

# Etiology, Epidemiology, and Treatment Type of Maxillofacial Traumas in Razavi Khorasan Province with Certain Insurance between 2016 and 2021

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## ABSTRACT

**Background:** Trauma is a leading cause of death and disability in developing countries, with maxillofacial fractures being a significant part of such cases. This study focuses on maxillofacial traumas among insured patients in Razavi Khorasan province (2016-2021), exploring the impact of gender, age, and trauma causes on injury prevalence and treatment approaches.

**Methods:** This retrospective cross-sectional study utilized the records of the patients who were treated for maxillofacial fractures in Mashhad Shahid Kamyab Hospital or a Private Trauma Center, from 2016 to 2021. Demographic characteristics of the patients (age and gender), educational backgrounds of surgeons, accident causes, year and location of the fractures, and reasons for referrals were recorded. The data were statistically analyzed using SPSS 20, and the significance level was set at 0.05.

**Results:** We examined the records of 60 patients (44 males, 16 females). Males (73.4%) exhibited a significantly higher prevalence of maxillofacial traumas compared to females (26%) ( $P$  Value < 0.05). Falling was identified as the most common cause of fractures (51.7%), followed by impacts from hard objects and motor vehicle accidents (MVA) ( $P$  Value = 0.63). Mandible fractures were observed in 48% of patients, followed by zygomaticomaxillary and panfacial fractures, subsequently ( $P$  Value < 0.05).

**Conclusion:** The study findings highlight the impact of age, gender, and trauma causes on maxillofacial fractures and treatments among patients with certain insurance. Understanding the origins and patterns of these fractures offers crucial insights for shaping effective health policies, providing valuable guidance for addressing such injuries in this population.

## KEYWORDS

Maxillofacial fractures; Trauma; Treatment; Complications

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## INTRODUCTION

The maxillofacial area is a complex and vital body region comprising essential bones and organs. Any impact on the face can result in damage to soft tissues, teeth, and critical components of the facial skeleton. Prompt and accurate diagnosis and treatment of these fractures are of

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paramount importance. Consequently, physicians bear dual responsibilities towards patients: first, to reconstruct the defects and restore the pre-injury appearance; and second, to reinstate the original functionality of the affected organ<sup>1</sup>. Given the potential for simultaneous fractures in this area and associated complications such as airway obstruction and hemorrhagic shock, it is crucial to promptly and meticulously evaluate these traumas through clinical and radiographic examination<sup>2,3</sup>.

Midfacial fractures are prevalent among various populations, highlighting the significance of the central portion of the face in terms of both function and aesthetics. The midfacial skeleton plays a crucial role in facilitating the functioning of the respiratory, olfactory, visual, and digestive system<sup>2</sup>. Facial fractures can be categorized into several general groups. The nasal bones, due to their location and relatively thin structure, are most commonly affected, resulting in nasal bone fractures. Following the nasal bones, the mandible represents the next frequent site of facial fractures. Among maxillary fractures, alveolar process fractures are the most common type. These fractures are associated with risks such as avulsion, crown or root fractures, tooth intrusion or extrusion, and malocclusion<sup>3</sup>. Fractures involving the palate, zygomaticomaxillary complex, naso-orbital-ethmoid (NOE) region, and orbit are other subtypes of midfacial fractures. Le Fort fractures, classified into three types, are considered the primary midface fractures<sup>4</sup>. In fractures affecting the upper third of the face, the frontal sinus wall is often involved due to its relative thinness compared to other parts of the frontal bone.

The examination of maxillofacial fractures, considering the severity and causes of injury, varies across different populations<sup>5</sup>. The frequency and causes of maxillofacial injuries differ among regions and cities, particularly in developing countries where changes in frequency and complications of maxillofacial trauma are observed. For instance, in developing countries, vehicle accidents have been reported as the most common cause of maxillofacial injuries<sup>4</sup>. However, in recent times, incidents such as beatings and physical fights have emerged as common causes of fractures<sup>6</sup>. With the rise in the number of vehicles and subsequent increase in road accidents, the prevalence of these fractures is growing progressively again. Technological advancements and the increasing use of motor vehicles also expose

individuals to trauma-related injuries resulting from road accidents<sup>5</sup>. In Iran, road accidents, including incidents involving pedestrians, car passengers, and motorcycle riders, have been identified as the primary etiology of maxillofacial fractures<sup>7,8</sup>. Various studies have highlighted road accidents, falling, injuries, and sports-related incidents as the key causes of maxillofacial fractures<sup>9-11</sup>. Additionally, facial bone injuries are predominantly attributed to driving accidents and acts of violence, with men being at higher risk of fractures and trauma<sup>2,5,9,12</sup>.

In patients with certain insurance, the etiology of injuries differs, leading to variations in the extent of injury and treatment methods. Notably, in military environments, factors like gunshots can contribute to head and neck trauma. Maxillofacial ballistic injuries can occur both among the general population and within the patients with certain insurance. Injuries causing trauma in civilians are typically associated with low-velocity weapons such as handguns and shotguns. However, in military conflicts, high-velocity fragments have been identified as the primary cause of jaw and face injuries<sup>13</sup>.

Differences in the injury mechanism and the environment in which they occur necessitate distinct timelines for addressing civilian and military injuries. In both cases, initial damage control measures should be implemented within the first hour as temporary assistance. However, due to the severity of military injuries and the need to prioritize treatment for life-threatening conditions, maxillofacial injuries may be postponed until the patient's overall condition stabilizes. Once the patient's condition is improved and is deemed suitable for transfer, they can be referred to a specialized center for maxillofacial treatment<sup>13</sup>.

Taking into account the high occurrence and seriousness of maxillofacial traumas, as well as the distinct injury patterns observed among patients with certain insurance compared to the general population, this study was conducted to assess the treatment and treatment outcomes of military insurance patients with maxillofacial trauma in Razavi Khorasan Province between 2016 and 2021.

## METHODS AND MATERIALS

This retrospective cross-sectional study utilized patient records from Shahid Kamyab Hospital and

a Private Trauma Center in Mashhad.

The study received ethical approval from the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran (code: IR.SBMU.TEB.POLICE.REC.1402.020). Strict adherence to ethical considerations was followed, and patient personal information and names were not recorded at any point during the research.

The study sampling was conducted between 2022 and 2023. Patient clinical and radiographical documents from the period between 2016 and 2021, covered by certain insurance, were examined. The study included all patients with maxillofacial trauma and fractures who referred to above mentioned centers, while excluding those with jaw dislocation or insufficient data. Information such as age, gender, educational background of the surgeon, cause and year of the accident, location of trauma, and reason for referral were recorded for all patients.

Data analysis involved the use of chi-square, Fisher's exact test, *t*-test, analysis of variance, or their non-parametric equivalents. The data were statistically analyzed using SPSS 20 (IBM Corp., Armonk, NY, USA). A *P*-value less than 0.05 was considered statistically significant.

## RESULTS

Data from 60 patients were recorded, comprising 44 males and 16 females. Among them, 15 patients (14 males, 1 female) were examined at Private Trauma Center, while 45 patients (30 males, 15 females) were examined at Shahid Kamyab Hospital. A significant difference was observed between the two hospitals in terms of age and gender (*P* value < 0.05). At Shahid Kamyab Hospital, females accounted for 33.3% of the patients, while males represented 66.7%. On the other hand, at Private Trauma Center, females constituted 6.7% of the patients, while males made up 93.3%. The average

age of patients at Shahid Kamyab Hospital was 31.5 years; while at Private Trauma Center, it was 27.5 years.

### Treatment team

All surgeons at Private Trauma Center were oral and maxillofacial surgeons, representing 100% of the healthcare providers. At Shahid Kamyab Hospital, 64.4% of treatments were conducted by oral and maxillofacial surgeons, 28.9% by ear, nose, and throat (ENT) surgeons, and 6.7% by oral and maxillofacial surgeons and neurosurgeons. The Fisher's statistical test revealed a significant difference between the two hospitals under investigation (*P* Value = 0.03).

### Trauma type

Table 1 presents the distribution of trauma types in the examined hospitals. Nasal, dental, skull, and frontal traumas were not observed in Private Trauma Center. The most prevalent trauma type in Private Trauma Center was mandible-related. In the Shahid Kamyab hospital, the most common trauma was also mandible-related, while the least common traumas were associated with the skull, frontal region, and dental area. The statistical analysis (*P* Value = 0.41) did not indicate a significant difference in trauma distribution between the two hospitals.

### Cause of the accident

Table 2 presents the causes of maxillofacial fractures in the two investigated hospitals. In both hospitals, falling were identified as the most common cause of fractures, followed by motor vehicle accidents and impact from hard objects. Statistical analysis (*P* Value = 0.63) did not indicate a significant difference in the causes of accidents between the investigated hospitals.

**Table 1:** Types of maxillofacial traumas in the investigated hospitals

| Hospital              | Trauma type |          |          |          |           |               |           |            | Total     | <i>P</i> Value |
|-----------------------|-------------|----------|----------|----------|-----------|---------------|-----------|------------|-----------|----------------|
|                       | Nasal       | Dental   | Skull    | Frontal  | Panfacial | Zygomaxillary | Maxilla   | Mandible   |           |                |
| Private Trauma Center | 0 (0%)      | 0 (0%)   | 0 (0%)   | 0 (0%)   | 3 (20%)   | 1 (6.7%)      | 2 (13.3%) | 9 (60%)    | 15 (100%) | 0.41           |
| Shahid Kamyab         | 8 (17.8%)   | 1 (2.2%) | 1 (2.2%) | 1 (2.2%) | 5 (11.1%) | 7 (15.6%)     | 2 (4.4%)  | 20 (44.4%) | 45 (100%) |                |
| <b>Total</b>          | 8 (13.3%)   | 1 (1.7%) | 1 (1.7%) | 1 (1.7%) | 8 (13.3%) | 8 (13.3%)     | 4 (6.7%)  | 29 (48.3%) | 60 (100%) |                |

### Treatment type

The most common treatment performed in both hospitals was Close Reduction. However, the percentage of close reduction in Private Trauma Center (53.3%) was higher than in Shahid Kamyab Hospital (44.4%). Statistical analysis (*P* Value = 0.18) did not indicate a significant difference in the type of treatment between the investigated hospitals.

### Referral reasons

Table 3 presents the reasons for the referral of maxillofacial fractures in the two hospitals. In Private Trauma Center, the most common reason for referral was pain-occlusion disorder, followed by pain-bleeding-occlusion disorder. On the other hand, in Shahid Kamyab Hospital, the most common causes of referral were pain and pain-bleeding-occlusion disorder, followed by pain-occlusion

disorder. The Fisher’s statistical test indicated a significant difference between the two hospitals (*P* Value = 0.01).

### Severity of trauma

The majority of traumas in both hospitals were classified as moderate, while the least common traumas were classified as mild. However, the statistical analysis (*P* Value = 0.29) did not reveal a significant difference between the two hospitals in terms of trauma severity (Table 4).

## DISCUSSION

In this study, various aspects of the patients’ demographic information, including the type and number of fractures, trauma severity, reason for referral, cause of the accident, and surgeon’s educational background, were examined and

**Table 2:** Evaluating causes of maxillofacial fractures in the two investigated hospitals

| Hospital              | Cause of fracture |          |                   |                         |                  |                     | Total     | P Value |
|-----------------------|-------------------|----------|-------------------|-------------------------|------------------|---------------------|-----------|---------|
|                       | Falling           | Gunshots | Domestic violence | Motor vehicle accidents | Other etiologies | Hard objects impact |           |         |
| Private Trauma Center | 9 (60%)           | 0 (0%)   | 0 (0%)            | 3 (20%)                 | 0 (0%)           | 3 (20%)             | 15 (100%) | 0.63    |
| Shahid Kamyab         | 22 (48.9%)        | 1 (2.2%) | 1 (2.2%)          | 10 (22.2%)              | 3 (6.7%)         | 8 (17.8%)           | 45 (100%) |         |
| <b>Total</b>          | 31 (51.7%)        | 1 (1.7%) | 1 (1.7%)          | 13 (21.7%)              | 3 (5%)           | 11 (18.3%)          | 60 (100%) |         |

**Table 3:** Investigating the causes of referral in the investigated hospitals

| Hospital              | Type of treatment performed |                             |            |                         |               |                                  |               |                  | Total     | P Value |
|-----------------------|-----------------------------|-----------------------------|------------|-------------------------|---------------|----------------------------------|---------------|------------------|-----------|---------|
|                       | Occlusion disorder          | Bleeding-occlusion disorder | Pain       | Pain-occlusion disorder | Pain-bleeding | Pain-bleeding-occlusion disorder | Pain-hematoma | Facial deformity |           |         |
| Private Trauma Center | 1 (6.7%)                    | 1 (6.7%)                    | 3 (20%)    | 4 (26.7%)               | 0 (0%)        | 3 (20%)                          | 1 (6.7%)      | 2 (13.3%)        | 15 (100%) | 0.01    |
| Shahid Kamyab         | 0 (0%)                      | 0 (0%)                      | 12 (26.7%) | 9 (20%)                 | 8 (17.8%)     | 12 (26.7%)                       | 4 (8.9%)      | 0 (0%)           | 45 (100%) |         |
| <b>Total</b>          | 1 (1.7%)                    | 1 (1.7%)                    | 15 (25%)   | 13 (21.7%)              | 8 (13.3%)     | 15 (25%)                         | 5 (8.3%)      | 2 (3.3%)         | 60 (100%) |         |

**Table 4:** Investigating the severity of trauma in the investigated hospitals

| Hospital              | Severity of trauma |            |            | Total     | P Value |
|-----------------------|--------------------|------------|------------|-----------|---------|
|                       | Mild               | Moderate   | Severe     |           |         |
| Private Trauma Center | 4 (26.7%)          | 6 (40%)    | 5 (33.3%)  | 15 (100%) | 0.29    |
| Shahid Kamyab         | 4 (8.9%)           | 21 (46.7%) | 20 (44.4%) | 45 (100%) |         |
| <b>Total</b>          | 8 (13.3%)          | 27 (45%)   | 25 (41.7%) | 60 (100%) |         |

compared between patients referred to Private Trauma Center and Shahid Kamyab hospital in Mashhad, which use patients with certain insurance. The patients in the two hospitals showed statistical differences in terms of gender and age. It is noteworthy that there were more men than women in both hospitals, which can be attributed to the higher participation of men in the active population, particularly in underdeveloped countries where they are exposed to greater risks. Factors such as driving vehicles, engaging in sports activities, having an active social life, and substance use, including alcohol, contribute to their increased vulnerability<sup>9</sup>. Different studies examining demographic information have yielded varied results. The prevalence of maxillofacial trauma among genders is influenced by cultural and socio-economic factors<sup>14</sup>. The findings of this study align with previous research conducted in Switzerland, Pakistan, Uganda, Nairobi, and other studies conducted in Iran<sup>7,9,12,15-18</sup>. Additionally, a systematic review focusing on maxillofacial trauma in the countries of the Persian Gulf region also indicated a higher prevalence of such trauma among men<sup>15</sup>.

Regarding the average age, patients in Private Trauma Center had an average age of 27.5, while those in Shahid Kamyab Hospital had an average age of 31.5. Previous studies have reported an average age range of 20 to 30 years for individuals with maxillofacial trauma<sup>8,9,15</sup>.

The treatment teams in the two hospitals exhibited a significant difference. At Shahid Kamyab Hospital, patients received treatment from the oral and maxillofacial surgery or ear, nose, and throat (ENT) departments. Conversely, at Private Trauma Center, all patients were admitted to the oral and maxillofacial surgery department. This difference may arise from the educational nature of the Shahid Kamyab hospital, the presence of specialists from various fields in the emergency room, and variations in doctors' shift arrangements.

It is worth noting that three patients at Shahid Kamyab Hospital received joint treatment from oral and maxillofacial surgery specialists as well as neurosurgery specialists due to the severity of trauma and the affected areas. This case highlights the importance of interdisciplinary cooperation between different specialties in the treatment and management of maxillofacial trauma.

The causes of maxillofacial fractures have undergone

continuous changes over the past three decades and continue to evolve<sup>12,19</sup>. Maxillofacial trauma can result from various factors, including motor vehicle accidents, falling, assaults, industrial accidents, sports injuries, and firearm injuries. Motor vehicle accidents are often caused by factors such as lack of road safety awareness, inadequate road conditions, speeding, the use of old vehicles without safety equipment, failure to wear seat belts and helmets, and violations of traffic regulations<sup>9</sup>.

The causes of road accidents can vary based on socio-economic and environmental factors in different countries. Persian Gulf countries share similar economic characteristics, particularly in terms of car ownership per capita. This can explain the higher prevalence of car-related accidents in these countries<sup>15</sup>.

According to similar studies, the primary causes of maxillofacial trauma are motor vehicle accidents and violence<sup>5,18,20</sup>. However, in this study, falling were identified as the most common cause, followed by motor vehicle accidents and impacts from hard objects. This difference may be attributed to the fact that patients involved in accidental incidents, who have records of ambulance transportation or official registration by law enforcement agencies, are typically covered by national insurance in Iran and do not usually utilize their personal insurances.

The mandible, known for its strength, is yet susceptible to fractures due to its unique shape, the presence of impacted wisdom teeth, and its mobility<sup>11</sup>. In our study, the majority of fractures were observed in the mandible, followed by the zygomaticomaxillary, panfacial fractures (involving multiple areas simultaneously), and the maxilla. These findings align with previous studies that also highlight the involvement of the mandible in fractures<sup>10,11</sup>. However, our results contradict studies that emphasize the zygoma and midface, potentially due to the prominence of the zygomaticomaxillary complex<sup>15-17</sup>. Generally, the mandible and subsequently the zygoma appear to be the most vulnerable parts of the facial skeleton in Asian countries and Persian Gulf countries. These findings differ from studies conducted in Western countries, where complex fractures of the nasal and zygomatic bones are more common<sup>9,12,15</sup>. Nonetheless, Arslan ED et al. observed that the majority of injuries are concentrated in the middle and upper thirds of the face<sup>21</sup>.

At Shahid Kamyab Hospital, the most common reason for referral was isolated pain, as well as pain accompanied by occlusion disorders and bleeding. On the other hand, at Private Trauma Center, referrals were primarily due to pain and occlusion disorders. Considering the nature of the fractures, pain and occlusion disorders were the leading causes for referral, especially considering the prevalence of mandible fractures, which often coincide with occlusion disorders. Most of the traumas observed in our study were of moderate to severe severity, with fewer referrals related to mild traumas. Mild trauma patients are likely to visit hospitals less frequently due to fewer complications.

The management of maxillofacial fractures can vary among different surgeons. It is influenced by the available tools and resources. However, it is important to prioritize treatment based on the type of injuries rather than relying solely on individual surgeons and their preferred techniques. In both hospitals, the most frequently employed treatment method was Close Reduction, although the percentage of Close Reduction cases was higher at Private Trauma Center compared to Shahid Kamyab Hospital. This finding is consistent with similar studies where the close reduction method has been commonly utilized for treating maxillofacial fractures<sup>6,7</sup>.

The utilization of the ORIF (Open Reduction Internal Fixation) technique necessitates specific equipment such as screws and plates. Given the requirement for this treatment in cases of more severe traumas, it is advisable to ensure an adequate supply of these provisions to meet the hospital's needs. The results indicate a significant preference for Shahid Kamyab Hospital among individuals with certain insurance compared Private Trauma Center. As the designated trauma center in Khorasan Razavi, Shahid Kamyab Hospital consistently faces a high influx of patients, particularly those with maxillofacial trauma. Considering the substantial patient load in Shahid Kamyab Hospital and the presence of dedicated hospitals for the patients with certain insurance, it is recommended to provide more suitable conditions to accommodate this specific category of patients.

## CONCLUSION

Patients' age, gender, and trauma causes significantly contributed to the prevalence of maxillofacial fracture types and treatment plans in the patient

population with certain insurance. Furthermore, understanding the etiology and epidemiology of maxillofacial fractures among patients with certain insurance can provide valuable insights for the formulation of health policies that offer assistance and guidance in addressing these injuries effectively.

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## CONFLICTS OF INTEREST

The authors declare that there is no conflict of interests.

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