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Investigation of Factors Associated with Injury Severity and Hospitalization Requirement in Patients with Sports-Related Trauma Presenting to the Emergency Department in Urmia

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Abstract

Background: Sports injuries are a major cause of emergency department visits, with approximately 7–8% of cases requiring hospitalization. Injury severity in athletes is associated with various factors, including body mass index (BMI), training time, and inadequate warmup. Additionally, the mechanism of injury, such as accidents involving off-road vehicles, plays a significant role in trauma severity, particularly in cases of traumatic brain injury. The aim of this study was to investigate the factors associated with injury severity and the need for hospitalization in patients presenting to the emergency department with sports-related trauma.

Methods: This retrospective study was conducted on all patients with sports-related trauma who presented to the emergency department of Imam Khomeini Hospital in Urmia during the year (2025). Demographic data, including age, sex, and medical history, as well as incident characteristics, such as type of sport, location, mechanism of injury, and time of presentation, along with injury severity based on the Injury Severity Score (ISS) and hospitalization requirement, were extracted from medical records. The data were analyzed using descriptive statistical methods to determine frequency distributions and percentages, and inferential analyses, including Chi-square tests, independent t-tests, and logistic regression, were performed to identify factors associated with injury severity and hospitalization.

Results: The results showed that the most affected age group was 18–35 years, and men accounted for the highest frequency of sports-related injuries. The most common mechanisms of injury included falls and direct contact with sports equipment. The mean Injury Severity Score (ISS) was higher among hospitalized patients than among those discharged, and logistic regression analysis indicated that older age, greater initial injury severity, and the mechanism of fall were significantly associated with the need for hospitalization ($p < .05$).

Conclusion: The findings of this study indicate that injury severity and the need for hospitalization in patients with sports-related trauma are significantly associated with demographic factors such as age, injury mechanism, and initial injury severity. Identifying these factors can aid in predicting emergency care requirements, optimizing clinical management, and effectively allocating resources in the emergency department. Therefore, considering these factors is crucial for planning and policymaking in sports health management.

Keywords: Sports Injuries, Trauma, Emergency Department, Hospitalization, Injury Severity, Risk Factors

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Assessment of the Effect of Topical Heat Patch Application on Pain Reduction in Patients with Musculoskeletal Trauma in the Emergency Department: A Randomized Clinical Trial

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Abstract

Background: Pain resulting from musculoskeletal trauma is one of the most common and debilitating complaints in emergency departments, necessitating rapid, safe, and nonpharmacological approaches for pain management. Topical heat can reduce pain in acute soft tissue injuries by increasing blood flow, decreasing muscle tension, and modulating nociceptive receptor activity. Heat patches by providing consistent superficial heat without pharmacological side effects, represent a simple and accessible option for alleviating acute pain in patients with musculoskeletal trauma. This study aimed to evaluate the effect of topical heat patch application on pain reduction in patients with musculoskeletal trauma in the emergency department. The study aimed to determine the extent of early clinical improvement and to examine the feasibility of using heat patches in the emergency setting.

Methods: The research was conducted as a randomized clinical trial to assess the efficacy of this non-pharmacological intervention compared to standard care in terms of pain intensity and its changes following the intervention in 2025 in the emergency department of Imam Khomeini Hospital, Urmia. Patients with musculoskeletal trauma who met the inclusion criteria were randomly assigned to either the intervention or control group following initial assessment. The intervention group received a topical heat patch for a predetermined duration, while the control group received standard pain management care. Pain intensity was measured at baseline and after the intervention using the Visual Analog Scale (VAS). The data were analyzed using appropriate statistical tests.

Results: Pain intensity in the group receiving the heat patch significantly decreased after the intervention, with a notable difference compared to the control group. Furthermore, the reduction in pain in the intervention group was sustained both immediately after application and during short-term follow-up. Patients in the intervention group reported higher satisfaction with pain control and greater improvements in physical function. These findings indicate the heat patch's effectiveness in alleviating acute pain from musculoskeletal trauma.

Conclusion: The use of topical heat patches can be an effective, safe, nonpharmacological method to reduce pain in patients with musculoskeletal trauma in the emergency department. This approach not only provides rapid pain relief but also enhances patient satisfaction and physical function, potentially reducing the need for analgesic medications. Therefore, heat patches represent a simple, low-cost, and accessible option for managing acute pain in the emergency setting.

Keywords: Heat Patch, Musculoskeletal Pain, Trauma, Emergency, Clinical Trial, Topical Heat Therapy

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Prevalence and Associated Risk Factors of Wound Infection in Patients Presenting to the Emergency Department with Traumatic Wounds in Urmia Hospitals in 2025: A Cross-Sectional Study

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Abstract

Background: Traumatic wound infection is one of the significant complications in patients presenting to the emergency department, which can lead to mortality, prolonged hospitalization, and increased healthcare costs. The prevalence of this infection in emergency traumatic wounds has been reported to be approximately 2–3% in various studies. The main risk factors include diabetes, wound contamination, wound length greater than 5 centimeters and wound location in the lower extremities. Furthermore, the presence of foreign bodies in the wound and older patient age are associated with an increased likelihood of infection. The aim of this study was to deter-

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mine the prevalence of traumatic wound infections in patients presenting to the emergency department and to identify factors associated with an increased risk of these infections in Urmia hospitals in 2025. This research was conducted to provide practical evidence for improving wound management, preventing infections, and reducing related complications.

Methods: This study was conducted as a cross-sectional investigation in 2025 in the emergency departments of Urmia hospitals. All patients with traumatic wounds who met the inclusion criteria were consecutively enrolled in the study. Data were collected on demographic characteristics, wound characteristics, potential risk factors, and infection status during follow-up. Wound infection was diagnosed based on standard clinical criteria, and data analysis was performed using descriptive and inferential statistical tests to determine the associations between various factors and the risk of infection.

Results: In this study, among 300 patients presenting to the emergency department with traumatic wounds, 15 patients (5%) developed wound infections. The prevalence of infection was significantly higher in wounds located in the lower extremities and in wounds longer than 5 centimeters. Furthermore, the presence of foreign bodies in the wound, a history of diabetes, and older age were significantly associated with an increased likelihood of infection ($p < .05$). Multivariate analysis indicated that wound length and location were among the most important independent predictors of infection in this population.

Conclusion: The findings of this study indicated that, despite a relatively low prevalence, traumatic wound infections in patients presenting to the emergency department were influenced by multiple factors including wound length and location, the presence of foreign bodies, age and chronic comorbidities. Identifying these risk factors can contribute to improved clinical wound management, infection prevention, and reduction of associated complications. The results of this research may provide valuable guidance for the development of standardized care protocols in hospital emergency departments.

Keywords: Wound Infection, Traumatic Wounds, Emergency Department, Risk Factors for Infection, Incidence of Wound Infection, Wound Management

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Years of Life Lost (YLL) Due to Motorcycle-Related Traffic Mortality in Babol, Iran, 2024: A Burden of Disease Analysis

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Abstract

Background: Motorcycle users represent a major vulnerable road-user group in Iran, where traffic injury remains a leading cause of premature mortality. The aim of this study was to estimate the Years of Life Lost (YLL) attributable to motorcycle-related deaths in Babol in 2024, based on verified epidemiological patterns observed in 2023.

Methods: Source data were extracted from an official 2023 traffic-injury dataset from Babol, including 5796 injuries and 116 deaths. As the dataset did not include mechanism-specific mortality, proportional mortality modeling was applied using the observed motorcycle-related share of all traffic incidents in 2023. Standard WHO/GBD methods were used for YLL calculation: YLL = Number of deaths × Standard life expectancy at age of death. Trends were projected to 2024 using a conservative linear trend assumption and stable mechanism distribution.

Results: Motorcycle-related injuries accounted for 33% of all incidents in 2023. Applying proportional mortality yielded an estimated 38 deaths from motorcycle crashes in 2023. Assuming a modest 2% year-to-year increase in motorcycle crash mortality—consistent with stable or slightly increasing trends reported in similar Iranian settings—the estimated motorcycle-related deaths for 2024 were 39 deaths. Using GBD standard life expectancy, total YLL for 2024 was estimated at approximately 1,270 years.

Conclusion: Motorcycle-related mortality constitutes a substantial share of premature mortality in Babol, with a high burden concentrated among young adults. The resulting YLL highlights the persistent public health impact of motorcycle crashes and underscores the need for multisectoral road-safety interventions.

Keywords: Years of Life Lost, Mortality, Consciousness, Traffic Injury, Burden of Disease

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Estimation of the Burden of Road Traffic Accidents in Babol Using Disability Adjusted Life Year (DALY) and Quality-Adjusted Life-Year (QALY) Index 2023-2024

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Abstract

Background: Understanding the local burden of road traffic injuries is essential for effective policymaking and resource allocation. Our study aimed to estimate the burden of road traffic injuries in Babol, Iran (2024) using disability-adjusted life years (DALYs) and quality-adjusted life years (QALYs) indicators.

Methods: This cross-sectional study was conducted to estimate the disease burden from road traffic accidents in Babol city. For this purpose, years lost due to premature death (YLL) and years lost due to disability (YLD) were extracted from the hospital information system of Babol city hospitals and forensic medicine during the period from 1st of April to 19th of March 2013. Then, the disability status of the injured was asked by telephone, and their type of disability was determined. Then, the DALY and QALY indicators of the patients were determined based on the severity of the disability. Data were analyzed using t-test, analysis of variance (ANOVA), and Chi-square tests.

Results: The total DALY in this study was 1.26786 years, of which 90.8% (24326.88) were in men and 84% (1.22490) were from YLD. The highest and lowest DALYs in both sexes were in the 15-29 and over 80 age groups, respectively. The total QALY during the study period was 197575.81 years, of which 85.9% were in men. The highest and lowest QALYs in both sexes were observed in the 15-29 and over-80 age groups, respectively.

Conclusion: The high DALY rate indicates the profound impact of these events on reducing life expectancy and quality of life of the affected individuals. Reducing the burden of disease from road traffic accidents requires a comprehensive and holistic approach that encompasses its various dimensions, including controlling risk factors, improving emergency care, and strengthening rehabilitation and rehabilitation structures.

Keywords: Quality-Adjusted Life Years, Disability-Adjusted Life Years, Road Traffic Accidents

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Evaluation of the Clinical high-risk factors Model as a Decision Instrument for Predicting Traumatic Brain Injury in Minor Head Trauma Patients

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Abstract

Background: Mild head trauma is known as one of the leading causes of emergency admission, and there are several guidelines regarding the decision to perform a brain CT scan in these patients. In this study, we aimed to validate four of these guidelines and identify the most relevant clinical symptoms associated with abnormal CT scan findings.

Methods: This retrospective cross-sectional study examined the patients admitted to the emergency departments of two selected hospitals in Tehran, Iran, from 2017 to 2022. Demographic characteristics, mechanism of trauma, clinical symptoms, abnormal findings in brain CT scans, and the final outcome of the patients were collected based on their medical records. The diagnostic performance of four CCHR, NEXUS, NICE, and NOC guidelines was evaluated and compared with each other based on patient information.

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Using regression models, clinical symptoms related to abnormal findings in CT scans were selected, and their diagnostic performance was compared with the other mentioned guidelines based on the area under the receiver operating characteristic (ROC) curve.

Results: Among the 940 patients, 444 patients were eligible to enter the study (age: M = 42.3 years, SD = 22.8, and 79.7% male). The most common mechanism of trauma was fallen from <1 m. There was no significant difference between the two groups of patients with a normal brain CT scan and patients with abnormal findings in the brain CT scan, except for the presence of visible trauma above the clavicle, as the most common clinical symptom of the patients (p = 0.037). 431 out of 444 patients had a normal brain CT without any traumatic brain injury. Abnormal findings in the CT scan of the patients were 12 cases (2.7%) of skull fracture, 8 cases (1.8%) of brain contusion, 8 cases (1.8%) of subdural hematoma, and 5 cases (1.1%) of skull base fracture. 34 patients (7.7%) needed observational care in the emergency room, and 9 patients (2%) underwent brain surgery. No death was reported. Among the reviewed guidelines, NOC performed well, with 100% sensitivity, whereas the other three guidelines (CCHR, NEXUS, and NICE) had sensitivities ranging from 55% to 68%. "High-risk clinical symptoms model," with 100% sensitivity and an AUC of 0.91, and reducing the need for CT scans by 52%, had the best performance compared to other guidelines.

Conclusion: "High-risk clinical symptoms model," including ten clinical symptoms that are most associated with abnormal findings in brain CT scans of patients with mild head trauma, can be used as a decision-making tool for performing brain CT with high diagnostic performance. It will reduce the use of brain CT scans by half.

Keywords: Mild Head Trauma, Brain CT Scan, Diagnostic Tool Modeling, Trauma Emergency

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Is Knee Coronal Alignment Different in Knees with Anterior Cruciate Ligament (ACL) Tear?

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Abstract

Background: Neutral alignment is not always the natural anatomy. A better understanding of the knee alignment variability seems necessary. This study aimed to compare the phenotypes of the knees with anterior cruciate ligament (ACL) injury against normal knees.

Methods: This cross-sectional study included 388 knees in 194 patients with unilateral ACL injury, and 402 knees in 201 normal participants. GROUPS? Phenotypes were reported using hip–knee–ankle angle (HKA), femoral mechanical angle (FMA), and tibial mechanical angle (TMA) based on functional phenotypes, and arithmetic HKA (aHKA), and joint line obliquity (JLO) based on the coronal plane alignment of the knees (CPAK) classification. The functional phenotypes describe the alignment direction (NEU, VAR, VAL), the measured angle (HKA, FMA, TMA), and the mean deviation (0, 3, 6, …). The CPAK classification uses aHKA (varus, neutral, valgus) and JLO (apex proximal, apex neutral, apex distal).

Results: The mean HKA, FMA, and TMA were M = 176.15°, SD = 3.43°, M = 92.22°, SD = 2.64°, and M = 86.96°, SD = 3.09° in the ACL-injured knees and M = 176.03°, SD = 3.01°, M = 92.01°, SD = 2.77°, and M = 86.52°, SD = 2.73° in normal knees, which were not significantly different (p not reported). We found 96 functional phenotypes, with the most common being VARHKA3°+NEUFMA0°+NEUTMA0°in the ACL-injured knees, and NEUHKA0°+NEUFMA0°+NEUTMA0° in the ACL-intact group and the normal population. The most common phenotypes in ACL-injured knees were not significantly different from those in ACL-intact knees (p = .154) and the normal population (p = .154). CPAK types I and II were the most common types. Type I was the most common in ACL-injured knees and normal participants, and type II was the most frequent in ACL-intact knees. The distributions were not significantly different (p = .711).

Conclusion: We found no differences in phenotypes between knees with ACL injury and those with normal ACL. Also, the patients had a mild varus, possibly due to their being prone to ACL injury or ethnicity. Moreover, we report more phenotypes in our participants than in previous studies.

Keywords: Knee, Alignment, Phenotype, HKA, FMA, TMA, Varus, Valgus, Anatomical Alignment, Mechanical Alignment, Coronal Plane Alignment of the Knees, Joint Line Obliquity

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Comparison of TRISS, RTS, ISS, NISS, and KTS Scores in Terms of the Accuracy of Predicting Mortality and Morbidity in Penetrating Trauma Patients

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Abstract

Background: Considering the importance of dealing with trauma patients in increasing the survival and social health level, we aimed to conduct this study by examining the injury severity score (ISS), new injury severity score (NISS), revised trauma score (RTS), trauma and injury severity score (TRISS), and Kampala trauma score (KTS) to predict the morbidity and mortality in trauma patients injured by firearms and cold weapons.

Methods: This retrospective cross-sectional study was conducted using clinical records of patients, recording age, gender, type, cause, and location of trauma, as well as the corresponding scores for each patient.

Results: 152 patients with a mean age of M=33.45 years, SD=11.56, were examined. In terms of mortality prediction, only ISS and NISS had satisfactory predictive power ($p=0.001$). Also, the ISS and NISS scale scores had a positive and significant relationship with all three morbidity factors ($p<0.05$). As the scores on these two scales increased, the length of hospitalization and the patient's need for intubation increased. The TRISS score showed a significant negative relationship with all three morbidity factors ($p<0.05$). The RTS and KTS criteria showed a significant negative relationship only with ICU length of stay and the need for intubation ($p<0.05$).

Conclusion: The ability of the ISS and NISS scales to predict mortality in trauma patients was demonstrated in this study. This difference between studies may be related to differences in the type and mechanism of trauma in each study, as well as to influential factors in the calculation of each scoring scale.

Keywords: Trauma, Cold Weapon, Firearm, Mortality, Morbidity

Diagnostic Accuracy of Focused Assessment with Sonography in Patients Admitted with Multiple Trauma to A General Hospital

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Abstract

Background: The evaluation of trauma patients using FAST has been proposed as a valuable procedure for the emergency care of multiple trauma patients. Considering the importance of early diagnosis of trauma in the emergency room, it is important to determine whether it is possible to eliminate the need for DPL, CT scan, or exploratory laparotomy and other invasive procedures by only performing FAST in the emergency room. This study investigated the accuracy of FAST performed by an emergency medicine specialist in multiple trauma patients admitted to the emergency department of a specific hospital in Tehran, Iran.

Methods: This descriptive cross-sectional retrospective study was conducted on 200 patients who were referred to the emergency department and were admitted with the primary diagnosis of multiple trauma. The findings of FAST were compared with the findings of CT scan. The sensitivity, specificity, positive and negative predictive values, and accuracy of FAST compared to the findings of the CT scan were measured using R software.

Results: In this study, 200 patients with multiple trauma were examined. The average age of patients was 34.21 years, with the lowest and highest ages of 18 and 56 years, respectively. Of these, 12.5% were women and 87.5% were men. Based on the results of this study, CT was reported as positive in 17.5% and negative in 82.5%. These FAST test values were 16% positive and 84% negative. Sensitivity, specificity, positive predictive value, negative predictive value, accuracy, and Kappa coefficient of agreement were 0.60, 0.9333, 0.6563, 0.9167, 0.875, and 0.552, respectively.

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Conclusion: The results of this study showed a significant difference between the diagnostic ability of FAST performed by emergency medicine specialists at a selected Hospital and the calculated global average.

Keywords: Multiple Trauma, FAST Ultrasound, CT Scan

Factors with Hospital Length of Stay for Patients with Vertebral Fractures

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Abstract

Background: Vertebral fracture is common and frequently caused by trauma. One of the indicators for assessing trauma care is length of hospital stay (LOS). The purpose of this study is to assess the risk factors that predict LOS in surgical patients.

Methods: This cross-sectional study included 119 patients, aged 18 to 90 years, who underwent surgery at a selected hospital in Tehran, Iran, between March 1 and March 30, 2022. The exclusion criteria consisted of preexisting conditions except for osteoporosis, diabetes, and hypertension. The risk variables analyzed were age, gender, medical conditions, location of vertebral fracture, and laboratory findings. Adjusted Regression analyses were used to model associations between risk factors and LOS. Because the study was based on a single-center, observational, cross-sectional portion of the population, future studies should also be done to complete ours.

Results: In this study, 47.9% of the patients were male. The patients' median LOS was 4 days. There was no distinction between the older and younger patients, two genders, individuals with diabetes and hypertension, or otherwise healthy patients. Among laboratory factors, only neutrophil, platelet, and lymphocyte counts, neutrophils-to-lymphocytes, and platelets-to-lymphocytes ratio were directly associated with LOS.

Conclusion: lymphocyte, platelet and neutrophil counts, PLR and NLR can be regarded as readily available indicators for assessing the financial burden of vertebral fractures. Considering these factors and an effective attempt to develop appropriate triage strategies can lead to reduced LOS and economic burden on the health system.

Keywords: Risk Factors, Length of Hospital Stay, Vertebral Fracture, Medical Condition, Laboratory Findings.

Implementation of a Self-management Program Based on the Five-A Model and Its Impact on the Self-efficacy of Patients with Traumatic Brain Injury

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Abstract

Background: Patients with head injuries are considered the most challenging category of trauma victims, accounting for the second highest mortality rate in the country and the highest loss of active years of life. The disabilities caused by these injuries have a significant impact on the individual's self-efficacy. This study was carried out to develop and implement a self-management program based on the Five A's model and to assess its impact on the self-efficacy of patients with head trauma.

Methods: This Randomized controlled trial study was conducted at the Shohadaye Haftome Tir Hospital, which is affiliated with the Iran University of Medical Sciences. The study employed a pre-test and post-test design. A total of 70 patients who met the inclusion criteria were selected through a convenience sampling method. The self-efficacy questionnaire was completed by both the test and

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control groups prior to the intervention and at the three-month follow-up. Patients in the test group participated in eight 60-minute face-to-face self- management training sessions.

Results: The patients in the intervention group demonstrated a statistically significant enhancement in self-efficacy and its constituent dimensions following the intervention, when compared to the pre-intervention period ($p<0.001$). No statistically significant difference was observed in self-efficacy and its dimensions in the control group before and after the intervention. The partial eta-squared value was employed to evaluate the magnitude of the intervention's impact, which, according to Cohen's classification, is deemed to be a small effect at 0.01, a medium effect at 0.06, and a large effect at 0.14. A statistically significant difference was observed in self-efficacy and its dimensions between the two groups following the intervention, with the mean self-efficacy score in the intervention group significantly higher than that in the control group ($p<0.001$).

Conclusion: The implementation of a self-management program based on the Five A's model has the potential to enhance the self-efficacy of patients with traumatic brain injuries. Interventions such as educational self-management programs can support these patients, thereby enhancing their self-efficacy, quality of care, and overall quality of life.

Keywords: Self-Management, Self-Efficacy, Head Trauma, Patients

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Performance of Emergency Medical Technicians in Using Traction Splints for Femoral Shaft Fractures

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Abstract

Background: Femoral shaft fractures are a major cause of adult mortality and disability, frequently seen in trauma centers with an incidence of 1/10,000 person-years. These injuries commonly present with pain and hemorrhage. Traction splints (TSs) are used by EMT to reduce these symptoms and immobilize the limb to prevent further injury during transport. A suspected isolated midshaft femur fracture indicates traction splint use, and contraindications include ankle/foot fractures and partial amputations with only marginal tissue connecting the distal limb. This study aims to assess the performance of emergency medical technicians in using (TSs) for femoral shaft fractures at the 115 Emergency Center in Asadabad City (1-5).

Methods: This descriptive study was conducted on 45 personnel of the 115 Emergency Center (EMT) in Asadabad City. The sampling method was census. A demographic information questionnaire and a performance assessment questionnaire regarding the use of traction splints in femoral shaft fractures were used to collect information.

Results: This study found that only 37.4% of participants demonstrated desirable performance in using traction splints for femoral shaft fractures, with a mean performance of $M = 9.13$, $SD = 1.48$. No statistically significant association was observed with the participants' overall demographic characteristics.

Conclusion: The study results indicated that emergency medical technicians' performance in using traction splints for femoral shaft fractures is generally moderate to poor. Therefore, conducting periodic practical training sessions focused on scenarios and case-based application of traction splints is recommended.

Keywords: Performance, EMT, Traction Splints, Femoral Shaft Fractures

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Trends in the Burden of Injuries and Falls in Iran (1990–2023): A National and Subnational Analysis with Implications for Emergency Care

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Abstract

Background: Injuries are among the leading causes of emergency department (ED) visits and mortality in Iran. Up-to-date, province-level data on injury trends are essential for planning emergency care and prevention strategies. This study aimed to describe national and subnational trends in the incidence, prevalence, and mortality of all injuries, unintentional injuries, and falls in Iran from 1990 to 2023.

Methods: We conducted a descriptive, ecological analysis using estimates from the Global Burden of Disease (GBD) 2023 study. Age-standardized rates per 100,000 population for incidence, prevalence, and deaths due to all injuries, unintentional injuries, and falls were extracted for Iran and its provinces, by sex, for the years 1990, 2000, 2010, and 2023. We calculated absolute and relative changes over time and compared patterns between males and females and across provinces.

Results: In 2023, the age-standardized incidence rate of all injuries in Iran was approximately 9,770 per 100,000 (males ≈ 11,974, females ≈ 7,461 per 100,000). From 1990 to 2023, the incidence of all injuries decreased by about 43%, while the age-standardized mortality rate dropped from 182 to 42 deaths per 100,000 (≈ 77% reduction). Mortality from unintentional injuries declined by nearly 88% (from ≈119 to ≈15 deaths per 100,000). In contrast, falls showed a modest 5% decrease in incidence (from ≈3,632 to ≈3,459 per 100,000), despite a ≈47% reduction in falls-related mortality (from ≈8 to ≈4 deaths per 100,000). In 2023, provincial incidence rates of all injuries ranged roughly from 8,600 to 12,100 per 100,000, with the highest rates observed in Tehran and some western provinces. Across all years and causes, injury rates were consistently higher in males than in females.

Conclusion: Over the past three decades, Iran has achieved substantial reductions in fatal injuries, particularly unintentional injuries, but only moderate declines in non-fatal injuries, especially falls. Persistently high incidence rates and a marked male predominance indicate a sustained burden on emergency departments. Integrating injury-prevention policies with strengthened prehospital and ED trauma care, and implementing targeted fall-prevention programs, should remain key priorities for emergency medicine in Iran.

Keywords: Injuries, Unintentional Injuries, Falls, Iran, Epidemiology, Emergency Medicine, Global Burden of Disease

Spatiotemporal Analysis of Traffic Accidents in Yazd Province and Designing a Targeted Educational Program for EMS Personnel

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Abstract

Background: Road traffic accidents remain a significant public health concern, and Yazd Province bears a high burden of injuries due to widespread motorcycle use, climatic conditions, and unique traffic patterns. Understanding the temporal distribution of incidents and identifying high-risk months is essential for planning prehospital emergency operations. This study aimed to analyze monthly trends in road traffic accidents in Yazd Province and model monthly risk to support data-driven decision-making in Emergency Medical Services (EMS).

Methods: This descriptive-analytical study analyzed 1,464,367 EMS mission records related to traffic incidents in Yazd Province during 2024–2025. Variables, including the month of occurrence, vehicle type, victim role, and frequency patterns, were assessed. A Monthly Risk Index was calculated by comparing each month's accident count to the peak month (September).

Results: September recorded the highest number of incidents (14,825), followed by July, October, and August, indicating a clear seasonal trend with more accidents during warmer months. April exhibited the lowest frequency. Motorcycles accounted for the largest proportion of accidents (67,644; 46.2%). Regarding victim roles, drivers (74,550) comprised the largest group, followed by passengers (40,078) and pedestrians (12,271). The monthly risk model demonstrated predictable seasonal surges that directly affect EMS operational requirements.

Conclusion: Traffic accident patterns in Yazd Province exhibit distinct temporal and seasonal characteristics that can inform strategic EMS planning. Increased risk during summer necessitates enhanced ambulance deployment, additional staffing, and targeted public education—particularly on motorcycle safety. Implementing a structured monthly risk model can improve preparedness, reduce response time, and enhance prehospital trauma care outcomes.

Keywords: Motorcycle Accidents, Road Traffic Injuries, Emergency Medical Services, Prehospital Care, Risk Modeling, Temporal Patterns, Yazd Province.

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Machine Learning–Based Prediction of ICU Admission and Mortality Among Air-Lifted Trauma Patients in North Khorasan Province, Iran (2017–2024)

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Abstract

Background: Due to the presence of geographically inaccessible areas in North Khorasan Province, Iran, helicopter emergency medical services (HEMS) were initiated in 2017 to expedite the transfer of critically injured patients to Imam Ali Hospital in Bojnurd, the provincial trauma center. Early prediction of outcomes among air-lifted patients can enhance triage accuracy and resource allocation. This study aimed to evaluate the performance of machine learning models in predicting ICU admission and mortality among patients transported by HEMS.

Methods: This retrospective observational study analyzed 162 patients transferred by helicopter to Imam Ali Hospital between 2017 and 2024. Among them, 28 (17.3%) were female, and the mean age was 28.79 years. Seasonal distribution included 40 (24.7%) cases in spring, 46 (28.4%) in summer, 38 (23.5%) in autumn, and 38 (23.5%) in winter. Triage levels were recorded as: Level 1: 40 (24.7%), Level 2: 85 (52.5%), Level 3: 36 (22.2%), Level 4: 1 (0.6%). All but one patient arrived within 24 hours post-injury. The most common presenting complaints were trauma (34 cases;21%) and motor vehicle accidents (65 cases;40.1%). The mean length of hospital stay was 5.8 days. ICU admission occurred in 31 (19.1%) patients, and 21 (13%) patients died. After preprocessing, four machine learning algorithms—Decision Tree, Support Vector Machine (SVM), Random Forest, and LogitBoost—were implemented in Python to predict ICU admission and mortality. Model performance was evaluated using accuracy and the area under the ROC curve (AUC).

Results: Among all evaluated algorithms, Random Forest achieved the highest performance for both outcomes, with an accuracy of 87.04% and an AUC of 80.8 for ICU admission, and an accuracy of 95.07% and an AUC of 93.3 for mortality.

Conclusion: Random Forest–based machine learning models demonstrated strong predictive ability for ICU admission and mortality among air-lifted trauma patients in North Khorasan. These findings highlight the potential for integrating machine learning into emergency and prehospital workflows to support clinical decision-making and improve resource allocation. Future studies with larger datasets and real-time data integration are recommended to enhance predictive accuracy and applicability.

Keywords: Air Medical Transport, ICU Admission, Mortality, Prehospital Care, Helicopter Emergency Medical Services (HEMS), Trauma

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Designing, implementing and assessing virtual reality-based software for practical teaching and assessment of disaster Triage

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Abstract

Background: Disasters cause extensive human casualties and disrupt communities, making triage crucial for crisis management. The START triage method rapidly assesses casualties and assigns color-coded categories, making it widely used in mass casualty incidents. Traditional training lacks a stressful environment for skill assessment, while physical drills are costly. Virtual Reality (VR) provides an innovative, cost-effective solution by simulating crisis scenarios and enabling repeated practice. This study aimed to design and evaluate a VR-based software for teaching and assessing START triage.

Methods: This quasi-experimental pretest-posttest study involved the development of VR-based crisis simulation software featuring the Imam Reza Shrine and four culturally adapted casualty characters. After validation by emergency medicine specialists, 43 medical

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interns and 24 emergency medicine residents participated. All watched a START triage training video, completed a 10-question test as a pretest and Chen et al.'s Technology Readiness Index. They were randomly assigned to two groups: the control group received traditional training, while the intervention group practiced triage on four virtual cases with feedback. A posttest and Likert-scale satisfaction survey followed.

Results: The VR group had significantly higher posttest scores ($p < .05$). Participants with moderate to high technology readiness in VR reported greater satisfaction than the control group.

Conclusion: VR-based training enhances START triage learning and user satisfaction, making it a promising alternative to traditional methods

Keywords: Disaster Management, START Triage, VR, Medical Education, Technology Acceptance

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Umbrella Review of Predictive Performance of Deep Learning (Dl), Ensemble and Traditional Machine Learning Models for Predicting Adverse Traumatic Brain Injury Outcomes

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Abstract

Background: Traumatic brain injury (TBI) is a leading cause of mortality and disability worldwide, with machine learning (ML) models increasingly utilized to predict adverse outcomes such as mortality and disorders of consciousness (DOC). Despite their growing application, the comparative performance of different ML model categories remains unclear. This umbrella review aimed to synthesize evidence from systematic reviews and meta-analyses to compare the predictive performance of Deep Learning (DL), Ensemble, and Traditional ML models (e.g., Support Vector Machine [SVM], Decision Trees [DT], k-Nearest Neighbors [k-NN], Logistic Regression [LR]) for adverse TBI outcomes.

Methods: A systematic search was conducted in PubMed, Embase, Cochrane Library, Web of Science, and Scopus up to July 1, 2025, following PRISMA guidelines. Eligible studies were meta-analyses reporting pooled Area under the Curve (AUC) values for ML models predicting TBI outcomes. Data were extracted on study characteristics, ML models, outcomes, and performance metrics. Quality was assessed using the PROBAST tool. A random-effects meta-analysis was performed using Stata to compare model categories, with heterogeneity assessed via I^2 and Q statistics.

Results: Five studies were included, evaluating 156 ML models. A random-effects meta-analysis revealed significant differences between model categories ($Qb = 8.65$, $p = .013$). Traditional models showed poorer performance ($\theta = 0.84$, 95% CI [0.79, 0.88]) compared to DL ($\theta = 0.91$, 95% CI [0.89, 0.93]) and Ensemble models ($\theta = 0.90$, 95% CI [0.81, 0.99]). Traditional models had the lowest AUC range (0.79–0.87), with k-NN performing weakest (AUC = 0.79, 95% CI [0.70, 0.88]). Ensemble models exhibited high heterogeneity ($I^2 = 93.6\%$), while DL models were consistently effective ($I^2 = 0.3\%$). Key predictors included Glasgow Coma Scale, age, and CT findings.

Conclusion: DL and Ensemble models outperform Traditional models in predicting TBI outcomes, with DL showing the most consistent performance. These findings support the integration of advanced ML models in clinical decision-making for TBI, though high heterogeneity in Ensemble models warrants further investigation.

Keywords: Traumatic Brain Injury, Machine Learning, Deep Learning, Meta-Analysis, Outcome Prediction

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Effects of Pre-hospital Care on ICU Admission, Length of Hospital Stay, and In-hospital Mortality of Patients Presenting to the Emergency Department

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Abstract

Background: Pre-hospital care and the mode of hospital arrival may significantly influence patient outcomes, yet large-scale comparative data across triage levels remain limited.

Methods: This retrospective registry-based study analyzed 393,034 consecutive hospital encounters from 2017 to 2023. Mode of arrival was categorized as self, Emergency Medical Services (EMS), or other. The primary outcomes were ICU admission, in-hospital mortality, and length of hospital stay (LOS, days). Triage level was recorded for all patients, and analyses were stratified accordingly. Descriptive statistics, chi-square tests, and Wilcoxon rank-sum tests were conducted using R software.

Results: Among 393,034 patients, 81.3% arrived by themselves, 13.7% via EMS, and 3% by other means. Overall, ICU admission was significantly higher among self-arrivals (42.1%) compared to EMS (11.1%) and other (14.8%) ($p < .001$). Similarly, in-hospital mortality was higher for self-arrivals (41.9%) than for EMS (11.1%) and other (13.6%) ($p < .001$). Median length of stay was 0 days for both self and EMS groups, and 2 days for the "other" group. When stratified by triage level, these patterns remained consistent. For example, in triage level 1, ICU admission rates were 23.5% for EMS, 36.4% for other, and 18.0% for self-arrivals; in triage level 3, ICU admission rates were 10.9% for EMS, 10.3% for others, and 37.7% for self. Mortality rates by triage level also reflected these trends, with self-arrivals generally having higher mortality within each category.

Conclusion: Patients arriving by themselves experienced significantly higher ICU admission and in-hospital mortality rates compared to those transported by EMS, across all triage levels. These findings underscore the importance of optimizing EMS utilization and understanding the factors influencing self-arrival.

Keywords: Mode of Arrival, ICU Admission, Mortality, Length of Stay, Triage, Hospital Outcomes,

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Applications of Artificial Intelligence Algorithms in Emergency Department Patient Triage: A Systematic Review

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Abstract

Background: Triage is a critical process in emergency departments for prioritizing patients based on clinical severity. However, high workload and rapid decision-making increase the likelihood of human error. Traditional triage systems, such as ESI and CTAS, rely on subjective judgment and often show inconsistent performance in high-pressure environments. In recent years, artificial intelligence (AI) and machine learning (ML) algorithms, capable of analyzing complex patterns in electronic health record data, have emerged as promising tools to improve the accuracy and consistency of triage decision-making. This study aimed to systematically review published literature on the applications and performance of AI algorithms in emergency patient triage.

Methods: This study was conducted as a systematic review. A structured search was carried out in the online databases PubMed, Scopus, Web of Science, IEEE Xplore, and the search engine Google Scholar for articles published between 2015 and 2025. The keywords used included "machine learning," "artificial intelligence," and "emergency triage." Studies employing algorithms such as deep neural networks (DNNs), support vector machines (SVMs), or random forests (RFs) to predict disease severity or mortality risk were included. The quality of evidence and risk of bias were evaluated using the PROBAST tool. A total of 29 studies met the inclusion criteria and were analyzed.

Results: Among the 29 reviewed studies, 11 (38%) DNNs, 9 (31%) RFs, and 5 (17%) used gradient boosting models. Physiological and vital sign data were the primary input features in 90% of the studies. In 22 studies (76%), the AUC-ROC exceeded 0.80, and in 17 (59%), model sensitivity ranged between 0.85 and 0.90. Only seven studies (24%) conducted external validation on independent data, limiting the generalizability of these models.

Conclusion: The results indicate that AI algorithms have substantial potential to improve the accuracy and stability of decision-making during emergency triage and can assist in identifying high-risk patients. However, existing evidence remains insufficient to confirm their clinical effectiveness. The absence of external validation, heterogeneous data sources, and variability among triage systems continue to restrict their generalizability. Future multicenter, prospective studies with standardized designs and thorough evaluations of cost-effectiveness, model transparency, and ethical considerations are essential to ensure the safe and effective integration of AI-based triage systems into clinical practice.

Keywords: Artificial Intelligence, Machine Learning, Triage, Emergency Department, Systematic Review

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