Scientific Foundation SPIROSKI, Skopje, Republic of North Macedonia
Open Access Macedonian Journal of Medical Sciences. 2024 Dec 15; 12(4):536-541.
https://doi.org/10.3889/oamjms.2024.11942
eISSN: 1857-9655
***Category:*** *E – Public Health*
***Section:*** *Public Health Epidemiology*

# Increasing Number of Facial Injury in Mangusada General Hospital, Bali: Prevalence and Epidemiology

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**Edited by:** Sasho Stoleski
**Citation:** Tillasman NS, Mulya PIM, Roosseno RRN. Increasing Number of Facial Injury in Mangusada General Hospital, Bali: Prevalence and Epidemiology. Open Access Maced J Med Sci. 2024 Dec 15; 12(4):536-541. https://doi.org/10.3889/oamjms.2024.11942
**Keywords:** Facial Injury; Trauma; MVA
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**Received:** 05-Jul-2024
**Revised:** 04-Oct-2024
**Accepted:** 29-Oct-2024
**Ahead of print:** 20-Nov-2024
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**Funding:** This research did not receive any financial support
**Competing Interests:** The authors have declared that no competing interests exist

**Abstract**

**BACKGROUND:** Facial injury has repeatedly been shown to be associated with motor vehicle accident and assaults, which both can be prevented. In Indonesia, motorcycle is the most popular mode of transportation and is accounted for almost 85% of the total registered vehicles in Bali.

**AIM:** This study is aimed to describe the prevalence of facial injury in one of Bali's Urban Major Trauma Centre to provide documentation for prompt treatment and prevention.

**METHODS:** All the trauma patients who attended the Department of Plastic Surgery, Regional Public Mangusada Hospital, Badung, Bali during the period of 2020–2022 was included in the study. The incidence, prevalence, age, sex distribution and etiology of maxillofacial trauma were studied. The pattern and demographic distribution of fractures of maxillofacial skeleton also were studied.

**RESULTS:** We gathered 495 Facial Injury patients in our centre from January 2020 to December 2022, with significant increase of data every year. We obtained 94 patients in 2020, 136 patients in 2021, and 300 patients in 2022. The result showed that injury involving midfacial regions were the most common (n = 217, 38.9%) with major causative factor was Motor Vehicle Accident comprising 71.1% (n = 352) of all cases. Facial fractures are associated with significant functional, cosmetic, psychological, and socioeconomic effects. Therefore, maxillofacial trauma management requires pertinent documentation.

**CONCLUSION:** The incidence of facial fractures at our center continues to rise annually, highlighting the need for more effective strategies.

## Introduction

Facial injuries (FI) are among the most common types of traumas treated at emergency departments, associated or not with injuries in other anatomic sites. Especially, maxillofacial fractures are often associated with severe morbidity, loss of function, substantial financial cost, and disfigurement [1], [2], [3].

Moreover, facial trauma is an important health issue because its incidence has repeatedly been shown to be associated with motor vehicle accidents and assaults, which both can be prevented [4], [5]. The review of several studies clearly suggests that the causes for FIs vary from one country to another and even within the same country, and verification of the etiology of FIs provides insight into the behavioral patterns of people from different regions [1], [6], [7].

Trauma is typically considered a problem affecting primarily young urban males, and maxillofacial injuries occur in a significant proportion of trauma patients [6], [7], [8]. Studies from most developing countries of Africa, Asia, and the Middle East, have shown that road traffic accidents are the predominant cause of maxillofacial trauma. Less common causes are fall, industrial accidents and sports [1], [9], [10].

Motorcycle is the most popular mode of transportation in Indonesia including Bali Province. It has an average annual growth rate of approximately 11% and accounts for almost 85% of the total registered vehicles in Bali [11]. The census data showed that Badung regency is on the second largest use for motorcycles after Denpasar which our center's both coverage area. Based on a medical device manufacturer of surgical implants and instruments-especially craniomaxillofacial (CMF) titanium fixation, shows that our centre has one of the largest numbers of use encouraging as one of Bali's Urban Major Trauma Centre.

Therefore, we want to conduct a comprehensive epidemiology study on facial trauma at Mangusada General Hospital Badung as a major Urban Trauma Centre. As understanding epidemiology may aid in establishing clinical and research priorities for effective treatment and prevention of these injuries.

## Methods

We gathered 495 patients of Facial Injury in our centre from January 2020 to December 2022, with significant increase of data every year. We obtained 94 patients in 2020, 136 patients in 2021, and 300 patients in 2022. All cases were referred to our center with the variation of time interval following the injury.

The retrospective descriptive study recruited 495 cases with facial injury in our center, obtained from January 2020 to December 2022. All were studied based on the review of the medical report, also polyclinic and operating theatre administrative data.

Principal demographic conditions of 495 cases were then analyzed by including sex, age distribution, areas of injury, causes or mechanisms of injury. Concomitant injury is also the subject of review.

Through a comprehensive examination involving medical reports, clinical diagnoses, and official radiologist readings, our analysis classified facial injuries into two distinct categories (refer to Figure 1). The categories of injury types comprise only soft tissue injuries and facial fractures that we identified into four primary regions (refer to Figure 3).

In terms of the region of the fracture classification, the first category is the craniofacial or upper facial region, encompassing fractures affecting the orbital floor up to the frontal sinuses. The maxillofacial or midfacial region covers the middle third area of the face, extending from the orbital floor down to a line projected horizontally across the alveolar process of the maxilla. The mandibulofacial or lower facial region involves fractures impacting the mandibular and temporomandibular joints. A separate category is designated for nasal fractures due to their common occurrence and varied configurations, constituting the fourth region.

Age was stratified into interval categories, Patient age was described according to age groups in years: 0-16, 17-34, 35-50, 51-64, 65-70, 71-85, >85. Mechanisms of injury were classified into Motor Vehicle Accidents (MVA), Assault, Sports, Occupation, and home accidents, with traffic-related occupational incidents subsumed under the MVA category.

Descriptive analysis is presented for all data obtained in this study. The purpose of descriptive statistical analysis is to describe the characteristics of the subjects and research variables. Variables with numerical and ratio data scales are displayed as mean and standard deviation. The results of the descriptive analysis are presented in graphs, tables, and narratives.

## Results

Based on the classifications of two types of facial injuries out of 495 patients in our department, 392 (79.1%) of them are associated with facial fractures. The rest presented with only soft tissue injuries (n = 103, 20.8%).

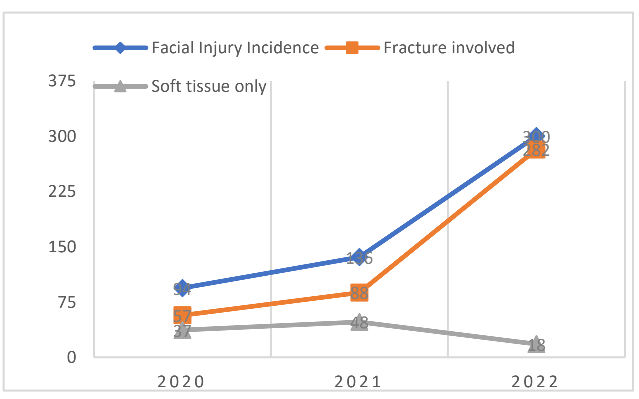


*Figure 1: Number of Plastic Surgery Facial Injury Patients in the last 3 years (n = 495)*

Basic demographic data showed that 67.6% (n=335) out of 495 cases were male, about 3:1 for the overall ratio of male to female. The highest frequency of facial fractures was found in the age group of 17–34 years old which comprises 43.8% of all cases (n = 217). The cases were distributed into age intervals, as shown in Figure 1. The frequency of facial fractures declines by the advance of the age and tends to be low at a later age.

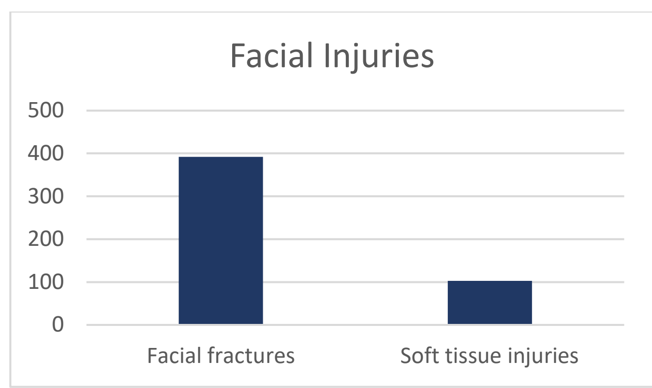


*Figure 2: Classifications of facial injuries*

Based on the area, the fractures were divided into the specific facial region affected. There was a case when a patient suffered from having more than one fractured facial region. Thus, one area of the

fracture was considered as a different fracture case. There were 558 regions that involved facial fracture area with midfacial fracture as the most common case.

**Table 1: Sample Distribution (n=495)**

| | n | (%) |
|---|---|---|
| **Age (years)** | | |
| 0 – 17 | 62 | 12.5 |
| 17- 34 | 217 | 43.8 |
| 35 - 50 | 138 | 27.8 |
| 51 - 64 | 55 | 11.1 |
| 65 - 70 | 16 | 3.2 |
| 71 - 85 | 5 | 1.01 |
| >80 | 2 | 0.4 |
| **Gender** | | |
| Male | 335 | |
| Female | 160 | |
| **Type of injury** | | |
| Facial fracture | 392 | |
| Soft tissue injury | 103 | |

About 62.8% (n = 311) of cases underwent surgery in our center. The remaining were either treated conservatively (n = 121, 24.6%) or in the condition where surgery was indicated but not performed due to non- medical reasons or surgery was delayed due to more threatening accompanying injury (n = 63, 12.6%).

**Table 2: Distribution of facial fractures based on the classified regions**

| Region | (n) | (%) |
|---|---|---|
| Isolated region | | |
| Upperfacial (U) | 61 | 15.6 |
| Midfacial (M) | 107 | 27.3 |
| Nasal (N) | 42 | 10.7 |
| Lowerfacial (L) | 55 | 14.0 |
| Combined region | | |
| U-N | 11 | 2.8 |
| U-M | 57 | 14.5 |
| L-N | 4 | 0.1 |
| U-M- | 11 | 2.8 |
| L M-L | 7 | 1.8 |
| U-M- | 13 | 3.3 |
| N U-L | 2 | 0.1 |
| M-N- | 7 | 1.8 |
| L N-L | 0 | 0.0 |
| Panfacial(1) | 11 | 2.8 |
| Le Fort I(2) | 3 | 0.1 |
| Le Fort II(3) | 1 | 0.0 |
| Le Fort III(4) | 0 | 0.0 |
| **Total facial fracture area** | | |
| Upperfacial (U) | 166 | 29.7 |
| Midfacial (M) | 217 | 38.9 |
| Nasal (N) | 89 | 15.9 |
| Lowerfacial (L) | 86 | 15.4 |

***(1)** Panfacial fracture category encapsulates fractures spanning the upper, mid, and lower facial regions. **(2)** Le Fort I level fractures are a separation of the hard palate from the upper maxilla due to a transverse fracture running through the maxilla and pterygoid plates just above the floor of the nose. **(3)** Le Fort II fractures transect the nasal bones, medial-anterior orbital walls, orbital floor, inferior orbital rims and finally transversely fracture the posterior maxilla and pterygoid plates. **(4)** Lefort III separates the maxilla from the skull base with a transverse separation of the nasofrontal suture, medial orbital wall, lateral orbital wall or zygomaticofrontal suture, zygomatic arch and pterygoid plates.*

## Discussion

This epidemiological study was conducted in a region of Badung, Bali that has a population of about 670,200, including urban and rural inhabitants [11]. The Plastic Surgery Department of our hospital is a reference center in the region around the city of Bali, in Badung region of western Bali.

Based on medical devise manufacturer of surgical implants and instruments-especially craniomaxillofacial (CMF) titanium fixation- the most common used in Indonesia, shows that our centre has the second largest number of uses encouraging as one of Bali's Urban Major Trauma Centre.

In 3 years, from January 2020 to December 2022, 495 patients were treated, and the analysis of this sample may provide knowledge about the current distribution facial injuries including facial trauma in western Bali, as well as help to build a database that may improve medical programs to prevent facial trauma.

**Table 3: Mechanism of Injury Distribution (n=495)**

| | (n) | (%) |
|---|---|---|
| **Mechanism of Injury** | | |
| MVA | 352 | 71.1 |
| Home accidents | 108 | 21.8 |
| Occupation | 19 | 0.03 |
| Assault | 11 | 0.02 |
| Sport related injury | 5 | 0.01 |

According to the classification of five different facial regions, that is, upperfacial or craniofacial (U), midfacial (M), nasal (N), and lowerfacial or mandibulofacial (L), we found the fractures on midfacial region were the most common (n = 217, 38.9%) followed by craniofacial region (n = 166, 29.7%), nasal fracture (n = 89, 15.9%), and mandibulofacial (n = 86, 15.4%) respectively. All were presented either in an isolated or in combination with other regions.

The etiologies of facial fractures in our center varied which the major causative factor was MVA comprising 71.1% (n = 352) of all cases and home accidents rank the second most common cause of 21.8% (n = 108), occupation (n = 19 0.03%), assault (n = 11, 0.02%), and sport-related injury (n = 5, 0.01%), respectively.

This study showed that the incidence rate of maxillofacial trauma has been rising significantly since 2020 to 2022. The lower incidence of facial trauma in 2020 may be related due to prevailing period of social distancing by Covid-19 pandemic according to the literature [12], [13], [14] which shows 54.5% reduction of facial trauma from 2019 to 2020 (n = 279 in 2019, and n = 127 in 2020). This is in line with decreased mobility in relation to people who were working from home [12], [13].

The traffic accidents were the cause of 71.1% of the cases (Table 2), a high percentage that raises serious concerns. The major risk factors for road traffic accidents are failure to follow traffic laws, speeding, drunk driving and damaged road facilities. Iida et al.14 conducted a retrospective study with 1502 patients with facial fractures and found that traffic accidents accounted for 52% of the cases, 38.8% of whom were unprotected patients, that is, cyclists (13.5%),

pedestrians (2.7%) and motorcyclists (23.1%). The explanation for the high incidence of traffic accidents was found in the study by Iida et al14. and our study lies in the type of hospital where both studies were carried out, namely, local reference centers for the treatment of trauma.

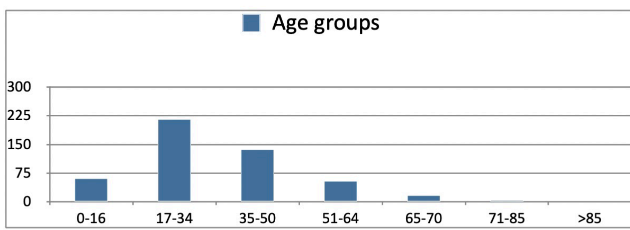


*Figure 3: Age groups Distribution (n=495)*

Various studies suggest that facial fractures commonly result from traffic accidents [2], [6], [7], [8], [10], [14], [15], [16], [17], [18] while some emphasize assault as a main cause [19], [20]. Our study aligns with the former, revealing a high number of fractures linked to traffic accidents, especially those involving motorcycles, and notably more among males aged 17-34. The men to women ratio is 3:1, similar to most of studies [2], [6], [7], [8], [10], [14], [18]. The prevalence of different causes, like home accidents, sport accident and assault, documented in our research, is tied to the age and gender of the patients. These factors significantly influence how often certain regions of the face experience fractures.

As indicated by the World Health Organization (WHO) in 2013, Of all the different types of motor vehicles used worldwide, motorcycle riders consistently face the most serious head and neck injuries [22]. In Bali, motorcycles make up 75% of all vehicles, far outnumbering other types. The increase in motor vehicle ownership and quick economic growth in Bali has led to a surprising rise in road traffic injuries, and this trend is expected to continue. This emphasizes the need for taking proactive steps to address the situation [11].

Unfortunately, despite existing helmet regulations, emphasize a concerning trend of suboptimal compliance among riders, with less than 50% maximizing the protective benefits of helmets [23], [24]. Our findings echo the repercussions of this lack of adherence, with a substantial portion of facial fractures stemming from traffic accidents, a significant proportion of which involve unprotected individuals, particularly motorcyclists.

The second most frequent etiological agent in this study was home accidents (21.8%) (Table 3), a finding that agrees with other studies10. Most patients that were injured from home accidents were toddler or elderly which caused by tripping or falling. The studies show that mostly home accident-related injury results in soft tissue injury.

The most common facial fracture site varied among studies. The results from most studies showed that the mandible or lower facial was the most affected area [6], [17], [21]. In this study, midfacial region were the most common fracture (n = 217, 38.9%) followed by craniofacial region (n = 166, 29.7%), nasal fracture (n = 89, 15.9%), and mandibulofacial (n = 86, 15.4%). respectively. A study showed the statistical significance of midfacial bone fracture in relation to motorcycle accidents and physical aggression in the 2019 cohort (p<0.05) 19 which is like other studies [6], [7].

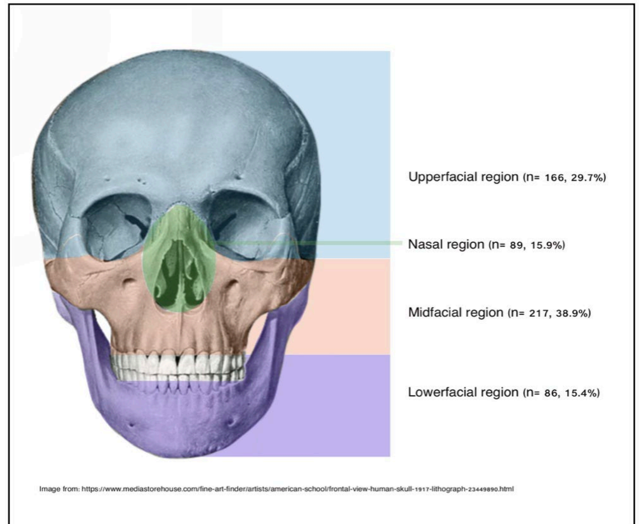


*Figure 4: Distribution of facial fracture regions according to four regions*

Likewise, in 2020, data demonstrated a significant proportion of midfacial fracture in motorcycle accidents. Part of midfacial is zygomatic bone, which is the side pillar of the face and absorbs a large part of the traumatic force in traffic accidents and physical aggressions, as they have a high kinetic load on impact [19]. The fact that individuals tend to turn their head at the time of the impact to avoid frontal or ocular contact should also be considered. All this makes the midfacial more susceptible to fracture.

Furthermore, Rusli et al.25 also showed similar result that the most prevalent maxillofacial fracture site was the mid-face 40.9% in the half-coverage helmeted group and 26.9% in upper-middle-lower in the unhelmeted group suggesting the importance of choosing the right helmet especially in motorcycle accidents. Insights gleaned from Chaichan et al.'s large sample size review (6529 participants) affirm the efficacy of full-face helmets in preventing head and cervical injuries in motorcycle accidents [26]. These collective findings unequivocally advocate stringent regulations, particularly the enforcement of full coverage helmets, as a proactive step to mitigate the escalating toll of facial injuries among motorcycle riders.

These findings emphasize the urgency for public policies to intensify the awareness of traffic law

and the importance of using standardized personal protective equipment. This study is also applicable for the development of new guidelines to prevent new injuries, education, and systematization care. Specifically, we propose a robust enforcement of full coverage helmet mandates to safeguard motorcycle riders. The alarming prevalence of facial injuries, especially among the unprotected, necessitates immediate and decisive action.

## Conclusion

In conclusion, we could see from this data that the incidence of facial injury at our center continues to rise annually which predominantly happened in male patient with the age of 17–34 years old. Facial fractures were the most common injury, especially in the midfacial region. Most cases underwent surgery. Motor vehicle accidents were the most common etiology. This data was highlighting the need for more effective strategies for preventing and managing facial injury.

## Recommendation

The prevalence of facial injuries, particularly in the context of motor vehicle accidents and assaults, necessitates a thorough understanding of effective treatment and prevention strategies. As the most popular mode of transportation in Indonesia, motorcycles contribute significantly to the regional injury profile, emphasizing the need for targeted interventions to mitigate the associated risks.

Moreover, given the secondary referral status of Mangusada General Hospital, a nuanced exploration of facial trauma epidemiology aligns with the hospital's commitment to comprehensive patient care. This study not only contributes to the local understanding of injury patterns but also provides valuable insights that can inform regional and national public health strategies. The rising incidence of facial fractures highlighted in our research underscores the urgency for more effective preventive measures, making this investigation not just academically pertinent but also pragmatically crucial for improving healthcare outcomes in the Badung region and beyond.

Based on demographic data in this study, facial trauma is most common in productive age. This shows that the greater the mobilization, the greater the risk of facial trauma. This needs to be studied from all factors, both in terms of the discipline of residents in obeying the rules, the provision of speed limits in an area, to adequate road facilities. The higher proportion of affected men may be related to men being generally more social and tend to be more aggressive in driving compared to woman. The prevalence of different etiological agents, including traffic accidents, assault, and others, as documented in our research, is intricately linked to the age and gender of the patients. These factors play a decisive role in determining the frequency at which specific regions of the facial skeleton sustain fractures.

In essence, the research on facial trauma epidemiology at Mangusada General Hospital emerges as a crucial step towards enhancing the hospital's trauma management protocols, informing public health policies, and ultimately improving the well-being of the diverse community served by this vital secondary referral governmental institution.

## Limitation

Further research is warranted to address several limitations identified in this study. Firstly, given the exclusive focus on patients within the plastic surgery department, future investigations should aim to include a broader patient population within Mangusada General Hospital to mitigate potential patient selection bias. Additionally, while the study concludes that motor vehicle accidents contribute significantly to facial injury, it is important to note that within the context of Bali, a substantial portion of MVAs are attributed to motorcycles. However, due to the limitations in data collection and reporting, the specific contribution of motorcycle accidents are not reflected in the findings. Understanding the specific contribution of motorcycle accidents, a prevalent cause of MVAs in Bali, could enhance the validity of findings and inform targeted interventions to reduce maxillofacial injuries.

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