

# DISTRIBUTION AND CHARACTERISTICS OF HEAD INJURY AND REFERRAL NUMBER AT DR H. ANDI ABDURRAHMAN NOOR GENERAL HOSPITAL, TANAH BUMBU, SOUTH BORNEO, INDONESIA



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## ABSTRACT

**Background:** Head injury (HI) has been one among leading causes of morbidity and mortality worldwide especially in the peripheries area. In South Borneo, 9.4% of trauma cases was a head injury. Especially, Tanah Bumbu Regency, one of peripheries area in South Borneo ranks third for head injuries after Tabalong and Tanah Laut Regency in 2007.

**Objective:** The aim of this study was to describe the characteristics of head injury patient and referral number at Dr. H. Andi Abdurrahman Noor general hospital.

**Methods:** All head injury patients admitted to the emergency department (ED) of Dr. H. Andi Abdurrahman Noor general Hospital in a one-year period (2017) were registered in this retrospective study. Using the total population sampling method,

413 cases of head injury during the period were included as a subject of study.

**Result:** This study showed that mild head injury was the most cases of head injury with 325 cases (78.2%). 61 patients were referred to a higher trauma center in 2017. Head injury was most common in 11-20 years old age group. Men also had higher incident rate compared to women (2:1). Most of the patients were a nonstate employee. Head injury is commonly caused by traffic accident.

**Conclusion:** This study shows that characteristics of HI in the peripheries area such Tanah Bumbu regency are no different from other countries. Our findings suggest that several prevention steps should be taken to reduce the number of head injury based on the distribution and characteristics of head injury sustainers.

**Keywords:** Head Injury, Distribution, Characteristics, Peripheries Area

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## INTRODUCTION

Head injury (HI) is trauma resulting injury to the scalp, skull or brain. It can be caused by any mechanism like a bump, blow, jolt, or penetration to the head. The term head injury is synonymous to traumatic brain injury (TBI) or craniocerebral trauma and is used interchangeably.<sup>1</sup> Head injuries have been one among leading causes of morbidity and mortality worldwide especially in peripheries.<sup>1,2</sup>

The World Health Organization (WHO) estimates that each year more than 10 millions people in the world sustain HI resulting in death or extensive hospitalization with the survivors often acquired a permanent disability. Most recent data indicate that HI is responsible for more than 4.5 million deaths a year which translates to approximately one in every 10 deaths in the world. This number is expected to increase, especially due to the rapidly increasing of HI in developing countries. The WHO predicts that by the year 2020, HI will be the leading cause of mortality and disability in the world, surpassing chronic disease and other current leading cause of death.<sup>3-5</sup>

Indonesia as one of developing countries has many head cases reported every year. In 2013, HI has caused 100.000 deaths in a traffic accident and made it the leading mortality reason. In South Borneo, 9.4% of trauma cases was a head injury. Especially, Tanah Bumbu regency one of peripheries area in South Borneo ranks third of HI after Tabalong and Tanah Laut Regency in 2007.<sup>6,7</sup>

While there are many causes of HI, road traffic accidents are responsible for about 60% of brain injuries in the world.<sup>3,4</sup> Globally, road traffic accidents are responsible for more than 50 million injuries every year, with about 1.2 million ending in death. Other causes are falls, which account for about 25% of brain injuries while nonmotor vehicle-related accidents along with acts of violence collectively account for about 15% of HI.<sup>1,3</sup>

CDC in 2005 reported that males are about 1.5 times as likely as females to sustain an HI. The two age groups at highest risk for HI are 0 to 4-year-olds and 15 to 19-year-olds. While in term

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of occupation, certain military duties (e.g. paratrooper) increase the risk of sustaining an HI. African Americans have the highest death rate from HI.<sup>1</sup>

Head injury is graded as mild, moderate, or severe on the basis of the level of consciousness or Glasgow Coma Scale (GCS) score after resuscitation.<sup>8</sup> Mild HI (GCS 14-15) is in most cases a concussion and there is full neurological recovery, although many of these patients have a short-term memory and concentration difficulties. In moderate HI (GCS 9-13) the patient is lethargic or stuporous, and in severe HI (GCS 3-8) the patient is comatose, unable to open his or her eyes or follow commands.<sup>8-10</sup>

Patients with severe HI (comatose) have a significant risk of hypotension, hypoxemia, and brain swelling. If these sequels are not prevented or treated properly, they can exacerbate brain damage and increase the risk of death. Major improvements in outcome can be achieved for such patients before they reach hospital by rapid resuscitation and direct transport to a major trauma facility, and in the hospital setting by monitoring of intracranial pressure and institution of adequate cerebral perfusion.<sup>8,10</sup>

Located 300 km away from the center of South Borneo, Banjarmasin, in which trauma center with neurosurgery facilities available makes management of HI in Tanah Bumbu Region becomes challenging. It takes 6 hours by car (ambulance) to transport a patient with HI. During the transfer period, stabilizing patient general condition is quite difficult. This article will further describe the characteristics of HI patient and referral number due to lack of neurosurgery facilities at Dr. H Andi Abdurrahman Noor (DHAAN) general hospital.

## METHODS

This retrospective study was carried out in DHAAN hospital as the only general public hospital in Tanah Bumbu Regency. Data in this study were collected from medical records of patients admitted to DHAAN emergency room and diagnosed with a head injury by the general practitioner from January to December 2017. This study was conducted with total population sampling methods. The severity of the head injury was classified by the Glasgow Coma Scale. GCS 14-15 was classified as mild HI, 9-13 as moderate HI, and 8 or below as severe HI at ED of DHAAN hospital. Characteristics of the subject in this study were later described based on age, gender, trauma mechanism, and occupation.

## RESULT

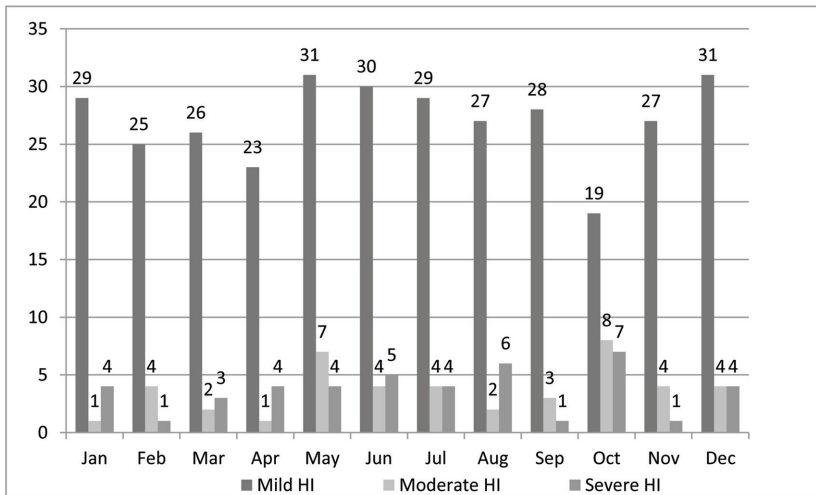
A total number of patients admitted to ED of DHAAN in 2017 with HI was 413 people. The highest incidence of HI happened in May with 42 cases (10.2%) followed by June and December with the same number of incidences reported as many as 39 cases (9.4%). Meanwhile, the lowest was recorded in April 2017 (28 cases, 6.8%). Based on the severity of HI, the highest incidence was mild HI with 325 cases (78.2%) followed by severe HI with 44 cases (10.9%) and moderate HI with 44 cases (10.9%) in one year. Distribution of incidence number and severity of cases may be in [Figure 1](#).

Age of patients varied from 8 months to 77 years. The highest incidence was recorded in the age group 11-20 years (126 people; 30.5%) followed by 21-30 years old subjects (83 people; 20.1%). Meanwhile, the lowest incidence was recorded by 0-10 years age group (38 people; 9.2%). The age distribution is visualized by [figure 2](#).

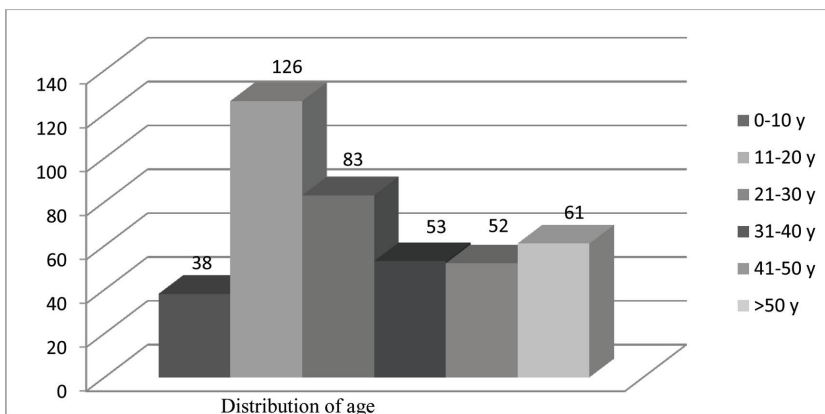
The ratio of male to female was 2:1. In 2017, 135 female patients (32.7%) and 278 male patient (67.3%) were admitted to ED due to HI. The main cause of HI reported in this study was traffic accident (388 cases, 93.9%). Fall accounted for 3.6% (15 cases) of HI while occupational accident accounted for 2.5% (10 cases). During the period of study, no HI case caused by assault, suicide attempt, sport, or recreational activities was reported. Distribution of gender and mechanism of HI are visualized by [figure 3](#) and [4](#).

As many as 159 patients (38.5%) with HI were a nonstate employee. This group consisted of subjects who worked for the private sector, run their own business, farmer, or freelancer. This group was noted as the highest population of HI sustainer. In the second rank, there was a student group with 114 subjects (27.6%) suffered from HI. In third and fourth rank were unemployed and state employee group with 87 (21.1%) and 53 (12.8%) sustainers out of 413 subjects.

Among 413 patients with HI at DHAAN 88 people with moderate and severe classification were indicated to be referred to higher level facilities with an available neurosurgeon. Only 61 patients (69.3%) were transferred while 25 (30.7%) patients refused to be referred to resulting in 4 out of 6 death due to HI at DHAAN emergency room. Among 61 transferred patients, 40 patients were male (65.6%) while the other 21 patients were female (34.4%). Most of the transferred patients were in 11-20 years age group (18 patients; 29.5%). Distribution of gender and age of transferred patient are visualized in [figure 5](#) and [6](#).



**Figure 1** Distribution of incidence number and severity in 2017



**Figure 2** Age distribution of HI at DHAAN general hospital in 2017

## DISCUSSION

Tanah Bumbu regency is one of 13 regencies in South Borneo province and located at the southern tip of Borneo island with 10 sub-districts. Tanah Bumbu regency is 5.067 km<sup>2</sup> large which is equal to 13.5 % of total South Borneo province area. Based on the population census in 2015, Tanah Bumbu regency had 306,641 inhabitants consisted of 157,701 males and 148,940 females. The highest inhabitants age range was 10-20 years (60,585 inhabitants; 19.8%). Tanah Bumbu regency only has one general hospital (DHAAN general hospital) as a referral center for 10 primary health centers and 2 private hospitals. The closest government facilities with neurosurgical service are Ulin General Hospital Banjarmasin which is located 300 Km away from Tanah Bumbu regions. It takes 6 hours by car (ambulance) to transport a patient with HI.<sup>11</sup>

In 2017, the highest incidence of HI at DHAAN general hospital was reported in May followed by June and December. This may have a strong association with traffic density which increases during school holiday every end of the semester. Even

though the special event is held every April in Tanah Bumbu but the number of HI incidence was relatively lower than other months. Since the event is annual and runs for almost 30 days, the local government always improves their preparations every April to decrease the number of traffic accidents as a main cause of HI in Tanah Bumbu due to traffic concentration in certain area.<sup>12,13</sup>

Classification of HI in this study is only based on GCS score due to the limitation of radiology equipment. CT scanner in DHAAN hospital has been just operated in the second semester of 2017. Most of HI cases in this study is mild head injury (78.2%) while moderate and severe head injury shared the same percentage (10.9%).<sup>14,15</sup> In case of mild HI, six hours observation at ED was performed for making sure there are no symptoms of increased cranial pressure or other neurologic deficit on the patients before they could be discharged with few notes about critical signs or symptoms they might experience as the sequel of HI. It has been a big challenge for managing patients with moderate to severe HI because advance neurological interventions are needed. Even though CT scanner is available now but there is still a demand for a neurosurgeon. Few studies have been conducted to determine the golden hour of severe HI. A study by Michael N. Din with 983 subjects sustained severe HI resulting in the conclusion that survival benefit was increased by the early arrival of severe HI patient to a designated trauma center. Survival benefit may still achieve 90 to 120 minutes from the time of injury.<sup>16</sup> Data in Michael N. Din et al study showed a higher percentage of mortality of patients who did not undergo urgent craniotomy procedure within less than twenty-four hours but based on current American College of Surgeon quality indicators as mentioned in the study urgent craniotomy should be performed within 4 hours from the injury time. 106 of 147 deaths (72.1%) reported in the study were patients who did not receive urgent craniotomy while 41 deaths (27.9%) were patients who underwent craniotomy.<sup>8,16,17</sup>

Referring to Alaska state guideline for acute head management in rural facility (CT scanner and medical provider are available but no neurosurgeon is on staff) early transfer to any facility with the neurosurgical ability is needed. In case of mild head injury with no CT scan available, skull Xray may be performed first to find any skull fracture. When skull fracture is found then the patient must be transferred to a higher level facility with a CT scan. In the management of moderate HI, the patient must be sent for CT scan as soon as possible. In case abnormal findings exist, neurotrauma consultation should be considered except for the following condition : Non-depressed skull fracture-open

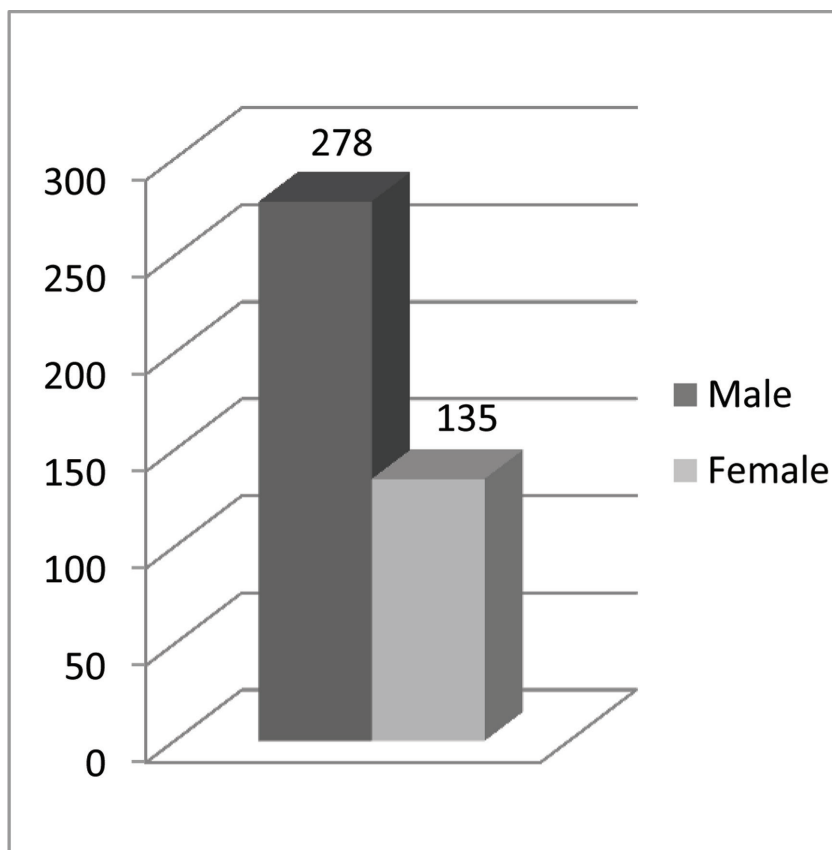


Figure 3 Gender distribution

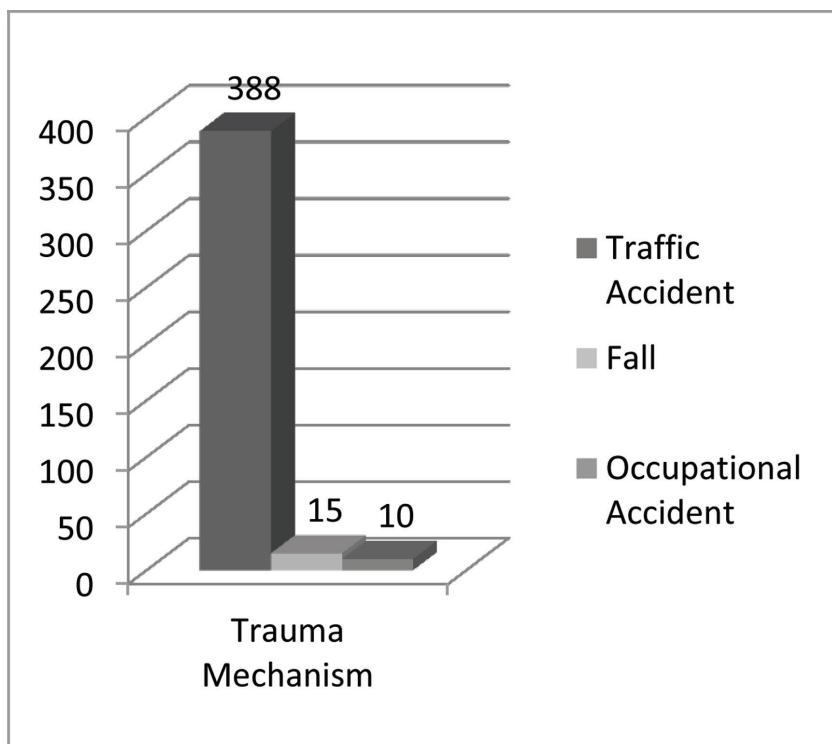


Figure 4 Mechanism of trauma distribution

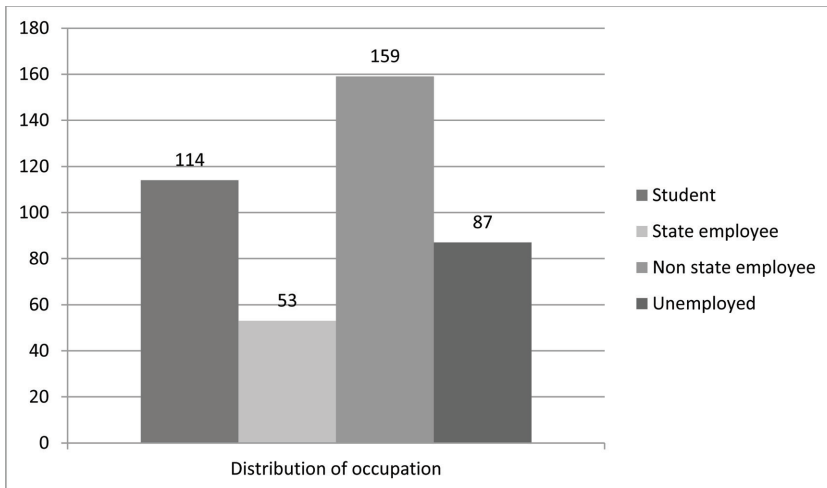
or closed, solitary contusion < 10 mm, contusions < 5 mm, subarachnoid blood < 4 mm, isolated pneumocephalus, and subdural hematoma < 4 mm.

while for no abnormal findings of head CT scan in mild HI, patient can be observed for 24 hours. Unfortunately for severe HI, there is no other option but to obtain head CT scan and transfer patient to facility with neurosurgical capabilities. Considering the long distance between Tanah Bumbu and Banjarmasin with the risk of lower survival outcome then a neurosurgeon is needed as staff in DHAAN hospital.<sup>17</sup>

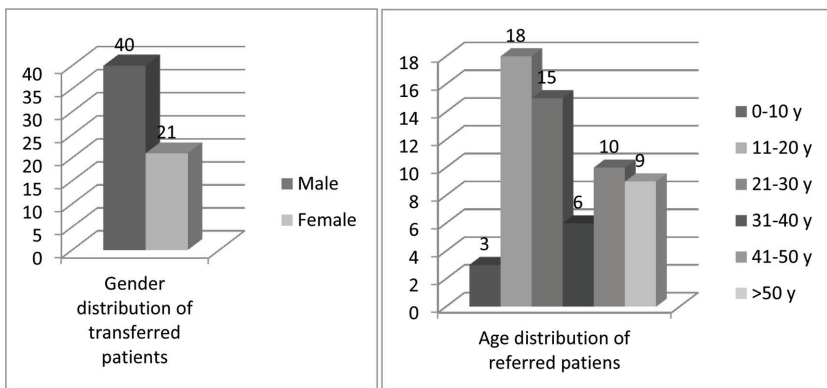
The highest incidence of HI has been reported in the age group of 11–20 years by most of the authors. In our study, the age of patients varied from 8 months to 77 years. Majority of the subjects were 11–20 years old (126 people; 30.5%). A study of HI in U.K. across all ages shows the peak incidence in the 15–30 years age range.<sup>18</sup> Frank Kennedy et al in their series of 192 patients reported that 90% of HI sustainer was in 0–14 years age range. Another study in northern Sweden resulting in the fact that younger individuals were fewer than older men but had more often a severe traumatic brain injury from a traffic accident.<sup>19</sup> In the study, the authors found that many underage subjects had already ride motor vehicles. Some were for transportation purpose. The Geographic condition of Tanah Bumbu in which some areas are located far from the center and public transportation is limited becomes the reason why many teenagers are allowed to ride a motorcycle even when they do not have any license. Careless riding attitude including the absence of helmet usage along with low parental supervision resulted in a high number of HI due to a traffic accident in teenagers population.<sup>19–21</sup>

The overall male and female subjects ratio was 2:1. Most of the USA reports show an incidence ratio of 2 or more for males compared to females. Adam et al, in their series of 672 patients showed 533 was male and 139 female patients.<sup>22</sup> Yattoo GH et al stated in his study 3: 1 ratio of male and female with a head injury. Young adult males are at highest risk for HI, but the male/female incidence ratio reaches 1:1 at age 65 years.<sup>13</sup> Even though the incidence of HI is higher in male than female population but more recent studies indicate poorer HI outcome in females whereas only a few investigators report a better outcome.<sup>13,23</sup> In a prospective study of severely and moderately brain-injured individuals, Kraus et al. found that females were 1.75 times more likely to die of their brain injury than males and were 1.57 times more likely to experience poor outcomes, i.e., severe disability or persistent vegetative state. Higher incidence in men is mostly related to the fact that men left the house more often and more actively working than women.<sup>24,25</sup>

The most common mechanism HI found is traffic accident which accounts for 93.9% of cases



**Figure 5** Distribution of occupation in HI sustained a population at DHAAN general hospital in 2017



**Figure 5** Gender distribution of transferred patients with HI to higher trauma facility **Figure 6** Age distribution of transferred patients with HI to higher trauma facility

followed by fall and occupational accident. This result is similar as Bohleet all showed in their study at Acharya Binova Bhavne Rural Hospital of Central India, the most frequent causes are motor vehicle accidents, bicycle accidents, or pedestrian-vehicle accidents (82%). Other causes reported include falls from height (9,5%).<sup>19</sup> According to Yatoo et, al. study the most common cause of HI is traffic accident (44.4%) followed by fall from height (32,2%).<sup>13</sup> Heskestad et all showed in their study in Norway had different profile HI causes. The highest incidence rate for HI is caused by a fall (51%) followed by a traffic accident (21%).<sup>26</sup> Fall was the most common cause of injury in children younger than 10 years and in adults above 40 years. Old people above 80 years is an interesting observation in their study, as the incidence for those above 80 is twice as high as for teenagers. As mentioned before geographical condition and limited public transportation play important role in increasing

motorcycle and car user every year.<sup>26-28</sup> The trend of private vehicle contributes to higher traffic accident rate as well as the road condition which is not very ideal.<sup>26,29</sup>

Majority of subjects were a nonstate employee (159 people; 38.5%) followed by the student (114 people; 27.6%). While state employee accounted for 12.8% (53 people) of HI and the unemployed group consisted of pre-school aged children, housewives, and elderly people stayed at home only were 21.1% (87 people) of the study population. This result is constant to Yatoo et al study which showed that the majority of patients admitted were laborers followed by students and government employee.<sup>13</sup> Occupation state of patient slightly affects the decision-making process when an HI patient was indicated for transfer to a higher trauma center. Many nonstate employee patients were not covered by any insurance.<sup>13,30,31</sup>

Among 88 patients who were indicated to be referred only 61 patients agreed to be transferred. 40 patients were male (65.6%) while the other 21 patients were female (34.4%). This is related to the fact that the majority of HI patient in this study are men who mostly were head of the family. Based on the observation of the author, since the head of the family was the victim, the decision-making process becomes slightly complicated. Times needed to start transfer was longer and predicted to cause a bad outcome.<sup>16,17</sup>

Majority of transferred patients were 11-20 years old (29.5%) as most subjects were in this age range. Transferring patient with moderate to severe HI is quite challenging due to long distance from Tanah Bumbu to Banjarmasin. It is worsened by confounding factors that delay the transfer process. Most common problems that medical staff have to deal with family consent. Few factors may be identified such as health insurance, financial support for family members accompanying transferred patient, and a discussion culture which involves too many relatives. In case of urgent craniectomy for decompression is indicated, delay in transfer to the neurological facility may lead to a higher mortality rate. Based on some studies of decompressive craniectomy, time plays an important role.<sup>8,16</sup>

The reason for performing decompressive craniectomy is to recover cerebral perfusion by surgically expanding intracranial space, consequently maintaining the cerebral perfusion pressure and reducing ICP to minimize secondary damage. There is no consensus as to the optimal time to perform the decompressive craniectomy, but there is no question that the operation should be performed before irreversible neurological

deficit occurs. Some advocates that the onset of brain swelling after TBI is within the first two to three hours and although opinions on the time duration for early surgical decompression may vary, there are many reports which state that by having performed early decompressive craniectomy, expected or initially secondary ischemia or axonal injury by refractory intracranial hypertension was preventable.<sup>8,16</sup>

Park et al recommended early operation for those with GCS lower than 6, with intracranial hematoma, and brain swelling and cerebral herniation, whereas Seelig et al had stated that ultra-early surgery of within 4 hours had shown mortality of only 30%, whereas those over the scope of 4 hours had mortality of over 90%.<sup>16,18</sup> Considering times needed to reach Banjarmasin is 6 hours by car then one alternative is to establish neurosurgical service within DHAAN general hospital.

## CONCLUSION

Being a retrospective review of this study work on the assumption that history and clinical records accurately represents the events. This study showed that mild head injury was the most cases. Head injury is most common in 11-20 years old age group. Men also have a higher incident rate compared to women. Most of the patients were a nonstate employee. Head injury most commonly caused by traffic accident. A large number of teenagers with a mild TBI due to a traffic accident need for continuous prevention.

This study also supports that characteristic of HI in the peripheries area such as Tanah Bumbu regency are no different from other countries. Our findings suggest that several prevention steps should be taken to reduce the number of head injury based on the distribution and characteristics of head injury sustainers.

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