Observational Study

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Acute burn care and outcomes at the Hospital Nacional Guido Valadares (HNGV), Timor-Leste

A 7-year retrospective study

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Abstract

The purpose of this study was to describe the epidemiology of patients presenting with acute burns and undergoing admission at Hospital Nacional Guido Valadares (HNGV) in Dili, Timor-Leste in the period 2013 to 2019. HNGV is the only tertiary referral hospital in Timor-Leste. This was a retrospective study involving all acute burn patients admitted to the surgical wards of HNGV from 2013 to 2019. The data was collected from patient charts and hospital medical archives. Data were reviewed and analyzed statistically in terms of age, gender, residence, cause, total body surface area (TBSA), burns depth, length of stay (LOS), and mortality. The outcomes were analyzed using logistic regression. Over the 7-year period, there were 288 acute burn patients admitted to the surgical wards of HNGV. Most patients were children (55%), male (65%) and from the capital city of Dili or surrounding areas (59%). The most common cause of burns in children was scalds and the most common cause among adults was flames. Of the admitted patients 59% had burns affecting >10% of the TBSA and 41% had full thickness burns. The median LOS was 17 days (1–143) and the average mortality for admitted burn patients in HNGV was 5.6% (annual mortality 0–17%). The odds ratio for extended LOS was 1.9 (95% confidence interval 1.1–3.2) in female compared with male patients. The odds ratio for mortality was 14.6 (95% confidence interval 2.7–80.6) in the older adults when compared with younger adults. Higher TBSA, full thickness burns, and flame burns were also significantly associated with longer LOS and higher mortality. Children and male patients were disproportionately overrepresented among patients admitted to HNGV, while female patients had longer LOS and older adults had more severe injury and a higher risk of mortality. Establishment of a national program for the prevention of burns is essential.

Abbreviations: CI = confidence interval, HNGV = Hospital Nacional Guido Valadares, LMIC = lower- and middle-income country, LOS = length of stay, OR = odds ratio, TBSA = total body surface area.

Keywords: burns, epidemiology, Hospital Nacional Guido Valadares, mortality, Timor-Leste

1. Introduction

Burn injuries are one of the major public health challenges in the world and a leading cause of death.[1,2] The global incidence of burns is estimated at 11 million people, and each year around 200,000 to 300,000 deaths worldwide are attributed directly to burns.[3] Burn injuries also cause significant morbidity with both short- and long-term consequences, affecting patients and their families physically, psychologically, and notably economically. Disability Adjusted Life Years attempt to quantify the impact of diseases and trauma but there are substantive societal costs which are much harder to measure. Treatment often involves long hospital stays, complicated wound and scar treatments and rehabilitations, all of which are challenging to deliver in a resource-limited health setting.[4] Nevertheless successful prevention and treatment strategies have helped to decrease burn mortality rates in many developed countries.[5] Today, most burn deaths occur in lower- and middle-income countries (LMICs), particularly in Sub-Saharan Africa and Southeast Asia.[1,3] Peck and Pressman showed that the lower the income level of a country, the higher the burn mortality rate.[6] Proposed explanations for this observation include a lower standard of prehospital and hospital care and limited access to expensive modern treatment.[7,8] It has

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The data that support the findings of this study are available from a third party, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are available from the authors upon reasonable request and with permission of the third party.

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also been observed that women in LMICs have higher mortality rates than men and that children <5 years old are more at risk.[9,10] The strong socio-economic gradients observed between countries also exist within countries. Delgado et al showed that environmental factors such as low income, crowding and lack of water supply are associated with an increased risk of burns.[10] In children, most burn accidents happen at home and are caused by scalds from hot liquids. The risk of burns for them is higher if maternal education is lower or if their mother has 3 or more other children.[3]

Epidemiological characteristics and risk factors for burn injuries are important data for a country to design or modify public health strategies and monitor as well as evaluate their impact.[11] Reports on the epidemiology of burns in LMICs are still scarce and data are often extrapolated from neighboring countries with a different economic status and cultural background.[12] Even though most burn injuries and mortality occur in LMICs, the existence of prevention programs in these countries are also very limited.[13]

Timor-Leste is a small island nation in Southeast Asia with a population of 1.3 million which attained independence in 2002.[14] With a Gross Domestic Product per capita of only US$1442 Timor-Leste is classified by the World Bank as a LMIC and is rebuilding a health system in a post-conflict environment. The government provides free public healthcare, however mountainous terrain combined with cultural-, and socio-economical barriers make it challenging for the population to access medical services within an appropriate time frame.[15–17]

Hospital Nacional Guido Valadares (HNGV) is located in the capital Dili and is the national referral hospital and Timor-Leste's largest hospital. It is the only tertiary hospital of the country and provides secondary health services for the residents in 5 of 13 districts.[18] It provides both inpatient health care (260–340 inpatient beds) and a wide range of outpatient health services in a challenging resource-limited environment.

Burn patients are managed in a general surgical ward without a specialized burn unit. As the only tertiary-level hospital in the country, HNGV receives referrals of burn patients from all district hospitals in Timor-Leste.[19] There are 5 secondary-level district hospitals in Timor-Leste and 2 of them have the capability to provide care for minor and moderate burns. All other hospitals provide initial resuscitation before transferring burn patients to the HNGV. Table 1 outlines the criteria for referral to the HNGV during this study period.

The initial clinical management and resuscitation of burn patients in HNGV was carried out according to the Advanced Trauma Life Support standard and guidelines from the Australian and New Zealand Burn Association. Total body surface area (TBSA) estimation was performed using the Lund and Browder chart. The burn patients in HNGV were coordinated and managed by a local senior general doctor trained in Surgery, who had been trained in Emergency Management of Severe Burns course and had undergone an instructor training program. There is no specialist plastic surgeon in Timor-Leste.

Table 1

Criteria for transfer of burns patients from district referral hospital to HNGV (at least one of the following conditions).

Partial thickness burns >10% TBSA (adults)
Partial thickness burns >5% TBSA (children)
Full thickness burns in any age group
Burns of the very young or older population (<5 or >60-yr-old)
Burns involving the face and/or with suspected inhalation injury
Burns involving flexor creases of joints, neck, axilla, genitalia or perineum
Circumferential limb burns and burns involving the hand or digit
Electrical burns
Chemical burns
Burns due to explosion
Burns in a confined building

HNGV = Hospital Nacional Guido Valadares, TBSA = total body surface area.

The burden and outcomes of burns in Timor-Leste have not been described previously and the aim of this study was to describe the characteristics and outcome of patients admitted for burns at the only tertiary-level hospital in Timor-Leste. Knowledge of the characteristics, causes, and associated risk factors of severe burns can inform a National Burns' Prevention and Management program in Timor-Leste.

2. Materials and Methods

This was a retrospective cohort study of acute burn patients admitted to HNGV, Dili, Timor-Leste from January 1, 2013 to December 31, 2019.

Patients were identified from the HNGV hospital medical record archive and a burn registry collected by the surgical department. A review of patient records provided demographic data and clinical details of the burns management. Data collected included hospital ID, name, sex, age, residence, cause of burns, percentage of burn to TBSA, burn depth, treatment, complications, as well as admission and discharge dates. Primary outcome was inpatient mortality. Secondary outcome was treatment duration expressed in extended days (length of stay [LOS]). Approval of this study was granted by the ethical commission of the HNGV and the clinical hospital director of HNGV gave permission to use the data.

2.1. Inclusion and exclusion

All patients admitted for acute burn injuries were eligible for inclusion. All re-admissions were excluded. Additional exclusion criteria were patients with the presence of late complications of burn injuries at the time of admission, such as burn wound infections, scarring, contracture, etc.

2.2. Data definition

Age was measured in years, and children were defined as 0 to 18 years old. Younger adults were >18 years and patients aged ≥65 years were defined as older adults. Residence was categorized as Dili, comprising the city of Dili and the hospital coverage area, or others, which includes all other districts in Timor-Leste. Cause of burns was categorized as liquid scalds, flame burns, chemical burns, and electrical burns. TBSA was presented in percentage. Depth of burns was classified as partial or full thickness recorded by the treating clinicians.

2.3. Data analysis

Crude data were collected and analyzed in Excel (Microsoft, version 2105). Continuous variables were expressed as median with the corresponding interquartile range. Categorical variables were expressed as whole numbers (n), frequencies and percentages. The statistical analyses were computed in "R," version 3.6.1 A language and environment for statistical computing. (R Foundation for Statistical Computing, Vienna, Austria). URL https://www.R-project.org/ (R Core Team 2019). The significance of differences of the variables was assessed and calculated with a series of Pearson chi-squared test and the Fisher exact test. For the LOS analysis, extended LOS is LOS longer than the median LOS of 17 days. The outcomes were analyzed using logistic regression and presented in Forest plots with odds ratio (OR) and corresponding 95% confidence interval (CI).

3. Results

A total of 303 burn patients were admitted to HNGV during the 7-year study period (Fig. 1). Fifteen patients came with late

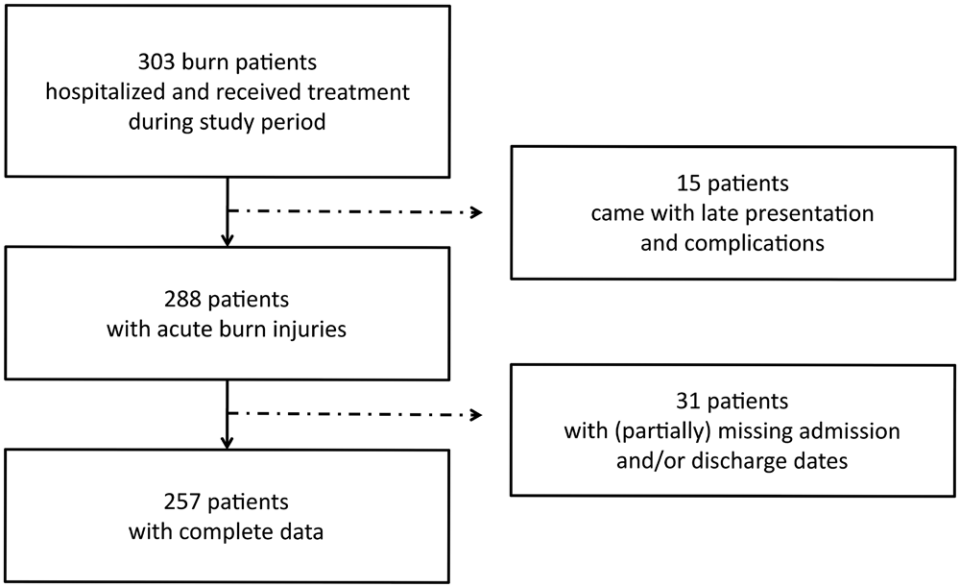

Figure 1. Flowchart of patients who met inclusion and exclusion criteria for the study population.

complications of burns and were excluded. Further analysis was based on the data of 288 admissions of acute burn injuries. For the LOS analyses, 31 patients were not included because of partially missing admission or discharge dates. Each year approximately 3500 patients were admitted to the surgical wards of HNGV, and acute burn patients comprised 1 to 1.6% of these surgical admissions.

3.1. Age, sex, and residence

Overall, 54.9% of admissions were pediatric patients and 33.7% were in the 1 to 10 years age group. There was a predominance of males (65% males vs 35% females). 59.4% of patients resided in Dili or the adjacent districts whilst around 40% were referred from the outer districts (Table 2).

3.2. Cause of burns

The distributions of causes of burns with different age groups are shown in Figure 2. More than 80% of the pediatric burns were caused by scalding liquids. Only 16% of burns in children were caused by flame and almost none by chemical or electrical burns. On the contrary, most burns were caused by flames in younger adults and older adults (61.8% and 71.4%, respectively). Scalds and electrical burns were of similar low frequency both in younger and older adults. Females were more likely to incur burn injuries due to scalding by hot liquid. Electrical and chemical burns occurred more often in men (Supplement S2, Supplemental Digital Content, http://links.lww.com/MD/I51).

3.3. TBSA and depth of burns

Almost half of the patients sustained TBSA of 10% or less. A majority (59%) were of partial thickness burns. Liquid scalds, flame burns, chemical burns and electrical burns comprised 52.4, 36.8, 1 and 9.4%, respectively, of the cause of burns (Table 2).

The TBSA of patients differed significantly in different age groups and increasing age was associated with a higher percentage of TBSA ($P < .01$). Higher TBSA was also observed if the burn patient lived outside the coverage area of HNGV (16 vs 12, $P = .05$), or among patients who had full thickness burns (18 vs 12, $P = .02$). Gender and cause of burn did not have any significant association with TBSA (Table 3). Similarly, the depth of burn was significantly associated with the age groups, residence of patients, and cause of burns. The distributions of depth of burns between the children, younger adults and older adults followed a similar pattern: increased age of burn patients was associated with higher percentage of patients with full thickness burns ($P < .01$). Burn patients from the city of Dili and surroundings had more partial thickness burns in comparison to patients from other districts (64.3 vs 50%, $P = .02$). As a cause of burns, flame burns patients had different distributions of burns depth with a tendency more to full thickness burns ($P < .01$) (Table 4).

3.4. Length of hospital stays

LOS of survivors with complete data (n = 241) is presented in Figure 3. The median LOS of these patients in HNGV during the study period was 17 days (interquartile range = 26). The LOS of pediatric patients was significantly shorter than adult patients (OR = .43, 95% CI 0.26–0.73). Female gender, residence outside the city of Dili, TBSA >30%, full thickness burns, and flame burns were significantly associated with extended LOS.

3.5. Mortality

Sixteen patients died during their treatment giving an overall mortality of 5.6%. Risk factors associated with mortality are presented in Figure 4. Older adults were significantly more likely to die than adult patients (OR = 14.6, 95% CI 2.6–80.6). TBSA >30%, full thickness and flame burns were also significantly associated with mortality, as 94% of the burn-related deaths occurred in patients with TBSA >30% and full thickness burns. Flame-related burns accounted for 75% of the deaths compared to 25% of death related to scalds. Gender and residence were not associated with mortality.

4. Discussion

This study describes for the first time the characteristics and outcomes of patients admitted for burns at the only tertiary-level hospital in Timor-Leste. Increased knowledge of causes and risk

Table 2

Basic demographic features of hospitalized burn patients in Hospital Nacional Guido Valadares, Dili, Timor-Leste.

		Patients	
Variables	**Categories**	**n**	**%**
Overall		288	**100**
Age groups	Children (≤18)	158	54.9
	Younger adults (19–64)	123	42.7
	Older adults (≥65)	7	2.4
Gender	Male	187	64.9
	Female	101	35.1
Residence	Dili	171	59.4
	Other	112	38.9
	NA	5	1.7
Cause of burns	Scalds	151	52.4
	Flame	106	36.8
	Chemical	3	1.0
	Electrical	27	9.4
	NA	1	0.3
TBSA%	0–10	117	40.6
	11–20	109	37.8
	21–30	24	8.3
	31–40	18	6.3
	41–50	6	2.1
	51–60	7	2.4
	>60	7	2.4
Depth of burn	Partial thickness	170	59.0
	Full thickness	117	40.6
	NA	1	0.3

TBSA = total body surface area.

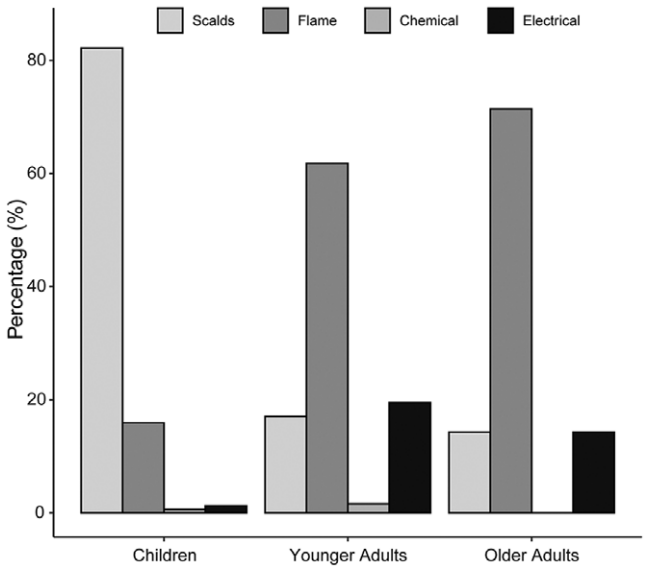

Figure 2. Causes of burns in different age groups. Pearson chi-squared test and Fisher exact test, $P < .001$.

factors of severe burns can help inform the country's National Burn's Prevention and Management programs. Furthermore, base-line data can form the basis of future evaluations of prevention and management strategies.

Worldwide, the burden of burns is unequally overrepresented in children, especially in LMICs.[20–22] In Timor-Leste, almost half of all admitted burn patients were children <10 years old and the most common cause of burns in this age group was scalds from hot liquids, presumably at home. Previous studies have mentioned the socioeconomic status of the family and living environment as the most important factors contributing to the higher incidence of burn injuries in children, and caregiver

Table 3

Burn characteristics of the patients, TBSA.

			TBSA%	
		n	Median (IQR)	*P*
Overall		288	13 (12)	
Age groups	Children	158	12 (10)	<.01
	Younger adults	123	15 (15.5)	
	Older adults	7	18 (37.5)	
Gender	Male	187	12 (13)	.67
	Female	101	14 (9)	
Residence	Dili	171	12 (10.5)	<.05
	Other	112	16 (15.25)	
	NA	5	5 (1)	
Cause of burns	Scalds	151	12 (10)	.18
	Flame	106	16.5 (22)	
	Chemicals	3	4 (1)	
	Electrical	27	6 (10.5)	
	NA	1		

P values comparing the categories are calculated using Pearson chi-squared test.
IQR = interquartile range, TBSA = total body surface area.

characteristics associated with increased risk of burn injuries in children include illiteracy or poor education and household overcrowding. We believe that the high incidence of burns in children in Timor-Leste could be reduced by educating the parents or caregivers on how to build a safe kitchen and the careful handling of hot liquids. Other environmental factors that can decrease the risk of burns include fire alarms, separate kitchen facilities, a residential water heater, and appropriate first aid response.[13,20,23] Socioeconomic status has also been an important risk factor for adults, with low-income patients presenting with a higher incidence, and more extensive and more severe burns.[3,6]

In this study, males were almost twice as likely to present with burn injuries in all age groups. The gender distribution in other studies describes similar results.[11,13,24] Patients who came from other districts tended to have more severe burns and flames were the most common cause of their burns. These patients had higher TBSA, and more often full thickness burns, which also caused significantly more extended LOS than patients from Dili and surrounding areas, although in terms of mortality no significant difference was observed (Figs. 3 and 4). Geographical barriers and lower socio-economics status for rural populations could explain this observation. Almost 90% of burns in this study were caused by flames and scalds from liquids. We found that flame burns cause more severe burns in terms of higher TBSA. Flame burns also caused significantly deeper burns than any other etiology and were associated with a higher mortality risk than scald burns. A study from the USA found that flame-burned patients have significant differences in outcome in comparison to scald-burned patients. They have a higher risk of multi-organ failure, sepsis, and mortality.[25]

More than half of all admitted patients had >10% of their TBSA burned and a fifth of all admitted patients had >20% of TBSA burned. There were more severe burn patients than mild- and moderate burn ones in HNGV as the only hospital providing tertiary-level care in Timor-Leste. In this study, patients with <10% TBSA were almost all pediatric patients <10 years old. Studies from USA showed that the cutoff of TBSA for having high risks of mortality, burn wound infection, sepsis, and organ failure was approximately 40% in adults and 60% in children.[26–28] In HNGV, the mortality of admitted burn patients has increased proportional to TBSA from 14.3% (2 of 14) in the 31 to 40% TBSA group to 85.7% (6 of 7) in the above 61% TBSA group. Costa Santos et al reported that deeper burns were significantly more prevalent in the >65 year age group in Portugal.[29] The present study shows similar results as the prevalence of full thickness burn that are significantly higher in older

Table 4

Burn characteristics of the patients, depth of burns.

			Depth of burn		
			Partial thickness	Full thickness	
		n	n (%)	n (%)	*P*
Overall		288	170 (59)	117 (41)	
Age groups	Pediatric	158	118 (74.7)	40 (25.3)	<.01
	Younger adults	123	51 (41.5)	71 (57.7)	
	Older adults	7	1 (14.3)	6 (85.7)	
Gender	Male	187	105 (56.1)	82 (43.9)	.15
	Female	101	65 (64.4)	35 (34.7)	
Residence	Dili	171	110 (64.3)	61 (35.7)	.02
	Other	112	56 (50)	55 (49.1)	
	NA	5	4 (80)	1 (20)	
Cause of burns	Scalds	151	117 (77.5)	34 (22.5)	<.01
	Flame	106	39 (36.8)	67 (63.2)	
	Chemicals	3	1 (33.3)	2 (66.7)	
	Electrical	27	12 (44.4)	14 (51.9)	
	NA	1	1 (100.0)	0 (0.0)	

P values comparing the categories are calculated using Pearson chi-squared test.

adults (85.7%) than in younger adults (57.7%) and children (25.3%) age groups. This might suggest that burns might be more aggressive and severe in older patients.

The overall median LOS in the HNGV was 17 days, which is comparable but slightly lower among the mean or median in other studies from developing countries.[11,13,30,31] The LOS depends on the severity of the burns, the age, gender and residence of the patients, as well as the burn care and management. Referral patients from other district hospitals present more often with severe burns compared to patients from the hospital coverage area. Severe burn patients with higher TBSA affected often need more surgical treatment and therefore stay longer in hospital.[3] Interestingly, being female was associated significantly with an extended LOS compared to male patients although the severity of burns did not differ significantly.

For the investigated period we calculated an overall case fatality rate of 5.6%. This is relatively low in comparison to other studies representing the other LMICs.[3,11,31,32] This varied between the years (Supplement S1, Supplemental Digital Content, http://links.lww.com/MD/I50) and was highest in 2019. It is difficult to explain the high mortality in year 2019. However, more severe cases were referred and presented to HNGV in the later years and might contribute to the higher mortality. The overall low average mortality rate could be due to good established burn care in the HNGV, but on the other hand, it could also be due to already high mortality before the patient could be admitted to hospital. Our study showed that the burn-related mortality was associated significantly with older age, higher TBSA, full thickness burns, and flame burns. Peck et al also described inhalational injury as one of the main causes of in-hospital mortality,[3] but such data were not collected in this study.

This is the first study to review the epidemiology of burn patients admitted to the national referral hospital of HNGV in Dili, Timor-Leste. The finding will enable us to analyze the capacity of Timor-Leste to handle burn injuries and compare the results with those of other LMICs. Although the low number of burn patients and outcome events limit us to run multivariate analyses, the factors that were significantly associated with extended LOS and mortality may still help local clinicians to stratify patients and predict outcomes for burn injuries. This study also describes the different burn injury mechanisms and identifies at-risk groups thus providing contextually relevant information which can help inform programs for education and prevention to target by increasing awareness, improving safety in the environment, and hopefully reduce burn injuries.

World Health Organization Global Burden of Disease Database (2002) calculates a burn-related death rate of 11.6% per 100,000 population in Southeast Asia. Deriving from that rate, we estimated that there will be around 150 burn deaths in Timor-Leste every year.[1,5] In comparison to that, our study surely highlights only a fraction of the epidemiology of burn patients in Timor-Leste as our cohort included only those patients admitted to HNGV. We recognize that a significant number of burns patients is likely to exist outside our study group and hence this study underestimates the burden of this condition in Timor-Leste. This unreported cohort includes burn patients who died before admission and those who received outpatient treatment. Additional patients might obtain burn care from their primary care provider and bypass the hospital system. Referral patients from other districts with severe burns were overrepresented in our cohort because those with mild or moderate burns were often treated as outpatients or admitted to district hospitals. In addition, the population in rural areas of Timor-Leste is reluctant to utilize the health-care system because of various reasons, such as lack of patient transport, out-of-pocket expenses for hospital visits, cultural belief, and geographical barriers[16,33] and prefers instead to use traditional healers.[15] Often patients present very late after the burn injuries and already have complications. Other studies have reported that less than half of burn patients utilize hospital care and only about 5% of those need further care and require admission to an acute care facility.[13,24] We believe the number of patients utilizing hospital care in Timor-Leste is much lower and we believe the incidence of burns is much higher. Other limitations to this study design are the dependence on the medical examiner and the quality of the registry. The reporting quality of each case was very variable, and many case note records were incomplete. The registry has several gaps, for example it does not collect data on the place of the accident, the time of presentation after the accident, the vital clinical parameters for each patient on admission and holds no data on coexisting medical conditions. The data also lack information on the location details of the injury, type of management and number of surgeries as well as the cause of death.

Even though the number of hospital admissions for burn care has remained stable over the years, the severity of burns of the admitted patients seems to be higher in recent years. We speculate that this may be the indirect effect from improved transport infrastructure and improved care in district hospitals in recent years allowing better initial treatment and a reduction in early mortality for severe burns resulting in a greater number of survivors transferred to HNGV for ongoing management. Additionally, more mild and moderate burn patients receive

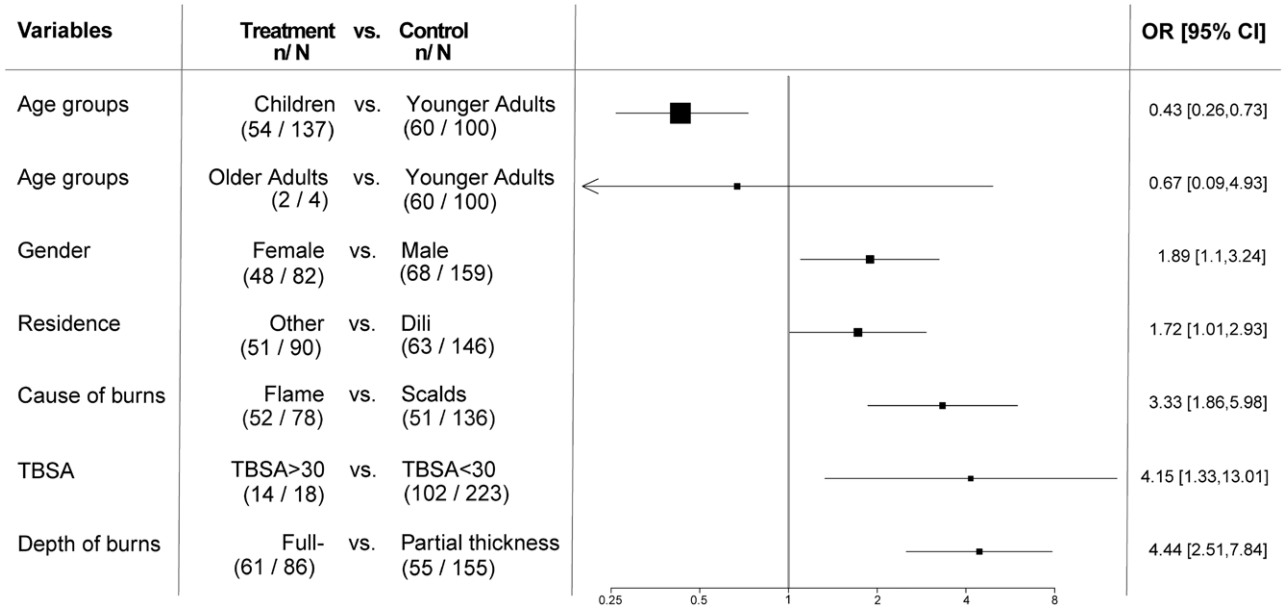

Figure 3. Forest plot for categories that associated with *extended LOS (length of stay) in burn patients. n = number of extended LOS in the category, N = total number of patients in the category, OR = odds ratio, CI = confidence interval. *Extended LOS = LOS longer than the median LOS of all patients (LOS >17 days).

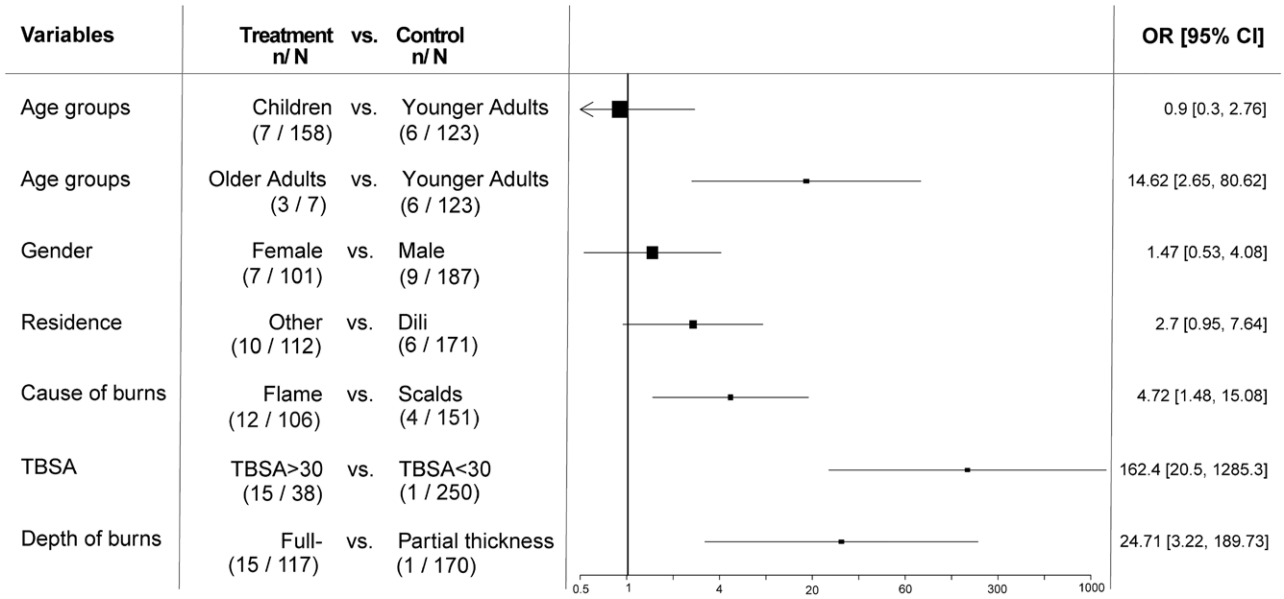

Figure 4. Forest plot for predictor associated with mortality in burns. n = number of mortalities in the category, N = total number of patients in the category, OR = odds ratio, CI = confidence interval.

definitive treatment in the district health care facilities. Data from other district hospitals of Timor-Leste were not available for us when we collected data for the current study. For future studies, it will be crucial to improve the reporting quality and include burn patients from all secondary-level hospitals in Timor-Leste. The data will be an important baseline to tailor the burn prevention strategy and the burn care capacity in HNGV and in district hospitals accordingly by, for example, educating or training more healthcare personnel and providing specialized units.

5. Conclusion

This study describes the characteristics, risk factors and outcomes of patients admitted for acute burns at the only tertiary-level hospital in Timor-Leste. Children and male patients were disproportionately overrepresented. Female patients had a longer LOS and older adult patients had more severe injury and a significantly higher risk of mortality.

A National Burns' Prevention program should be established in view of current data to reduce the incidence of burns. The program should increase the awareness of burn risk especially for young children and male adults.

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Validation: Lars Hagander.
Visualization: Junius Salendo.
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