materials and methods

### Subjects

From July 2007 to June 2010, we carried out an observational research program “analyzing the key treatments to increase the survival of the patients with severe sepsis”. This study enrolled patients with severe sepsis who were admitted to the

medical ICU of Chang Gung Memorial Hospital-Keelung (CGMH-Keelung) during the three years. Severe sepsis was defined as sepsis with organ dysfunction, hypo-perfusion, or hypotension [11]. The medical ICU at CGMH-Keelung is a 10-bed closed unit staffed with a full-time ICU physician who is a qualified pulmonary and CCM specialist. Eight physicians rotated in ICU care monthly during the three years when this full-time ICU physician was off or rotated to the general ward. If a patient was admitted to one physician and cared by another physician later, this patient was classified to the physician who cared these patients for more time during the first 3 days of admission. Repeated admission to ICU was set as a new admission and that subject had the same age, gender and medical history. High and low care volumes are defined according to Lin's study from a analysis of Taiwan's National Health Insurance [10].

This study recorded the following clinical data: age, gender, medical history, infection source, Acute Physiology and Chronic Health Evaluation (APACHE) II score, comorbidity, and treatments in the first three days of ICU admission. The recorded treatments were the standard bundle therapies used to manage sepsis according to SSC guidelines [4]. These bundle therapies included fluid resuscitation (normal saline or hydroxyethyl starch), broad spectrum antibiotics, use of low-dose steroids in septic shock, use of activated protein C (APC), adequate blood transfusion, sedation/paralysis, blood glucose control, renal replacement therapy as needed, stress ulcer prophylaxis, and basic support. Fluid resuscitation was administered with either crystalloid or colloid infusion to maintain central venous pressure between 8 and 12 mmHg. APC was given for septic patients with an APACHE II score >25 and without contraindications. An adequate hemoglobin maintenance was red blood cell (RBC) transfusion for hemoglobin <7.0 mg/dl to target 7.0–9.0 mg/dl. All of the treatments were based on the ICU patient's condition and physician's decision without any intervention by data collectors. Survivors were defined as the patients alive after 28 days of ICU admission. The data collected from this observational study were divided into fixed and rotated groups to compare the survival of these two different ICU care strategies. Because this research program was an observational study without any intervention and

**Table 1 Physician characteristics and care volume in 3 years.**

	Patients	Age	Years out of training	Number of weekly outpatient service in the ICU month
Physician 1	18	47	16	3
Physician 2	31	50	16	3
Physician 3	42	46	14	3
Physician 4	38	50	9	3
Physician 5	32	41	7	3
Physician 6	298	40	6	3
Physician 7	13	35	5	3
Physician 8	12	36	4	3

Abbreviation: ICU: intensive care unit.

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