

# *A COMPARISON OF ABBREVIATED BURN SEVERITY INDEX (ABSI) SCORE WITH R-BAUX SCORE AS A PREDICTOR OF MORTALITY IN BURN PATIENTS*

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## ABSTRACT

**Introduction:** Several studies regarding the mortality prediction model in burn patients have been carried out in several cities and countries. However, none have ever happened in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. This study aims to analyze the R-Baux Score and Abbreviated Burn Severity Index (ABSI) Score as a mortality prediction model in burn patients, which are relevant and useable in services at Dr. Soetomo General Academic Hospital.

**Methods:** This study used quantitative research with a cross-sectional design and retrospective design utilizing secondary data.

**Results:** It was found that 263 patients met the inclusion criteria; with 73 patients died, 60.27% of whom were male, 50% with inhalation trauma, 19.18% were in the age range of 56-65 years old, 24.66% had a burn area of 61-70%, and 35.62% with a full- thickness burn. The results showed that the sensitivity value from the ABSI Score ( $p < 0.001$ ) was 82.19%, with a specificity of 82.11%, a positive predictive value of 63.83%, and a negative predictive value of 92.31%. The R-Baux Score ( $p < 0.001$ ) showed that the sensitivity value obtained was 80.82%, with a specificity of 80.00%, a positive predictive value of 60.83%, and a negative predictive value of 91.57%.

**Conclusion:** There was no significant difference between the R-Baux Score and the ABSI Score as the predictor of mortality in burn ( $p > 0.05$ ). Therefore, both the R-Baux Score and the ABSI Score can be used as prediction models of death in burn patients at Dr. Soetomo General Academic Hospital.

## Highlights:

1. The R-Baux Score and ABSI Score can be used as model predictors of death in burn patients at Dr. Soetomo General Academic Hospital.
2. There was no significant difference between the R-Baux Score and the ABSI Score as the predictor of mortality in burn patients.

## INTRODUCTION

In the last few decades, the survival rate of burn patients has increased significantly due to scientific advances in burn treatment,

but the mortality rate from burns is still high<sup>1</sup>. The World Health Organization (WHO) noted that burns remain a global health problem. There are 180,000 deaths

yearly caused by burns, and more occur in countries with low-medium economic groups, especially in African and Southeast Asian countries<sup>2</sup>.

In 2015-2018, out of 313 burn patients treated at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, there were 24% incidences of death and significant positive relationships between the extent of burns, inhalation trauma, sepsis, diabetes mellitus (DM), acute kidney injury (AKI), and the age of burn patients to burn death rates<sup>3,17</sup>. Based on the cause, burns are divided into several types: fire, hot water, chemicals, electricity, lightning, radiation, sunburn, hot furnaces/hot air, bomb explosions, and very low temperatures (frostbite)<sup>4,5</sup>. Based on the data collected from the Burn Unit of Dr. Soetomo Hospital in 2017-2020, the most common cause of burns in the hospital sequentially were fire (56%), electricity (19%), scald/hot water (15%), cooking oil (20%), chemicals (3%), followed by thermal contact (2%)<sup>6</sup>.

Many scoring systems are used to predict the occurrence of death in burn patients and have been used since the mid-20<sup>th</sup> century, including the Acute Physiology and Chronic Health Evaluation (APACHE II), Abbreviated Burn Severity Index (ABSI), Belgian Outcome in Burn Injury (BOBI), Ryan model, revised Baux Score (R-Baux Score), and FLAMES model. Of these six scoring systems, the most frequently used is the R-Baux Index, followed by the ABSI and the Clark mortality prediction model<sup>7</sup>. Besides being able to assess the probability of death of burn patients, accurate and reliable “mortality predictors” can also be used as a standard tool to measure the performance of burn services<sup>1</sup>.

Often as doctors who work in primary or referral health facilities, we are faced with questions, such as whether the condition of a patient with burns is severe enough and can

cause death or whether they must be referred to a certain health facility. Several studies regarding the mortality prediction model in burn patients have been carried out in several cities and countries, but not in Dr. Soetomo Hospital. This study was conducted to see and compare two mortality prediction models in burn patients that are most often used according to Dahal, namely the R-Baux Score and the ABSI Score, which are both relevant and can be used in services at Dr. Soetomo Hospital.

### METHODS

This research was a quantitative cross-sectional analysis using a retrospective design from secondary data and was conducted at Dr. Soetomo Hospital in February-May 2022. The population of this study was data on burn patients treated at Dr. Soetomo Hospital, with the research sample being data on all burn patients treated at Dr. Soetomo Hospital for the period 2018 to 2020. Patient data were in the form of secondary data obtained in medical records according to RM 03-12. This study used a total sampling system. All data on burn patients treated at Dr. Soetomo Hospital for 2018-2020 were included in the study sample size. The data collected were included in the R-Baux Score and ABSI core formula (Table 1).

Table 1. Abbreviated Burn Scoring Index (ABSI) Score

Parameter	Finding	Points	Parameter	Finding	Points
Sex	Female	1	TBSA (%)	1-10	1
	Male	0		11-20	2
Age (years)	0-20	1	21-30	3	
	21-40	2	31-40	4	
	41-60	3	41-50	5	
	61-80	4	51-60	6	
	81-100	5	61-70	7	
Inhalation injury	Yes		71-80	8	
	No		81-90	9	
Full Thickness burn	Yes		91-100	10	
	No				



**Revised Baux Score (R-Baux Score)**

R-Baux Score=TBSA+age+(17xR), in which TBSA is total burn surface area (burn area). R=1 if there is an inhalation injury, while R=0 if there is no inhalation injury. The independent (free) variables in this study were the ABSI Score and the R-Baux Score. The dependent variable was the incidence of death in burn patients at the Burn Center of Dr. Soetomo Hospital from January 1, 2018 to December 31, 2020. Each independent variable was collected based on the cut-off value. The data were analyzed using Chi-Square Test and McNemar Test with SPSS version 26.0. All data were presented in the form of pictures, tables, and graphs. This research has received an approval letter from the Health Research Ethics Committee of Dr. Soetomo Hospital Ref. No.: 0789/LOE/301.4.2/II/2022, dated February 11, 2022.

**RESULTS**

The medical record data of the burn patients treated by the Burn Unit of the Department of Reconstructive Plastic and Aesthetic Surgery, Dr. Soetomo Hospital in the period January 2018-December 2020 contained 263 patients who were suitable with the inclusion criteria of this study, with a distribution of 179 (68.1%) male patients and 84 (31.9%) female patients (Figure 1).

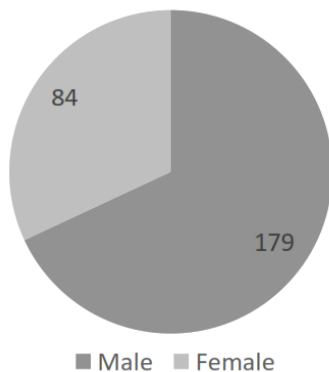


Figure 1. Diagram of the sex distribution of burn patients treated at Dr. Soetomo Hospital for the 2018-2020 period

A total of 73 patients (27.8%) were reported to have died from burns, with 44 patients (60.27%) of whom were male (Figure 2). The most significant number of patients who died were in the age range of 56-65 years, with 14 people (Figure 3).

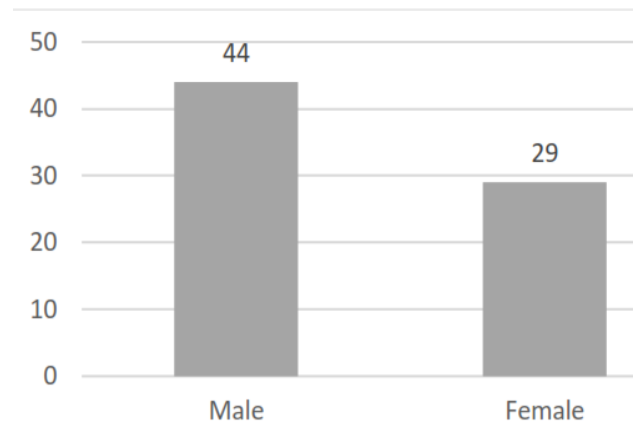


Table 2. Diagram of the sex distribution of burn patients who died and were treated at Dr. Soetomo Hospital for the 2018-2020 period

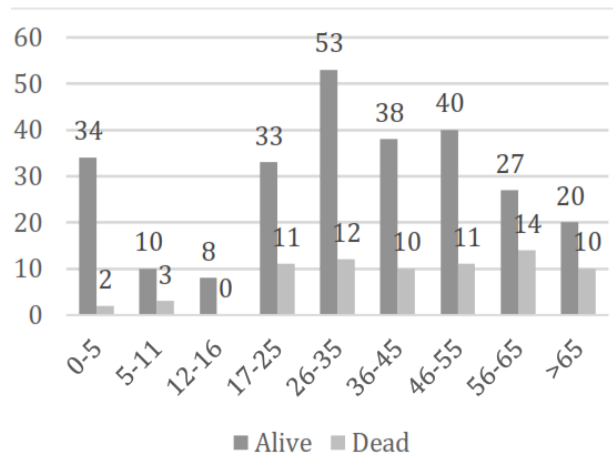


Figure 3. Age distribution diagram of burn patients treated at Dr. Soetomo Hospital for the 2018-2020 period

Of the patients who died, 18 suffered a 61-70% burn area, and 2 suffered a 91-100% burn area (Figure 4). One patient with a 93% burn area was in the exclusion criteria because they insisted on being discharged. Twenty-six (37.14%) patients with full-thickness burns died (Figure 5).

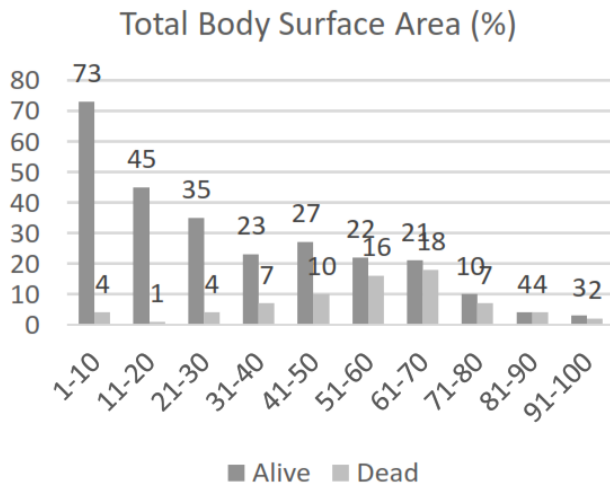


Figure 4. Diagram of the distribution of total burn surface area treated at Dr. Soetomo Hospital for the 2018-2020 period

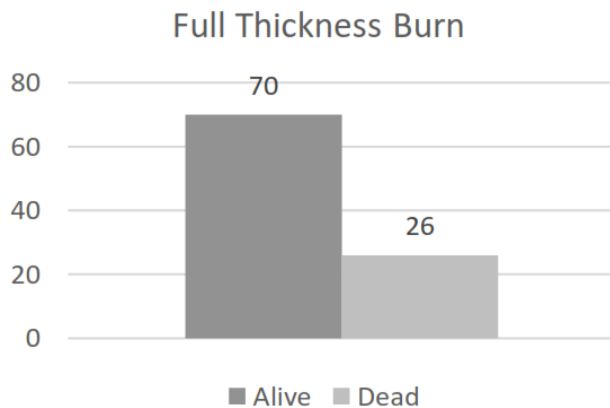
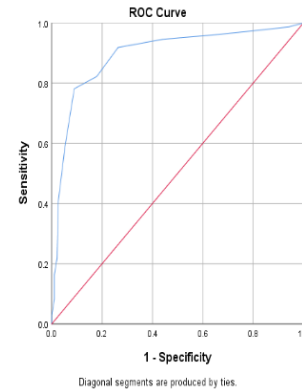


Figure 5. Distribution diagram of burn patients with full-thickness burns treated at Dr. Soetomo Hospital for the 2018-2020 period

Figures 6 and 7 show the cut-off value based on mortality was  $\geq 7.50$  for the ABSI

Score, while it was  $\geq 84.8$  for the R-Baux Score.



### CUT OFF ABSI

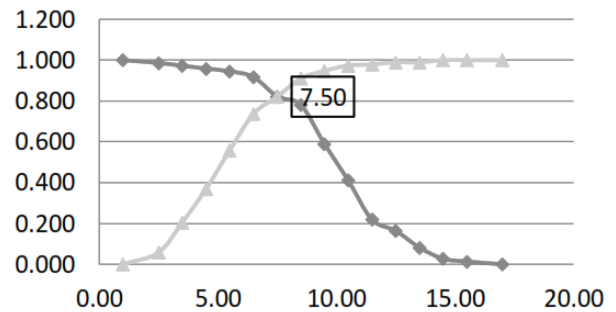
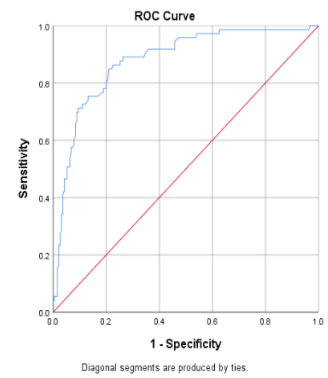


Figure 6. ROC Curve and cut-off ABSI Score for burn patients treated at Dr. Soetomo Hospital for the 2018-2020 period, the blue line shows the sensitivity value, while the gray line shows the specificity value



### CUT OFF R-BAUX

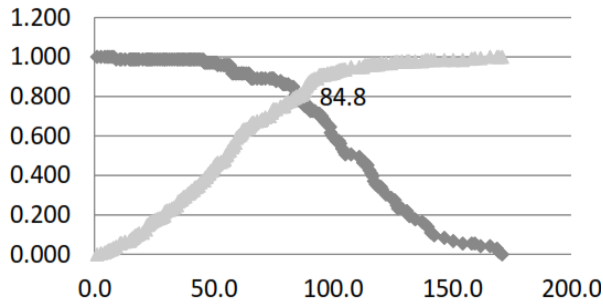


Figure 7. ROC Curve and cut-off R-Baux Score for burn patients treated at Dr. Soetomo Hospital for the 2018-2020 period, the dark gray line shows the sensitivity value, while the light gray line shows the specificity value.

The collected data were included in the ABSI Score and R-Baux Score calculation formula. The assessment using Mann-Whitney Test showed that the ABSI Score ( $p < 0.001$ ) (Table 2), as well as the R-Baux Score ( $p < 0.001$ ) (Table 3) of the patients who died were more remarkable than those who survived.

Table 2. Distribution of mortality in burn patients treated at Dr. Soetomo Hospital for the 2018-2020 period using the ABSI Score

Mortality	n	Median (min-max)	p-value
No	190	5 (2-14)	<0.001
Yes	73	10 (2-16)	

Table 3. Distribution of mortality in burn patients treated at Dr. Soetomo Hospital for the 2018-2020 period using the R-Baux Score

Mortality	n	Median (min-max)	p-value
No	190	57 (2-163)	<0.001
Yes	73	110 (8-170)	

The sensitivity value obtained for the ABSI score was 82.19%, with 82.11% specificity, 63.83% positive predictive value, and 92.31% negative predictive value. The ABSI Score was significant for assessing mortality in burn patients ( $p < 0.001$ ) where p-value was analyzed using the Chi-square Test (Table 4).

Table 4. The incidence of mortality in burn patients using the ABSI Score

Mortality	ABSI Score		Total	p-value
	<7.5	≥7.5		
Dead	13	60	73	0.000
Alive	156	34	190	
<b>Total</b>	<b>169</b>	<b>94</b>	<b>263</b>	

Table 5 shows that the R-Baux Score was significant in assessing mortality in burn patients ( $p < 0.001$ ), where p-value was analyzed using the Chi-square Test with a sensitivity of 80.82%, a specificity of 80.00%, a positive predictive value of 60.83%, and a negative predictive value of 91.57%.

Table 5. The incidence of mortality in burn patients using the R-Baux Score

Mortality	R-Baux Score		Total	p-value
	<84.8	≥84.8		
Dead	14	59	73	0.000
Alive	152	38	190	
<b>Total</b>	<b>166</b>	<b>97</b>	<b>263</b>	

The two scoring systems were then compared (Table 6), and the results showed that there was no significant difference between the R-Baux Score and the ABSI score ( $p > 0.05$ ) in predicting death in burn patients treated at Dr. Soetomo Hospital for the 2018-2020 period where p-value was analyzed using the McNemar Test .



Table 6. Comparison of mortality in burn patients using the R-Baux Score and ABSI Score

R-Baux Score	ABSI Score		Total	p-value
	<7.5	≥7.5		
<84.8	155	11	166	0.690
≥84.8	14	83	97	
<b>Total</b>	<b>169</b>	<b>94</b>	<b>263</b>	

### DISCUSSION

Among the 73 incidents of death at the Dr. Soetomo Hospital for the period January 2018 to December 2020, 60.27% were male. This means that there were more male burn patients who died than women. This might be due to the influence of the hormone estrogen, so the immune system of women is generally higher than that of men. The hormone estrogen in women can reduce the hypothalamic IL-1 response, thereby weakening systemic inflammation. It also plays a role in reducing neuronal degeneration, increasing cognitive function, and improving myocardial and blood vessel function via upregulation of heat shock protein (HSP) expression, weakening the inflammatory response in lungs, reducing apoptosis and release of renal inflammatory cytokines, and increasing endothelial cell survival of the kidney<sup>8</sup>. The effect of the influence of hormonal reactions to burn patients was also enforced in a study conducted by N.N Lam et al. in 2016-2018, where the results, when compared to men, showed that women have a lower level of trauma severity, thus require fewer surgeries and shorter hospital stay<sup>9</sup>.

Inhalation trauma, also known as airway trauma, can increase mortality in all cases of burns by up to thirty percent and increases the risk of developing pneumonia. Absorption of combustion products can lead to serious local or systemic toxic effects<sup>10</sup>.

Research conducted by El-Helbawy and Ghareeb on 130 burn patients at the Menoufiya Burn Center, Egypt, in 2008-2010 concluded that the presence of inhalation trauma, the high area of burns, and the old age of a person would increase the risk of death ( $p < 0.01$ ), with a percentage of 41.5% of deaths in burn patients related to inhalation trauma. Whereas in a study of 710 burn patients at the Spanish Burn Center, the mortality rate in burn patients with inhalation trauma was 66%. A total of 83.1% of burn patients with inhalation trauma died in a Turkish study from 1986-1995<sup>11</sup>.

The prognosis for burns is generally poor in both the very young and the elderly. In old age, degenerative processes can reduce acceptability, compensatory power, and the body's resistance to trauma<sup>5</sup>. As we get older, the thickness of the skin also atrophies, so it impacts the immune cell components of the skin, such as fibroblasts, mast cells, macrophages, and antigen-presenting cells, which leads to delays in wound healing. Aging reduces dermal lymphatic drainage and inhibits wound contraction<sup>12</sup>.

From the study's results, 18 people died with a burn area of 61-70%. This is consistent with the theory that the larger the body's surface area that is traumatized, the more severe the trauma and the worse the prognosis. The higher the burn area, the higher the risk of exposure to the wound, which causes infection, sepsis, and organ failure, ultimately leading to death. The incidence of infection increases in patients with a burn area of more than 40% in adults and 60% in pediatrics. Extensive burns can lead to hypovolemic conditions due to fluid deficit and coagulopathy<sup>13</sup>.

The deeper the damaged tissue, the more severe the burn condition and the poorer the prognosis. The healing process



takes longer and causes a higher degree of disability. Risa et al. in their research stated that healing in grade IIA burns could occur spontaneously within 10- 14 days, while recovery in grade IIB burns takes more than one month. This correlates with the hospitalization length and that most burn patients are not treated intensively. The longer the patient is hospitalized, the greater the risk of exposure to nosocomial infections, which can lead to sepsis and death<sup>14</sup>.

The existing literature and research show that the most commonly used scoring system to predict mortality is the R-Baux Index, followed by the Abbreviated Burn Severity Index (ABSI) and the Clark Mortality Prediction Model. Here the researcher compares the R-Baux and the ABSI score systems. Of the two variables studied, there was no significant difference between the R-Baux Score and ABSI Score in predicting death in burn patients treated at Dr. Soetomo Hospital from January 2018 to December 2020, as seen from the results of  $p > 0.05$  from the McNemar Test. Both can be used to predict death in burn patients. The research was conducted by Risa et al. in April 2017-April 2018 on four prediction models of death in burn patients, i.e., the ABSI Score, BOBI Score, Ryan Model, and R-Baux Score. The ABSI Score was able to provide the best estimate of death, with a sensitivity of 81.6% and a specificity of 92.5%. In a study of the R-Baux Score by Aditya et al. at Dr. Cipto Mangunkusumo Hospital in 2016, the R-Baux Score performed well and proved to be able to describe an estimate of death by assessing the clinical conditions, with a cut-off value of 73, 77.9% sensitivity, and 76, 9% specificity<sup>15</sup>. Research conducted by Rahmani on 250 burn patients at Sina Hospital Tabriz, with an ABSI cut-off score of 9, can describe the estimated mortality

in burn patients with a sensitivity value of 85% and a specificity of 95%<sup>16</sup>.

In this study, it was found that there were limitations in data collection, such as patients with extensive burn areas, but it could not be determined whether the patient died or not because the patient was in forced discharge status.

## CONCLUSION

The R-Baux Score can be used as a diagnostic tool to determine the prediction of death in burn patients at Dr. Soetomo Hospital, with a sensitivity value of 80.82%, a specificity of 80.00%, a positive predictive value of 60.83%, and a negative predictive value of 91.57%. The ABSI score can be used as a diagnostic tool to predict mortality in burn patients at Dr. Soetomo Hospital with a sensitivity value of 82.19%, a specificity of 82.11%, and a positive predictive value of 63.83% and a negative predictive value of 92.31%. There is no significant difference between the R-Baux Score and the Abbreviated Burn Severity Index (ABSI) Score as a predictor of mortality in burn patients at Dr. Soetomo Hospital. This means that both the R-Baux Score and the ABSI Score can be used as a prediction model for the occurrence of death in burn patients at Dr. Soetomo Hospital.

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## CONFLICT OF INTEREST

There was no conflict of interest in this research.

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This research was conducted without any sources of funding.

## AUTHOR CONTRIBUTION

All authors contributed to writing this research.

## REFERENCES

1. Salehi SH, et al. Comparison of Six Outcome Prediction Models in An Adult Burn Population in a Developing Country. *Ann Burns Fire Disasters*, 2017. 30(1):13-17.
2. WHO, 2018. *Burn*. [Online] Available at: <https://www.who.int/en/news-room/fact-sheets/detail/burns> [Accessed January 8, 2022].
3. Kristel C, 2019. *Faktor Resiko Prediktif Angka Kematian pada Pasien Luka Bakar di Burn Centre RSUD Dr. Soetomo Surabaya*. [Online] Available at: <https://repository.unair.ac.id/91805/> [Accessed January 15, 2022].
4. Noer MS, et al., 2006. *Penanganan Luka Bakar*. 1 ed. Surabaya: Airlangga University Press.
5. Moenajad Y, 2009. *Luka Bakar Masalah dan Tatalaksana*. Jakarta: Balai Penerbit FK Universitas Indonesia.
6. Hariani L, 2021. Epidemiologi Luka Bakar. In: *Manajemen Luka Bakar Fase Akut*. Surabaya: Airlangga University Press, pp. 1-3.
7. Dahal P, et al., Baux's and Abbreviated Burn Severity Score for the Prediction of Mortality in Patients with Acute Burn Injury. *Journal of College of Medical Sciences-Nepal*, 2015.11 (4): 24-27.
8. Bosc F, et al., Gender Differences in Trauma, Shock, and Sepsis. *Military Medical Research*, 2018.5 (35):1-10.
9. Lam N N, et al., Influence of Gender Difference on Outcomes of Adult Burn Patients in a Developing Country. *Ann Burn Fire Disasters*, 2019.32 (3):175-178.
10. ANZBA, 2016. *Emergency Management of Severe Burns*. 18th ed. Albany Creek, Qld: ANZBA
11. Ghareeb R, et al. Inhalation Injury as a Prognostic Factor for Mortality in Burn Patients. *Ann Burns Fire Disaster*, 2011.24 (2):82-88.
12. Meenakshi RM, et al. Aging and the Pathogenic Response to Burn. *Aging and Disease*, 2012.3 (2):171-180.
13. Irfan M, et al. Prognostic and Predictive Factors of Mortality in Burn Patients at dr. Cipto Mangunkusumo General Hospital, Indonesia. *The New Ropanasuri Journal of Surgery*, 2021.6 (2): 11-14
14. Risa H, et al. Clinical Outcome and Comparison of Burn Injury Scoring Systems in Burn Patient in Indonesia. *African Journal of Emergency Medicine*, 2021. 11 (3):331-334.
15. Wardhana A, et al. Implementation of revised Baux Score to Predict Mortality Burn Injured Patients in Burn Unit of dr. Cipto Mangunkusumo General Hospital, Jakarta. *New Ropanasuri Journal of Surgery*, 2016. 1 (1): 23-26.
16. Rahmani F, et al. Comparison of ABSI and Full-Thickness Burns Indexes in the Prediction of Hospital Mortality in Burn Patients. *Acta Medica Iranica*, 2021.59 (1):37-43.
17. Samiyah, Wardhani RIL, & Saputro ID. Hubungan antar Infeksi dan Lama Perawatan Pasien Luka bakar Berdasarkan Jenis Kuman di RSUD Dr. Soetomo Surabaya. *Jurnal Rekonstruksi Dan Estetik*. 2022, 7(1):1-10.