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One-Hour Sepsis Bundle Compliance on Serial SOFA Scores and 28-Day Mortality: A Prospective Investigation in Bekasi Regency Referral ICUs

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Abstract

Background: *Sepsis mortality remains high in intensive care units (ICUs). This study aims to evaluate compliance with the implementation of the One hour sepsis bundle and changes in SOFA scores to predict 28-day mortality rates, knowing the 28-day mortality rate and to identify strong mortality factors mortality in sepsis patients in the ICU two of Type B Hospital, Bekasi Regency.* ***Methods****: A prospective observational cohort study was conducted in the ICUs of two Type B hospitals in Bekasi Regency in 2025. Sixty adult sepsis patients with with characteristics, SOFA score, One hour sepsis bundle compliance, Temperature, Respiratory rate (RR), Capillary refill time (CRT), Lactate level examination on admission, 24th hour and 5th day. Data were analysed using bivariate analysis.****Results:*** *The 28-day mortality rate was 81.7%. Bundle compliance showed no significant correlation with SOFA score changes or 28-day mortality rates. Bivariate analysis proved that 24-hour and 5-day SOFA, 24-hour and 5-day ΔSOFA, GCS components and renal function in 5-day SOFA scoring were significantly correlated with 28-day mortality rates.* ***Conclusion****: Compliance with the One hour sepsis bundle did not significantly affect the 28-day mortality rate. 24-hour and 5-day CRT examinations, 24-hour and 5-day SOFA scoring, 24-hour and 5-day SOFA Δ, day-5 temperature examination, day-5 lactate and Δ lactate levels, SOFA GCS scoring components and renal function can affect the 28-day mortality rate of sepsis patients in the ICU of Type B Hospital, Bekasi Regency.*

Keywords*: Sepsis, one hour sepsis bundle Surviving Sepsis Campaign, 28-day mortality, CRT, SOFA score*

Abstrak

Latar belakang: Angka kematian akibat sepsis masih tinggi di unit perawatan intensif (ICU). Studi ini bertujuan mengevaluasi kepatuhan pelaksanaan *One hour sepsis bundle* dan perubahan skor SOFA untuk memprediksi angka mortalitas 28 hari, mengetahui angka mortalitas 28 hari serta mengidentifikasi faktor-faktor yang berkorelasi dengan angka mortalitas pada pasien sepsis di ICU dua RS tipe B Kabupaten Bekasi. **Metode:** Penelitian ini merupakan studi kohort observasional prospektif dilakukan di ICU dua rumah sakit tipe B di Kabupaten Bekasi tahun 2025. Sebanyak 60 pasien sepsis dewasa dievaluasi dengan karakteristik, skor SOFA, kepatuhan *One hour sepsis bundle*, Suhu, Respiratory rate (RR), Capillary refill time (CRT) dan pemeriksaan kadar laktat saat masuk, jam ke-24 dan hari ke-5. Data dianalisis menggunakan uji bivariat Hasil: Angka mortalitas 28 hari sebesar 81,7%. Kepatuhan terhadap bundle tidak menunjukkan korelasi bermakna dengan skor SOFA, perubahan skor SOFA maupun angka mortalitas 28 hari. Analisis bivariat membuktikan bahwa SOFA 24 jam dan 5 hari, ΔSOFA 24 jam dan 5 hari, komponen GCS dan fungsi renal pada skoring SOFA 5 hari berkorelasi signifikan dengan angka mortalitas 28 hari. **Kesimpulan:** Kepatuhan pelaksanaan *One hour sepsis bundle* tidak bermakna memengaruhi angka mortalitas 28 hari. Pemeriksaan CRT 24 jam dan 5 hari, skoring SOFA 24 jam dan 5 hari, Δ SOFA 24 jam dan 5 hari, pemeriksan suhu hari ke 5, kadar laktat dan Δ laktat hari

ke 5, komponen skoring SOFA GCS dan fungsi renal dapat berkorelasi dengan angka mortalitas 28 hari pasien sepsis di ICU dua RS tipe B Kabupaten Bekasi.

Kata kunci -- Sepsis, *One hour sepsis bundle* Surviving Sepsis Campaign, CRT, skor SOFA, angka mortalitas 28 hari.

I. INTRODUCTION

Sepsis is a life-threatening medical emergency characterised by organ failure caused by an abnormal host immunological response to infection. Untreated sepsis, which has previously been associated with Systemic Inflammatory Response Syndrome (SIRS) criteria such as temperature instability, tachypnoea, and leucocytosis, rapidly escalates to organ destruction, coagulation problems, septic shock, and Multiple Organ Dysfunction Syndrome (MODS). Because of its urgent nature, intravenous broad-spectrum antibiotics must be administered within the first hour of diagnosis, followed by a reassessment 72 hours later when culture results are available.[1–8]

The global impact of sepsis is astounding, with an estimated 49 million cases and 11 million fatalities per year. Mortality rates remain high in the Intensive Care Unit (ICU), a specialised multidisciplinary environment for patients with life-threatening diseases. Asian data reveal an ICU sepsis death rate of 44.5%, however historical data from Cipto Mangunkusumo Hospital (RSCM) in Indonesia show rates as high as 84.5%. Research at Premiere Bintaro Hospital found a 40.1% incidence of sepsis and septic shock in the ICU (25.2% sepsis, 15.0% septic shock), with fatality rates of 68.3% for septic shock and 37.7% for sepsis alone. The Sequential Organ Failure Assessment (SOFA) score is critical for managing and prognosticating these patients. A SOFA score of ≥2 suggests organ impairment. Serial examinations on days 1, 3, and 5 are especially important, as an increased score within the first 48 hours is associated with a mortality risk greater than 50%.[3,9]

Effective sepsis management is dependent on the Surviving Sepsis Campaign (SSC) 2021 "One Hour Sepsis Bundle." The international guideline recommends lactate monitoring, blood cultures, broad-spectrum antibiotics, crystalloid resuscitation (30 mL/kg), and vasopressor therapy to maintain a Mean Arterial Pressure (MAP) of ≥65 mmHg. Despite these established standards, statistics on sepsis outcomes in regional referral centres are limited. As of 2025, Bekasi Regency operates 55 hospitals, seven of which are Type B institutions, but there is a dearth of specific predictive data on ICU sepsis mortality. The purpose of this study is to assess compliance with the One Hour Sepsis Bundle and its impact on serial SOFA score changes in order to better predict death rates and identify contributing factors in Type B ICUs in Bekasi Regency.

II. METHODS

This prospective observational cohort study took place in the intensive care units (ICUs) of two referral Type B hospitals in Bekasi Regency, West Java, throughout September to December 2025. The Institutional Ethics Committee approved the study, and the patient's legal representatives provided informed consent. A one-tailed hypothesis test for comparing two proportions was used to estimate the minimal sample size, which was 27 people per study site. To account for potential dropout or missing data, an additional 10% was added, resulting in 30 individuals per facility. Because the study was conducted in two hospitals, the total minimum needed sample size was 60 participants. A consecutive sampling strategy was used to register 60 adult patients (aged ≥18 years) diagnosed with sepsis using the Sepsis-3 criteria (suspected infection with a SOFA score ≥2).

Patients having a "Do Not Resuscitate" (DNR) order or discharged against medical advice during the first 24 hours were excluded. The five components of the 2021 Surviving Sepsis Campaign (SSC) "One-Hour Bundle"—lactate measurement, blood culture collection before medications, broad-spectrum antibiotic delivery, fluid

resuscitation (30 mL/kg), and vasopressor initiation—were assessed for compliance. In this study, "time zero" was defined as the time of ICU admission, when the sepsis diagnosis was formally established based on a thorough clinical, laboratory, and haemodynamic assessment. Given the diversity in timing and documentation of treatments began prior to ICU admission, particularly in the emergency department, compliance assessment centred on whether each bundle component was completed during the patient's course of care in relation to this predetermined time point. This method was adopted to provide consistent and reliable data collection across all individuals while reducing misclassification caused by missing or non-standardized pre-ICU records. Organ dysfunction was evaluated serially using the Sequential Organ Failure Assessment (SOFA) score at three time points: admission (H0), 24 hours (H1), and day 5 (H5). Clinical indicators such as capillary refill time (CRT) and body temperature were also measured at the time of diagnosis.

The primary outcome was a connection between bundle compliance and changes in serial SOFA values. Secondary outcomes included a 28-day death rate. Data were analysed with SPSS. For categorical variables, the Chi-square test or Fisher's exact test were used, while non-normally distributed continuous data was analysed using the Mann-Whitney U test.

III. RESULTS

The study was carried out from September to December 2025. During this period, 92 ICU patients were detected at Bekasi Regency Hospital and Hermina Grand Wisata Hospital with a diagnosis of sepsis, and 60 patients who fulfilled the inclusion criteria but not the exclusion criteria. The cohort presented with a median age of 49 years (range: 18–60) and a gender distribution of 51.7% male and 48.3% female. Data collection revealed that 50% of the participants were classified as obese and 70% had documented comorbidities. The ICU mortality rate was 81.7%, with 11 patients (18.3%) surviving the total observation period. Additionally, compliance with the One-Hour Sepsis Bundle was recorded in 18 patients (30.0%)

TABLE 1. BASELINE AND CLINICAL CHARACTERISTICS

Baseline Characteristics	(n=60)
Gender	
Female	29 (48.3%)
Male	31 (51.7%)
Age	49 (18 – 60)
Comorbidities	
Not Present	18 (30.0%)
Present	42 (70.0%)
One Hour Sepsis Bundle Compliance	
Not Compliant	42 (70.0%)
Compliant	18 (30.0%)
Admission	
Surgical	7 (11.7%)
Medical	53 (88.3%)
Body Mass Index	
Underweight	6 (10.0%)
Normoweight	24 (40.0%)
Obese	30 (50%)
Mortality	
Survive	11 (18.3%)
Deceased	49 (81.7%)

Variables	Admission (n=60)	24 hours (n=38)	Day 5 (n=27)
SOFA Score	6.00 (2 – 16)	7.00 (0 – 15)	6.00 (0 – 12)
ΔSOFA	-	1 (-3 – 11)	1 (-7 – 6)
SOFA Components			
Central Nervous System	2 (0 – 4)	2 (0 – 4)	0 (0 – 4)
Renal Function	0 (0 – 4)	0 (0 – 4)	1 (0 – 4)
Lactate	0.47 (0.20 - 0.78)	0.5 (0.2 – 0.79)	0.55 (0.21 – 4.80)
ΔLactate	-	0.04 (-0.51 – 0.55)	0.02 (-0.37 – 4.19)
Capillary Refill Time			
<2 Seconds	5 (8.3%)	0 (0%)	7 (25.9%)
2-3 Seconds	23 (38.3%)	19 (50%)	7 (25.9%)
>3 Seconds	31 (51.7%)	19 (50%)	13 (48.1%)
Respiratory Rate			
Eupnea	17 (28.3%)	19 (50%)	20 (74.1%)
Tachypnea	43 (71.7%)	18 (47.4%)	7 (25.9%)
Bradypnea	0 (0%)	1 (2.6%)	0 (0%)
Apnea	0 (0%)	0 (0%)	0 (0%)
Temperature	36.6 (36.0 - 40.2)	36.7 (36.2 – 38.1)	36.6 (36.2 – 37.3)

At admission, the majority of patients (88.3%) took the medical (non-surgical) route, frequently presenting in states of physiological distress characterized by tachypnea (71.7%) and poor peripheral perfusion. Initial assessments found that 51.7% of patients had a Capillary Refill Time (CRT) greater than 3 seconds, with only 8.3% maintaining a normal CRT. Longitudinal data at the 24-hour mark revealed a worsening clinical trajectory in the remaining 38 patients, as reflected by an increasing median SOFA score of 7 (0-15) and universal perfusion impairment (100% extended CRT). Despite the general physiological deterioration, median lactate levels were reasonably steady at 0.5 mmol/L (0.2–0.79). By the fifth day of observation, evaluations of the 27 surviving patients revealed symptoms of respiratory improvement, with 74.1% experiencing eupnea. However, haemodynamic stability remained uneven; while the median SOFA score dropped to 6 (0-12), 48.1% of the surviving cohort still had a CRT of >3 seconds. On day five, the lactate profile exhibited considerable variability, with a median of 0.55 mmol/L but a maximum of 4.80 mmol/L, indicating a major part of the remaining patients were still experiencing severe metabolic and circulatory problems.

Based on the findings of this study, One Hour Sepsis Bundle compliance was not significantly connected with 28-day death in sepsis patients. Compliance to the One Hour Sepsis Bundle was not substantially linked with SOFA scores either at admission, 24 hours, or day 5. Table 2 provides details on the comparative analysis outcomes. The lack of a significant relationship between bundle compliance and 28-day mortality (p=0.719) should be interpreted with caution, as the small number of compliant patients (n=18) and high overall mortality may have limited the statistical power to detect a meaningful difference, increasing the risk of a type II error.

After analysing the One-Hour Sepsis Bundle and its relationship with 28-day mortality, the study looked into the relationship between baseline clinical parameters and patient survival. In addition to medication compliance, physiological indicators and demographic information collected at the time of admission were analysed to find potential predictors of clinical outcomes. This expanded analysis, which includes variables such as nutritional condition, age, and initial organ dysfunction scores, tries to provide a more complete picture of the causes that contributed to the 81.7% mortality rate in this group

TABLE 2. BIVARIATE ANALYSIS OF ONE HOUR SEPSIS BUNDLE COMPLIANCE TO 28-DAY MORTALITY AND SOFA SCORES.

Characteristics	One Hour Sepsis Bundle Compliance			P value
	Total N (%)	Compliant	Not Compliant	
28-day Mortality*				
Survive	60 (100)	4 (22.2)	7 (16.7)	0.719
Deceased		14 (77.8)	35 (83.3)	
SOFA (Admission) **	60 (100)	6 (2 – 11)	6 (2 – 16)	0.715
SOFA (24 Hour) ***	38 (100)	7 ±1	7 ±1	0.672
ΔSOFA (24 Hour) ***	38 (100)	2 ±1	2 ±1	0.786
SOFA (5 days) ***	27 (100)	6 ±1	6 ±1	0.796
ΔSOFA (5 days) ***	27 (100)	-1 ±1	1 ±1	0.362

*Data is presented in n (%). analysis using Chi-square or Fisher's exact if it does not meet the Chi-square requirements.
**Data are presented with Median (IQR). analysis using the Mann-Whitney U test
***Data are presented as mean ± standard deviation. analysis using T-Test.

Alongside the baseline evaluation, the longitudinal data indicates that clinical trajectory is a significant predictor of survival. Analysis of the initial admission data revealed that Capillary Refill Time (CRT) and the GCS component of the SOFA score were strongly linked with the 28-day mortality rate ($p < 0.001$, $p = 0.027$, respectively). This suggests that early neurological state and peripheral perfusion are important indicators at the time of ICU entrance. The 24-hour evaluation highlighted the significance of dynamic physiological monitoring, as CRT examination, total SOFA score, ΔSOFA, body temperature, and lactate levels were significantly associated with 28-day mortality.

By the fifth day of care, CRT, total SOFA, ΔSOFA, and ΔLactate remained significant predictors of patient outcomes. Notably, specific organ dysfunction markers, particularly the GCS and renal components of the SOFA score, emerged as significant predictors of mortality on Day 5 ($p = 0.048$ and 0.010). These data indicate that persistent perfusion deficits and progressive multi-organ failure, rather than admission status alone, are strongly associated with the 81.7% mortality rate reported in this population. Table 3 provides details on the comparative analysis.

TABLE 3. BIVARIATE ANALYSIS OF CHARACTERISTICS AND BASELINE CLINICAL PARAMETERS TO 28-DAY MORTALITY

Characteristics	28-Day Mortality			P value
	Total N (%)	Survive	Deceased	
Gender*				
Male	31 (100)	5 (16.1)	26 (83.9)	0.745
Female	29 (100)	6 (20.7)	23 (79.3)	
Age**	60 (100)	49 (19 – 60)	48 (18 – 59)	0.358
Body Mass Index*				
Underweight	6 (100)	1 (16.7)	5 (83.3)	0.405
Normoweight	24 (100)	3 (12.5)	21 (87.5)	
Obese	30 (100)	7 (23.3)	23 (76.7)	
Admission*				
Surgical	7 (100)	1 (14.3)	6 (85.7)	>0.999
Medical	53 (100)	10 (18.9)	43 (81.1)	
Comorbidities*				
Present	42 (100)	8 (19.0)	34 (81.0)	>0.999
Not Present	18 (100)	3 (16.7)	15 (83.3)	

		Admission		
SOFA**	60 (100)	4 (2 – 8)	7 (2 – 16)	0.061
Temperature**	60 (100)	36.6 (36.2 – 36.8)	36.7 (36.0 – 40.2)	0.061
Lactate**	60 (100)	0.52 (0.31 – 0.72)	0.45 (0.20 – 0.78)	0.724
CRT**				
<2 seconds	5 (100)	5 (100)	0 (0.0)	**<0.001**
2-3 seconds	23 (100)	6 (26.1)	17 (73.9)	
>3 seconds	32 (100)	0 (0.0)	32 (100)	
		24 Hour		
SOFA***	38 (100)	5 (±2)	8 (±4)	**0.012**
ΔSOFA**	38 (100)	0 (-1 – 2)	2 (-3 – 11)	**0.012**
Temperature**	38 (100)	36.5 (36.2 – 36.8)	36.7 (36.2 – 38.1)	**0.035**
Lactate***	38 (100)	0.57 (±0.15)	0.47 (±0.15)	**0.012**
ΔLactate**	38 (100)	0.06 (-0.22 – 0.40)	0.04 (-0.51 – 0.55)	0.245
CRT**				
2-3 seconds	19 (100)	10 (52.6)	9 (47.4)	**0.003**
>3 seconds	19 (100)	1 (5.3)	18 (94.7)	
		5 Days		
SOFA***	27 (100)	3 (±3)	8 (±3)	**<0.001**
ΔSOFA**	27 (100)	-1.64 (±3)	2 (±3)	**0.003**
Temperature**	27 (100)	36.5 (36.3 – 36.8)	36.8 (36.2 – 37.3)	0.064
Lactate***	27 (100)	0.4 (0.21 – 0.78))	0.59 (0.22 – 4.8)	0.134
ΔLactate**	27 (100)	-0.19 (-0.37 – 0.41)	0.09 (-0.19 – 4.19)	**0.039**
CRT**				
<2 seconds	7 (100)	7 (100)	0 (0.0)	**<0.001**
2-3 seconds	7 (100)	4 (57.1)	3 (42.9)	
>3 seconds	13 (100)	0 (0.0)	13 (100)	

*Data is presented in n (%). analysis using Chi-square or Fisher's exact if it does not meet the Chi-square requirements.
**Data are presented with Median (IQR). analysis using the Mann-Whitney U test
***Data are presented as mean ± standard deviation. analysis using T-Test.

IV. DISCUSSION

Despite significant breakthroughs in its definition, pathophysiology, and therapeutic strategies over the last decade, sepsis is still the primary cause of death among critically sick patients in intensive care units. According to recent reports, the sepsis fatality rate remains high, particularly in patients who require advanced intensive care and have multiple organ dysfunction.[2, 5] Currently, sepsis is defined as life-threatening organ dysfunction caused by an abnormal immunological response to infection.[1-5] Because organ dysfunction is key to this framework's clinical evaluation, the severity and progression of organ failure throughout time have a substantial impact on patient outcomes.[2]

Patients in poor clinical condition dominated the study population; the mortality rate of 81.7% is significantly higher than many ICU sepsis studies (often in the range of 30-50%), as evidenced by the high mortality rates among sepsis patients in Bekasi Regency Hospital and Hermina Grand Wisata Hospital. This can still happen in middle-income areas with delayed referrals, limited resources, and a large case mix. These findings are consistent with ICU cohort studies completed over the last five years, which discovered that patients with sepsis who had multiple organ involvement were considerably more likely to die than those without progressive organ dysfunction.[3, 11, 14]

This study's 49 patients died primarily from concomitant cardiovascular problems (hypertension and CHF) and metabolic disorders, such as Type II Diabetes Mellitus.

According to recent ICU research, characteristics such as age, gender, and nutritional state frequently have a lower impact during the critical phase of sepsis than the severity of persistent organ failure and decreased perfusion.[4, 12, 15]

The Surviving Sepsis Campaign created the One Hour Sepsis Bundle to demonstrate the need of early detection and resuscitation for sepsis patients. This bundle includes lactate assessment, blood culture collection prior to antibiotic administration, early broad-spectrum antibiotic delivery, fluid resuscitation, and the use of vasopressors as needed.[5]

Adherence to the One Hour Sepsis Bundle differed between the ICUs of Hermina Grand Wisata Hospital and Bekasi Regency Hospital, and bivariate analysis found no significant relationship between One Hour Sepsis Bundle adherence and 28-day mortality or SOFA scores in sepsis patients. These findings do not decrease the significance of executing the One Hour Sepsis Bundle for sepsis patients. According to studies conducted at Haji Adam Malik Regional Hospital, using the One Hour Sepsis Bundle in sepsis patients resulted in a significant reduction in their SOFA scores at 24 and 72 hours.[13] Another study found that complete adoption of the One Hour Sepsis Bundle significantly reduced 90-day mortality in sepsis patients compared to partial implementation.[16]

In both hospitals, noncompliance with the One Hour Sepsis Bundle was mostly due to the blood culture component. This occurred due to a lack of reagents for continuous blood culture testing and a breakdown of the blood culture equipment near the end of the trial. Other bundle components were mostly adopted by Bekasi Regency Hospital and Hermina Grand Wisata Hospital. These findings demonstrate that adherence to the One Hour Sepsis Bundle is driven not just by clinical practice but also by system-level factors, emphasising the necessity of seeing the bundle in the larger context of comprehensive sepsis therapy. According to the findings of this study, the One Hour Sepsis Bundle should be viewed as part of a comprehensive sepsis management approach. The bundle's effectiveness as a stand-alone intervention is evaluated in conjunction with continuous monitoring of organ failure and tissue perfusion during therapy.[5, 14]

The interpretation of clinical measures and severity scores that represent peripheral perfusion, organ failure, and the patient's metabolic reaction during treatment is an important focus of this discussion. This technique is consistent with recent worldwide guidelines emphasising the need of dynamic and multimodal examination for determining the prognosis of sepsis patients in the critical care unit.[5, 17] The SOFA score is frequently used to quantify the degree of organ dysfunction in sepsis patients, and it has become an important part of the current sepsis criteria. According to the Sepsis-3 framework, a high SOFA score (>2) is beneficial for identifying and categorising sepsis patients since it signals substantial organ dysfunction and is associated with a higher risk of death.[2]

In this study, there was a link between the GCS components of the SOFA score on admission at both institutions and 28-day mortality, but not with the SOFA score. These findings imply that the initial SOFA score does not adequately reflect the patient's clinical outcome, especially in the early stages of treatment when the patient's response is unstable and resuscitation and causative therapy are in progress. 2, 5. In contrast, serially assessed SOFA scores at 24 hours and 5 days of hospitalisation had a higher and more significant connection with 28-day mortality. Because these ratings represent how the patient responds to treatment and how organ failure advances, it appears that the dynamics of organ dysfunction during hospitalisation have a

higher predictive value than a single examination at admission.[8, 14, 14]

In this study, an increase in the SOFA score within the first 24 hours was strongly related with death. This was caused by persistent tissue hypoperfusion, as demonstrated by increased capillary refill time (CRT) and lactate levels. Hypoperfusion causes cellular hypoxia and mitochondrial dysfunction, accelerating the progression of multiple organ failure. As a result, changes in the SOFA score at 24 hours indicate both the severity of organ dysfunction and the failure to restore adequate systemic perfusion. These results are consistent with an ICU study in Pakistan that showed that both the continuous SOFA score and changes in SOFA score over time are significant predictors in critically ill patients. During hospitalization, patients with consistently high or increasing SOFA scores were more likely to die than those with decreasing SOFA scores. [17]

The change in SOFA score (ΔSOFA) provides greater insight into illness development than the absolute number. Observational studies have consistently linked progressive organ failure to poor outcomes in sepsis patients. This is evident in the rising trend of ΔSOFA in patients who died. This study discovered that a change in the SOFA score of less than 25% at 24 hours and day 5 was associated with a high probability of 28-day mortality. [18]

The 28-day mortality rate (28-day mortality) is a clinical indicator that measures the number of patient deaths within 28 days of a specific event, such as intensive care unit (ICU) admission, sepsis diagnosis, or initiation of critical illness treatment. This rate is used in the ICU as a benchmark for the speed and effectiveness of medical interventions in saving critically ill patients and evaluating their survival. In this study, prolonged CRT, a SOFA score ≥ 4 at 24 hours, a SOFA score ≥ 6 at day 5, ΔSOFA, and Δ lactate levels were able to predict 28-day mortality in sepsis patients treated in the ICU of a Type B hospital in Bekasi Regency. In this study, CRT consistently and significantly correlated with 28-day mortality, particularly during treatment follow-up assessments. Demonstrating persistent peripheral perfusion deficits, patients with longer CRT have a poorer prognosis than those with shorter CRT. 27 The state of tissue microcirculation is indirectly reflected by CRT, a simple clinical metric used to evaluate peripheral perfusion. Despite improvements in macroscopic hemodynamic indicators, microcirculatory abnormalities are known to significantly contribute to the development of organ dysfunction in sepsis patients. [1, 15]

Resolving peripheral perfusion impairment may be crucial for clinical outcomes in sepsis patients. At this point, a prolonged CRT may indicate a failure of microcirculatory improvement, increasing the likelihood of death and subsequent organ failure. [5, 15] Recent studies have shown that CRT is a useful bedside indicator for peripheral perfusion monitoring because it is easy to perform, requires no specialized equipment, and can be repeated repeatedly. CRT has good prognostic value and can complement traditional hemodynamic indicators in the assessment of sepsis patients, according to several studies conducted over the past five years. [15, 16]

The combination of CRT with the SOFA score in this study provides a more complete picture of patient status, including features of tissue perfusion and systemic organ dysfunction. This strategy is consistent with the concept of multimodal evaluation, which is promoted in contemporary sepsis care. When combined with severity scores, basic clinical measurements can yield significant predictive information. [5, 15] The therapeutic significance of CRT as a meaningful prognostic indicator that can be used across various care settings, including in resource-

limited facilities, is reinforced by the consistent correlation between CRT and mortality in two hospitals with different care settings. [15]

Blood lactate levels are associated with tissue hypoperfusion and disease severity, and lactate is often used as a metabolic biomarker in sepsis patients. Lactate measurement is recommended by international standards for the initial assessment and therapeutic response in sepsis.5 However, current knowledge of the pathophysiology of sepsis indicates that tissue hypoxia is not always the sole cause of lactate elevation. The relationship between lactate levels and mortality is more complex and not always linear, as lactate can also arise as a result of changes in aerobic metabolism, mitochondrial dysfunction, and activation of adrenergic responses.[19]

The analysis of this study indicates that absolute lactate levels and changes in lactate levels within 5 days are associated with 28-day mortality. Clinically, absolute lactate levels in the first 24 hours reflect the severity of ongoing tissue hypoxia.34 This is in line with the theory that resuscitation success is assessed not only by macroscopic vital signs but also by the body's ability to clear lactate. Patients who fail to reduce lactate levels or even experience increased lactate accumulation within the first 24 hours indicate a failure of biological compensation and a poor response to therapy.[20, 21]

In this investigation, GCS scores were found to be significantly linked with death in sepsis patients. Pathophysiologically, a low GCS is a strong sign of Sepsis-Associated Encephalopathy (SAE). GCS is an important part of the SOFA score because neurological impairment can appear early as an indication of multiple organ failure. The study's findings demonstrate that a low GCS score or one that does not improve by day five indicates the severity of cerebral hypoperfusion suffered by sepsis patients, with persistent diminished consciousness indicating increasing neurological impairment or untreated metabolic encephalopathy. [22]

These results align with previous research, which found that central nervous system dysfunction was the strongest predictor of mortality, with GCS scores dominating the association between SOFA scores on admission and 28-day mortality. Multivariate analysis of other studies also showed that a low GCS score is associated with increased mortality and remains the most important factor in both male and female subgroups. [22 – 24]

Kidney failure is another common and potentially fatal indication of sepsis. In addition to hypoperfusion, endothelial dysfunction, inflammation, and decreased renal microcirculation can all contribute to acute kidney damage during sepsis. Kidney involvement raises the risk of progressive organ failure and mortality by disrupting internal balance and extending the systemic inflammatory response. Regardless of the source of infection, current research has revealed that chronic renal impairment during sepsis is a strong predictor of poor prognosis.[25]

In this study, renal function components played a crucial role in predicting patient mortality, particularly on the fifth day of observation. This finding contrasts with other studies, where renal dysfunction was often the lowest predictor of mortality on the first and seventh days compared to other components. This low predictive power is likely due to renal replacement therapy, which compensates for filtration failure. Nevertheless, early-detected renal function failure in this study remains an important indicator of patient mortality.[25]

Cardiovascular dysfunction, assessed through Mean Arterial Pressure and the need for vasopressors and inotropic agents, is an

indicator used to classify septic patients in the intensive care unit. The results of this study indicate that neither the initial cardiovascular component nor the evaluation had a significant association with mortality. This aligns with previous studies, which found that the cardiovascular component of the SOFA score is no longer fully effective. Studies have shown that measuring MAP alone is insufficient to reflect true cardiovascular dysfunction. The allocation of SOFA score points to vasoactive agents is also considered increasingly imprecise because the optimal MAP target has not yet been determined. To reflect comprehensive cardiovascular dysfunction, adding points based on cardiac biomarker levels could improve discrimination in this component. However, overall, cardiovascular failure remains a strong predictor of mortality in sepsis patients. [23, 26]

Respiratory dysfunction, assessed by the PaO2/FiO2 ratio, was not significantly associated with mortality in this study. This contrasts with studies that found that the PaO2/FiO2 ratio was inversely associated with hospital mortality. These findings reinforce the clinical evidence that mortality in sepsis patients tends to increase as the degree of hypoxemia worsens. 42 Persistent respiratory failure into the later stages of treatment is a signal that the body is no longer able to compensate for the systemic impact of severe infection. [28]

The results of this study indicate that 24-hour temperature is associated with mortality, although with insignificant predictive power. This confirms that the inability to maintain normothermia, a rare condition in sepsis, is an indicator of critical homeostatic failure. Persistent temperature instability into the later stages of treatment reflects metabolic fatigue and severe central thermoregulatory disturbances. This study confirms a nonlinear relationship and a threshold effect between temperature and mortality. Hypothermia (≤36.5°C) at initial diagnosis nearly doubles the risk of death, with the risk increasing with each 1°C decrease below this threshold. In contrast, fever was not associated with an increased risk of mortality.[29 – 31]

Overall, this series of findings emphasizes that predicting mortality in sepsis patients cannot rely solely on a single variable upon arrival at the hospital. Sepsis is a highly dynamic condition, so serial and multimodal evaluations are key to more accurately assessing the patient's disease course in the intensive care unit. The high accuracy of peripheral perfusion parameters such as CRT, neurological stability using the GCS, close monitoring of temperature thresholds and lactate levels, and the SOFA score provide a more in-depth perspective on the patient's compensatory capacity during sepsis.

The integration of these variables demonstrates that the body's failure to restore homeostasis by the fifth day of treatment is a critical signal of irreversible cellular damage and refractory shock. These study findings encourage clinicians to shift from solely targeting macro vital signs to also monitoring micro indicators that are more sensitive to patient physiological changes. This study does not yet rule out the effect of the moderate bundle on mortality (high type II risk). This will ultimately help clinicians optimize the implementation of the one-hour sepsis bundle and make more precise therapeutic decisions to reduce sepsis mortality in the future.

A weakness of this study includes high mortality rates in the 24-hour and 5-day evaluations. Upon admission to the ICU, a sample of 60 patients remained within 24 hours, and 27 remained by the fifth day. Most had comorbid cardiovascular disorders (hypertension and CHF) and metabolic disorders, such as Type II Diabetes Mellitus. This resulted in an uneven distribution of

events across the sample group, resulting in less reliable statistical estimates.

A limitation of this study is the inclusion of two hospitals in Bekasi Regency, which are expected to reflect both government and private type B hospitals.

V. CONCLUSION

In conclusion, this study of sepsis patients at Type B hospitals in Bekasi Regency found an 81.7% 28-day fatality rate. While compliance with the One-Hour Sepsis Bundle had no significant effect on 28-day survival, multiple longitudinal clinical indicators emerged as important predictors of death. There were significant relationships between 28-day mortality and 24-hour and 5-day SOFA scores, ΔSOFA values, body temperature on Day 5, and absolute and Δlactate levels on Day 5. Furthermore, particular organ dysfunction measures, such as the GCS component and renal function in the SOFA score, were significantly associated with patient outcomes. 24-hour CRT was significantly associated with mortality in sepsis patients, with higher values indicating an increased risk of death; however, the wide confidence interval suggests variability in the estimate and warrants cautious interpretation.

REFERENCES

[1]. Feather A, Randall D, Waterhouse M. Kumar & Clark's Clinical Medicine Tenth Edition. 10th ed. Elsevier; 2021. 151–168 p.
[2]. Singer M, Deutschman CS, Seymour C, Shankar-Hari M, Annane D, Bauer M, et al. The third international consensus definitions for sepsis and septic shock (sepsis-3). JAMA. 2016 Aug 1;315(8):801–10.
[3]. Dharmawan A, Istia MJ, Tan HT, Suparto S, Anastasia MC, Layanto N. The Outcome of Patients with Sepsis at Tarakan Hospital Central Jakarta in 2018. Muhammadiyah Medical Journal. 2021 Oct 28;2(2):49–54.
[4]. Gyawali B, Ramakrishna K, Dhamoon AS. Sepsis: The evolution in definition, pathophysiology, and management. Vol. 7, SAGE Open Medicine. New York: SAGE Publications Ltd; 2019. p. 1–13.
[5]. Evans L, Rhodes A, Alhazzani W, Antonelli M, Coopersmith CM, French C, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021. Intensive Care Med. 2021 Nov;47(11):1181–247.
[6]. Helena Hoeboer S. Biomarkers of infection and its complications in the critically ill. [Netherlands]: Erasmus University Rotterdam; 2015.
[7]. Gül F, Arslantaş MK, Cinel İ, Kumar A. Changing definitions of sepsis. Turk Anesteziyoloji ve Reanimasyon Dernegi Dergisi. 2017 Mar 14; 45:129–38.
[8]. Teniya Ariq Fauziyah H, Pujo Semedi B, Lestari P, et al. Analisis Sistem Skoring APACHE II dan SOFA Terhadap Outcome di Intensive Care Unit RSUD Dr. Soetomo Surabaya. Jurnal Anestesiologi Indonesia. 2021 Jul 1;13(2):99–113.
[9]. Sejati A, Pitoyo CW, Abdullah M. Faktor-Faktor Prognostik Mortalitas Pasien Sepsis Berat Fase Lanjut di Unit Perawatan Intensif Rumah Sakit Cipto Mangunkusumo, Jakarta. Indonesian Journal of CHEST Critical and Emergency Medicine. 2015 Mar;2(1):20–30.
[10]. Wicaksono A, Adisasmita A. Frekuensi dan mortalitas pasien sepsis dan syok septik di ICU rumah sakit swasta tipe B di Tangerang Selatan. J Epidemiol Kesehat Indones. 2022;6(1):4. doi.org/10.7454/epidkes.v6i1.6031
[11]. Melaku E, Urgie B, Dessie F, Seid A, Abebe Z, Tefera A. Determinants of Mortality of Patients Admitted to the Intensive Care Unit at Debre Berhan Comprehensive Specialized Hospital: A Retrospective Cohort Study. Patient Related Outcome Measures. 2024 Feb 22; 15:61–70.
[12]. Demass TB, Guadie AG, Mengistu TB, et al. The magnitude of mortality and its predictors among adult patients admitted to the Intensive care unit in Amhara Regional State, Northwest Ethiopia. Scientific Reports. 2023 Jul 25;13(12010):1–7.
[13]. Muda Dalimunthe SS, Lubis A, Prasetya RJ. The Effect of One Hour Bundle Sepsis Management of Sepsis Patients on Lactic Acid and Sofa Scores. International Journal of Scientific and Research Publications (IJSRP). 2020 Mar 24;10(3): p99107.
[14]. Seymour CW, Gesten F, Prescott HC, et al. Time to Treatment and Mortality during Mandated Emergency Care for Sepsis. N Engl J Med. 2017; 376:2235–2244.
[15]. Hernandez G, Ospina-Tascón GA, Damiani LP, et al. Effect of a Resuscitation Strategy Targeting Peripheral Perfusion Status vs Serum Lactate Levels on 28-Day Mortality Among Patients with Septic Shock: The

ANDROMEDA-SHOCK Randomized Clinical Trial. Lancet. 2019; 394:139–147.

[16]. Charoentanyarak S, Chopetgool T, Boonsawat W, Sawanyawisuth K. Completion of the 1-Hour Sepsis Bundle on 90-Day Mortality in Adult Patients with Sepsis. J Am Coll Emerg Physicians Open. 2025;7(1):100296. Published 2025 Dec 5. doi:10.1016/j.acepjo. 2025.100296

[17]. Vincent JL, De Backer D. Circulatory shock. N Engl J Med. 2013; 369:1726–1734.

[18]. Shariq T, Rahman AS, Jamal Q, Siddiqui M, Khan U, Taufiq F. The SOFA score as a mortality predictor in ICU patients: insights from a tertiary care hospital in Pakistan. BMC Res Notes. 2025;19(1):12. Published 2025 Dec 6. doi:10.1186/s13104-025-07596-3

[19]. Karakike E, Kyriazopoulou E, Tsangaris I, Routsi C, Vincent JL, Giamarellos-Bourboulis EJ. The early change of SOFA score as a prognostic marker of 28-day sepsis mortality: analysis through a derivation and a validation cohort. Crit Care. 2019;23(1):387. Published 2019 Nov 29. doi:10.1186/s13054-019-2665-5

[20]. Bakker J, Nijsten MW, Jansen TC. Clinical use of lactate monitoring in critically ill patients. Ann Intensive Care. 2013; 3:12.

[21]. Kang HE, Park DW. Lactate as a Biomarker for Sepsis Prognosis? Infect Chemother. 2016;48(3):252-253. doi:10.3947/ic.2016.48.3.252

[22]. Lam BD, Struja T, Li Y, et al. Analyzing how the components of the SOFA score change over time in their contribution to mortality. Crit Care Sci. 2024;36: e20240030en. Published 2024 Nov 22. doi:10.62675/2965-2774.20240030-en

[23]. 23. Jentzer JC, Wiley B, Bennett C, et al. Early noncardiovascular organ failure and mortality in the cardiac intensive care unit. Clin Cardiol. 2020;43(5):516-523. doi:10.1002/clc.23339

[24]. Knox DB, Lanspa MJ, Pratt CM, Kuttler KG, Jones JP, Brown SM. Glasgow Coma Scale score dominates the association between admission Sequential Organ Failure Assessment score and 30-day mortality in a mixed intensive care unit population. J Crit Care. 2014;29(5):780-785. doi:10.1016/j.jcrc.2014.05.009

[25]. Fuchs PA, Czech IJ, Krzych ŁJ. Mortality Prediction Using SOFA Score in Critically Ill Surgical and Non-Surgical Patients: Which Parameter Is the Most Valuable? Medicina (Kaunas). 2020;56(6):273. Published 2020 Jun 4. doi:10.3390/medicina56060273

[26]. Peerapornratana S, Manrique-Caballero CL, Gómez H, Kellum JA. Acute Kidney Injury from Sepsis: Current Concepts, Epidemiology, Pathophysiology, Prevention, and Treatment. Kidney International. 2019; 96:1083–1099.

[27]. Lörstad S, Wang Y, Tehrani S, et al. Development of an Extended Cardiovascular SOFA Score Component Reflecting Cardiac Dysfunction with Improved Survival Prediction in Sepsis: An Exploratory Analysis in the Sepsis and Elevated Troponin (SET) Study. J Intensive Care Med. 2025;40(3):320-330. doi:10.1177/08850666241282294

[28]. Anggraini, D., Hasni, D., & Amelia, R. (2022). Pathogenesis of sepsis. Scientific Journal, 1(4), 334-341.

[29]. Dao CX, Dang TQ, Luong CQ, et al. Predictive validity of the sequential organ failure assessment score for mortality in patients with acute respiratory distress syndrome in Vietnam. Sci Rep. 2025;15(1):7406. Published 2025 Mar 3. doi:10.1038/s41598-025-92199-y

[30]. Kushimoto S, Gando S, Saitoh D, et al. The impact of body temperature abnormalities on the disease severity and outcome in patients with severe sepsis: an analysis from a multicenter, prospective survey of severe sepsis. Crit Care. 2013;17(6): R271. Published 2013 Nov 13. doi:10.1186/cc13106

[31]. Thomas-Rüddel DO, Hoffmann P, Schwarzkopf D, et al. Fever and hypothermia represent two populations of sepsis patients and are associated with outside temperature. Crit Care. 2021;25(1):368. Published 2021 Oct 21. doi:10.1186/s13054-021-03776-2

[32]. Yang W, Zhou D, Peng H, Jiang H, Chen W. The association between body temperature and 28-day mortality in sepsis patients: A retrospective observational study. Med Intensiva (Engl Ed). 2025;49(4):205-215. doi: 10.1016/j.medine.2024.08.004