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Describe the patterns of injuries resulting from nighttime accidents And its relationship to the quality of field response

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Abstract:
This paper will explain the trends of injuries caused by nighttime accidents and discuss the correlation with the quality of field response by the emergency and ambulance teams. The significance of the research is that the night hours are related with higher rates and more serious injuries because of poor visibility, tiredness and low levels of concentration among the drivers, and this may require the knowledge of the nature of the injuries and the ways of addressing it in the field. The research followed the descriptive method through an examination of what was mentioned in past local and international research and aligning it to the fact on the ground with the view of establishing the most prevalent pattern of injuries including head and spine injuries, bone fractures, deep wounds and how factors influencing the quality of the response including speed of arrival, initial assessment skills, emergency decision-making, and transport organization to the hospital are affected. The findings of the literature review show that there is a clear correlation between the magnitude of nighttime accident injuries and the effectiveness of first aid responses whereby time, equipment supply, and experience of paramedics are critical in minimizing the number of complications and deaths. It was also revealed that the enhancement of the nighttime response measures, increased field training, and support technologies offered to the teams are some of the most significant influencing factors that can help to increase the quality of emergency care and minimize the risk of injuries. The work offers applicable suggestions to strengthen the work of response teams and increase nighttime preparedness and this will have a positive change on the safety of the injured.

Keywords :Nighttime accident injuries – Quality of field response – Ambulance – Pre-hospital assessment – Head injuries – Road accidents – Emergency.

Introduction

Nighttime traffic accidents have characteristics that differ from their daytime counterparts Factors such as reduced visibility fatigue or drowsiness and possibly increased speed on empty roads at night often lead to accidents with serious injuries Common injury patterns include Multiple injuries Head and spinal injuries in particular require precise and immediate immobilization as do chest and abdominal injuries resulting from violent impact and complex and open fractures of the limbs Managing these types of injuries necessitates rapid prioritization of care especially given the limited lighting which may conceal some wounds or bleeding The nighttime environment also presents additional challenges for Saudi Red Crescent response teams directly impacting the quality of field response and the timing of intervention These challenges include On the existence The difficulty in accurately and quickly determining locations the slow movement of rescue teams in the dark the need to use additional lighting equipment to properly assess and examine the injured in addition to the high psychological stress on paramedics and the injured

as the success of ambulance teams in overcoming these obstacles is what determines the effectiveness of the life-saving procedures provided immediately and quickly1,2
In addition the relationship between acute night injuries such as multiple life-threatening injuries and the quality of field response demonstrates the paramount importance of developing and adapting ambulance protocols to suit night work conditions Effective handling of these injuries requires specialized training for paramedics on evacuation and stabilization techniques in low-light conditions the use of advanced positioning and communication technology and the provision of integrated equipment for advanced airway management and on-site hemorrhage control Improving the quality of night response directly contributes to reducing mortality rates and limiting disabilities resulting from traffic accidents in the Kingdom9,6

Discussion

- **The concept of nighttime accidents and the factors that influence them**

Nighttime accidents are defined as traffic accidents that occur during the period of darkness from sunset to sunrise They differ radically from daytime accidents in terms of causes and consequences Although traffic volume decreases at night compared to the day the rates of fatal or serious accidents increase significantly sometimes up to three times This increase is attributed to a combination of negative factors that lead to more severe and dangerous injuries This concept focuses on the nighttime period as a crucial environmental factor affecting drivers' abilities and emergency response Human error is the primary cause of the majority of accidents and its negative impact is amplified at night due to biological and psychological changes Drowsiness and fatigue Drivers experience a decrease in concentration levels and reaction time due to circadian rhythm disruption Especially late at night or after a long day of work Reckless driving and speeding are also more common at night due to the belief that the roads are empty in addition to the possibility of driving under the influence of drugs or alcohol which greatly impairs the ability to control perceive and make sound decisions 10
Environmental factors related to darkness also play a pivotal role in increasing the risk of nighttime accidents Among the most prominent of these is reduced visibility Darkness reduces the driver's field of vision and makes it difficult to judge distances and dimensions and to identify objects on the road such as pedestrians animals or obstacles especially on poorly lit roads The glare from oncoming headlights can also cause temporary blindness for the driver In addition there are vehicle-related factors including poor condition of headlights and taillights inefficient lighting and neglect of tire and brake maintenance which can lead to loss of control at the high speeds taken at night When considering the multiple factors that increase the risk of nighttime accidents preventive and technological intervention becomes important to reduce them At the human level this includes continuous awareness of the dangers of driving when fatigued and regulating rest periods At the infrastructure level it is necessary to improve the quality of road lighting and use highly efficient reflective road markings Modern technology in vehicles also plays a major role such as driver fatigue detection systemsnight vision systems and adaptive headlights that direct light according to the driving angle and oncoming traffic thus enhancing the driver's ability to see and avoid potential hazards in the dark 2,8

- **Driver behavior during night driving**

A driver's behavior is significantly affected during nighttime driving due to the body's circadian rhythm This leads to negative behaviors that increase the risk of accidents One of the most prominent of these behaviors is driving under the influence of fatigue and drowsiness where the level of concentration and alertness decreases reaction time is noticeably delayed and the driver may begin to stare at one point which increases visual fatigue or unconsciously veer into adjacent lanes In severe cases they may fall asleep for short periods He is unaware of it and driving while severely drowsy is equivalent to driving under the influence of alcohol in terms of impaired cognitive performance and control It is also observed that some drivers exhibit more reckless and aggressive behaviors at night driven by the mistaken belief that there is less traffic enforcement and fewer vehicles These behaviors include on Excessive speed that exceeds the permitted speed limits or exceeds the driver's ability to maneuver safely in the dark failure to maintain a sufficient safety distance despite low visibility requiring a longer response distance and taking

risks in overtaking on single-lane roads and these behaviors in addition to the possibility of using intoxicating or narcotic substances that negatively affect judgment and control increase the likelihood of collisions that are often severe and fatal6,7

In addition some drivers also exhibit behaviors related to poor night vision Some may use high beams continuously and irresponsibly causing glare for oncoming drivers and reducing their visibility Others may fail to adjust their speed to the limited range of their headlights at night Drivers also tend to take their eyes off the road to deal with the glare from rear-end headlights by checking their mirrors Furthermore not cleaning headlights and windshields properly at night is another common behavior that reduces visibility and indicates a lack of prioritization of safety in low-light conditions Night driving also affects the driver's psychological state leading them to adopt unhealthy coping mechanisms Driving in the dark can cause feelings of loneliness and anxiety in some drivers potentially leading to increased speed as a means of reaching the destination quickly and alleviating the sense of isolation In an attempt to overcome fatigue and poor concentration drivers may resort to excessive reliance on stimulants such as caffeine and loud music These are temporary solutions that may mask the signs of true fatigue rather than address them Another common behavior is looking directly at oncoming bright lights in the hope of better vision which actually increases temporary blindness It reduces the chance of seeing the edge of the road or obstacles reflecting a failure to properly adapt visually to the night driving environment3,6

- **Common injury patterns in nighttime accidents**

Nighttime accidents especially those caused by excessive speed or driving under the influence of fatigue are characterized by severe injuries leading to a significant increase in cases of multiple injuries This involves injuries to multiple body systems simultaneously such as head injuries with limb fractures In these accidents the impact forces and the effects of acceleration and deceleration are greater meaning that internal injuries are more severe even if not visible externally These types of injuries require advanced and rapid emergency intervention according to critical injury management protocols Head and spinal injuries are also common and critical at night Due to the force of the impact and sometimes the failure to use seat belts the head is subjected to severe trauma leading to concussions or intracranial hemorrhages which are the leading cause of death at the scene Spinal injuries are also recorded This can cause paralysis if the patient is not immobilized correctly and immediately In addition chest injuries such as rib fractures and pneumothorax are common Abdominal injuries that may include rupture of the spleen or liver as a result of the incorrect direction of the impact forces8,5

Despite the seriousness of central head and trunk injuries peripheral injuries common in nighttime accidents cannot be overlooked and these patterns include complex fractures Which are often open wounds accompanied by tears in the skin and tissues increasing the risk of severe bleeding and infection Amputations are also observed in rollover or severe entrapment accidents and these injuries require not only careful immobilization to prevent further damage but also effective management of bleeding in the field to avoid hypovolemic shock This is a crucial step in saving the life of the injured person before transferring them to the hospital Besides these patterns there are some dangerous patterns that may increase at night such as entrapment injuries The victim becomes trapped inside the wreckage of the severely damaged vehicle due to the force of the impact This entrapment leads to a deterioration in the victim's condition due to delayed arrival tissue strain and crush syndrome This requires specialized management and nighttime incidents that occur at high speeds increase the likelihood of fires breaking out In vehicles fuel leaks and contact with hot wires can lead to a dangerous pattern of injuries namely thermal burns These burns which can range from first to third degree require paramedics and rescue teams to work extremely quickly not only to extract the injured person but also to assess and treat the shock resulting from the burns in the field7,1

- **Environmental factors affecting the severity of injuries at night**

Reduced lighting is the most significant environmental factor at night and directly affects the severity of injuries In darkness the driver's field of vision is greatly reduced decreasing the reaction time available to avoid a collision or slow down When a driver only sees an obstacle or curve at the last moment they

are forced to brake suddenly or maneuver violently which is often insufficient This results in a collision occurring at a higher and more sudden speed This higher speed at the moment of impact translates into more severe injuries such as increased spinal fractures and head injuries The condition of the road itself and its characteristics at night also affect the severity of accidents On unlit roads outside cities it is difficult for drivers to see warning signs changes in the road surface or unexpected obstacles such as animals or debris from previous accidents Even with reflective markings their effectiveness is affected by time Nighttime weather phenomena such as fog or light rain can cause glare and make vehicles more prone to skidding All of these factors can lead to loss of control in less-than-ideal conditions resulting in accidents such as rollovers Or going off course and colliding with a stationary object with tremendous force accidents known for high rates of critical injuries and deaths8,2

The difficulty of assessing the site and the increased emergency response time do not cause the injury itself but they increase the severity of the clinical results of the injury In the dark Red Crescent teams face greater difficulty in accurately and quickly determining the location of the accident especially in remote areas where there may not be a lighting network or distinctive signs Darkness at the accident site also hinders the process of paramedics assessing the injuries of the injured and evaluating their severity especially when dealing with internal bleeding or small wounds that may conceal large internal injuries The increased response time resulting from these environmental difficulties means a delay in starting critical care which reduces the chances of survival and increases the likelihood of going into shock or suffering permanent damage to the injured9,1

- **Quality of field response in nighttime incidents**

Speed is the first and most important criterion in measuring the quality of field response especially in nighttime incidents with critical injuries Quality is measured by the ability to reduce response time which is the period from receiving the report until the ambulance teams arrive at the scene and begin providing care at night The challenge of speed increases due to the difficulty of accurately determining locations and driving in the dark Quality is considered high when the Saudi Red Crescent teams succeed in reaching the injured This is the critical period in which rapid intervention has the ability to prevent death or permanent disability especially in cases of internal bleeding or serious head injuries that are common at night Quality is not limited to speed alone but extends to the efficiency and quality of medical care provided in the field at night Ambulance teams must have high skills to deal with the difficult work environment which includes the quality of intervention and rapid and safe assessment of the injured under limited lighting as well as advanced management of airways for unconscious patients complete spinal stabilization in cases of suspected multiple injuries and effective control of severe bleeding Quality requires the availability of advanced rescue equipment to deal with entrapment cases as well as continuous training for paramedics on protocols for dealing with acute injuries in harsh conditions to ensure the provision of care that meets international standards9,2

Therefore the high quality of field response depends on effective coordination between ambulance and civil defense field teams the operations center and the receiving hospitals at night where clear and accurate communication becomes crucial for conveying information about the patient's condition and the type of injuries so that the hospital can prepare the surgical team immediately upon arrival Quality is also measured by the paramedic's ability to accurately document data despite difficult circumstances and provide a handover report Comprehensive and rapid it prioritizes treatment and this smooth and flexible coordination ensures that precious time is not wasted in the transport and reception phases and guarantees the continuity of effective care from the site to the operating room9,2

- **Challenges faced by emergency teams during nighttime response**

The biggest and most obvious challenge is the dark environment which affects every stage of the response In the location and arrival phase it becomes difficult for teams to pinpoint the accident site accurately and quickly especially on remote or desert roads lacking lighting or clear landmarks Upon arrival reduced visibility poses a serious threat to the safety of the paramedics themselves increasing the risk of collisions with other vehicles or tripping over wreckage Darkness also hinders the assessment of the injured making

it more difficult to detect internal wounds or minor bleeding that a paramedic might overlook This necessitates the use of powerful portable lighting equipment Emergency teams also face increasingly complex logistical and operational challenges at night as equipment efficiency can be affected Searching for medical supplies or rescue equipment such as metal cutters for entrapment cases becomes slower and more difficult In addition ambulance centers face the challenge of securing sufficient and qualified staff for night shifts as the physical and psychological stress of night work demands a high level of alertness and concentration to handle multiple injuries Nighttime accidents are characterized by difficulties in communicating with receiving hospitals and this may be due to reduced staffing levels in some health facilities at night hindering the transfer of the injured Quickly and effectively2,5
Furthermore nighttime response is also affected by the behavior of the injured and bystanders at the scene Some injured individuals may be under the influence of alcohol or drugs or in a state of extreme exhaustion making them less cooperative or more aggressive This hinders the assessment and treatment process Moreover the gathering of citizens around the scene in the dark can pose a greater risk to the safety of ambulance crews and impede their movement Citizens often interfere with rescue efforts without proper planning requiring emergency teams to exert additional effort in securing the scene and controlling the situation In addition to the primary focus on quickly saving lives emergency teams face direct human and psychological challenges stemming from nighttime work as working during nighttime hours disrupts the body's biological rhythms The body's natural response increases the likelihood of paramedics experiencing fatigue and drowsiness This fatigue not only affects the safety of driving to the scene but also reduces the intensity of concentration and the ability to make quick and accurate decisions necessary in critical injury cases Moreover dealing with more serious accidents and the prevalence of serious and fatal injuries at night imposes greater psychological and professional pressures on paramedics which requires the availability and provision of sufficient psychological support and rest programs to ensure the continuity of performance quality3,6

- **The relationship between arrival time and the success of nighttime field interventions**

Arrival time It is the crucial factor that determines the success of nighttime field interventions and this success is measured by the critical period following the occurrence of a severe injury during which early emergency medical intervention is able to save the life of the injured person or prevent permanent disability and Because nighttime accidents often result in severe and critical injuries such as internal bleeding or head injuries every minute saved in arrival time reduces the period the victim is exposed to shock and oxygen deprivation significantly increasing their chances of survival Conversely exceeding the arrival time leads to a rapid deterioration in the victim's condition especially with common patterns of nighttime injuries such as in cases of severe bleeding Delayed access leads to greater blood loss and rapid onset of hypovolemic shock This makes subsequent interventions in the hospital less effective and similarly in cases of traumatic brain injury Since the delay leads to increased intracranial pressure and permanent damage to nerve cells the relationship here is inverse The longer the arrival time at night due to difficulty in locating the location or slow movement the lower the chances of a successful emergency intervention6,7
Therefore the success of shortening response times is not limited to saving lives but extends to include long-term human and economic benefits When emergency teams arrive in a timely manner and provide advanced on-site care such as spinal stabilization or hemorrhage control they reduce injury complications and increase the speed of recovery This in turn reduces the length of hospital stay reduces the need for complex and long-term surgical procedures and limits permanent disability rates Thus investing in nighttime response time shortening technologies such as advanced navigation systems and securing work teams represents an investment in quality of life and reducing the financial burden on the Kingdom's healthcare system1,7

- **Determinants for improving the quality of field response in nighttime incidents**

Environmental and infrastructural factors are key determinants of improved field response in nighttime incidents The challenge of low visibility and darkness is a primary factor affecting the quality of response In remote areas or on highways outside cities it is difficult for teams to accurately locate the incident and

reach it in a timely manner Even with the use of navigation devices delays in initiating treatment in addition to the presence of weak or incomplete infrastructure such as poor road lighting that makes it more difficult to assess the injured a lack of clear road markings at night or weak network coverage in some remote areas which hinders rapid reporting and coordination between emergency teams and hospitals Logistical and operational constraints also directly affect the efficiency of intervention the most prominent of which is the operational pressure on human resources as night work requires paramedics with a high level of alertness to combat fatigue which poses a challenge in securing a sufficient and qualified staff for long night shifts In addition there are training constraints as the quality of response requires paramedics to be trained in dealing with critical injuries In low-light conditions and with the use of complex evacuation and rescue techniques at night this type of specialized training often requires additional cost and time to ensure efficiency under pressure7,3

Technical upgrades and securing funding are also important material determinants as the quality of response at night requires significant investment in accurate positioning devices such as the use of smart location applications high-quality portable lighting equipment and advanced technologies inside ambulances to facilitate medical procedures in the dark Regular and accurate maintenance of equipment to be ready for night work especially metal cutting and rescue equipment represents a continuous financial burden The lack of availability or continuous updating of these technical and logistical tools sets a maximum limit on the quality of care that can be provided to those injured in nighttime accidents7,8

Methodology

The research is founded on descriptive approach which examines the contents of former researches pertaining to night time accidents injuries and quality of field response. Relevant literature on the subject was gathered, their findings were retrieved, and categorized as per the injury patterns and factors that influence the quality of response. They were then contrasted with the present study to draw similarities and differences and to have the overall perspective of the literature. The focus was on elements related to the type of injury, the severity of the damage, the speed of reaching the site, first aid procedures, and the efficiency of transport to the hospital. This approach helps in building a clear knowledge base that supports a more comprehensive understanding of the phenomenon, and contributes to interpreting the expected results of the current study and linking them to what has been stated in the scientific literature.

- **Results and recommendations**

Results

- The study showed that nighttime accidents are directly linked to severe injuries resulting from excessive speed and delayed human reaction time This has led to the prevalence of critical injury patterns most notably multiple injuries Head and spinal cord injuries
- The study revealed complex and open fractures acute internal and external bleeding injuries and impingement injuries These are the most dominant clinical patterns requiring immediate and advanced rescue and ambulance team interventions
- The study showed that negative nighttime human behaviors such as fatigue drowsiness and the use of stimulants or substances contribute to exacerbating the accident conditions and making it more dangerous which directly increased the likelihood of soft tissue injuries and multiple fractures
- The study showed that environmental challenges such as darkness and poor road infrastructure at night are a major limiting factor that has led to longer arrival times for Saudi Red Crescent teams which reduces the likelihood of initiating life-saving interventions thus negatively affecting the final outcomes for the injured
- The study showed that the difficulty of accurate visual assessment in the dark and lack of lighting at the accident site affected the quality and efficiency of the application of advanced first aid protocols especially with regard to effective spinal stabilization and rapid control of bleeding in the field
- The results indicated the need to develop the Red Crescent's logistical and technical infrastructure to meet nighttime challenges including investing in precision navigation devices high-efficiency portable lighting equipment and specialized training to address fatigue and the challenges of rescue in the dark

Recommendations

These recommendations aim to enhance the quality and effectiveness of the Saudi Red Crescent's field response to nighttime incidents and reduce mortality and disability rates resulting from acute injuries These recommendations which were reached by the study can be explained as follows

- Advanced specialized training programs should be designed and implemented under simulated dark and stressful conditions to enhance paramedics' skills in rapid and accurate assessment and application of immobilization and evacuation procedures in a low-light environment
- It is necessary to implement strict protocols for managing fatigue of night-working teams including setting standard working hours providing adequate rest periods and providing continuous psychological support to ensure high alertness and sound decision-making during the response to critical injuries
- Emergency teams must be provided with specialized training in dealing with entrapment cases especially those that occur at night to ensure a quick and safe rescue that does not exacerbate spinal injuries
- The need to invest in advanced navigation technology that integrates with the reporting system to pinpoint the location of the incident with extreme accuracy as quickly as possible especially in areas that lack clear reference signs with the aim of shortening and reducing arrival time and increasing response speed
- Ambulances and rescue equipment must be equipped with highly efficient ambient lighting systems as well as headlamps and portable lighting equipment for paramedics to ensure clear visibility of the scene and improve the ability to assess complex injuries such as bleeding
- It is necessary to secure effective and stable communication channels at night to ensure flexible coordination between field teams the operations center and hospitals enabling surgical teams to be prepared in advance based on the paramedic's report on the injured person's condition
- It is necessary to intensify public awareness campaigns in cooperation with the competent authorities to focus on the dangers of fatigue drowsiness and excessive speed at night and to emphasize the need to check vehicle lights before traveling to reduce the root causes of accidents
- The need to strengthen the partnership with the Ministry of Transport and the authorities responsible for infrastructure to improve the quality of lighting and maintenance of reflective signs on highways at night which contributes to reducing accidents of swerving and collisions with obstacles

Conclusion

The study aimed to analyze the risk factors associated with nighttime accidents such as poor lighting human fatigue high rates of speeding and delayed reporting The study included addressing several key areas such as types of injuries like head and spine injuries internal bleeding response speed paramedic efficiency and operational constraints and challenges associated with night work

The results showed that nighttime accidents tend to cause more serious injuries compared to daytime accidents especially those resulting from high speed or poor night vision The results indicated a clear correlation between the speed of response and the quality of ambulance service in terms of controlling bleeding and resuscitating the injured The study emphasized the need to enhance the readiness of Red Crescent teams during nighttime periods by increasing the number of teams on duty and providing them with advanced night vision and navigation technologies in addition to developing special training programs to deal with nighttime accidents which would enhance the quality of service provided and the safety of paramedics and the injured alike

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