

## EPIDEMIOLOGY AND MORTALITY OF BURN INJURY IN CIPTOMANGUNKUSUMO HOSPITAL, JAKARTA: A 5 YEAR RETROSPECTIVE STUDY

Aditya Wardhana<sup>1\*</sup>, Gammaditya Adhibarata Winarno<sup>2</sup>

1. Universitas Indonesia, Departemen of Surgery, Division of Plastic Reconstructive and Aesthetic Surgery, RSUPN Cipto Mangunkusumo Jakarta, Indonesia
2. General Practitioner, Intern Participant in Plastic Reconstructive and Aesthetic Surgery, RSUPN Cipto Mangunkusumo Jakarta, Indonesia

### ABSTRACT

**Background :** Burns is a significant cause of morbidity and mortality worldwide. Particularly in low- and middle-income countries (LMICs), burns account for an estimated 180.000 deaths every year. Burn-related mortality rates are exceptionally high in South-East Asia (11.6 deaths per 100 000 population per year) compare with much lower rates of 1.0 deaths per 100.000 people per year in high-income countries. This study aims to investigate the demographic data, etiology, and outcome of the patients treated in burn unit Ciptomangunkusumo Hospital, Jakarta, Indonesia.

**Method:** This is a retrospective cross-sectional study, collecting epidemiologic data from the medical record through Electronic Health Record. A total of 709 patients admitted to burn unit between 2013-2017 were reviewed based on age, sex, total burn surface area (TBSA), burn grade, inhalation injury, etiology, length of stay, outcome, and payment method. Inclusion criteria are patients that were admitted to burn unit of Ciptomangunkusumo Hospital between 2013-2017, while there are no exclusion criteria in this study.

**Result :** Admission of patients between 2013-2017 has inclined throughout the year, from 97 in 2013 to 166 in 2017. Average patient admission per year, reaching 141,8±26,761. Jakarta, and its suburb Bogor, Depok, Tangerang, and Bekasi, has dominated the proportion of referring hospital with 538(75.9%) The most amount of payment method is NHI (JKN / BPJS) with 534(75.3%) population. A total of 465 were male, and 244 were female, with a ratio of 1.9:1. The highest incidence in terms of age group is 16-35 years old (269, with the average age of patients, is 29±19. The highest incidence of burn injury is caused by a stove gas explosion with 253(35.7%), followed by flame 189(26.7%). There are 63 out of 709 patients with inhalation injury, where the incidence rate is 8.9%. Patients admitted to the Ciptomangunkusumo burn unit has an average length of stay of 15 days hospitalization. The most frequent population of extent, staying >14 days is 21-30% TBSA (88). The mortality rate in the Ciptomangunkusumo burn unit is 25.8% (183), with the highest number of death came from TBSA >40% (136).

**Conclusion:** A total of 709 patients were admitted to the Ciptomangunkusumo burn unit in Jakarta, Indonesia, over 5 years, with an average of 141 patients per year and an increase of 171% from 2013 to 2017. Most patients were diagnosed with >40% TBSA and 2<sup>nd</sup>-3<sup>rd</sup> grade burn injury. An average of 15 days of hospitalization for patients leading up to 25.8% mortality rate, they are with septic shock as the most common condition causing death in the burn unit.

**Keywords:** *Epidemiology, Burn Injury*

**Latar Belakang:** Luka bakar adalah penyebab signifikan morbiditas dan mortalitas di seluruh dunia. Khususnya di negara-negara berpenghasilan rendah dan menengah (LMICs), luka bakar menyebabkan sekitar 180.000 kematian setiap tahun. Angka kematian terkait luka bakar sangat tinggi di Asia Tenggara (11,6 kematian per 100.000 penduduk per tahun) dibandingkan dengan angka kematian yang jauh lebih rendah yaitu 1,0 kematian per 100.000 orang per tahun di negara-negara berpenghasilan tinggi. Penelitian ini bertujuan untuk menyelidiki data demografi, etiologi, dan hasil dari pasien yang dirawat di unit luka bakar Rumah Sakit Ciptomangunkusumo, Jakarta, Indonesia.

**Metode:** Penelitian ini adalah studi *cross-sectional* retrospektif, mengumpulkan data epidemiologi dari rekam medis melalui *Electronic Health Record*. Sebanyak 709 pasien yang dirawat di unit antara tahun 2013-2017 ditinjau berdasarkan usia, jenis kelamin, total luas permukaan luka bakar (TBSA), tingkat luka bakar, cedera inhalasi, etiologi, lama rawat, hasil rawatan, dan metode pembayaran. Kriteria inklusi adalah pasien yang dirawat di unit rawat inap Rumah Sakit Ciptomangunkusumo antara 2013-2017, sementara tidak ada kriteria eksklusi dalam penelitian ini.

**Hasil:** Penerimaan pasien antara 2013-2017 telah cenderung sepanjang tahun, dari 97 pada 2013 menjadi 166 pada 2017. Rata-rata penerimaan pasien per tahun, mencapai 141,8 ± 26,761. Jakarta, dan pinggirannya Bogor, Depok, Tangerang, dan Bekasi, telah mendominasi proporsi rumah sakit rujukan dengan 538 (75,9%). Metode pembayaran yang paling banyak adalah JKN / BPJS dengan 534 (75,3%) populasi. Sebanyak 465 adalah laki-laki, dan 244 adalah perempuan, dengan rasio 1,9: 1. Insiden tertinggi adalah pada kelompok umur 16-35 tahun (269, dengan usia rata-rata pasien, adalah 29 ± 19. Insiden tertinggi luka bakar disebabkan oleh ledakan gas kompor dengan 253 (35,7%), diikuti dengan api 189 (26,7%). Terdapat 63 dari 709 pasien dengan cedera inhalasi, di mana tingkat kejadiannya adalah 8,9%. Pasien yang dirawat di unit luka bakar Ciptomangunkusumo memiliki rata-rata lama tinggal di rumah sakit 15 hari. Populasi yang paling sering dirawat lebih dari 14 hari adalah 21-30% TBSA (88). Angka kematian di unit pembakaran Ciptomangunkusumo adalah 25,8% (183), dengan jumlah kematian tertinggi berasal dari luas luka bakar 40% (136).

**Kesimpulan:** Sebanyak 709 pasien dirawat di unit luka bakar Ciptomangunkusumo di Jakarta, Indonesia, selama 5 tahun, dengan rata-rata 141 pasien per tahun dan meningkat 171% dari 2013 hingga 2017. Sebagian besar pasien didiagnosis dengan luas luka bakar lebih dari 40% grade 2 dan 3. Rata-rata pasien dirawat 15 hari di Unit Luka Bakar dengan tingkat kematian 25,8%, dengan syok septik sebagai kondisi paling sering menyebabkan kematian.

**Keywords:** *Epidemiology, Burn Injury*

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## INTRODUCTION

Burns is a significant cause of morbidity and mortality worldwide<sup>1</sup>. Long-term morbidity caused by burns is often a substantial problem that creates suffering for the individual as well as for family and community<sup>2</sup>. Burns is a leading cause of disability and disfigurement, which limits the functional abilities of the patients and thus their chance of leading normal, economic productive lives<sup>3</sup>. They also burden the health system by taking up the available healthcare resources due to prolonged hospitalizations<sup>4</sup>.

Particularly in low- and middle-income countries (LMICs), burns account for an estimated 180.000 deaths every year. Burn-related mortality rates are especially high in South-East Asia (11.6 deaths per 100 000 population per year) compare with much lower rates of 1.0 deaths per 100.000 people per year in high-income countries<sup>3</sup>. In many high-income countries, burn death rates have been decreasing<sup>5</sup>.

LMICs have some particular risk factors of burn injury, that includes; age, gender, socioeconomic level and environment. Household accidents are reportedly occurring frequently, which involves the aforementioned factors, particularly age, gender and cause burn injury. The developing economics that is the characteristic of LMICs, typically is parallel to overcrowding, which can increase the occurrence of household incidents causing burn injury due to ignorance of safety precaution of household utensils.

## METHOD

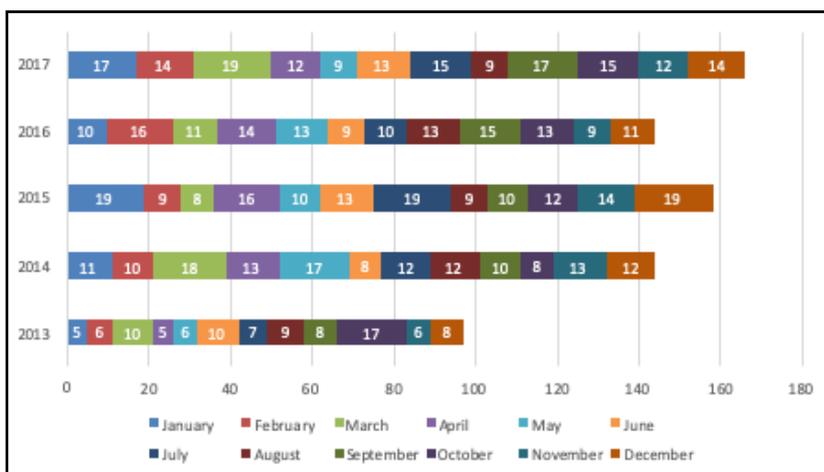
This research is a retrospective cross-sectional study, conducted in January 2018 in Ciptomangunkusumo Hospital, Jakarta, collecting epidemiologic data from the medical record through Electronic Health Record. A total of 709 patients admitted to burn unit between 2013-2017, were reviewed based on age, sex, total burn surface area (TBSA), burn grade, inhalation injury, etiology, length of stay, outcome and method payment. Inclusion criteria are patients that were admitted to burn unit of Ciptomangunkusumo Hospital between 2013-2017, while there are no exclusion criteria in this study. Statistical analysis and tabulation of the data using SPSS 20 for Mac.

## RESULT

### Patient Admission between 2013-2017

Admission of patients between 2013-2017 has inclined throughout the year, from 97 in 2013 to 166 in 2017, meaning there is an increase in incidence rate. Average patient admission per year, reaching 141,8±26,761. The highest number of admitted patients in a month is 19, which has occurred on four different occasions in March 2017, January, July, and December 2015, as can be seen in chart 1. The highest average of patient admission is in March (13.2±4.970), followed by October (13.0±3.391), December (12.8±4.087), July (12.6) and January (12.4±5.639), as can be seen in table 1. However, the least range of patients admitted is in August, with an average number of a patient admitted (10.4±1.949), meaning it has a fairly similar distribution of admitted patient in each year

Chart 1: Patient Admission per Year Between 2013-2017



**Disclosure:** The authors have no financial interest to disclose.

	N	Range	Minimum	Maximum	Mean	Std. Deviation
January (N=62)	5	14	5	19	12.40	5.639
February (N=55)	5	10	6	16	11.00	4.000
March (N=66)	5	11	8	19	13.20	4.970
April (N=60)	5	11	5	16	12.00	4.183
May (N=55)	5	11	6	17	11.00	4.183
June (N=53)	5	5	8	13	10.60	2.302
July (N=63)	5	12	7	19	12.60	4.615
August (N=52)	5	4	9	13	10.40	1.949
September (N=60)	5	9	8	17	12.00	3.808
October (N=65)	5	9	8	17	13.00	3.391
November (N=54)	5	8	6	14	10.80	3.271
December (N=64)	5	11	8	19	12.80	4.087

Table 1. Patient Admission on Monthly Basis

**Referring Medical Facilities Area**

Indonesia has had a transition of National Health Insurance between the years, which later will be discussed, but this study categorized the insurance as one. Jabodetabek area, which stands for Jakarta, and its suburb Bogor, Depok, Tangerang, and Bekasi, has dominated the proportion of referring hospital with 538(75.9%). Followed by patients that went straight to Ciptomangunkusumo hospital (before a new era of NHI) with massive difference

88(12.4%), then outside Jabodetabek but within Java 41(5.8%), and outside java 11(1.6%). There are 31(4.4%) of patients without referral data on the medical record. The most amount of payment method is NHI (JKN/BPJS) with 534(75.3%) population, followed by independent payment 100(14.1%), others that includes company, social service department and not managed 42(5.9%), regional insurance 18(2.5%), and debt statement 15(2.1%).

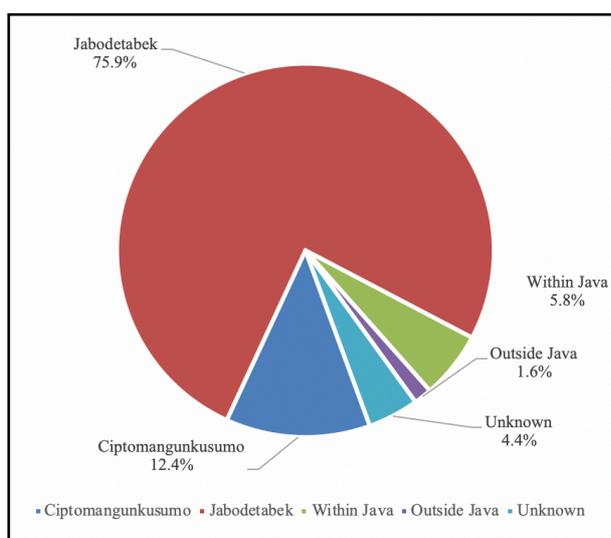


Chart 1. Area of Referring Medical Facilities

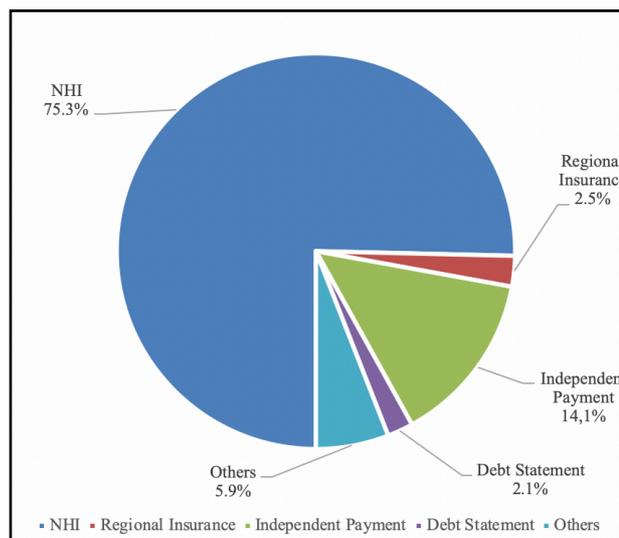


Chart 2. Payment Method of Patients Admitted to Burn Unit

**Patient Demographic Characteristic**

Out of 709 patients admitted to burn unit between 2013-2017, 465 were male, and 244 were female, with a ratio of 1.9:1. The highest incidence in terms of age group is 16-35 years old (269), with higher number of male 186(69,1%) admitted than female 83(30,9%),

followed by age group 36-55 years old (197), with 128 male and 69 female, as can be seen on chart 3. The average age of patients is 29±19, and the median is 29, with the oldest patient treated is 89 years old, and the youngest is 17 days old.

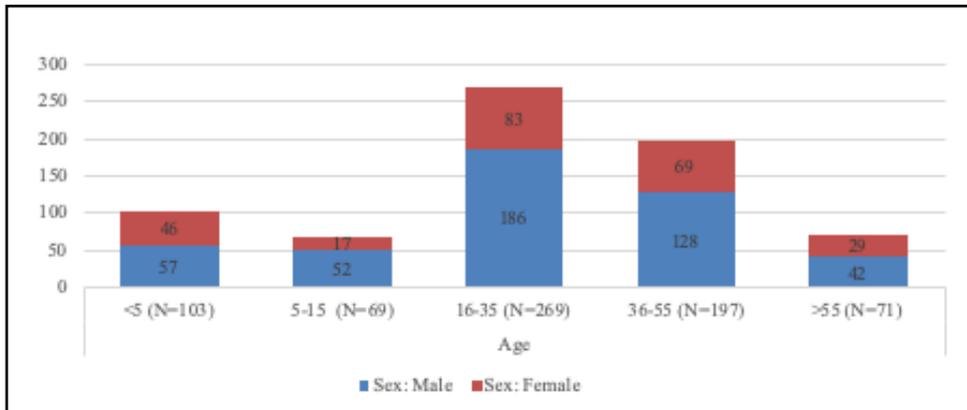


Chart 3. Age and Sex Distribution

**Burn Injury Profile**

The highest incidence of burn injury is caused by gas explosion with 253(35.7%), followed by flame 189(26.7%), scald 118(16.6%), electrical 83(11.7%), others that include contact and vapor 35(4.9%), and the least is chemical 31(4.4%) as can be seen in chart 4. Most of the patients admitted have been

diagnosed with burn injury with TBSA >40% grade II-III (203), followed by 21-30% (131). The diagnosis speaks for itself for the most TBSA is >40% (95), and grade II-III (596), with average TBSA being 34.2%±22.6, a median of 29.8%, while the least extent is 1% and the most extent is 100%.

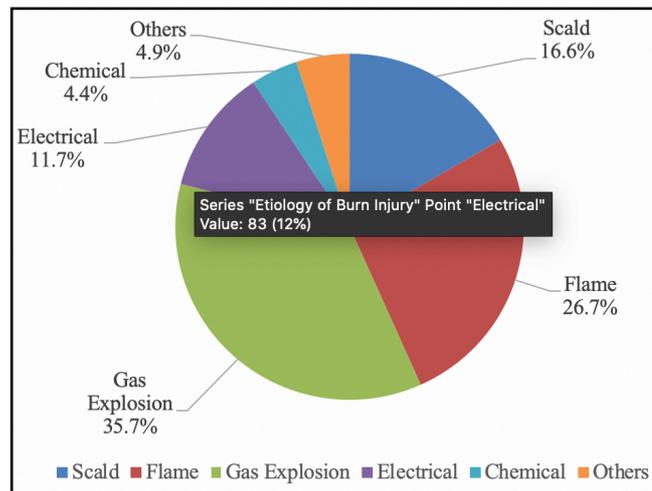


Chart 4. Etiology of Burn Injury

		Grade I (N=4)	Degree Grade II A-B (N=105)	Grade II-III (N=596)	Grade III (N=4)
TBSA	<10% (N=88)	4	24	60	0
	10-20% (N=168)	0	50	117	1
	21-30% (N=147)	0	14	131	2
	31-40% (N=95)	0	10	85	0
	>40% (N=211)	0	7	203	1

Table 2. Burn Injury Profile Distribution

**Inhalation Injury**

The occurrence of inhalation injury isn't analyzed by a further cross-tabulation with any other variables.

There are 63 out of 709 patients with inhalation injury, meaning that the incidence rate is 8.9%.

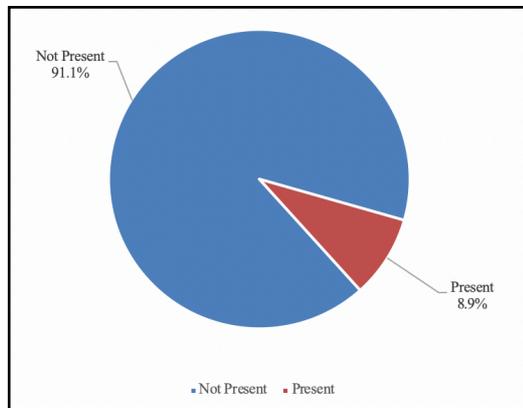


Chart 5. Inhalation Injury Incidence Rate

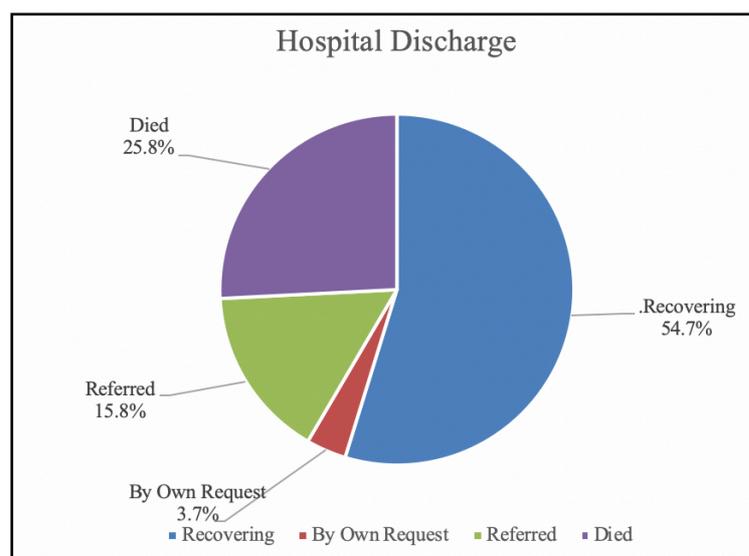
**Length of Stay and Outcome**

Patients admitted to the Ciptomangunkusumo burn unit has an average length of stay of 15 days hospitalization (median=12), with the shortest length of stay being a day and the longest time being 157 days. The most frequent population of extent staying >14 days is 21-30% TBSA (88), although the number of the entire population of patients with 21-30% TBSA has the highest outcome of recovering (133) with only 14 death. However, the 2<sup>nd</sup> greatest extent to be treated >14 days is >40% TBSA, with also the highest mortality (136). Determined by the massive gap of the population between grade II-III and all other degrees, it is also clear that the most frequent degree treated >14 days is grade II-III (252).

The mortality rate in Ciptomangunkusumo burn unit is 25.8% (183), with the highest number of death came from TBSA >40% (136), followed by 31-40% with significant gap (23). In contrast, the population of burn degree with the highest mortality is grade II-III by some amount (176). While 25.8% of death contributes to the 2<sup>nd</sup> most amount of patients discharged, most of the hospital discharge is patients recovering, with 526(54.7%). Patients partially recovered usually being referred to lower-tier hospital due to some reasons, 112(15.8%) patients were referred, and the rest with 26(3.7%) discharging themselves/their family by request.

		Length of Stay			Outcome	
		<7 (N=170)	7-14 (N=250)	>14 (N=289)	Recovering (N=388)	Died (N=186)
<b>TBSA</b>	<10% (N=88)	49	26	13	82	6
	10-20% (N=168)	42	70	56	164	4
	21-30% (N=147)	18	41	88	133	14
	31-40% (N=95)	8	29	58	72	23
	>40% (N=211)	53	84	74	75	136
<b>Degree</b>	Grade I (N=4)	1	2	1	4	0
	Grade IIA-B (N=105)	32	39	34	99	6
	Grade II-III (N=596)	136	208	252	420	176
	Grade III (N=4)	1	1	2	3	1

**Table 3.** Length of Stay & Outcome Based on Burn Injury Profile



**Chart 6.** Hospital Discharge

**Cause of Death**

In Ciptomangunkusumo Burn Unit, the most condition triggering death is Septic Shock with 89(48.6%), followed by Acute Respiratory Distress Syndrome (ARDS) 21(11.5%), others that includes cardiac arrest, acute kidney injury and other complications 20(10.9%), and Multi-Organ Failure (MOF) with 17(9.3%). There is a hefty amount of cause of death that wasn't stated on the medical records with 36(19.6%).

In this study, extensive burns (>40%) contributed most of the death by septic shock (67) and all other causes of death with other complications (17), MOF (15), and ARDS (13) respectively. 2<sup>nd</sup>-3<sup>rd</sup> grade degree contributed the highest number of all causes of death, as can be seen in table 3. The highest frequency of mortality in terms of length of stay has been from 7-14 days long category (83), most of it caused by septic shock (47), followed by <7 days (59), and >14 days (41).

		Cause of Death				
		Septic Shock (N=89)	MOF (N=17)	ARDS (N=21)	Others (N=20)	Unknown (N=36)
<b>TBSA</b>	<10%(N=6)	1	2	0	1	2
	10-20% (N=4)	0	0	1	0	3
	21-30% (N=14)	6	0	2	1	5
	31-40% (N=23)	15	0	5	1	2
	>40% (N=136)	67	15	13	17	24
<b>Degree</b>	Grade I (N=0)	0	0	0	0	0
	Grade IIA-B (N=6)	3	0	3	0	0
	Grade II-III (N=176)	86	17	18	19	36
	Grade III (N=1)	0	0	0	1	0
<b>LOS</b>	<7 (N=59)	22	11	11	8	7
	7-14 (N=83)	47	4	6	7	19
	>14 (N=41)	20	2	4	5	10

**Table 4.** Burn Injury Profile & Length of Stay Leading to Cause of Death

## DISCUSSION

Burn Unit in Ciptomangunkusumo Hospital has 6 High Care Unit (HCU) bed, 2 Intensive Care Unit (ICU) bed, and an operating theatre, with integrated service of a multidisciplinary team. The average patients per year are reaching 141 per year and are considered high, meaning that Indonesia, as a low-middle income country, still does not have the necessary effort to prevent the incidents of burn injury effectively. However, in this study, the intention of the incidence was not investigated. There is an increasing trend of patient admission up to 171% over the last five years, from 97 to 166. In this study, the male has a higher prevalence than the female with a 1.9:1 ratio. The highest incidence of age group comes from 16-35 years old, a productive period for most people, and it is very pitiful for someone to suffer burn injuries as it could restrict their career. Some of it may involve occupation-related burn injury, with most of Indonesian are blue-collar workers, dealing with potentially burn causing situation especially without a strict and clear operating procedure and safety precautions.

The latest amendments to the national health insurance system under the Ministry of Health Regulation no. 71 2013, ensuring Burn Unit Ciptomangunkusumo – as the national center – to be the highest tier of patient referral. Most patients referred, paid their dues to the hospital using national healthcare insurance, with a huge gap to the second-highest (independent payment), due to the high expense of burn treatment. Based on the distribution of data, there was no significant difference between the months, whereas the maximum number of patients per month (19) appeared 4x. There were still patients that have been transferred from outside of Java island, meaning that long hours of transferring process experienced. Inadequacy of resources might force medical facilities outside Java island, especially in remote areas, to refer their patients to as far as Ciptomangunkusumo in Jakarta. In this study, the most frequent etiology of all was a gas explosion, meaning that the unintentional incidence of a gas explosion is very high in at least the Jabodetabek region, based on its most frequent referring medical facilities' area.

There was not enough data to support whether the safety precaution of household gas usage is adequate to prevent unintended gas leakage. Therefore the further investigation is necessary. Devastatingly, 203 patients out of 709 (28.6%), is diagnosed with >40% grade II-III burn injury, meaning the severity of patients is likely to be high. While the average TBSA to be treated in the Ciptomangunkusumo burn unit is 34.2% TBSA, the most severe, based on its extent, is up to 100% TBSA. Therefore, none of the patients' cutaneous area was saved. Diagnosed definitely by using bronchoscopy, the incidence of inhalation injury is up to 8.9%, whereas it can happen in gas explosions and flame, it adds up to 14.3% of patients with gas explosions and flame to have had an inhalation injury. The average length of stay in burn unit Ciptomangunkusumo is 15 days hospitalization. A variety of treatments is performed based on the clinical pathway and standard operational procedure added to the experience and skill of the multidisciplinary medical team working. Gauze used in Ciptomangunkusumo is mostly paraffin gauze, and it is applied to patients with around 2-3 days routinely examined, removed, and newly installed. Also, with early excision and skin grafting is done frequently to most of the patients. This has been an effort to reduce the length of stay and improve the outcome for the patients. Examined by the length of stay, most frequent patients discharged <7 days are patients with >40% TBSA (53). However, it also has the highest mortality (136). Grade II-III also have the highest frequency of being discharged <7 days (136) but have the highest death amongst all (176). Therefore, deductively, it can be seen that the more severe patients' burn is, the more likely it is to die <7 days in treatment. On the other hand, 289 patients were treated >14 days in a burn unit. This is also related to the complications of nosocomial infections that could lead to the leading cause of death, which is septic shock (48.6%). It has been reported that the incidence of nosocomial infection in 2016 is mostly by *P. aeruginosa* has been as high as 45.2% (Djan). A total of 183 patients died during treatment (25.8% mortality rate), caused by a variety of conditions including septic shock, other complications, MOF, and ARDS, respectively, in terms of incidence. Recovery rate reaching 54.7% with the effort as mentioned above to reduce mortality, although the quality of life relating to long term burn injury complications are not assessed in this study. The stepdown referral is also considered as betterment in condition as mentioned before with the new regulations of the healthcare system,

Ciptomangunkusumo should be the highest tier of a medical facility. Due to various factors, that might include payment method, bed occupation rate (BOR), turnover interval (TOI) and all, patients are down-referred to lower-tier medical facilities, but the improvement of condition should still be the main reason.

## CONCLUSION

A total of 709 patients were admitted to the Ciptomangunkusumo burn unit in Jakarta, Indonesia, over five years, with an average of 141 patients per year and an increase of 171% from 2013 to 2017. Most of it was male, with age group of 16-35 years old, referred from mostly around the Jabodetabek area. The gas explosion was the most frequent cause of burn injury, with 35.7% of the population. An overwhelming number of severe burn patients with >40% TBSA and 2<sup>nd</sup>-3<sup>rd</sup> grade burn injury with 203 patients were admitted. An average of 15 days hospitalization for patients leading up to 54.8% recovery rate and 25.8% mortality rate, with septic shock as the most frequent condition causing death in a burn unit.

## Limitation

This is a five-year retrospective cross-sectional study describing the epidemiology of patients admitted to burn unit Ciptomangunkusumo hospital in Jakarta, Indonesia. Cause-effect factors are not assessed in-depth in this study. Therefore a further investigation of etiology prevention, safety precautions, occupation-related injury is necessary to help prevent and lower the incidence of burn injury and its mortality rate. Also, this study is just evaluating from one center of a country. In contrast, more burn unit is operating all over the country, and a furthermore whole nationwide survey will be more comprehensive.

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## Corresponding author :

**Aditya Wardhana**

Departemen of Surgery, Division of Plastic  
Reconstructive and Aesthetic Surgery

Cipto Mangunkusumo General National Hospital  
aditya\_wrdn@yahoo.com

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