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Assessment of role of the trauma centers located along Pakistan national highways in manmade disasters

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Abstract

Due to earthquakes, floods, tsunamis, civil wars, terrorism, *etc.*, disasters are becoming more frequent and lethal on a daily basis throughout the world. One of the manmade disasters is traffic accidents, which result in serious injuries or can be fatal for people, particularly those between the ages of 1 and 44. Road accidents regularly put the lives of 1.25 million people in danger. More than 20 to 50 million people annually experience non-fatal injuries that could result in disability. While responding to a crisis, our main aim is to preserve lives. This is done in two steps: firstly, we manage the life-threatening injuries, and secondly, we work to prevent secondary injuries by dealing with the original injuries effectively. We require trauma centers and emergency medical services that are easily accessible for the avoidance of secondary injuries and their successful recovery. To provide care for patients who have sustained severe injuries, trauma centers offer the required tools, specialized resources, and a trauma team with specialized training. A trauma center may treat all of the same illnesses and injuries that are treated in an emergency room, and it can offer patients with catastrophic injuries prompt multi-disciplinary, all-inclusive emergency medical care. The objective of this study was to assess how trauma centers, particularly those close to highways, contribute to the management of trauma. A quantitative questionnaire was created for this purpose, and the information gathered was then statistically compared, contrasted, and analyzed. The study concludes that trauma management should be provided in close proximity to the site of incidents so that morbidity and mortality can be reduced.

Keywords: Trauma, emergency, triage, disasters, injury, management

INTRODUCTION

Earthquakes, floods, civil conflicts, terrorist operations, and tsunamis are just a few of the disasters that are becoming more frequent every day around the world, causing enormous havoc and fatalities. In the last decades, millions of people were affected worldwide by natural catastrophes, illustrating the scope of the problem the globe faces[1]. From 1994 and 2003, there were 58,000 deaths annually on average as a result of natural disasters[2]. Both forms of disasters, including natural hazards and manmade disasters, cause traumatic injuries and losses in terms of life and property, with car accidents being the most common significant traumain case of manmade disasters. Throughout our everyday routine, we see several reports of accidents through various media, including the news, social media, and publications. For people, particularly those aged 1 to 44 years, it frequently results in severe injuries or may even result in death[3]. Every year, 1.25 million people lose their lives in traffic accidents. From 20 to 50 million persons had non-fatal injuries that may have left them disabled[4]. Therefore, road accidents can safely be counted as manmade disasters.

In order to further augment our discussion of categorizing road accidents as manmade disasters, we can examine how many people die in traffic accidents in relation to population trends. Road safety, as the World Health Organization (WHO) has noted, is not an accident. Road traffic deaths and injuries are predictable and preventable; therefore, they fall into the category of manmade disasters. As indicated in Table 1, the WHO published statistics on traffic fatalities in 2017. One in four Americans are injured and in need of medical attention. Due to inadequate care provided during the "golden hour", severe injury caused 97,860 fatalities in 1999[5]. In China, 268,127 persons lost their lives in road accidents because timely surgical care was not provided. The death rate in China, which is 2.87% per 100,000 people, places it at position 94 in the world[6]. In 2017, death rates per 100,000 employed individuals varied across different countries. The rates were as follows: 0.87 in Belgium[7], 4.45% in Brazil[8], 6.83 in Iran[9], 3.16 in India[10], 3.68 in Iraq[11], 2.22 in Pakistan[12], 0.05 in Netherlands, 1.75 per in Türkiye[13], 1.52 in US[14], 1.05 in New Zealand[15], 0.51 in Norway[16], 0.39 in United kingdom[17]. These values are shown in Table 1. Among these given countries, Iran shows the maximum rate of death with a world rank of 38, while the United Kingdom shows a minimum death rate with a world rank of 180. If we observe Pakistan, it shows 27,081 deaths in 2017, which can be attributed to a lack of critical care and surgical diagnosis[18].The latest interactive map up until 2019 is shown in Figure 1[19].

Automobile traffic trauma leads to substantial economic fluctuation for victims, their dependents, and the whole nation[20]. The biggest losses of traumatic incident sequences are caused by the cost of therapy, lost productivity, and activities that disrupt the families of trauma victims[21]. 3% of their gross domestic product cost in most countries is due to road traffic crashes[20].

Other trauma injuries are described based on the external cause of injury (e.g., burns, falls, drowning, poisoning, and other blunt injuries)[22]. More than 60% of accidents occur on roads, which include falls 35.7%, stuck by objects 18.27%, and motor vehicle injuries 12.5%[22]. These accidents may cause thousands of death per year due to unavailability of proper aid at that critical time[23].

Over the world, injuries are a significant source of death and disability; in 2000, it was estimated that nearly 5 million people died as a result of injuries. As is the situation in Pakistan, which frequently experiences manmade disasters such as traffic accidents that seriously harm human life. Our policies ensure that victims

Table 1. Rate of road accident deaths, percentage of total death, death rate, and death rate ranking in circumpolar countries in 2017 per 100,000 employed

Countries	Death	%	Rate	World rank
China	268,127	2.87%	17.50	94
Belgium	800	0.88%	6.61	148
Brazil	47,068	4.45	21.96	72
Iran	22,143	6.83	30.32	38
India	278,383	3.16	22.51	67
Iraq	6,476	3.68	22.34	69
Pakistan	27,081	2.22	15.42	104
Netherland	607	0.50	2.81	179
Türkiye	6,954	1.75	8.85	135
United States	34,908	1.52	10.04	127
New Zealand	247	1.05	5.74	158
Norway	173	0.51	2.93	176
United Kingdom	1,846	0.39	2.58	180

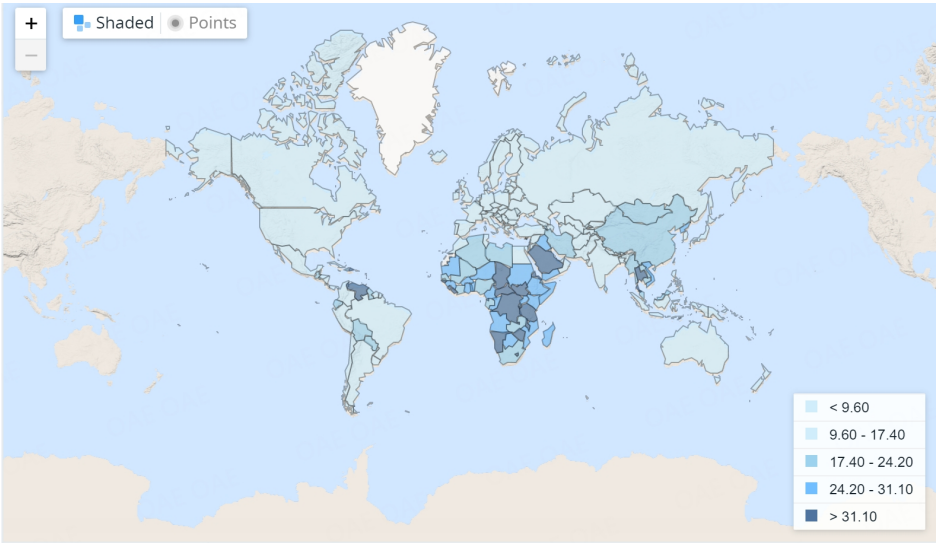

Figure 1. Interactive map showing mortality caused by road traffic injury (per 100,000 population).

survive by focusing on saving lives and addressing traumatic casualties properly. If it is not achieved, there will be significant difficulties, which will lead to several issues.

Sustainable development goals (SDGs) also focus on health improvement, as SDG 3 states the importance of ensuring healthy lives and promoting well-being for all at all stages of life. At a national level in Pakistan, the emergency plans at national, provincial, and district levels are prepared for all levels of emergencies by respective levels of authorities, which concentrate on the human health insurance[24]. The experience of many developed & developing countries has demonstrated a significant reduction in road-related deaths and injuries in the last two decades (WHO, 2014). The interventions made by these countries are not based on rocket science and are often in sync with the five pillars of Road Safety detailed by WHO, viz.: management, safe vehicles, safe roads, road user behavior, and post-crash response[24]. According to the author, the trauma center was badly needed along highways and motorways as there was no suitable facility to provide medical treatment to those injured in road accidents in the near vicinity. It was also noted that

"The center is properly equipped with the latest gadgets to provide complete health facilities to the villagers, including women, living near the Super Highway" (Staff Report, 2017).

The development of the China-Pakistan Economic Corridor (CPEC) is a great development opportunity for Pakistan. As traffic on these trade routes and the volume of vehicles and passengers increases, there will be an enhanced propensity to traffic accidents with a sizeable number of injuries. Consequently, this will lead to an increasing demand for trauma support and care to address these incidents. Proper handling of traumatic causalities, with a focus on saving lives, is guided by established guidelines to make sure the survival of victims. If these guidelines cannot be effectively implemented, there will be huge complications, which will create many problems. So, we have to focus on the deficiencies found while responding to trauma for better results. Because of the difficulties in evaluating the effectiveness of trauma centers and the methodological limitations of previously published studies, the relative benefits of establishing an organized system of trauma care remain controversial, especially classically responding to a disaster[25]. For better outcomes, we must concentrate on the shortcomings identified while responding to trauma. This study will offer a suggested strategy for trauma centers for CPEC in order to improve their performance and enhance overall patient care.

METHODOLOGY

The research design links the observed data in a logical way to provide an answer to the research question. It serves as a roadmap or action plan for an empirical research study and outlines key concepts such as the research methodology, sample, and tools and techniques used for data collection and analysis[26]. It describes the measures necessary for obtaining the information needed to construct and solve research problems[27]. The quantitative research design was used to conduct this study. In a quantitative research design, a set of a small number of structured questions is administered to a large number of respondents[28]. The collected data thus can be statistically compared and contrasted. Moreover, the findings are clear and exact and have broad and generalized applicability for the entire population[29].

The abstract idea refers to a substantial collection of many cases from which a researcher draws a sample and generalizes results from it[30]. The population of the study primarily consisted of the doctors from trauma centers, allied health professionals, nurses, and paramedic staff in the study area, selected and targeted for the data collection. The establishment of trauma centers for CPEC is a plan that will assist us in maintaining both health care and economic growth. We define a sample as a finite part or subset of participants drawn from the target population. In turn, the target population corresponds to the entire set of subjects whose characteristics are of interest to the research team. Based on results obtained from a sample, researchers may draw their conclusions about the target population with a certain level of confidence, following a process called statistical inference[31]. The chosen population is, therefore, located in the vicinity of the nearest highways. Also, it improves the tertiary-level accessibility of various places, which promotes greater individual mobility and adaptability in socioeconomic activity[32]. For this, research was conducted in various cities in Pakistan, including Lahore, Kasur, Sahiwal, Chakwal, Attock, Rawalpindi, Gujranwala, Sheikhupura, Okara, Layyah, Vehari, Bahawalnagar, Multan, Bahawalpur, LakkiMarwat, and Peshawar.

The inclusion and exclusion standards for choosing trauma centers and responders from the chosen demographic are described. Trauma facilities close to roads, physicians, members of the Allied Health Professions, nurses, and paramedics make up the whole personnel of trauma centers. In trauma centers, patients are registered, and both the staff and the patients are citizens of Pakistan. Apart from motorways, there are trauma hospitals where the staff members, including doctors, nurses, those of the Allied Health field, unregistered clients, patients, and non-Pakistani employees, do not work in trauma centers. We could

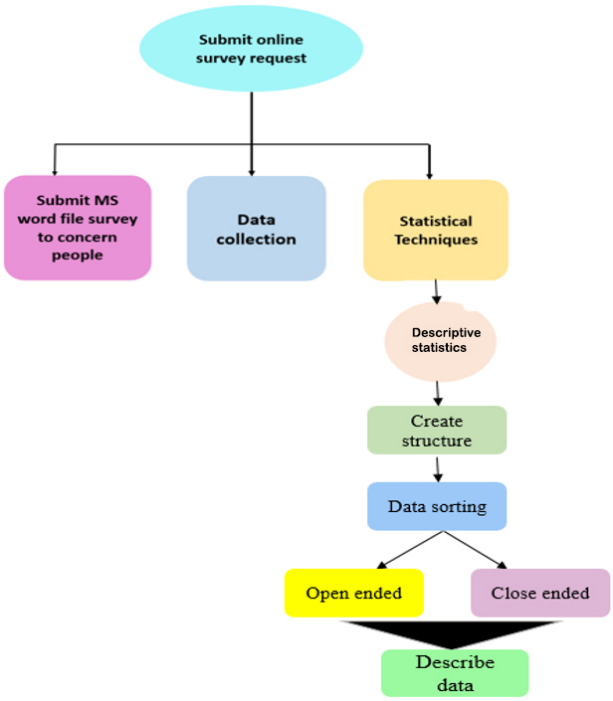

Figure 2. Graphical Framework of the study design.

measure every indication with 100 percent precision and give a perfect picture and information if all secondary and tertiary healthcare facilities were surveyed. Yet, it would be costly and time-consuming to deal with or gather data from all hospitals or healthcare facilities. So, to obtain estimates of the actual indicators regarding the target population, i.e., all healthcare facilities at trauma centers on roads, it is important to interview or choose a sample of these healthcare institutions. The stratified sampling technique was used to choose the samples. The number of trauma centers or trauma care facilities to be included in the study is referred to as the sample size in this situation. To accomplish the objective of this study, a stratified Sample of 24 trauma centers, including 13 secondary care facilities and 11 tertiary care facilities, was chosen [Figure 2].

RESULTS

Rating of trauma center according to trauma center level

An emergency hospital that treats patients with traumatic injuries, such as burns, unintentional wounds, falls, building collapses, blast wounds, *etc*., is known as a trauma center. The various levels (Level I, II, III, IV, or V) describe the different types of resources that are available in a trauma center and the annual number of patients admitted. These are the classifications that specify US national guidelines for hospital trauma care. Specialized treatment facilities enable us to help trauma patients recover. A Level I Trauma Center is a tertiary care hospital that offers complete regional resources. All injured patients can begin receiving final care at a Level II Trauma Center. Rapid evaluation, resuscitation, surgery, critical care, stabilization of injured patients, and emergency operations are all capabilities of a Level III Trauma Center. A Level IV Trauma Center has proven its ability to provide advanced trauma life support (ATLS) prior to the transfer of patients to a higher-level trauma center. While a Level V Trauma Center offers initial evaluation, stabilization, and diagnostic capabilities and prepares patients for transfer to higher levels of care. According to Figure 3, the respondents were asked about responses concerning how they rate trauma center services. Results show 49% of respondents claimed their trauma center is of level III according to

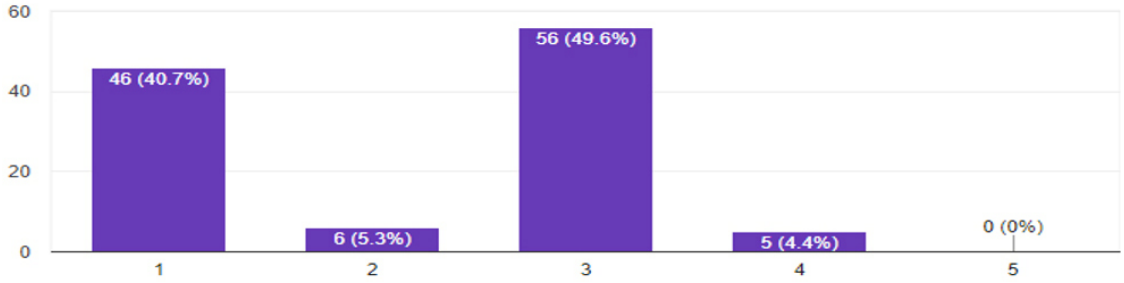

Figure 3. Study participants rating for trauma center according to different trauma levels.

standard guidelines. In contrast, 40.7% of respondents showed that the condition of the trauma center is level IV. Furthermore, 5.3% of respondents rated trauma centers at level II. The bar chart further explored and narrated 4.4% of respondents claimed the trauma center is level I, which belongs to a teaching institution or has all the recommended facilities.

Resources in a trauma center

The following chart [Figure 4] discussed the current number of facilities available in trauma centers. Results show that 99% of respondents thought that less than ten ambulances were available in trauma centers, whereas only 0.1% of respondents stated that there were 10-15 ambulances available. Moreover, the majority (98% of the respondents) claimed that less than ten emergency wards were available, while only one responded for 15-20 wards. When asked for the number of beds for trauma patients, 49% responded that there are fewer than ten, while 27% agreed that 10-15 beds were available in trauma centers. 18% of participants said that there were 15-20 beds, and only 0.4% responded that it is more than 20. With regards to medical equipment availability, 9% of respondents claimed there were less than ten pieces of equipment available in the trauma center. Whereas 60% of respondents showed that equipment was 10-15, 28% responded for 15-20, while 3% of respondents said that more than 20 medical equipment were available. The hygienic environment inquiry results show that 7% of them expressed that the hygienic conditions were good in trauma centers. Meanwhile, (61%) more than one-third of the total respondents revealed that the hygienic environment of the trauma center was satisfactory. 26% of the respondents suggested unhygienic conditions at the trauma centers, while only 4% of the respondents claimed that the hygienic environment was bad.

Positive changes within the past three years supporting the trauma center by the hospital's governing body including medical staff addition

In response to this question, 96% of respondents replied positively that the centers had been improved with regard to the addition of new facilities and equipment, while only 4% claimed that no improvements were observed in this period. 99.4% of respondents believed that medical professionals had improved during the previous three years when it came to this topic. In comparison, only one of them expressed dissatisfaction with it.

Significance of trauma centers near highways/superhighways in Pakistan

Responding to the question of significance of trauma centers near highways/superhighways in Pakistan, 100% of the respondents agreed and were convinced regarding the importance of trauma centers near highways/superhighways in Pakistan.

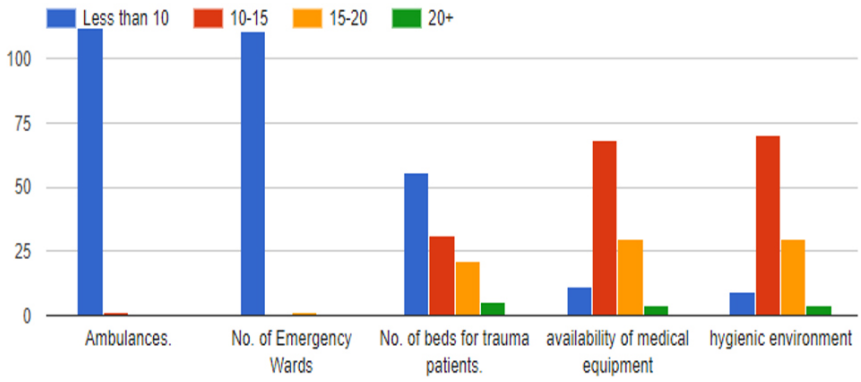

Figure 4. Available resources and facilities in a trauma center.

Availability of trauma centers along national highways saves any complications or secondary injuries to seriously injured persons

It was found that scattering of availability of trauma centers along national highways was agreed to by all the respondents, who all were convinced that it may result in the avoidance of any complications or secondary injuries to seriously injured persons.

Availability of trauma centers on highways reduces the risk of death due to serious injuries

Answering the question of importance of trauma centers in reducing the risk of deaths and serious injuries, the respondents opined that the availability of trauma centers on highways reduces the risk of death due to serious injuries. We can easily infer from the obtained data that the majority of the respondents, 98.2%, rate that the trauma system reduces the risk of death due to serious injuries on highways, while only one odd respondent felt that it is not related to reducing death risks and was undecided about the association of trauma centers toward reduction of risk of death.

Availability of trauma centers can save victims more efficiently than small or local healthcare unit

From the data gathered from the respondents, a comparison was drawn between the role of trauma centers viz-a-viz small and local healthcare units in saving victims more efficiently. The results elucidate that the majority of the respondents, 99.1%, agreed and were convinced that the availability of trauma centers can save victims more efficiently than small or local healthcare units.

Rating the services of trauma centers and emergency centers (of the hospital) for the incidents/accidents on highways/superhighways in Pakistan

Rating of services of trauma centers and emergency centers explains how much our trauma center is working efficiently in accidental conditions near the highway. According to Figure 5, the respondents were asked about responses concerning how they rate the services of trauma centers and emergency centers (of the hospital) for the incidents/accidents on highways/superhighways in Pakistan. Results show that 48% of respondents claimed that the trauma center has average results regarding the rating of trauma centers. Whereas according to 30.1% of respondents, services of trauma centers and emergency accidents on highways/superhighways in Pakistan are quite good. Furthermore, 14.2% of respondents said that services provided by trauma centers at the golden hour are excellent. 6.2% of respondents believed services of trauma centers were bad, while one of the respondents expressed that services of trauma centers and emergency centers are very bad in emergency conditions.

Rating the management of trauma centers in Pakistan

Figure 6 exhibits the management rate of trauma centers in Pakistan. Results revealed that 49.6% of

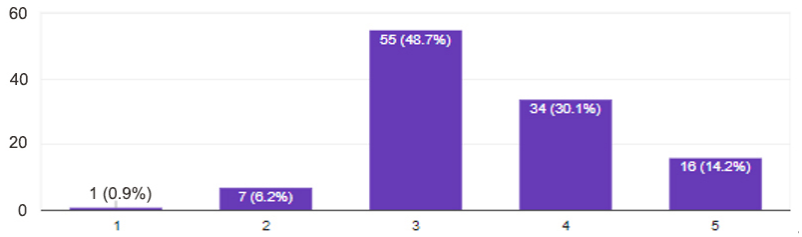

Figure 5. Rating of the services of trauma centers and emergency centers (of the hospital) for the incidents/accidents on highways/superhighways in Pakistan.

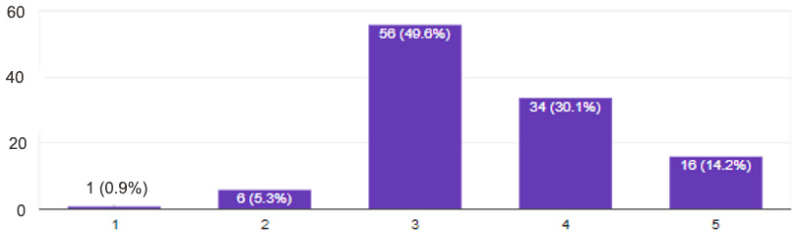

Figure 6. Management rating of trauma centers in Pakistan.

respondents rate the management of trauma centers in Pakistan at a satisfactory level, while more than one-fourth (30.1%) agreed that the management of trauma centers in Pakistan was quite good. 14.8% of the respondents strongly agreed that the management of trauma centers in Pakistan is excellent, while 5.3% rated the management as bad, and only one of the respondents rated it as poor.

Availability of trauma center emergency number in case of an accident

In response to the availability of emergency numbers at trauma centers in case of an accident, the results show that the majority (94%) of respondents agreed that there should be an emergency number of trauma centers in case of an accident; in contrast, 5.4% of respondents did not find it quite relevant.

Lack of essential services at a trauma center causes death which can otherwise be saved by an advanced medical facility

In response to the question to ascertain the role of lack of essential services at a trauma center, respondents felt that the lack of services at the trauma center can lead to death, which otherwise could have been saved by an advanced medical facility. The results show that all the respondents were convinced that the lack services of at trauma centers can lead to death, while advanced care can save lives.

Transfer plan with a trauma center for acceptance of your trauma patients.

The results of this question indicate that the majority of the respondents (99.1%) agreed that there should be a transfer plan within a trauma center for the acceptance of trauma patients. Meanwhile, only one of the respondents disagreed with this point.

Number of trauma deaths during the last fiscal year (in accidents on highways)

The following chart [Figure 7] explains trauma deaths occurring during the last fiscal year (in accidents on highways) in the light of responses received from the participants of the study. Given results show that 53% of respondents claimed there had been more than 40 trauma deaths during the last fiscal year. Whereas 44.2% of respondents said that there were 30-40 trauma deaths in the last fiscal year. 1.8% of the respondents stated 20-30 trauma deaths and only 0.9% narrated less than 20 deaths.

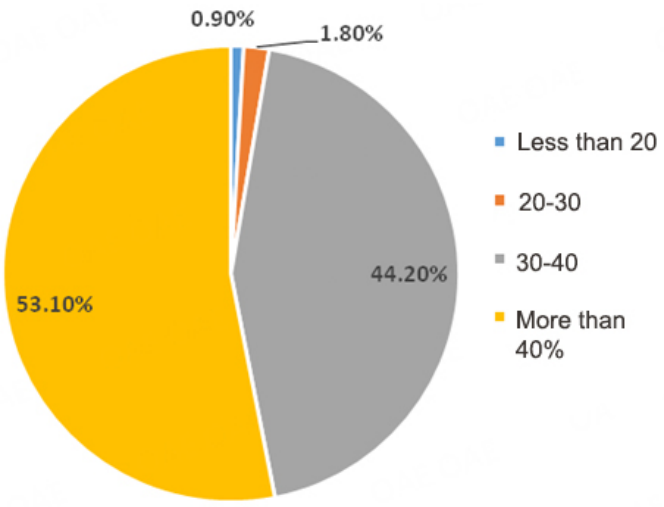

Figure 7. Trauma deaths during the last fiscal year (in accidents on highways).

Availability of education/training programs for physicians, nurses, and other supporting staff at a trauma center

The availability of education/training programs for capacity building of physicians, nurses, and other supporting staff at the trauma center was explored through this question. Results revealed that 95.6% of respondents claimed that an education program for physicians, nurses, and other supporting staff exists at a trauma center, and in contrast, 4.4% of respondents replied negatively.

Education programs for national highway authority drivers to handle emergencies

The results in reply to this question revealed that 86.7% of respondents agreed with the same point and opined that driver's education can save victims more efficiently than small or local healthcare units. Meanwhile, 13.3% of respondents disagreed with this point.

Availability of dedicated blood banks at trauma centers (near highways/superhighways)

Figure 8 depicts concerns for Trauma centers (near highways/superhighways) with regard to having their own blood banks. It was disclosed that the majority of the respondents (95.6%) said it is extremely important for trauma centers to have their blood banks, which has also been emphasized in another study but in the context of Covid-19 uncertainties[33]. Only 4.4% of the respondents did not find it important for trauma centers to have their blood banks.

Availability of room/staff/equipment required to deal with burn patients in trauma centers near highways

The question investigates the importance of the requirement of room/staff/equipment to deal with burnt patients in trauma centers near highways. The results show that a minimum percentage of the respondents, 1.8%, suggested that there is no need for room/staff/equipment to deal with burned patients in trauma centers near highways. In contrast, 98.2% of the respondents supported the statement that room/staff/equipment is mandatory to deal with burned patients in trauma centers near highways.

In addition, we also conducted the open-ended query for facilities essentially required in the trauma center near highways/superhighways. The majority of the respondents suggested advanced care facilities. This further validates the behavioral tendencies of the respondents, where they recommended improving trauma management, in which time complexity was the main issue. Most of the respondents claimed the

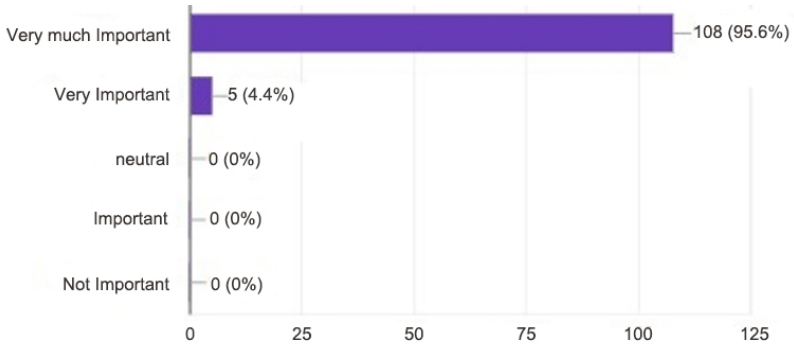

Figure 8. Availability of dedicated blood banks at Trauma centers (near highways/superhighways).

importance of having first aid centers, availability of surgeons, small ICUs, trained medical officers, and X-ray facilities. Additionally, they stressed that at least an ultrasound facility and, preferably, CT scan machines were the most important apparatus that should be present in trauma centers.

Respondents' responses regarding different aspects of availability and significance of trauma centers and benefits along CPEC

Interestingly, it was found that every respondent was somehow acquainted with CPEC. Further to this question, when questioned about the availability of these centers along the CPEC route, 74.1% of respondents replied negatively, stating that there are no trauma centers on CPEC. Meanwhile, 25.9% of respondents agreed to presence of some trauma centers near CPEC, although all the respondents agreed and were convinced that there should be trauma centers on CPEC in Pakistan.

Another query was conducted to inquire about the benefits of trauma centers on CPEC. Analysis of the results revealed that the majority of the respondents, 58%, thought it will help us to save the life of laborers who are working on this project and was also significantly important for the natives. In addition to this, it would accrue long-term benefits for road users in the future. Some respondents were of the view that it will prove to be very beneficial to manage the trauma in the golden hour. 35% of respondents thought that it will reduce the mortality and morbidity rate. In contrast, the remaining 7% of respondents opined against the benefits of the trauma center. Moreover, the opinions of the respondent about the benefits of trauma centers for adjacent areas of the CPEC route (such as villages near CPEC) revealed that the majority of respondents (97.3%) strongly agreed, while 1.8% of the respondents agreed. Only one of the respondents strongly disagreed and claimed that there would be no benefit for other areas than CPEC (such as villages near CPEC).

Chinese staff ratio of the trauma center on CPEC

The following chart [Figure 9] discusses what ratio of Staff of trauma centers on CPEC should be from China. Given results show that 45% of respondents agree and claim that there should be Chinese representation in the staff ratio of a trauma center on CPEC. 33.6% of respondents disagree with this suggestion. 18.6% of the respondents have neutral thoughts about the staff ratio. 1.8% strongly disagreed with the presence of Chinese staff.

Patient's part

This questionnaire is designed for patients about facilities being provided at the trauma center near highways in various incidents or accidents condition. The results are discussed below.

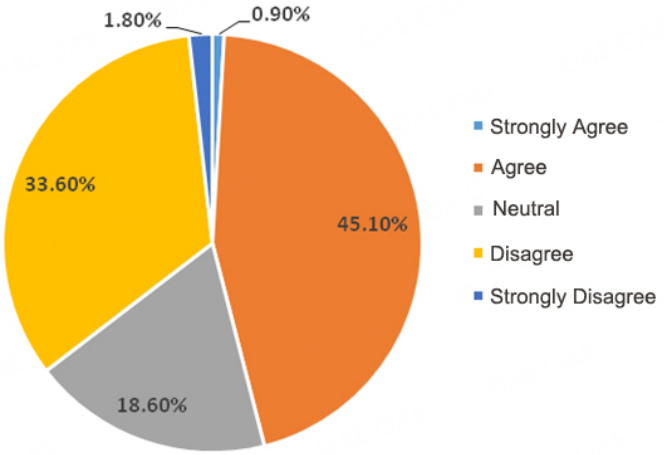

Figure 9. Figure showing the response to Chinese staff Ratio of a trauma center on CPEC from China.

Patient mode of transfer to the trauma center

The pie chart [Figure 10] narrates the opinions of the respondents as to how they were transferred to the trauma center. The results reveal that more than half of the respondents, 61.8%, said they were transferred to trauma centers via Rescue 1,122, while 21.6% of the respondents informed that they reached a trauma center on their own. 14.7% were brought to the medical center by some passersby. A very minor share of the respondents, 1.9%, said that they were transferred to the emergency through other modes.

Type of incidents that affect the victims

The results in Figure 11 show the type of incident/ accident generally suffered by these people. The results narrated that 51% of respondents faced trauma injuries through road traffic accidents (RTAs). Moreover, 18.6% of respondents were hurt by falling from a height, while 16.8% bore injuries in case of a fight. 8% of the respondents got injured due to fire incidents. Additionally, 5.3% of respondents were injured by the blast.

Type of vehicle in case of RTA

The following chart [Figure 12] discusses the results regarding those people who suffered RTAs due to different types of vehicles. Results show that 33.6% of respondents suffered RTAs due to motorbike - motorbike collisions/faults, whereas 11.5% of those respondents stated that they bore injuries from motorbikes - carts, motor car - public transport, and motorbike - public transport collisions/faults/ negligence. Further results demonstrated 4.4% of respondents claimed they got injured from motor car - motor car. Additionally, 6.2% of respondents were those who suffered accidents by motor car - motorbike and public transport - carts. 8.8% of respondents expressed they crashed by motorbike into a motor car.

Severity of injuries

Figure 13 validates triages of patients. A pie chart shows that 34.5% of respondents said that they were minorly injured, while 32.7% of the respondents were moderately injured. In some portions, 31% of respondents were those who suffered severe injuries, and only a marginal number of the respondents, 1.8%, showed that they required resuscitation.

Type of injury

The following chart [Figure 14] discusses the type of injury to the patients. Given results show that 26.5% of respondents bore open wounds, and 11.5% claimed that they endured open wounds with fractures.

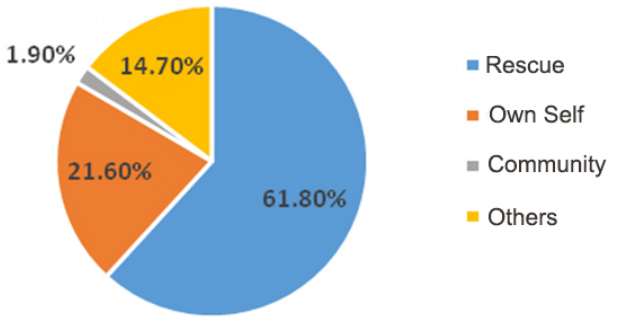

Figure 10. Estimated number of patients transferred to the trauma center.

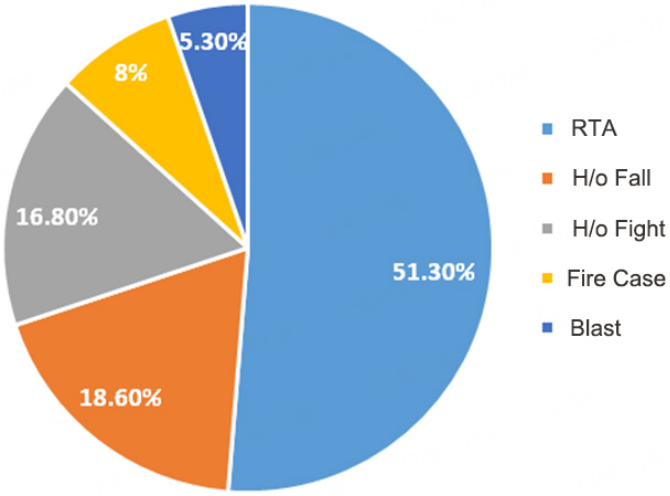

Figure 11. Distribution of patients with respect to the type of incident.

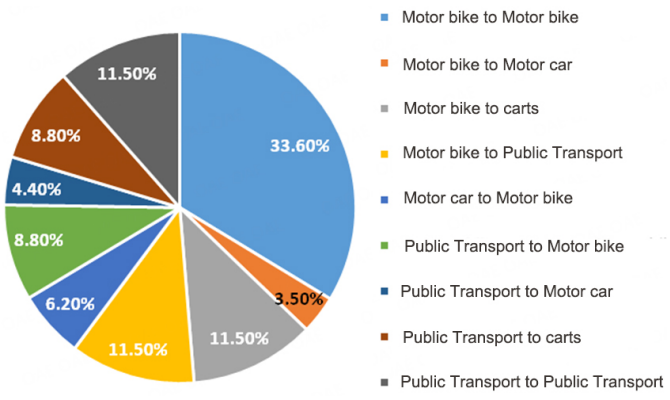

Figure 12. Type of vehicle in case of RTA.

Whereas 11.5% of respondents were those who experienced hardship due to crush injury, and 9.7% of respondents claimed that they suffered close wounds and head injury. Moreover, there were 8% of the respondents affected by a spinal injury. A few of them, 7.1%, were those suffering from the close wound with fractures. 5.3% of respondents were hurt from burning. A very low percentage of respondents suffered due to distress from the blast, blunt chest trauma, and amputated injuries.

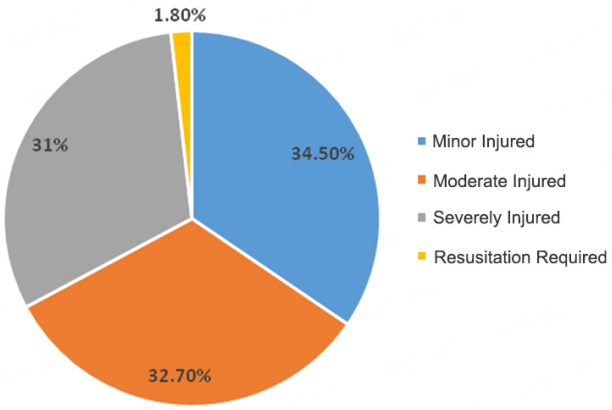

Figure 13. Figure showing Triage illustration.

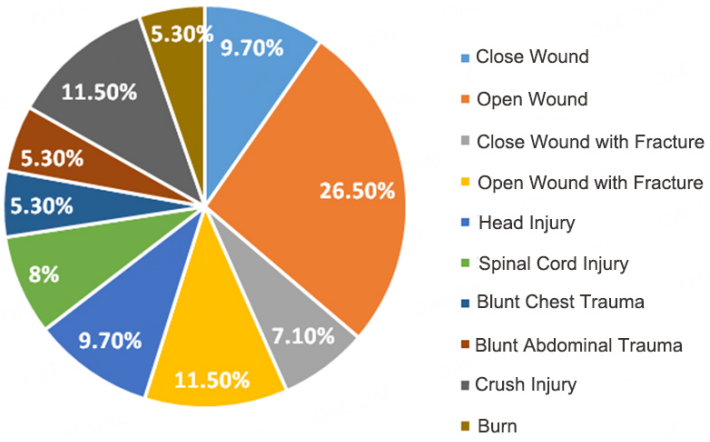

Figure 14. Distribution based on Injury type.

Treatment provided in the trauma center

Figure 15 discussed the treatment which was provided to the trauma-affected people. Results indicate that 48.7% of respondents said that they received first aid, whereas 31.9% of respondents stated that they were entertained with supportive treatment. Moreover, 15% of the respondents claimed that they were provided advance cure, and only 4.4% said that they were treated with resuscitation.

Outcome after treatment provided in the trauma center

Figure 16 explains the outcomes of patients after treatment showing that 50.4% of respondents said they were discharged after proper treatment. Because they were treated on golden time, 29.2% of the respondents were admitted for advance care to avoid inconvenience in the future. In some portions, 13.3% of respondents having severe injuries were referred to the tertiary care center for specialized healthcare, and unfortunately, 4.4% of patients expired because of improper resuscitation or no resuscitation on time. 2.7% of patients were those who left against medical advice (LAMA).

Subsequently, after applying the statistics and interpreting the results of the analysis, the major findings of the study are the following.

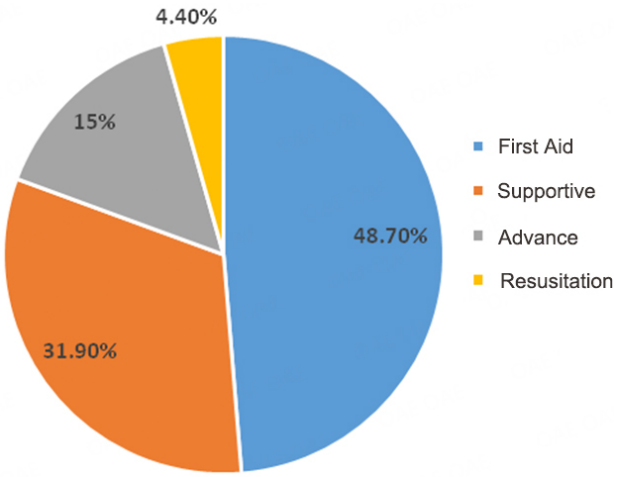

Figure 15. Treatment provided to patients.

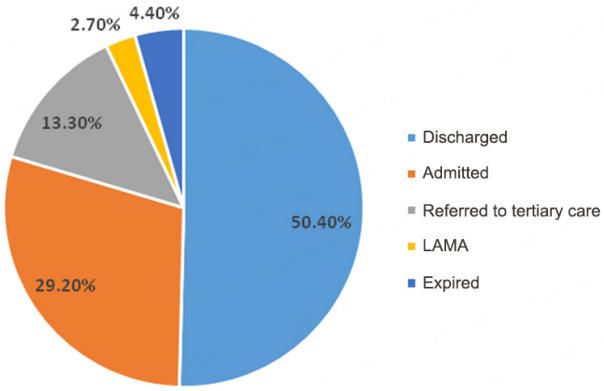

Figure 16. Chart showing outcome after treatment.

DISCUSSION

The geography, climate change, and socioeconomic status in Pakistan make it susceptible to both natural and manmade calamities. The impact of these catastrophes on people's lives is significant. One of the health effects of disasters that victims must deal with is injury, which can result in death and disability. In Pakistan, a considerable number of people get injuries on a regular basis. RTAs are one of these prevalent injuries. Injury management by trauma centers may lower the danger of fatality and handicap. The analysis demonstrates the dire state in which trauma centers are now operating in our nation. The reason is that trauma centers located close to roads typically have a limited supply of medical equipment and typically have less than ten ambulances, emergency wards, and beds available. The reason for the shortage of facilities is that 54% of trauma centers are chosen from secondary care; despite its shortcomings, it should be improved in order to handle mass casualties properly. As a result, we argue that trauma hospitals should be accessible from national highways in order to prevent complications or subsequent injuries in badly injured people. 51% of respondents reported experiencing traumatic injuries as a result of RTAs. Motorbike crashes into carts, vehicle crashes into public transportation, and motorbike crashes into public transportation account for more than 50% of the injuries, while others suffered from fractures, crush injuries, open wounds, wounds, and head injuries. In contrast to small or local healthcare facilities, trauma centers on roads lower the chance of mortality from major injuries and improve victim control.

Highways saw the majority of the fatalities on the road because of the significant truck, bus, and other traffic. The significance of trauma centers near highways is highlighted when the aforementioned aspect is taken into account. Especially in the present scenario where lots of road infrastructure is being developed in Pakistan as CPEC routes. Yet, there are low-level trauma centers, such as level III or level II trauma on roads. The majority of level I or level II trauma facilities are located within the cities, which is why patients who were injured in major road accidents from neighboring hospitals are sent to tertiary care, which loses time during the golden hour of treatment for these patients. Owing to the paucity of trauma treatment facilities at District Headquarters (DHQ) and Tehsil Headquarters (THQ) levels, patients who suffer from head injuries, crush injuries, open multiple fractures, blunt abdominal or chest trauma, or open multiple fractures die before they can be taken to tertiary care hospitals. We must upgrade the trauma centers along our highways, construct brand-new ones that are fully functional, and install all other facilities that are advised for a secure Pakistan. This study suggested a proposal for a chain of trauma centers at CPEC, which will be the longest international roadway in Pakistan, according to the necessity in light of the study findings.

CONCLUSIONS

Trauma centers are critical infrastructures that are essential to managing injured people, and thousands of people use their services on a regular basis. Their number, which was 195 in 2005, and distribution across Pakistan varies by region and demand[34]. The availability of trauma centers is increasing gradually, but there are still issues that can be solved and that call for substantial efforts to be made in this direction, especially in the current scenario of new routes development under CPEC. The objectives of the current study were to investigate how trauma centers located near national highways treat trauma patients during disasters and to make recommendations for how to establish trauma centers at CPEC. 30.1% of trauma centers and emergency accidents occur on highways/superhighways in Pakistan. Nevertheless, the trauma center management in Pakistan is just at a basic level and not at an advanced level. We came to the conclusion that a trauma center and its emergency number should be available in case of an accident. A trauma center or advanced medical facility on a major highway could prevent more deaths than they would otherwise because of the intricacy of the time involved. Decision-makers are encouraged to conduct quick triage procedures. A rapid triage can expedite the evacuation process and limit more casualties depending on the varying evacuation priorities for the injured, the homeless, and the deceased[35]. Also, it could be beneficial for a better recovery if we offered the transfer plan of the neighborhood trauma center because the past fiscal year saw a 20% increase in trauma mortality. Also, in order to recover from this severe loss, we should launch a specific training program for medical professionals, nurses, and other support staff in advanced golden hour trauma management. The results of our surveys demonstrated that trauma clinics close to roads can save victims more effectively than small or local healthcare facilities. On CPEC, there is only one trauma center requiring expansion of the trauma center network along different routes.The staff intended for the emergency center should be Pakistani. As anticipated due to the findings of this study, it would also be introduced next to highways, much like trauma centers. That is important for the locals and will help us save the lives of workers on the CPEC project. It will be important to handle the traumas during the "golden hour". We should upgrade the trauma centers already available on highways. There should be more trauma centers on highways, especially heavy traffic highways, i.e., Indus highway, super highway, GT road, Motorways, and CPEC routes. To make sure the services should be continued, trauma centers should be properly evaluated every six months or once a year. Programs for basic trauma care for the community and National Highway Authority (NHA) transporters and advanced trauma care for hospital staff must be established, and their execution must be ensured. After a specific amount of time, there should be refresher courses for hospital staff, community members, and NHA transporters.

Toward the attainment of SDG 3 and reducing disaster risks, the importance of trauma centers cannot be ignored. Though the research studies comprehensively cover different aspects related to the availability and management of trauma centers, further studies need to be carried out keeping in view the latest research and best practices for improving response to these manmade disasters[36].

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Authors' contributions

Authored the paper and carried out data collection and its analysis under the guidelines of Dr. Naeem Shahzad: Rashid M

The paper was reviewed and improved: Shahzad N

Availability of data and materials

Data are available on Google response forms completed by respondents.

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Conflicts of interest

Both authors declared that there are no conflicts of interest.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

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