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Role of Trauma Center in Disaster Management situated at National highways and establishment plan of Trauma Centers at CPEC

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Dedicated to

MY BELOVED PARENTS

&

MY FAMILY

For their everlasting love and continuous support

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(Muhammad Rashid)

ABSTRACT

Disasters are increasing day by day across the world consequently leading to death at unimaginable level due to earthquakes, floods, tsunamis, civil conflicts, terrorist activities etc. One of manmade disasters is road traffic accidents which lead to severe injuries or may cause death for people notably aged 1 to 44 years. Consistently, the lives of about 1.25 million people are at risk due road accidents. Approximately more than 20-50 million people sustain non-fatal injuries which may lead to disability. At the time of response to any disaster event our first priority is to save lives which take place in two steps i.e. managing the life threatening injuries and preventing further injuries by properly handling of the primary injuries to prevent secondary injuries. For prevention of secondary injuries and successful recovery of injuries we need the emergency medical services and trauma centers at easy access.

Trauma centers provide the necessary equipment, specialized resources, and a specially trained trauma team to care for severely injured patients. A trauma center can handle all of the same types of illnesses and injuries that are seen in an Emergency Department, and provide multi-disciplinary, comprehensive emergency medical services to patients who have traumatic injuries immediately. The purpose of study was to evaluate the contribution of trauma centers for managing trauma especially near highways. For this purpose quantitative questionnaire were developed and the data thus collected was statistically compared, contrasted and analyzed. Finally a plan for trauma centers at China Pakistan Economic Corridor (CPEC) has been developed for the sake of trauma management nearest to site of incidents so that morbidity and mortality can be reduced.

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LIST OF ABBREVIATIONS

CPEC	China Pakistan Economic Corridor
WHO	World Health Organization
MVC	Motor Vehicle Crash
RTA	Road Traffic Accident
PRC	Pakistan Red Crescent
SDGs	Sustainable development goals
PBS	Pakistan Bureau of Statistic
FWO	Frontier Works Organization
RCSC	Red Cross Society of China
ICU	Intensive Care Unit
DMS	Deputy Medical Superintendent
CT	Computed Tomography
LAMA	Leave Against Medical Advice
NHA	National Highways Authority
DHQ	District Headquarters Hospital
THQ	Tehsil Headquarters Hospital

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Chapter 1

INTRODUCTION

1.1 Background

Disasters are increasing day by day across the world that is why destruction and deaths are increased at unimaginable level by earthquakes, floods, civil conflicts, terrorist activities and tsunamis. Unfortunately, injuries and trauma associated accidents are part of our life (Fanelli & Edson, 1995). The world is facing disasters on a large scale and more than 255 million of world population gets affected by natural disasters per year between 1994 and 2003. During the period from 1994 to 2003, the average death rate per year was 58,000 results because of natural disasters (Guha-Sapir, Hargitt, & Hoyois, 2004).

Besides natural disasters losses in terms of human and property, manmade disasters also result in traumatic injuries among which road traffic accidents are a leading notable trauma. We observe huge figures of accidents in news, social media, and newspapers in our daily routine. It's often leads to severe injuries or may cause death for people notably aged 1 to 44 years (Museru, Mcharo, & Leshabari, 2002). Consistently, about 1.25 million people are dying due to road accident. Approximately more than 20-50 million people suffered with non-fatal injuries which may leads to disability (Jiang, Lu, Chen, & Lu, 2016).

1.2 Worldwide death rate through accidents

We can see the number of death by road accidents with respects to population dynamics. World health organization data (WHO) has published the data in 2017 on road deaths as shown in table 1.1. About 25% of Americans endure an injury and require medical attention. In 1999,

there were 97,860 deaths from traumatic injury due to lack of care on golden hour(Sanga, Giesecke, Wilson, & Sutcliffe, 2007).

In china, 268,127 people died due lack of surgical care on time in road accidents. China ranks 94 in world regarding death rate which is 2.87% per 100,000 of total population (Huang et al., 2012). In 2017 death rates ranged 0.87 per 100,000 employed in Belgium (MacGillivray, Spitz, De Wel, & Van Assche, 1989), 4.45% per 100,000 employed in Brazil (Boing & Rossi, 2007), 6.83 per 100,000 employed in Iran (Kwon, Rhee, & Yoon, 2015), 3.16 per 100,000 employed in India (Grimm & Treibich, 2013), 3.68 per 100,000 employed in Iraq (Zhao, 2011), 2.22 per 100,000 employed in Pakistan (Sánchez-Triana, Enriquez, Larsen, Webster, & Afzal, 2015), 0.05 per 100,000 employed in Netherlands, 1.75per 100,000 employed in turkey (Çelik & Senger, 2014), 1.52 per 100,000 employed in US (Herttua, Mäkelä, & Martikainen, 2008), 1.05 per 100,000 employed new Zealand (Heeley et al., 2011), 0.51 per 100,000 employed in Norway (Kristiansen et al., 2014), 0.39 per 100,000 employed in United kingdom (Chang, Wu, & Ying, 2012) shown in table 1.1.

Among these given countries, Iran shows maximum rate of death with world rank 38 while in United Kingdom shows minimum death rate with world rank 180. If we observe Pakistan, it shows 27,081 deaths in 2017can be attributed to lack of critical care and surgical diagnosis. (WHO Road Traffic death rate, 2013).

Table 1.1: 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	6476	3.68	22.34	69
Pakistan	27,081	2.22	15.42	104
Netherland	607	0.50	2.81	179
Turkey	6954	1.75	8.85	135
United states	34908	1.52	10.04	127
New Zealand	247	1.05	5.74	158
Norway	173	0.51	2.93	176
United Kingdom	1846	0.39	2.58	180

Automobile traffic trauma leading a substantial economic fluctuations to victims, dependents, and to whole nation(Ghaffar, Hyder, & Masud, 2004). Cost of treatment, loss of productivity and their activities which disturb the families of trauma effectives contributes the major losses of traumatic incident sequences (Hrymak & Perezgonzalez, 2007).3% of their gross domestic product cost in mostly countries due to road traffic crashes (Ghaffar et al., 2004).

1.3 Traumatic Injuries

In spite of this fact, we tend to shield ourselves from the suffering of others or to try to manage at the most primitive opportunity the awful things that happen to our communities (Neff, 2003).Though, to access the instant and suitable medical attention, particularly in a medical care center, can improve more chances for a patient's survival (Nathens, Jurkovich, Cummings, Rivara, & Maier, 2000).

Neck injuries can happen every day wear and tear or sudden trauma (Aiker Jr et al., 1975). Critical neck injuries are often the result of whiplash effect to the neck or head and cause sports related injuries, or external pressure applied to neck (Greenwald, Gwin, Chu, & Crisco, 2008). This type of injury may become source of severe pain, swelling, dizziness, and numbness. It is important to get immediate emergency care if you suspect a severe neck injury, especially one that could cause damage to the spinal cord (DeVivo, 1997).

Head injuries are caused by trauma to the scalp, skull, or brain and can be very dangerous. Concussions are also head injury and occur when the brain is jarred hard enough to bounce against the skull, often seen in car accidents or falls from a significant height (Winslade, 1999). A concussion can disrupt the normal functioning of the brain and have long-term effects if left untreated (Masel & DeWitt, 2010). Other traumatic brain injuries include a contusion, which is a bruise on the brain that causes swelling or a hematoma, and skull fractures(Bešenski, 2002).

1.4 Causes of Traumatic Injuries

Transport such as Cycle, motorcycle, Car, truck are typically causes of trauma injuries treated in emergency services (Kraus et al., 1984). The trauma that may come from a road accident can include fractures, soft tissue injuries, and head injuries such as concussions (Ehlers et al., 2002). Road-related injuries varies in seriousness depending on the type of vehicles involved, its speed during the collision, and other environmental condition such as road or weather (Beshah & Hill, 2010). Impact-related injuries are trauma sustained by the body when a part of the body impacts the interior of a vehicle or the road; penetrating injuries refer to cuts and scrapes that may be caused by broken glass or other loose objects (Ming Tse, Liu, P.W. Shim, Chong Teo, & Lee, 2017).

Other trauma injuries are described on the basis of external cause of injury (e.g., burns, falls, drowning, poisoning and other blunt injuries) (Villaveces, Mutter, Owens, & Barrett, 2006). The distributions of these injuries by severity with percentage are shown in figure 1.2.

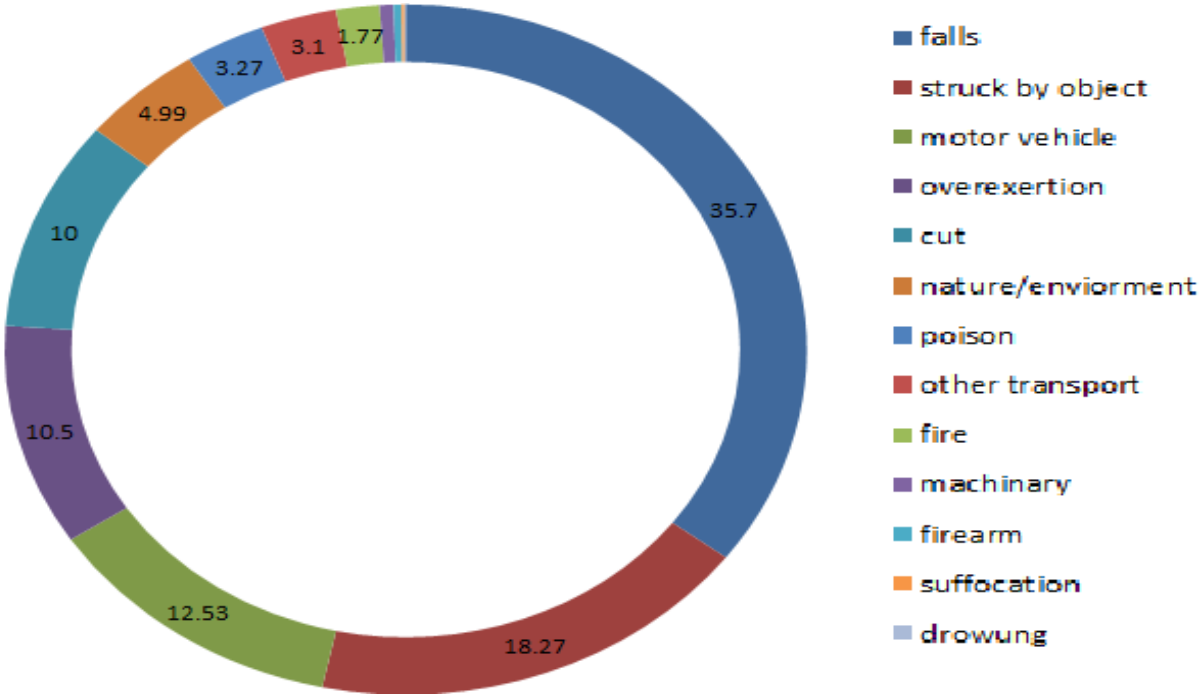


Figure 1.2: Distribution of causes of trauma injuries with percentage

It was observed that more than 60% of accidents are occur on roads, which include falls 35.7%, stuck by object 18.27% , motor vehicle injuries 12.5 % (Villaveces et al., 2006) and that may cause thousands of death per year due to unavailability of proper aid at that critical time (Friedman, Silva, & Vincent, 1998).

1.5 Relevance with need of Trauma Centers

Trauma centers helps to provide the essential equipment, specialized medical practitioner and a specially trained trauma team i.e. physicians and surgeons to care for severely injured patients (Warren, Fromm, Orr, Rotello, & Horst, 2004). A trauma center deals with all types of illnesses and injuries that observed in an Emergency Department, and make available multi-disciplinary and wide-ranging emergency medical services to trauma patients immediately (Dick, 2003). Injuries include those sustained automobile accidents, gunshot wounds, or severe neck and head injuries are examples of traumatic.(Peleg, Aharonson-Daniel, Michael, Shapira, & Group, 2003).

However, the basic aim of trauma care is to transportation of severe injured patients to a nearest trauma centers for complete cure from evaluation to surgical interventions within the "critical hour" (Peleg et al., 2003).Though, that evidence could be found in literatures, directly support the assumption. At the time of response to any disaster event, our first priority is to save lives which takes place in two steps i.e. managing the life threatening injuries and prevent the further injuries by ensuring the incident and surroundings are safe for properly handling the primary injuries which reduces the chances of them to leading them to secondary injuries (Day, Melnyk, Larson, Davis, & Whybark, 2012). For prevention of secondary injuries and successful

recovery of injuries we need the emergency medical services and trauma centers at easy access (Ghajar, 2000).

1.6. Descriptors of Levels of Trauma Services

The trauma centers designed based on facilities provided to injure as following criteria:

1.6.1 Level I Trauma Service

A Level One Trauma centers are best known for their versatile nature of medical care for injured. From early response on arrivals to recovery by to settling and restoration in the original state (Kraus et al., 1984). Level I trauma center Services includes: Data collection, Quality improvement program, Research, Education & Fellowship training, Trauma Systems overview, Prevention and awareness programs, Trauma record maintenance and Leadership responsibilities (MacKenzie et al., 2003).

A Level I service, serves with highest level of medical care, including trauma rooms, operation theatres and critical care units, having trained emergency staff and available for 24 hours (Dente et al., 2009). It is a 'central hub' of an medical care system, which is responsible for communications of urban, as well as rural services in any given region, and providing suggestions for Trauma care providing bodies (Hazzard, 2000). Level I trauma center also facilitates the patients to transfer from one to other Trauma care setup (Dunn, Gwinnutt, & Gray, 2007). It plays leading role in the coordination and management of mass casualty incident and preparedness for disasters (Cooper, McDermott, Cordner, & Tremayne, 1998). These types of hospital play a role as the pivotal centers for respond and react to receive the trauma victims from near areas or other low level trauma care centers (Dunn et al., 2007).

1.6.2 Level II Trauma Service

This Level of trauma centers participate medical care for metropolitan as well as rural based (Curtis & Ramsden, 2015). It provides broad clinical care of cruelly injured patient. These are mostly situated in a populated areas (Hulka et al., 1997). The clinical aspects of Level II hospitals are same as Level I service, except education, leadership or research role (Rotondo, Cribari, Smith, & Trauma, 2014). A Level II trauma centers having all types of specialists including neurosurgical and cardiothoracic like a level I all the time (Esposito, Rotondo, Barie, Reilly, & Pasquale, 2006). There should be a director of emergency who is responsible for organized management system like level one. These are also act as central bodies in synchronization and management of trauma when situated in non-metropolitan regions (Asensio & Trunkey, 2008). Transfers of heavy injured to higher level must be clear and in proper manner that guide receiver fully and don't any ambiguities. (DeGennaro Jr, DeGennaro, Bitar, Bitar, & Thaller, 2015).Helicopter landing site is also essential in it if it is located at highways.

1.6.3 Level III Trauma Service

It has all types of abilities which help to manage medium and minor type of wounds which have not needs to transfer to level I or II services (Veenema & Rodewald, 1995). These are resuscitation, stabilization and first aid specialist centers. A very few of the above this situation can be managed mutually coordinated with level one (Ainuddin & Routray, 2012). Level three offers all instantaneous care, plus some perfect care for non-major trauma patients according to patient needs (Wilcox et al., 2017). Sometime definitive care is provided with continuous surgical interventions to badly trauma victims (Veenema & Rodewald, 1995). It has the commitments with level two and one for patients referring. The expert doctors and nurses are

ready to respond to casualties with the facility of radiology (Dente et al., 2009). The capacity is varying among level three services for the stipulation of emergency surgical care (Razzak et al., 2013).

1.6.4 Level IV Trauma Service

Lowest level in the trauma care system saving service. Critical injured are unable to get treated here and transfer to definitive care as soon as possible (Razzak et al., 2013). Registered medical practitioner is should be there. Due to the experience of traumatic injuries and their management helps them to recognize and suggestion for provision of care. This thing leads the successful initial support and transfer of the patients to higher care level. Early evaluation and timely referring is the theme of story (MacKenzie et al., 2003). This level has two aspects of care and nature depending upon population. In big cities these are separate trauma centers having institutional affiliation. While same thing is different in small cities, where these are of small level of hospitals itself, having no specialists or definitive care or radiology facility (Grimm & Treibich, 2013). In case of highways ambulances with advance care are also categorized as level IV trauma centers.

1.7 Contribution of trauma centers (near highways) in disaster

With timely and appropriate medical care either pre-hospital or hospital; it strives to lessen the mortality and morbidity rate, as a mishandling of trauma. It is unmistakably proved by the studies that developing have six times greater death rate of critically injured than having level 1 trauma center in developed countries like united states (Mock, Kobusingye, Anh, Afukaar, & Arreola-Risa, 2005). Trauma expiries are common in early hours after the crash and contribute the serious issues i.e.

- Airway fails to intact
- Respiratory distress
- Uncontrolled bleeding

By taking small guided actions, the above mentioned problems controlled and ease the fatal rate or harshness of incident (Jamali, 2008). That is why trauma centers at highways are necessary, so that the disastrous or mass causality incident traumatic victims can be transported within golden hour and may save lives or further disability.

1.8 Current situation of Trauma centers near highway

The state of economic of Pakistan is unbalanced, which make it vulnerable it to disaster. Small level disasters have greater impact on Pakistan due to its instability. Due to the reasons Pakistan is ranking in top 10 most susceptible country for natural disasters (Khan et al., 2017) . Pakistan faced many major disasters which have notable human effects and losses since 1973. These include seven floods, Kashmir earthquake 1999 drought. The discussed disasters affect 40, 3 and 7 million population of the country which contributes huge impact on lives. Because of its impact and losses the 2010 floods were named as a ‘super flood’ (Deen, 2015). The unexpected and large scale of extensive natural disasters, like earthquakes, frequently produced serious injuries which the victims disable. Spinal cord injuries, amputations of the major parts of body like eye, limb etc., long bone fracture, head injuries, burn, nervous system collapse and crush injuries leads the disability (Heeley et al., 2011). Road traffic crashes include 20% of global burden of injuries. These incidents effect under 18 youngsters more as study narrates 0.8 million per year (M Peden, Oyegbite, & Ozanne-Smith, 2008).

Sustainable development goals also focus on health improvement as SDG no 3 states ensure stages sound lives and advance prosperity for all at all stages. At national level in Pakistan the emergency plans of national, provincial and district levels are prepared for all level of emergencies by respective level of authorities which concentrate on the human health insurance (Ainuddin & Routray, 2012).

Road safety did not achieve accidently. World Health Organization describes the traumatic injuries can be diminish or lower by structural and clinical framework development. On these grounds numbers of countries are saving lives from road accidents cases (World Health Organization, 2014). The facilitations adopted by the countries are not centered on advanced science. It simply constructed on 5 and are frequently in a state of harmony with the five backbones of Road Safety principles as proper management of everything, road users attitude, harmless and maintained roads, up to date automobiles and effective response after calamite events (Ainuddin & Routray, 2012).

51,525 people expired in road traffic fates from 2004 to 2013 in the Pakistan bureau of statistics reports. Motor vehicle crashes Sindh only contributed 9,639 lost their lives among the previous explained figures. For the sake of reduction and avoidance the incidents FWO introduced the trauma management facility on the Super Highway in Karachi.

Author said, it is need of time to build a trauma center Super Highway because there is no such facility available at the point to reduce the consequences of catastrophic events of roads and their victims. The suggestion is “The center is properly equipped with latest gadgets to provide complete health facilities to the villagers, including women, living near the Super Highway,” (Staff Report, 2017).

The Karachi authorities are focusing to enhance the transportations; road safety and provision of city's need based necessary facilities to ensure the safe and happy life of road users (Ramirez & Peek-Asa, 2005). Maintenance work continuation of super highway, is also contributing the road traffic accidents. There should be proper diversion of traffic for the sake of occurrence of any ill-fated incident (MacKenzie et al., 2006).

1.9 Emergence of trauma centers at China Pakistan Economic corridor

The hospital or trauma centers are such critical medical facilities, which must be the part of project of CPEC, for upcoming traffic's un-pleasurable incidents. Now there is one emergency hospital established at Gawadar to provide the emergency medical care for workers of the project and surrounded population.

Pakistan Red Crescent (PRC) is looking at the development of the China Pakistan Economic Corridor as a great development opportunity for Pakistan. The initiation of traffic on these trade routes the increased volume of vehicles and passengers, there will be an enhanced propensity to traffic accidents with sizeable number of injuries. These will inadvertently lead to an increase demand for trauma support and care. In this regard the PRC as a leading humanitarian organization of Pakistan which can provide with the support of Red Cross Society of China (RCSC) a long-term solution of health care needs, especially trauma care for the users of CPEC.

1.10 Problem Statement

Injury causes notable death and disability around world it was estimated that almost 5 million deaths occur due to injuries in 2000. As in case of Pakistan is regularly facing natural

disasters as well man-made disasters like road traffic accidents which causes damage and effects human lives badly. Proper handling of traumatic causalities on focusing to save lives we have guidelines which make sure the survival of victims. If it cannot attain, then there will be huge complications which creates many problems. So, we must focus the deficiencies found while responding to trauma for better results. For this betterment this study will suggest a proposal plan of trauma centers for CPEC.

1.11 Objectives

1. To identify the role of Trauma Center situated at National highways in managing trauma victims of Disasters.
2. To suggest the plan for development of trauma centers at China Pakistan Economic corridor.

1.12 Research Questions

1. How Trauma Center helps in managing disaster induced trauma situated at National highways?
2. How can we develop a comprehensive plan for establishment the network of Trauma centers at China Pakistan Economic corridor (CPEC)?

1.13 Scope of the Study

The research study has been carried out by assessing trauma centers of24 hospitals near highways. It includes thirteen secondary care and ten tertiary care hospitals. Many of these hospitals have responded to the natural and man-made disasters in last one decade. The study also suggested a proposal plan for China Pakistan Economic Corridor (CPEC).

1.14 Significance of the Study

The research provides information about the level of trauma centers for emergencies and disasters situated at highways. The limited literature on this study is available in the context of Pakistan.

In the past, such type of comprehensive study has not been carried out to assess the trauma centers at highways in Pakistan. The study will not only, to find the gaps but will also develop the proposed trauma centers plan for CPEC. Establishment of trauma centers at easy access will results in saving of precious lives.

1.15 Organization of thesis

Chapter I: INTRODUCTION

This chapter provides genera idea, background, objectives, problem statement, and scope of the study and significance of the study about national needs.

Chapter II: REVIEW OF LITERATURE

This Chapter includes literature review, work done previously on the same topic and in same context by different countries and researchers.

Chapter III: RESEARCH METHODOLOGY

This Chapter covers the Methodology, elaborates the procedures that how data was collected for this research and what mechanism was adopted for analysis.

Chapter IV: RESULTS AND DISCUSSION

The Chapter-IV presented the analysis and interpretation of the surveyed data.

Chapter V: CONCLUSSION AND RECOMMENDATIONS

The Chapter-V is last but not the least comprises of conclusion and recommendations. This chapter also described the comprehensive proposal of plan of the trauma center for CPEC.

Chapter 2

REVIEW OF LITERATURE

2.1 Introduction

Literature review forms association and understanding with the present form of information, which instills reliability and trustworthiness of ongoing research. Review of the current knowledge caters assistance to the researcher in the direction of interpretation of basic and central thematic questions. It is also a significant examination of a section of a published and printed form of information, owing to summary, organization, assessment and contrast of research enquiries, literature and theoretical sections (Wilcox et al., 2017). In addition, this section copes with the conceptual construction of the necessary terminologies.

Injury has become a threatening condition over the world. Its expiry rate exceeds so that 16000 injured in a day, those who escape from expiry, become victims of permanent ill health. The rate of disability, is more than the death rate, due to trauma. Low income countries are bearing this burden more than others. If we overview the global burden of injuries, 90% disability and death, facing these countries which make then more unstable (Mock, 2004).

2.2 What is Trauma?

Trauma is a physical hurt with rapid commencement and different level of severity, requiring abrupt medical consideration. The offense may originate systemic shock called “shock trauma”, and may require instantaneous revival efforts and life and limb saving interventions (Sar & Ozturk, 2006). Traumatic injuries are the result of a wide variety of blunt, penetrating and burn mechanisms. They include motor vehicle collisions, sports injuries, falls, natural disasters

and a multitude of other physical injuries which can occur at anywhere either street or home, work or sports fields and require instant care (Ramirez & Peek-Asa, 2005).

Number of accidental damages are being appropriately managed in emergency department of hospitals with different care levels. The sorting out of mass casualties, according to need of emergency care provision, is done at the site of incident by rescuers. The trauma alert may be responded with ambulances or helicopters, depending upon location and available resources. Rescue teams transfer the patients, most nearer and suitable hospitals or trauma centers in case of highways, with and time and resource management (Odero, Garner, & Zwi, 1997).

2.3 Types of Traumatic injuries

Traumatic injuries may range from minor to severe depending upon mode of injury and magnitude of incident. These are varying from region to region and have separate presentation. These can be classified as (Stone & Humphries, 2004);

- Head injury
- Maxillofacial and Neck trauma
- Chest trauma
- Abdominal trauma
- Genitourinary trauma
- Vertebral and spinal cord trauma

- Orthopedic trauma
- Hand trauma

2.3.1 Head Injury

Head injury is suspected for any patient reporting with blunt force to head and neck. It needs surgical intervention or conservative management. Collision of head to front of car, colliding object or falling on ground lead the thought of head and cervical spine injury; greater the force of collision greater the incidence on associated injuries. Head injury has some major sign and symptoms including:

- Loss of consciousness
- Vomiting
- ENT bleeding
- Fits

2.3.2 Maxillofacial and Neck Trauma

Any injury to maxillofacial bones which leads to swallowing difficulties so surgical interventions required in this situation. Laryngeal Airway Injury sign and symptoms include Hoarseness, dysphonia, edema, persistent pain below the hyoid bone, or crepitation over the thyroid cartilage. These signs can reverse by emergency intubation which is very difficult and contra indicated in case of fracture. Second option and solution of the situation is cricothyroidotomy or tracheostomy according to preference.

2.3.3 Chest Trauma

Chest trauma is contributing a major part in traumatic injuries. It contributes 20–25% deaths among the traumatic deaths. It ranges blunt chest injuries to open fractured injuries and have a different level of seriousness. The chest injuries need immediate attention otherwise it may lead to respiratory distress and ultimately death. Chest trauma may present with the following serious conditions;

- Pneumothorax
- Open pneumothorax
- Tension pneumothorax
- Hemothorax
- Flail chest injury
- Open fractured injury
- Sucking chest wound
- Pulmonary contusion
- Cardiac contusion
- Cardiac tamponade
- Blunt aortic injury
- Great vessel injury

2.3.4 Abdominal Trauma

Abdominal injuries are may be of life threatening conditions due to trauma. It is because of abdomen occupies a large area in the body which contains many of the organs, vascular structure that may be injured due to traumata. Abdominal injuries are categorized into two main types.

- Blunt abdominal trauma
- Penetrating abdominal injuries

Damaged internal structure of abdomen without any open wound is called blunt trauma. This is more harmful than open injury because it may not judge the severity of injury and abdominal cavity has much capacity for internal bleed or leakage which leads to shock. Blunt injuries mostly caused by motor vehicle collision. Penetrating abdominal trauma is cause by gunshot or stab injuries. It leads to protruding the internal organs to out of the cavity or massive bleeding. Both injuries require immediate emergency management and surgical interventions for reversion of consequences.

2.3.5 Genitourinary Trauma

Genitourinary trauma contributes 10–20% of traumatic injuries. Among the injuries if genitourinary tract shattered kidney or renal hilar disruption are serious injuries, rest of all have no threat to life. These injuries are easily picked by surgeon due to obvious sign and symptoms. If unfortunately, observer missed the diagnosis it may lead to disability. Common sign and symptoms to detect the genitourinary injuries are:

- Lumbar vertebral or lower rib fractures

- Pelvic fractures
- Flank pain or hematoma
- Abnormal prostate (high riding, non-palpable, or free floating) on rectal examination
- Blood at the urethral meatus
- Gross hematuria

2.3.6 Vertebral and spinal cord trauma

Spinal cord injury is suspected in those patients who have the blunt trauma, especially with head injury, severe mechanism, or neurologic complaints. Spinal cord injury is the leading cause of traumatic disability. Its care should be focused from the pre-hospital transfer of patient as well as in emergency department by immobilization and support because these are unstable injuries, so the utmost care must be taken to prevent additional harm to these patients. If proper immobilization could not occur it leads to peripheral disability.

2.3.7. Orthopedic Trauma

Orthopedic and musculoskeletal injuries contribute a large number of patients presenting to the emergency department. Orthopedic injuries can be life threatening and must be addressed according to the severity. Its severity depends upon the site of injury mode of accident and bleeding level. It requires emergency stabilization otherwise it leads of death and disability. Orthopedic injuries ranges

- Simple fracture
- Compound fracture

- Crush injuries
- Amputated injuries
- Dislocation
- Stressed injuries

2.3.8 Hand Trauma

Hand injuries are the minor injuries which are more commonly presented in emergency department. These injuries may be isolated or part of other trauma and these are not life threatening, fail to proper management may leads to disability, threatening a patient's livelihood and lifestyle. These injuries have significant economic impact with possible loss of occupation and lost time from work. Early assessment, initial care and proper management reduce the consequences of hand injury.

2.4 Trauma Center

Trauma center has a medical capability for the provision of short time medical attention to injured including diagnosis and therapeutic care. The notable role of trauma center capitals, is to minimize the mortality and morbidity as well as cost and time saving. Taking attention the need of structural requirements of the trauma center, clinical human resources, with respect to trauma victims to the care center, lead successful evaluation and planning for better establishment of trauma centers, for patients welfare (MacKenzie et al., 2006).

Trauma Alert should be triggered for critically injured patients and immediately evacuated to a resuscitation area which may look more like, an operating room than a traditional

emergency department. In this environment, a highly-skilled professional trauma team is ready to provide immediate life-saving procedures in state-of-the-art trauma bays. Research shows that getting to the right place at the right time, commonly known as the "Golden Hour" or first 60 minutes after the occurrence of a major multi-system trauma, is critical (McNicholl, 1994). Adult and pediatric trauma surgeons, trauma staff and resources must be ready and dedicated 24/7 to provide this unique level of response so that critically injured patients will have the best possible chance of survival and the least residual disability from their injuries.

Following care in the trauma resuscitation area at a Level One facility, patients may proceed to surgery, an intensive care unit or the trauma nursing floor, with all the resources and services of the hospital available in a true multi-disciplinary fashion. Patients brought to Level II-IV centers may remain at that hospital or be transferred to a higher level of care as appropriate.

2.5 Levels of Trauma Center

Trauma guidelines in the U.S. were first established in 1976 and an efficient sophisticated trauma network is now functioning (University of Florida Health). Hospitals are accredited and designated as Level I, II, III or IV Trauma Centers based on the care they are able to provide, as well as the volumes they serve, urban and rural. The trauma system is designed to accommodate mass casualties and disaster situations. Level I Centers provide the highest level of care with optimal resources and capabilities, staff and specialties around-the-clock, and are continuously monitored to assure that they meet or exceed national standards. Trauma centers work closely with their respective EMS systems so that care begins pre-hospital.

2.6 Mishandling of Trauma

According to study of author, the significance of trauma care center for the effective functioning of health systems has been recognized. Aim of this study to evaluate trauma caution facilities in different regions of Pakistan. Well-equipped facilities as well as human resource gaps were found in emergency systems at different medical care levels in Pakistan. These gaps were likely to compromise provisions of quality emergency care. The findings of this research pointed towards the execution of an inclusive well programmed emergency care system alterations in the province of Sindh (Razzak et al., 2013).

Trauma is the major cause of death across the world; it is made worse in developing countries because the victims are not treated in time. Delays in transportation of patients to hospitals and inadequate equipment, lack of supplies and doctors in countries like Pakistan contribute to the high death rate caused by trauma(Bickell, Wall, & Pepe, 2011).

According to experts, trauma services and emergency care is a mistreated all over the world like spinal cord or penetrating injuries. Due to poor infrastructure, lack of knowledge and initiative, vast tracts of national highways, roadways, and hazard zones are left unattended and under-served in the case of calamities, accidents and disasters(Theodore et al., 2013).

According to another study, considerable efforts are required in making health executives proficient in dealing with disability patterns essential for the improvement in qualitative and quantitative, medical terms. These steps include education, pre-hospital trauma training, establishment of a national trauma registry, trauma training, specialized emergency room, up gradation in resuscitation and development of disaster management plans(Theodore et al., 2013).

One of the major reasons for the high mortality rate due to trauma are long distances over regions to be transported before a patient can reach a concerned trauma medical center. Poor vehicle conditions, time taken for patients to reach hospitals and absence of appropriate equipment and supplies, besides skilled doctors, are some of the reasons for increased death rates(Nantulya & Reich, 2002). The study also suggested the key role in the treatment of the poly-traumatic patients such as gunfire wounds required more orthopedics emergency resources than other surgical areas. An orthopedic surgeon should be member of a team containing many specialists, including trauma medicine physicians, emergency surgeons, surgical subspecialists and other neurosurgeons.

Road traffic injuries are a deadly evil, taking the lives of about 1.2 million men, women and children over the world every year (MM Peden, McGee, & Krug, 2002). Besides road accidents, violence against healthcare workers hinder quality care to victims since during such situations, doctors and other workers have to stop working. Public awareness programs are required to be implemented to make people understand the gravity of this situation and ultimate shortcoming to patients. VIP movements and traffic jams are another bigger difficulty which hinders trauma access of patients to health care facilities(Li et al., 2014).

2.7 Role of trauma center in reducing the mortality and morbidity of trauma victims

For the welfare of trauma victims first of all we look at the demand of the area either populated or unpopulated so that how much trauma patients can be treated in trauma center daily. Keeping this in view, we need to evaluate the infrastructure of trauma center for managing the patients at every level of trauma center. This can describe that either patients have the sufficient

facilities for emergency management and follow up like admissions in respective department i.e. ICU, surgical or medical ward, pediatric care units.

A research shows the reduction in death rate is about 15%, where trauma center available this is very good signs, that favors the trauma centers. This study showed 8 in the 14 reports, the same results discussed above. The ratio of results proved trauma systems implementation weighted for the need community. Its evaluation and effective participation in the population welfare should be include in the agenda and strict compliance in this regard, will make us successful in our mission (Celso et al., 2006).

Twenty years ago, trauma systems plans were proposing, to reduced injured death rate. Due to limited literature studies and golden outcomes of the system, were unidentified that is why the development of trauma centers did not come in to ground realities. Later when interest built in the point discussed, the data were collected, to check the mortality rate in the states with and without trauma care system, from published inventory about trauma system, state statistical review and directors of emergency medical services of the states. First one showed the 9% lower death rates, which have the trauma care systems with compare to the others which have not. In addition, with the effective implementations of traffics rules, population-controlled flow, speed checking and age-controlled ground elevates this reduction up to 17% in the Motor vehicle crash (MVC) mortality. Establishment of the Trauma centers will take help from these facts and figures, which make its case powerful and defendable (Nathens et al., 2000).

Disaster history alarms that the traumatic injuries are major threats to life. Overflow of traffic at highways contributes a major part of trauma as well due to road side accidents. Severity of accidents increases on highways due to heavy traffic like truck buses. A small example is the explosion of oil tanker near ahmadpur sharkia Bahawalpur leads the death of about 200 peoples.

It requires the critical infrastructure like trauma centers prior to occurrence of any type of incidence at adequate level. In this regard up gradation of existing trauma centers and establishment of new trauma centers are requirement of time.

Chapter 3

RESEARCH METHODOLOGY

3.1 Introduction

Methodology is defined as procedures, materials and methods used by researcher to complete the process of data collection, analysis and interpretation (Labaree, 2013). The scientific method is a logical process (Jevons, 1877). The aim of this chapter is to describe the materials which are used in our study and research protocol which enlighten measurements and statistical methods which help to analyze the data. It provides information on the trauma centers studied, population and research design that was selected for the objectives of study. The chapter also presented the procedure and instrument that was used for data collection process. The statistical techniques used in the study were Simple and multiple Bar Charts and pi-square test for presentations of analysis of information gathered.

3.2 Research Design

The research design is a rational way that links the observed data to answer the research question. It is an action plan or blueprint for an empirical research study and includes the main ideas of the study like research method, sample and tools and procedures adopted for collecting and analyzing information or data (Simonsen, Bærenholdt, Büscher, & Scheuer, 2010). It describes the measures necessary for obtaining the information needed to construct and solve research problems (Kothari, 2004).

The quantitative research design was used to conduct this study. In a quantitative research design a set of a small number of structured questions are administered to a large number of

respondents (McMillan & Schumacher, 2010) and the data thus collected can be statistically compared and contrasted. Moreover the findings are clear and exact which have broad and generalized applicable for entire population (Jick, 1979) .

3.3 Population of the Study

The abstract idea of a large group of many cases from which a researcher draws a sample and to which results from a samples are generalized (Costello & Osborne, 2005). The Population of the study was preferably the doctors of trauma centers, allied health professionals, nurses and paramedic staff in the study area, selected and targeted for the data collection. Development of trauma centers for CPEC is a strategy which will help us to achieve sustained economic growth and health care.

The population of the study selected by the researcher was purely formed based on greater chances of accurate, thorough, authentic data and responses of the population. For this reason, that the selected population belong to the nearest area of highways. And it increases the accessibility of different regions at tertiary level which leads to higher personal mobility and versatility in socio economic activities (Callen et al., 2013). For this, research was conducted in Lahore, Kasur, Sahiwal, Chakwal, Attock, Rawalpindi, Gujranwala, Sheikhupura, Okara, Layyah, Vehari, Bahawalnagar, Multan, Bahawalpur, Lakki Marwat and Peshawar Pakistan.

3.4 Inclusion and exclusion criteria

It describes inclusion and exclusion criteria for the selection of trauma centers and respondents of selected population.

3.4.1 Inclusion criteria

- Trauma centers near highways.

- DMS, Doctors, Allied Health professionals, nurses and paramedics all the staff those are working in the trauma centers.
- Patients registered in trauma centers.
- Staff and patients have Pakistani nationality.

3.4.2 Exclusion criteria

- Trauma centers away from highways.
- DMS, Doctors, Allied Health professionals, nurses and paramedics all the staff those are not working in the trauma centers.
- Unregistered patients
- Staff and patients those are not Pakistani nationality.

3.5 Sampling Design and Sample Size

If all secondary and tertiary health care facilities being interviewed, we could measure all indicators with complete accuracy and could provide perfect picture and information. However, dealing or collecting information from all hospitals or health care facilities would be expensive and time consuming. It is therefore necessary to interview or select a sample of these health care facilities to obtain estimates of the actual indicators about the target population i.e. all health care facilities in trauma centers of highways.

The samples were drawn using stratified Sampling method. The sample size, in this case, refers to the number of trauma centers or trauma care facilities to be included in the study. A stratified Sample of 24 trauma centers both secondary care 13 and tertiary care 11 were selected for the currents study to achieve the study goal.

3.6 Tool of the Data Collection

The important-art of arithmetical research is the gathering of data. For this a self-administered questionnaire with two open ended and rest of the all are close ended questions was taken for the data collection in the current study.

3.6.1 Questionnaire

A tool or instrument that is used to collect information is entitled as questionnaire. In this study a questionnaire having close ended questions was employed to collect the data from the respondents in the study area. The questionnaire is attached as Annex 'A and B'. The mostly questions have only two responses yes or no, some have more than two responses among which few have level of agree upon a statement. Some have options about rating of trauma centers; the questionnaire projects the two types of rating of trauma centers first one is asking about levels of trauma centers which are given by health care commission according to care level i.e. secondary care, tertiary care or teaching institution. Second one is depending upon facilities and performance of trauma center i.e. poor to excellent and its perception of observer.

3.6.2 Response Rate

120 questionnaires are sent by mob app or email mostly while some are distributed personally among the selected population's individuals randomly. 114 people responded upon questionnaire.

$$\text{Response rate} = 114/120*100 = 95\%$$

So, response rate is 95%.

3.7 Data Analysis

A Univariate analysis was employed in the current study to observe the association and relationship between variables. Data was presented in the form of tables.

3.7.1 Statistical Techniques

The following statistical techniques were used for data analysis:

3.7.1.1 Descriptive statistics

Descriptive statistics, including frequencies and percentages were used to summarize different variables.

3.7.1.1.1 Simple or multiple Bar Graphs

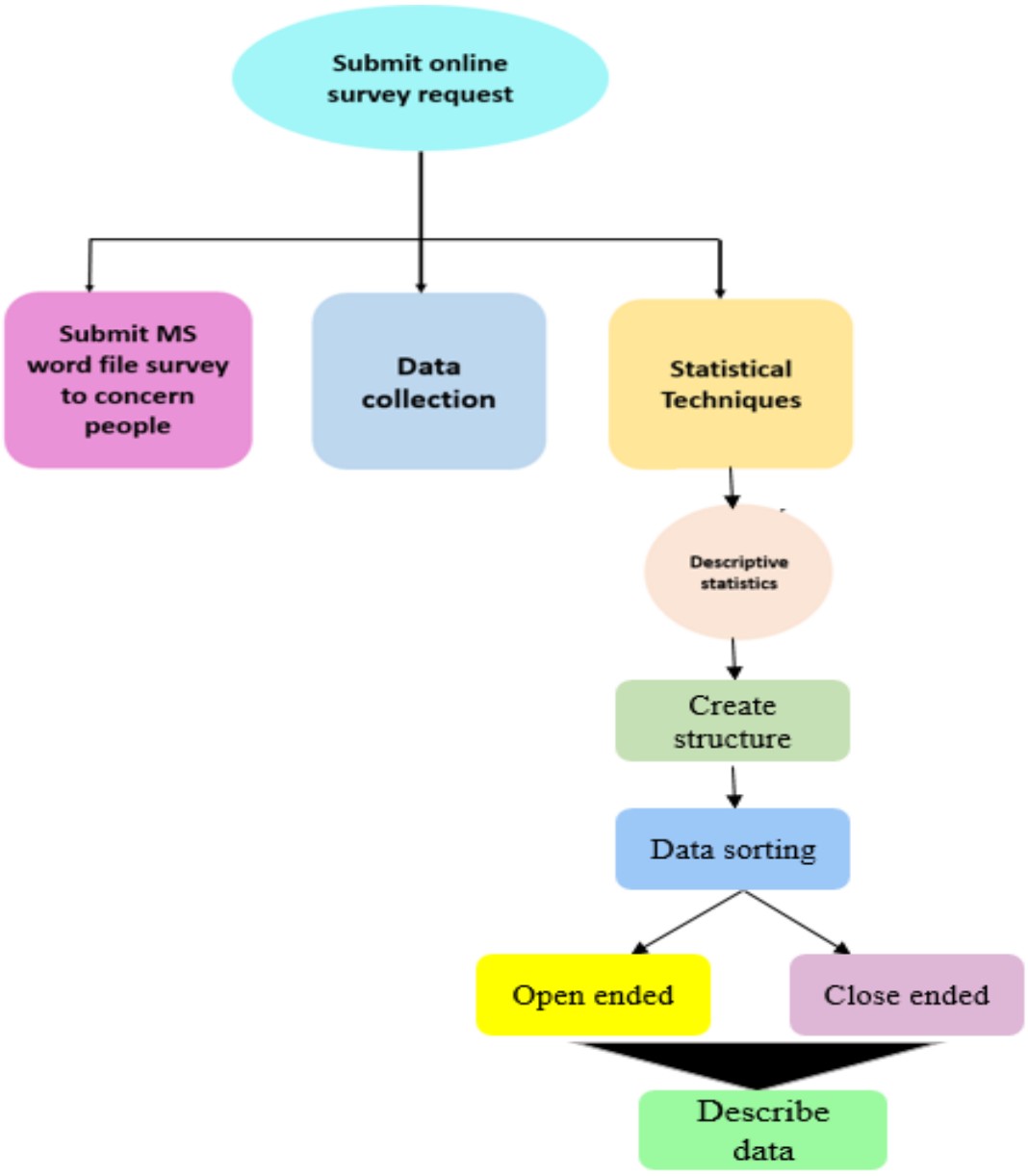
For visualization, simple bar chart is one of the techniques used to present data so that the reader easily gets all the information. Simple Bar graph is used to presents counts and percentages of different categories of variables. Graph consists of an axis and a vertical bar and showed frequencies of different values of a variable (Kinnear & Gray, 2006).

Multiple bar charts are extremely useful if you want to present a large amount of information in a small amount of space. Instead of having only one bar at each division on the horizontal axis, there are two (or more) bars (Huggett, 1990).

3.7.1.1.2 Pie Graphs

A Pie Chart is a type of graph that displays data in a circular graph. The pieces of the graph are proportional to the fraction of the whole in each category. In other words, each slice of the pie is relative to the size of that category in the group as a whole. The entire “pie” represents 100 percent of a whole; while the pie “slices” represent portions of the whole(Norusis, 1993).

3.8 Graphical framework



Chapter 4

RESULTS

4.1 Introduction

Univariate analysis is a method or process for examining and analyzing data on one single variable. It is the simplest form of statistical analysis which include distribution, percentages etc. Each and every variable in any data is explored entirely and independently. This chapter is classified into descriptive statistical orientation.

4.2 Presentation of the Results through Graphs

This portion summarizes the data collected in the form of graphs.

4.3 Descriptive Analysis

It is the method of data analysis which describes its summaries in the form of tables or graphs simply.

4.4 Evaluation of trauma centers

This part of questionnaire includes the questions which evaluate the level and performance of existing trauma centers near highways.

4.4.1 Rating of trauma center according to trauma center level

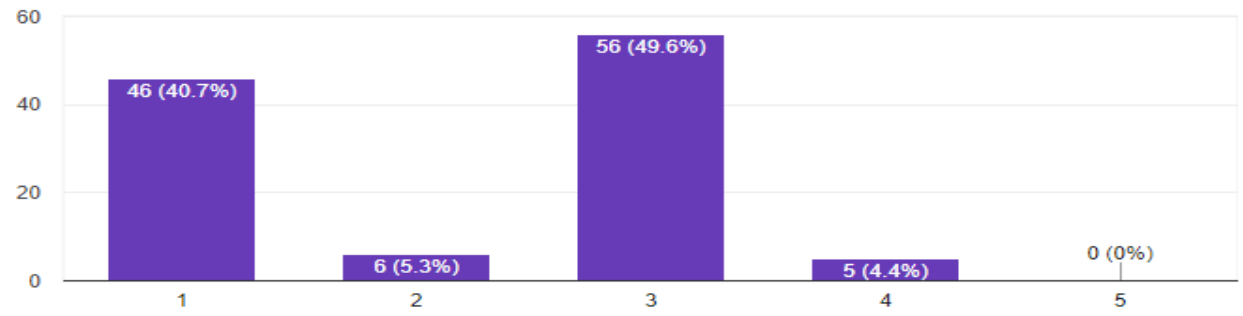


Figure 4.4.1: People rating for trauma center according to trauma levels

A trauma center is actually, emergency hospital which provides care to patients suffering from traumatic injuries such as burning, accidental wounds, falls, collapse of buildings, or blast wounds etc. Due to the presence of these specialized care centers we can overcome the victims of the traumas. According to the figure 4.4.1, the respondents were asked about responses concerning how they rate trauma centers services. Results show 49% of respondent claimed their trauma center is of level III according to standard guidelines. Whereas 40.7% of respondent showed that condition of trauma center is level IV. Furthermore 5.3% of respondent said their trauma center level II trauma center. The bar chart further explored and narrated 4.4% of respondent claimed the trauma center is level I which belongs to teaching institution or having all the recommended facilities.

4.4.2 Resources in a Trauma center

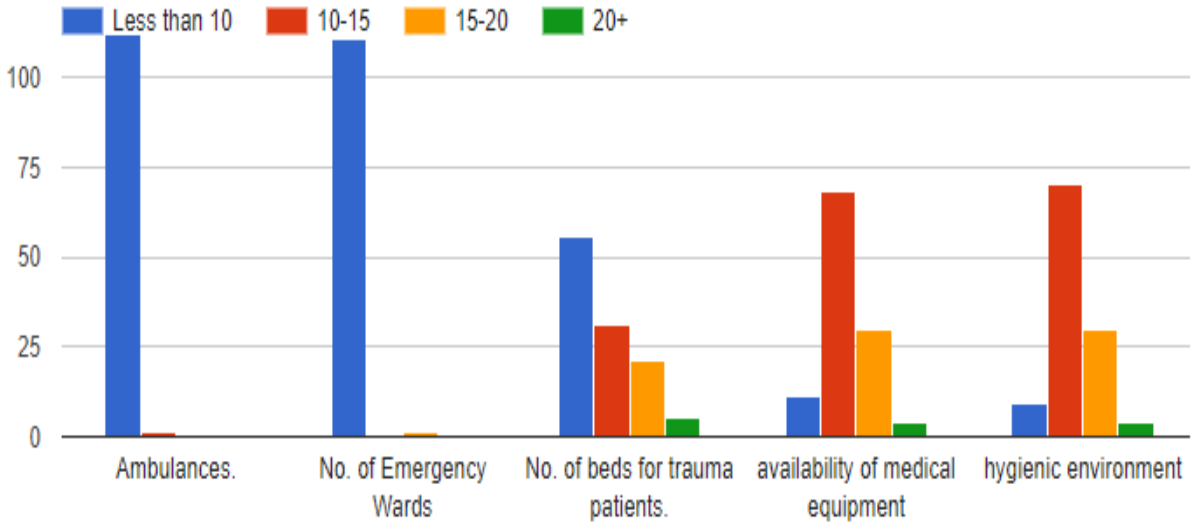


Figure 4.4.2: Current no. of facilities in trauma center

The above-mentioned chart (figure 4.4.2) discussed the current number of facilities available in trauma centers. Results show that 99% of respondent thought that less than 10 ambulances were available in trauma center. Whereas, only 0.1% respondent stated that there were 10-15 ambulances available. Moreover majority 98% the respondents claimed that less than 10 emergency wards were available while only one responded for 15-20 wards. When asked for no. of beds for trauma patients, 49% of responded that they are less than 10, while 27% were agreed to 10-15 bed 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. Of people claimed for more 0.09% of respondents claimed there were less than 10 equipments available in trauma center. Whereas 60% of respondents showed that equipments were 10-15, 28% responded for 15-20, while 0.3% of respondents said that more than 20 medical equipments were available. The hygienic environment enquiry results show that 0.7% of them expressed that the hygienic conditions were

good in trauma centers. Meanwhile, the 61%, more than one third of the total respondents revealed that environment of trauma center were hygienic. 26% of the respondents suggested unhygienic conditions at the trauma centers, while. Only 4% of the respondents claimed that hygienic environment was bad.

4.4.3 Positive Changes within the past three years supporting the trauma center by the hospital's governing body

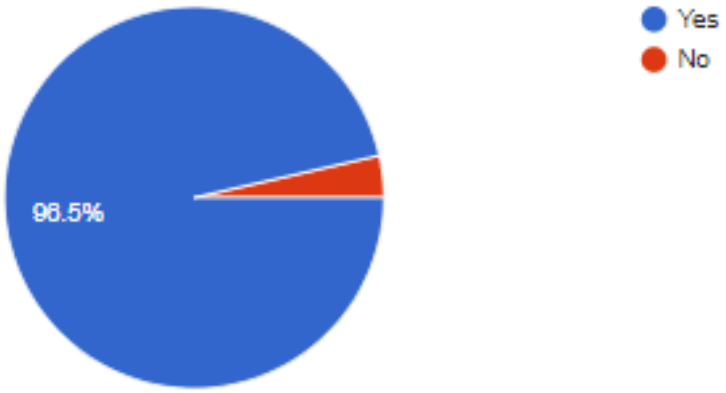


Figure 4.4.3: Positive Changes within the past three years supporting the trauma center by the hospital's governing body

Pie chart narrates responses about positive changes within the past three years to improve the trauma center by the hospital's governing body. Results of above mention table showed that 96% of respondent said yes there had been improvements in last three years. In contrast, 4% claimed that no improvements were observed in this period.

4.4.4 Improvement in medical staff within the past three years supporting the trauma center

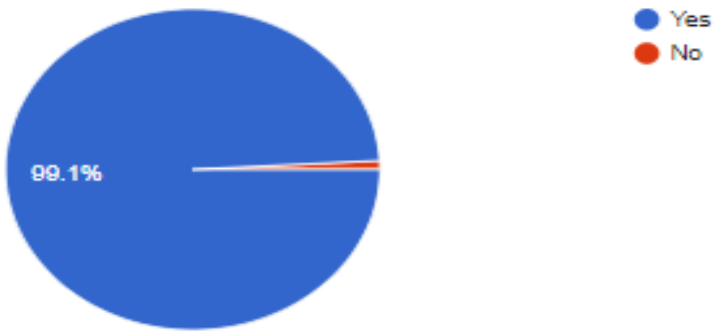


Figure 4.4.4: Improvement in medical staff within the past three years supporting the trauma center

Figure 4.4.4 shows inquiry regarding improvement in medical staff within the past three years supporting the trauma center. Almost, whole of the respondents 99.4% showed medical staff improvement within the past three years. While only one of them showed discontentment over it.

4.4.5 Significance of trauma centers near highways/superhighways in Pakistan

Figure 4.4.5: Significance of trauma centers near highways/superhighways in Pakistan

Above mentioned figure describes the significance of trauma centers near highways/superhighways in Pakistan. The results show that 100% of the respondents agreed and were convinced regarding importance of trauma centers near highways/superhighways in Pakistan.

4.4.6 Availability of trauma center at national highway save any complications or secondary injuries to serious injured persons

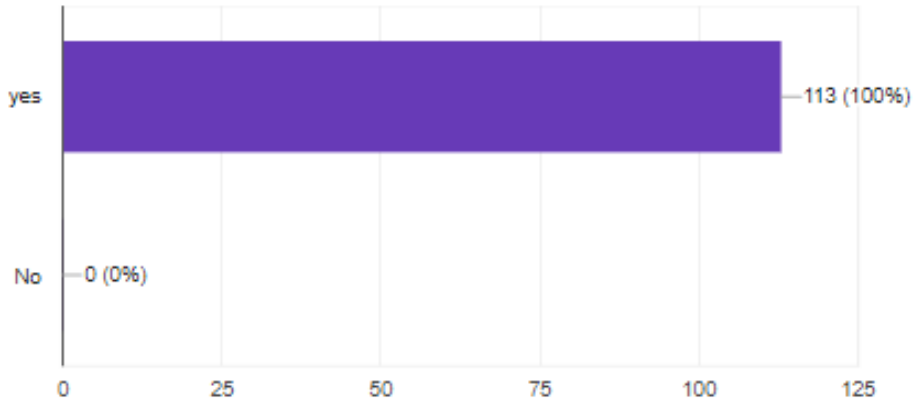


Figure 4.4.6: Importance of trauma center at national highway to avoid any complications or secondary injuries to serious injured persons

The Figure showed that scattering of availability of trauma center along national highway was considered agreed to by all the respondents who all were convinced that it may result in avoidance of any complications or secondary injuries to seriously injured persons.

4.4.7 Availability of trauma center at highway reduce the risk of death due to serious injuries

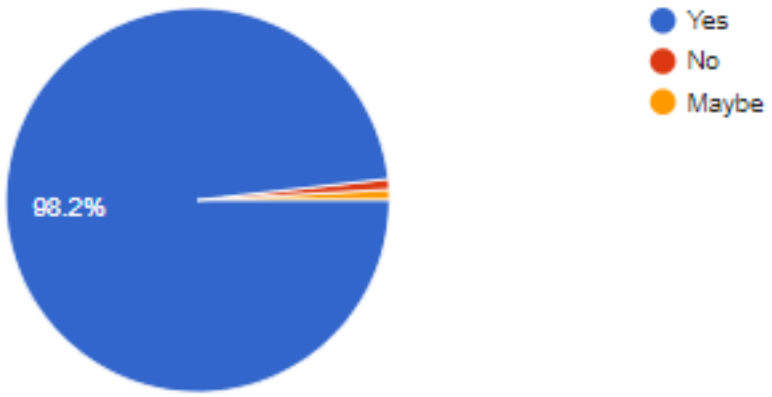


Figure 4.4.7: Availability of trauma center at highway reduce the risk of death due to serious injuries

Figure 4.4.7 showed the results that either availability of trauma center at highway reduces the risk of death due to serious injuries. Above Pie chart shows the outcomes. We can easily analyze from the above chart that most of the people 98.2% rate that trauma system reduces the risk of death due to serious injuries at high ways. While only one odd respondent felt that it is not related to reducing death risks and was undecided about the association of trauma centers towards reduction of risk of death.

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

Figure 4.4.8: Availability of trauma center can save victims more efficiently than small or local healthcare units

Pie chart illustrates respondent's attitude towards comparison of trauma center availability in saving victims more efficiently than small or local healthcare units. The results elucidate that majority of the respondents 99.1% agreed to the same point and were convinced that the availability of trauma center can save victims more efficiently than small or local healthcare units.

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

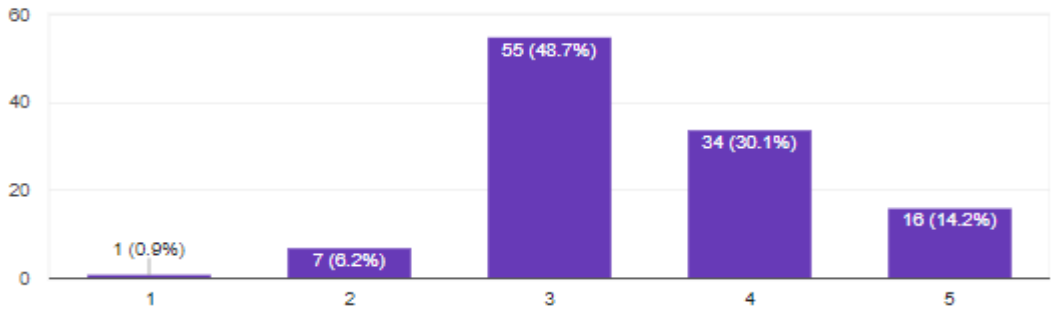


Figure 4.4.9: Rating of the services of trauma centers & emergency centers (of hospital) for the incidents/accidents on highways/superhighways in Pakistan

Rating of services of trauma centers & emergency centers explains how much our trauma center is working efficiently in accidental conditions near highway. According to the figure 4.4.9, the respondents were asked about responses concerning how they rate the services of trauma centers & emergency centers (of hospital) for the incidents/accidents on highways/superhighways in Pakistan. Results show that 48% of respondents claimed that the trauma center have average in results regarding rating of trauma centers.

Whereas 30.1% of respondents showed that services of trauma centers & emergency accidents on highways/superhighways in Pakistan is quite good. Furthermore 14.2% of respondent said that services provided by trauma centers at golden hour are excellent. 6.2% of respondent believed services of trauma centers were bad, while one of the respondents expressed that services of trauma centers & emergency centers are very bad in emergency conditions.

4.4.10 rating the management of trauma centers in Pakistan

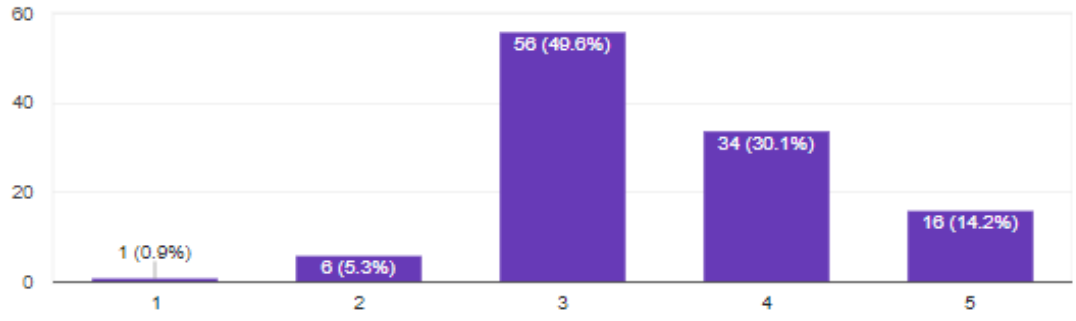


Figure 4.4.10: Management rate of trauma centers in Pakistan

Figure 4.4.10 exhibits the management rate of trauma centers in Pakistan. Results revealed that the 49.6% respondents rate the management of trauma centers in Pakistan at satisfactory level, while more than one fourth 30.1% agreed that management of trauma centers in Pakistan was quite good. 14.8% of the respondents strongly agreed that management of trauma centers in Pakistan is excellent, while, 5.3% rated the management as bad and only one of the respondent rated it as poor.

4.4.11 Availability of trauma center emergency number in case of accident

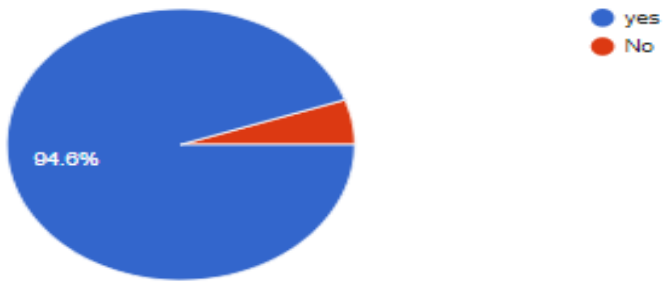


Figure 4.4.11: Availability of trauma center emergency number in case of accident

Figure 4.4.11 explores the significance of availability of emergency number at trauma centers have in case of accident. The results show that majority 94% of respondents agreed that there should be emergency number of trauma centers in case of accident, In contrast 5.4% of respondents thought, it is acceptable if there is no emergency number of trauma center in case of accident.

4.4.12 Deficient services of trauma center cause death that can be saved by advance medical facility

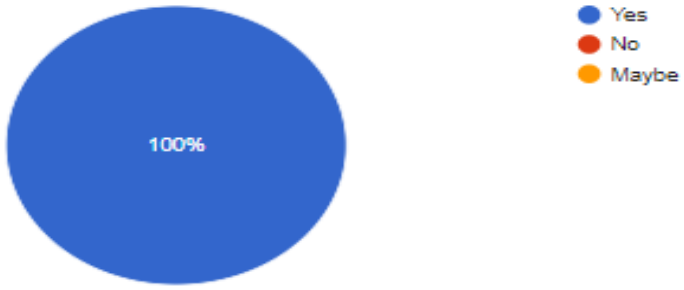


Figure 4.4.12: Lack services of trauma center may cause death that can be saved by advance medical facility.

Figure 4.4.12 refers that the question if the respondents feel that lack services of trauma center can cause death, which otherwise could be saved by advance medical facility. The results show that all the respondents were convinced that lack services of trauma center can lead to death, but advance care can save lives.

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

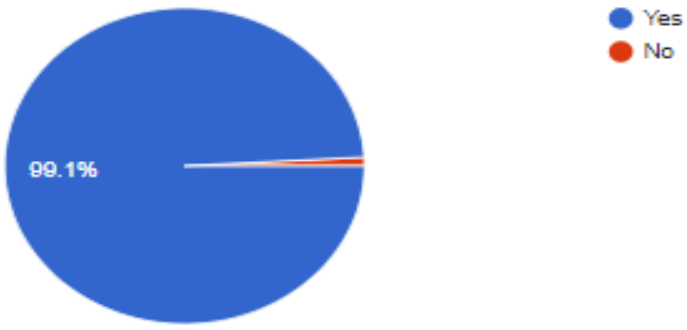


Figure 4.4.13: Transfer plan with a trauma center for acceptance of your trauma patients.

Figure 4.4.13 illustrates respondent's attitude towards transfer plan within a trauma center for acceptance of trauma patients. The results here elucidate that majority of the respondents 99.1% agreed that there should be a transfer plan within a trauma center for acceptance of trauma patients. Meanwhile only one of the respondents disagreed to this point.

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

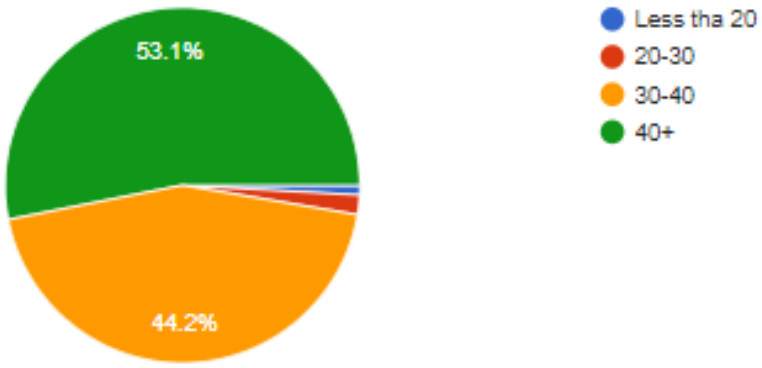


Figure 4.4.14: Trauma deaths during the last fiscal year (in accidents on highways).

Above mentioned chart discusses trauma deaths occurring during the last fiscal year (in accidents on highways). Given results show that 53% of respondent claimed there have been more than 40 trauma deaths during the last fiscal year. Whereas, 44.2% of respondent 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.

4.4.15 Availability of education/training programs for physicians, nurses & other supporting staff at trauma center.

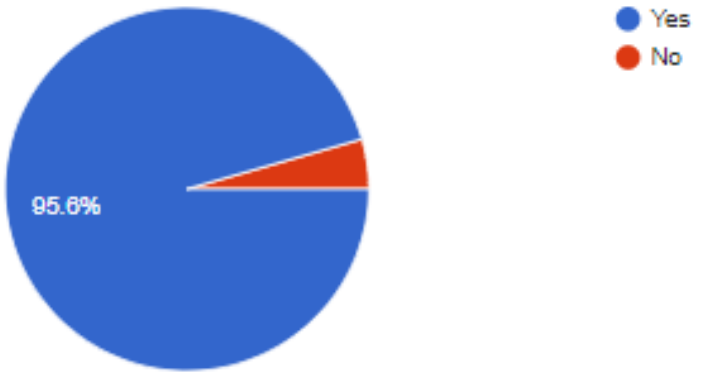


Figure 4.4.15: Availability of education/training program for physicians, nurses & other supporting staff at trauma center.

The availability of education/ training program for capacity building of physicians, nurses & other supporting staff at the trauma center was explored as shown in figure 4.4.15. Results revealed that 95.6% respondents claimed that education program for physicians, nurses & other supporting staff exists at trauma center and in contrast 4.4% of respondents replied negatively to this question.

4.4.16 Education programs for NHA drivers to handle emergency situations.

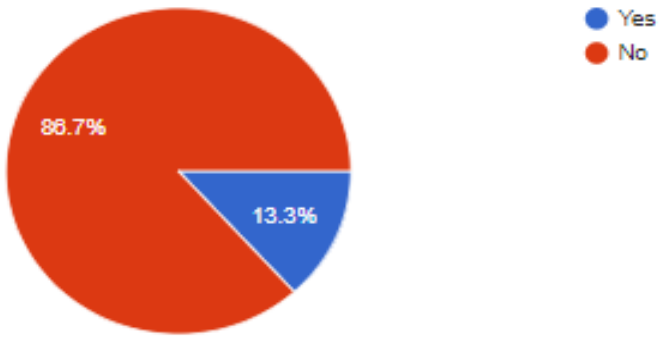


Figure 4.4.16: Education programs for NHA drivers to handle emergency situations.

Figure 4.4.16 illustrates respondent's attitude towards education programs for National Highway Authority drivers to handle emergency situations. The results elucidate that 86.7% of respondents agreed to the same point and opined that drivers' education can save victims more efficiently than small or local healthcare units. Meanwhile 13.3% respondents disagreed to this point.

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

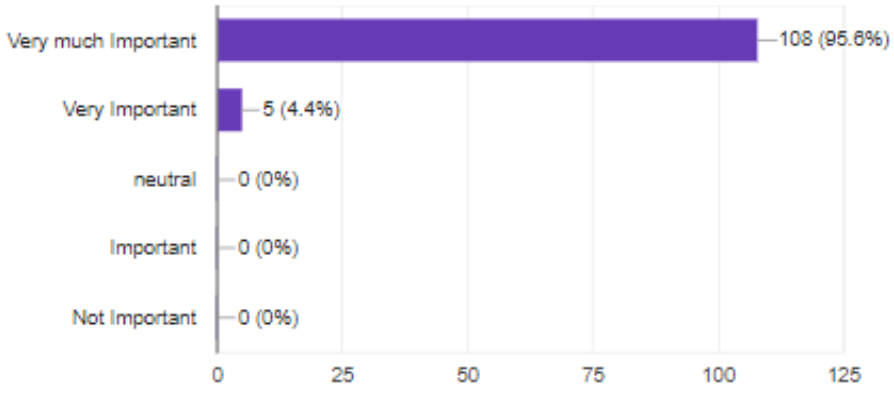


Figure 4.4.17: Availability of dedicated blood banks at Trauma centers (near highways/superhighways)

Figure 4.4.17 depicts concerns for Trauma centers (near highways/superhighways) with regards to having their own blood bank. It disclosed that more than one third of the respondents 95.6% said it is very much important for trauma centers to have their own blood banks. Only

4.4% of the respondents did not find it important for trauma centers to have their own blood banks.

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

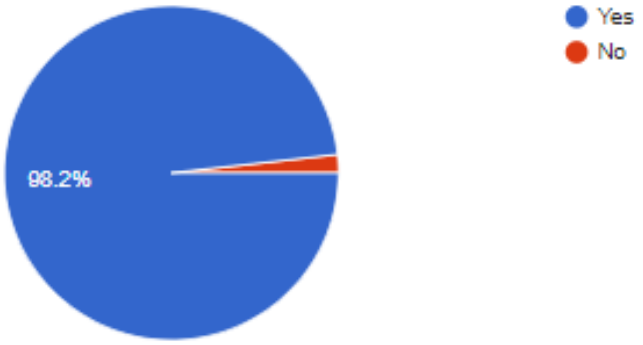


Figure 14.4.18: Availability of room/staff/equipment required to deal with burn patients in trauma centers near highways

The above cited figure describes importance of requirement of room/staff/equipment to deal with burnt patients in trauma centers near highways. The results present, that very percentage of the respondents 1.8% suggested that there is no need of room/staff/equipment to deal with burn patients in trauma centers near highways. While 98.2 % of the respondents supported the statement that room/staff/equipment is mandatory to deal with burnt patients in trauma centers near highways.

4.4.19 Requirement of first aid facility in trauma center

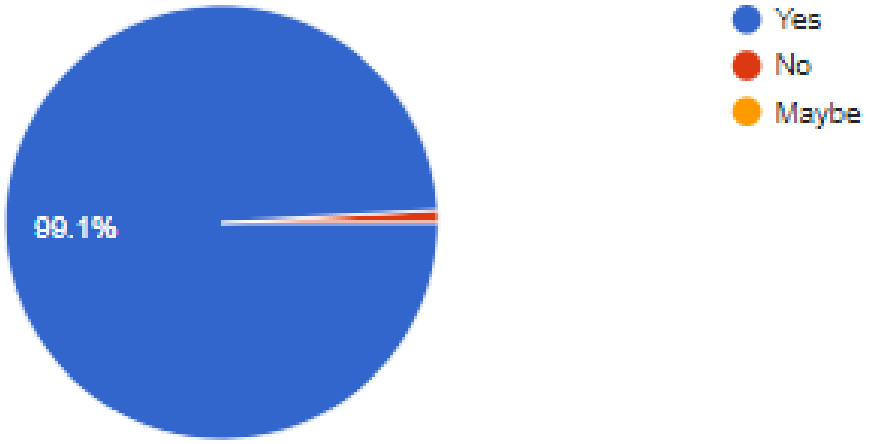


Figure 4.4.19: Requirement of first aid facility in trauma center

Figure 4.4.19 shows respondent's opinion about the requirement of first aid facility in trauma center. Results reveal that majority of respondents 99.1% emphasized on first aid facility is needed in trauma center while 0.9% of the respondents said there is no need for first aid facility near trauma center.

In addition, we also conducted the open-ended query for facilities which were most importantly needed to be present in the trauma center near highways/superhighways. Majority of the respondents suggested advance care facilities. This further validates behavioral tendencies of the respondents, where they recommended improving trauma management in which the time complexity was the main issue. Most of respondents claimed first aid center, availability of surgeon, small ICU, trained medical officers, X-ray and at least an ultrasound facility but preferably CT scan machines were the most important apparatus that should be present in trauma systems.

4.4.20 Respondents familiarity with CPEC

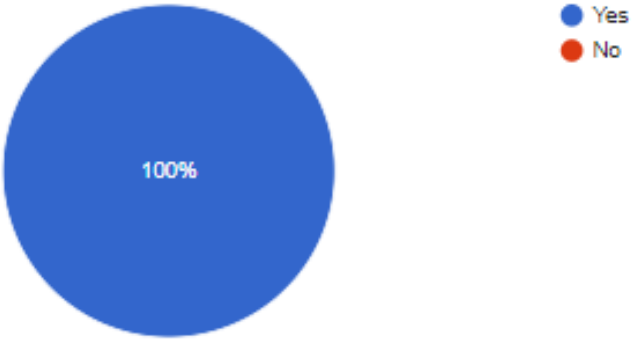


Figure 4.4.20: Respondents familiarity with CPEC

The above cited figure 4.4.20 describes how much people have any information about China Pakistan Economic Corridor (CPEC). It is interesting to note that every respondent was somehow acquainted with CPEC.

4.4.21 Availability of trauma center on CPEC

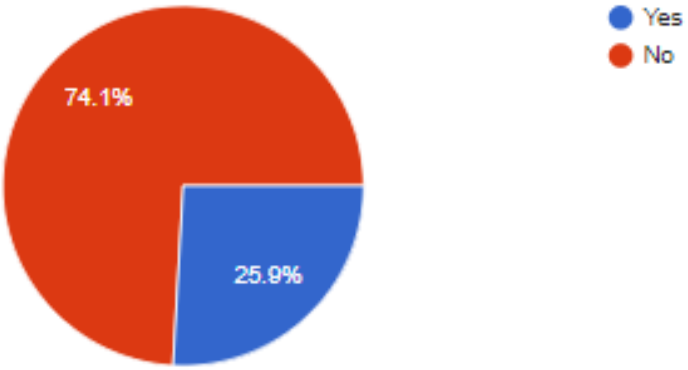


Figure 4.4.21: Trauma center on CPEC

Figure 4.4.21 illustrates respondent's responses against the existence trauma centers near CPEC. The results here elucidate that 74.1% of respondents were said no there are no trauma

center on CPEC. Meanwhile 25.9% respondents were agreed said yes there are some trauma centers near CPEC.

4.4.22 Significance of trauma centers along CPEC.

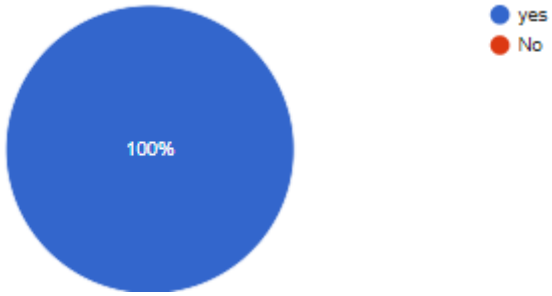


Figure 4.4.22: Significance of trauma center along CPEC.

Figure 4.4.22 describes the significance of trauma centers along CPEC in Pakistan. The results show that all the respondents agreed and were convinced that there should be trauma centers on CPEC in Pakistan.

The query was conducted to inquire the benefits of trauma centers on CPEC. When we analyzed the results, we came to know the benefits of trauma center. Majority of the respondents 58% thought it will help us to save the life of labors who are working in this project and also significantly important for the natives. In addition to this, it would accrue long term benefits for road users in future. Some respondent was of the view that it will prove to be very beneficial to manage the trauma in golden hour. 35% of respondents thought that it will reduce the mortality and morbidity rate. In contrast, the remaining 7% respondents opined against the benefits of trauma center.

4.4.23 Benefits for surrounding areas of CPEC (such as villages near CPEC)

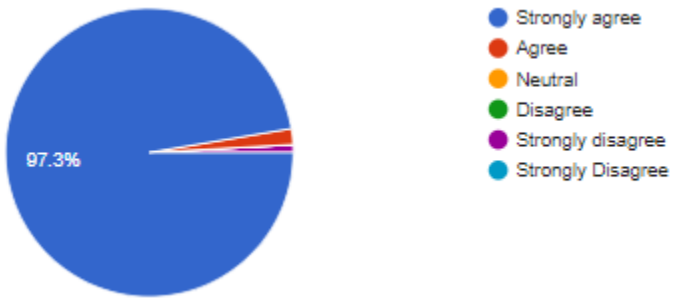


Figure 4.4.23: Benefits for other areas than CPEC (such as villages near CPEC)

Above figure 4.4.23 exhibits the respondent's opinion about benefits of trauma centers for adjacent areas of CPEC route (such as villages near CPEC). The results reveal that majority of respondents 97.3% strongly agreed while 1.8% of the respondents agreed. Only one of the respondents 0.8% from the study area strongly disagreed and claimed that there would be no benefit for other areas than CPEC (such as villages near CPEC).

4.4.24 Staff Ratio of trauma center on CPEC should be from China

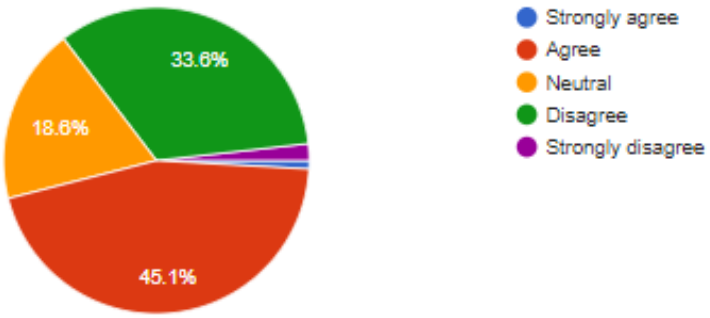


Figure 4.4.24: Staff Ratio of trauma center on CPEC should be from China

Above mentioned chart (figure 4.4.24) discuss what ratio of Staff of trauma center on CPEC should be from China. Given results shows that 45% of respondent agree and claim that

there should be Chinese representation in staff ratio of trauma center on CPEC. The 33.6% of respondents disagree with this suggestion. 18.6% of the respondents have neutral thoughts for the staff ratio. 1.8% strongly disagrees with presence of Chinese staff.

4.5 Patient's part

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

4.5.1 Patient mode of transferred to trauma center

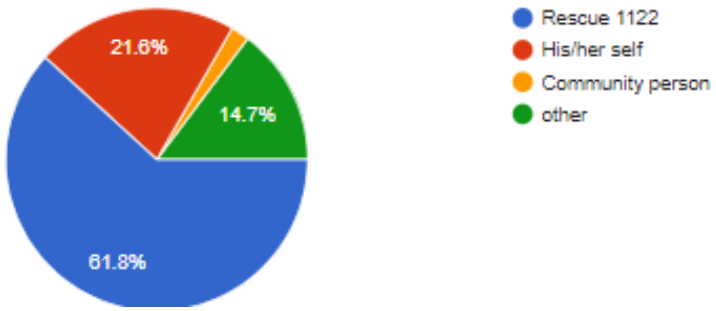


Figure 4.5.1: Patient transferred to trauma center

Pie chart 4.5.1 narrates respondent's opinions as to how they were transferred to trauma center. The results reveal that more than half of the respondents 61.8 % said they were transferred to trauma centers via Rescue 1122, while 21.6 % of the respondents informed that they reached to trauma center on their own. 14.7% were brought to medical center by some passerby's. Very minor share of the respondents 2.0% told that they were transferred to emergency through other modes.

4.5.2 Type of incidents which affect the victims

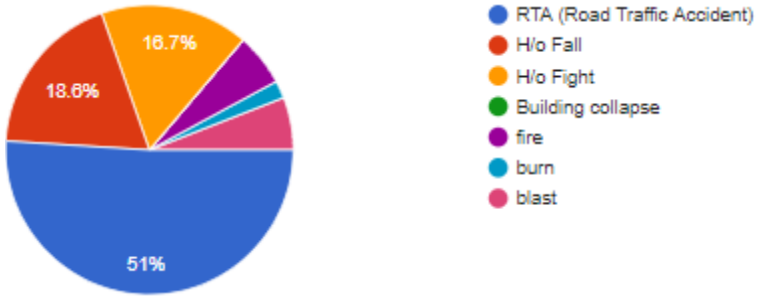


Figure 4.5.2: Shows the incident type

The results in figure 4.5.2 show the type of incident generally suffered by these people. The results narrated that 51% of respondent faced trauma injuries through road traffic accidents (RTA). Moreover, 18.6% of respondent were hurt by falling from height while 16.7% bore injuries in case of fight. 7.9 % of the respondents got injured due to fire incidents. Additionally, 5.9% of respondents were injured by blast.

4.5.3. Type of vehicle in case of RTA

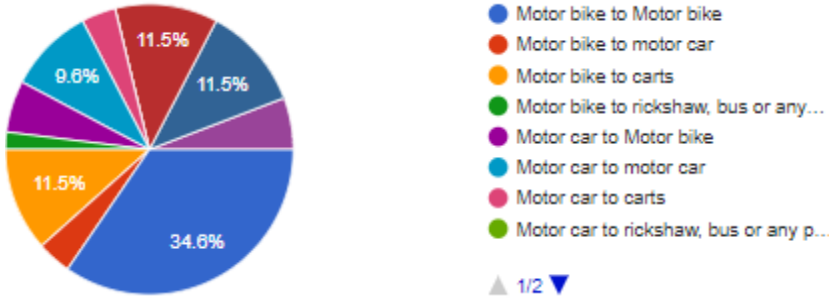


Figure 4.5.3: Type of vehicle in case of RTA

The above-mentioned chart (figure 4.5.3) discusses the results regarding those people who suffered RTAs due to different types of vehicles. Results show that 34% of respondent

suffered RTA due motorbike to motor bike collision/ faults. Whereas 11% of those respondents stated that they bore the injuries from motor bike to carts, motor car to public transport, motor bike to public transport collisions/ faults/negligence. Further results demonstrated 9.6% of respondent claimed they smacked from motor car to motor car. Additionally, 5.8% respondents were those who suffered accident by motor car to motor bike and public transport to carts. 3.5% of respondent expressed they crashed by motor bike to motor car.

4.5.4 Severity of injuries

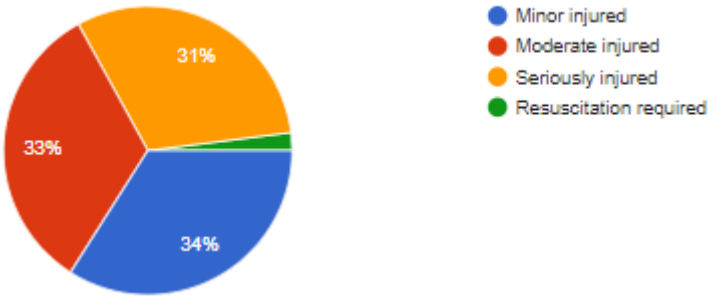


Figure 4.5.4: Triage illustration

Figure 4.5.4 validates triages of patients. Pie chart shows that 34% respondents said that they were minor injured, while 33% of the respondents were moderate injured. Some portions 31% of respondents were those who suffered severe injuries and only a marginal number of the respondents 0.5% showed that they required resuscitation.

4.5.5 Type of injury

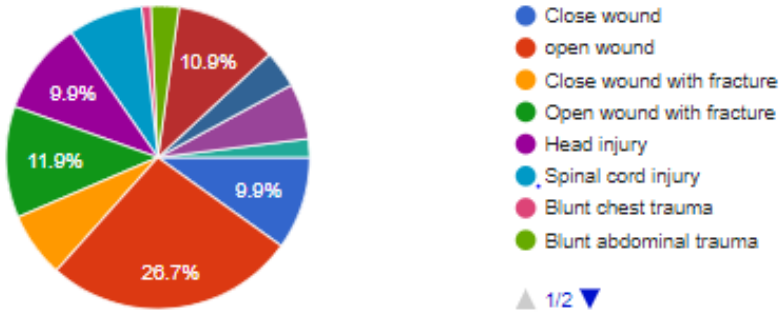


Figure 4.5.5: Injury type

Above mentioned chart (figure 4.5.5) discusses type of injury of the patients. Given results shows that 26.7% of respondent bore open wound and 11.9% claimed that they endured open wound with fractures. Whereas, 10.9% of respondent were those who experienced hardship due to crush injury and 9.9% of respondents claimed that they suffered close wounds and head injury. Moreover, there were 7.9% of the respondents who were affected from spinal injury. Few of them 6.9% were those suffering from close wound with fractures. 5.7% respondents were hurts from burning. A very low percentage of respondents suffered due to distress from blast, blunt chest trauma, optioamputated injuries.

4.5.6 Treatment provided in trauma center

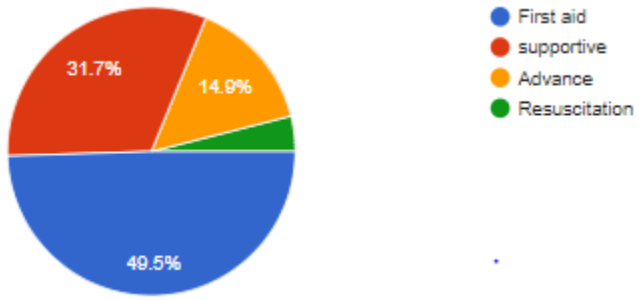


Figure 4.5.6: Treatment provided to patients.

Figure 4.5.6 discussed treatment which was provided to the trauma affected people. Given results show 49% of respondent claimed that first aid has been provided to them. Whereas, 31.7% of respondent stated that they were entertained with supportive treatment. Moreover, 14.9% of the respondents claimed that they were provided advance cure and only 4% said that they were treated with resuscitation.

4.5.7 Outcome after treatment provided in trauma center

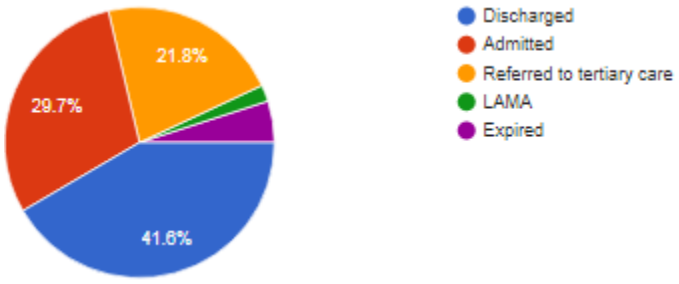


Figure 4.5.7: Outcome after treatment

Figure 4.5.7 certifies the outcomes of patients after treatment. Above pie chart shows that 41% respondents said they were discharged after proper treatment. Because they were treated on golden time, while 29% of the respondents were admitted for their more care to avoid the inconveniency in future. Some portions 21.8% of respondents having severe injuries were referred to tertiary care center for specialized healthcare and unfortunately 2.2% of patients were expired because improper resuscitation or no resuscitation on time. And 2.2% of patients were those who were gone LAMA.

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

4.6 Findings of the study

- Major trauma centers of our study 56% were ranked at level III because we took 13 secondary care hospitals which mostly have level III trauma center. While rating of trauma center 40% of the respondent believed their level of trauma center is level I which belongs to tertiary care.
- High majority 99% respondent thought that there are less than 10 ambulances were available in trauma center. Moreover majority 98% of the respondents claimed that less than 10 no of emergency wards available, 49% of participant beliefs that there were 10-15 beds. Whereas 60% of respondent showed that medical equipment available ranging 10-15. More than one third of the total 61% respondents revealed that environment of trauma centers was hygienic.
- Most of the 96% of respondent said yes there was resolution that was passed in last three years.
- Approximately, whole of the respondents 99.4% showed medical staff resolution had passed within the past three years.
- A very significant 100 % of the respondents accepted that trauma centers should be present near highways/superhighways in Pakistan.
- A widely held majority i.e. 100% of respondent agreed that there should be availability of trauma center at national highway save any complications or secondary injuries to serious injured persons.

- Most people 98.2% rate that trauma center reduce the risk of death due to serious injuries at high way.
- Majority of the respondents 99.1% were agreed to the same point and said yes availability of trauma center can save victims more efficiently than small or local healthcare units.
- 48% of respondent claimed their trauma centers have average in performance rating of trauma center & emergency centers (of hospital) for the incidents/accidents on highways/superhighways in Pakistan.
- 49.6% of respondents rate the management of trauma centers in Pakistan at satisfactory level.
- Majority 94% of respondents were agreed and unite at same point that there should be emergency number of trauma centers in case of accident.
- Substantial respondents were agreed and unite at same point and said yes, lack services of trauma center cause death that can be saved by advance medical facility.
- Most of the respondents 99.1% were agreed that there should be transfer plan with a trauma center for acceptance of your trauma patients.
- 53% of respondent claimed that more than 40 trauma deaths have there been during the last fiscal year.
- More than two third 95.6% respondents were claimed that trauma center has education program for physicians, nurses & other supporting staff in contrast 4.4% of respondent said there is no education program.

- More than half 86.7% of respondents were agreed to the same point that should be education and training program for NHA drivers also which can save victims more efficiently at incident site.
- More than one third of the respondents 95.6% 108 said it is very much important for trauma centers to have their own blood banks.
- 98.2 % of the respondents were purposed the statement that room/staff/equipment is mandatory to deal with burn patients in trauma centers near highways.
- Majority of respondents 99.1% were emphasized on first aid facility is needed in near trauma center.
- Majority of the respondent suggested us for advance care. We further validate behavioral tendencies of the respondents, they recommended us to improve trauma management in which the time complexity was the main issue. most of them acclaimed first aid center, availability of surgeon, small ICU, trained medical officers, X-ray facility and at least an ultrasound facility but preferably CT scan machines are the most important apparatus that should be present in trauma centers.
- A very significant ratio of respondent was somehow acquainted with CPEC.
- More than half 74.1% of respondents were said no there is no trauma center on CPEC.
- All the respondents were agreed and unite at same point that there should trauma centers on CPEC in Pakistan.
- Majority of respondents 97.3% were strongly agreed that Trauma center beneficial for other areas than CPEC (such as villages near CPEC).
- 45% of respondent agree and claimed that Staff of trauma center on CPEC should be from China.

- More than half of the respondents 61.8% were said they transferred to trauma centers via Rescue 1122.
- Almost half 51% of respondent faced trauma injuries through road traffic accidents (RTA).
- 34% of respondent suffered with RTA by motorbike to motor bike. Whereas 11% of those respondents who hypothesize that they bear the injuries from motor bike to carts, motor car to public transport, motor bike to public transport. Further results demonstrated 9.6% of respondent claimed they smacked from motor car to motor car.
- 34% respondents claimed that they were minor injured, while 33% of the respondents were moderate injured. Some portion 31% of respondents was those who suffered from severe injuries.
- 26.7% of respondent bear open wound and 11.9% claimed that they endure open wound with fractures. Whereas, 10.9% of respondent were those who experience hardship by crush injury and 9.9% of respondent acclaimed that they racked with pain by close wounds and head injury.
- 49% of respondent claimed that first aid has been provided to them. Whereas, 31.7% of respondent theorize they were entertained with supportive treatment.
- 41% patient's discharges after treatment, 29% admitted while 21.8% were referred to higher level, 2.2 % expired and 2.2% LAMA.

4.7 Discussion

Pakistan is vulnerable for natural as well as manmade disasters due to its geography, climate change and socioeconomic status. These disasters have notable impact on human lives.

Injury is one of the health impact induced by disasters faced by victims, which may lead death and disability. Large number of people got injuries in daily life in Pakistan. Among which road traffic injuries are common.

Trauma centers are managing the injuries, which may reduce the risk of death and disability. Mass road casualties are mostly occurred at highways due to heavy traffic like trucks, buses etc. Keeping in view the above point the importance of trauma centers at highways illustrated. But at highways we have low level trauma centers like level III or level II trauma mostly level I or level II trauma centers situated inside of cities that is why victims of mega road incident are referred from nearby hospitals to tertiary care which waste the time of patient's golden hour.

Due to lack of trauma care facilities at DHQ, THQ levels, blunt chest or abdominal trauma, open multiple fractures, head injuries, crush injuries are lost their lives before reaching the tertiary care hospitals. We have to strengthen our highways trauma centers and build new trauma centers with fully equipped and having all recommended facilities for safe Pakistan. According to the need in the light of above mentioned problems this study proposed a plan for chain of trauma centers at CPEC which is going to be longest international highway in Pakistan.

Chapter 5

CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

Trauma centers are critical infrastructure which plays a vital role in managing the injured individuals and thousand people take the benefits from its services in our daily life. Their number and distribution across the Pakistan varies according to area and demands which was 195 in 2005(Rathore et al., 2007). Availability of trauma centers is improving day by day, but challenges faced due to its need still addressable and demands serious attention to work in this regard.

The present study aimed to observe the role of trauma center situated at National highways in managing trauma victims of Disasters and suggest the plan for development of trauma centers at China Pakistan Economic corridor (CPEC). The study shows that the current situation of trauma center is poor in our country. The reason is usually ambulances are less than 10 in number; available emergency wards are less than 10 and low range of medical equipment in trauma centers nearer of highways. The reason of lack of facilities that is the 54% trauma centers selected from secondary care, it has limitations, but it should more improvements required to proper handling of mass casualties. So, we say that there should be availability of trauma center at national highway to save any complications or secondary injuries to serious injured persons. Almost half 51% of respondent faced trauma injuries through road traffic accidents (RTA). More than 50% of injuries due to crashed of motor bike to carts, motor car to public transport, motor bike to public transport. We also noticed smack from motor car to motor

car. And people bear open wound and endure open wound with fractures, crush injury and wounds and head injury. In this way it trauma centers at high way reduce the risk of death due to serious injuries and victims would be controlled more efficiently than small or local healthcare units.

30.1% of trauma centers & emergency accidents occur on highways/superhighways in Pakistan. However, rate the management of trauma centers in Pakistan at just satisfactory level not advance. So, we concluded that there should be trauma center and its emergency number in case of accident. Because lack services of trauma center and time complexity cause more death rate that can be saved by advance medical facility or trauma center at national highway. And if we offered the transfer plan of local trauma center to advance trauma system, it can also be valuable for better cure. Because 20% of trauma deaths have there been during the last fiscal year. Furthermore, to overcome this huge loss we should start the special education program for physicians, nurses & other supporting staff for golden hour advance trauma management. Our surveys proved by the responses availability of trauma center near highways can save victims more efficiently than small or local healthcare units.

For establish trauma center we also notify the advance care and first aid facility would be needed in near trauma center. To improve trauma management in which the time complexity was the main issue. Most of them acclaimed first aid center, availability of surgeon, small ICU, trained medical officers, X ray and at least an ultrasound facility but preferably CT scan machines are the most important apparatus that should be present in trauma systems. Room/staff/equipment is mandatory to deal with burn patients in trauma centers near highways.

When we survey for the China Pakistan Economic corridor CPEC, significant ratio of respondent was familiar with this corridor. Currently there is one trauma center on CPEC. So, there should trauma centers on CPEC in Pakistan. The purposed emergency center staff should be from Pakistan. It would also be launched like trauma centers as we expected near highways. It will help us to save the life of labors who working in CPEC project and significant for the natives. It will be proved significant to manage the traumas at golden hour.

5.2 Recommendations

- We should upgrade our trauma centers available at highways.
- There should be more trauma centers at highways especially heavy traffic highways i.e. Indus highway, super highway, GT road, Motorways and CPEC.
- Proper re-evaluation of trauma centers six monthly or annually to ensure the services should be continued.
- We must establish education and training programs at advance trauma care level for hospital staff and basic trauma care level for community and NHA transporters and ensure its implementation.
- There should be refresher courses for hospital staff, community and NHA transporters after definite period.

5.3 PROPOSAL OF PLAN OF TRAUMA CENTER FOR CPEC

World widely it is proved that Injury cause large number of death and disability. For the sake of prevention from complications and effective treatment it requires organized approaches. To promote the effective management of traumatic injuries there should be many improvements which may prove the ideal organizational structure for trauma management. Such improvements

may achieve by establishing of trauma center by the plan. We want to achieve the WHO standards for trauma management at realistic grounds for mass casualties at highways. We need some resources to achieve the required goals which are listed below:

- Physical requirements (infrastructure, equipment and supplies).
- Human requirements (staffing and training).

The chain of trauma center will prove to enhance the gold standards management of traumatic victims across the country, which requires the above-mentioned resources. Upon which guidelines of the trauma centers are being developed, the base of WHO guidelines is that improvements in organization and planning may lead to up gradation of trauma management services and ideal outcome of traumatic victims.

5.3.1 Objective of the plan

Achievement of maximum level of reduction in death and disabilities of traumatic injuries caused by road traffic accidents is the basic objective of the plan of establishing network of trauma center at China Pakistan Economic Corridor (CPEC) trauma care, theme of the network is minimized the distance of transfer of trauma patients' maximum up to 25 where the trauma center is at every 50 km at the highway.

WHO narrates about safety on road is that it does not become from miracles. It requires solid steps to prevent deaths and disabilities from road traffic trauma. By developing in trauma care services, developed countries achieved notable reduction in the complications of trauma in last two decades. The countries adopted the interventions which promote the trauma care is not based on special science, its simply consist of the five pillars of Road Safety detailed as:

- Management,
- Safe vehicles,
- Safe roads,
- Road user attitude
- Post incident response

Clarity and uniformity is the basic aim of plan to provide basic or advance trauma care facilities in trauma center. The plan is being constructed based on realistic implementations of the WHO guidelines of trauma care. The plan focusses the provision of quality trauma care for road accidents victims, so it proposes a structure of recommended health care facilities for trauma centers. Further its processing, progress review and implementations is the work of respective department of government which describe the major role and responsibilities of different stakeholders for implementations of the plan.

5.3.2 The components of plan of trauma centers for CPEC

The precious lives of traumatic victims can be saved by the basic and advance trauma life support facilities with or without replacements of fluids within a critical hour known as golden hour is a reasonable strategy of Trauma Care. This is the basic theme of trauma care network is to endurance of minimizing the transfer distance of trauma patients and critical hour management approach sustained for initial management and stabilization of injured. This shortest time gives surety of survival of trauma victims and reduction in disability. Strategic activities to achieve this objective include:

- Early transportation
- First aid and Initial stabilization by trained officials

- Establishment of medical care facilities to manage the cases

This Plan is proposed with an aim to establish 56 trauma centers, 28 Level-II; and 28 Level-III at CPEC especially in disaster/accident prone areas. The main strategies of the plan are as under:

- Ensure definitive treatment for the injured within the Golden Hour.
- Basic Life Support Ambulances at every 25 km over the Highway.
- Different levels of Trauma Center like Level III at every 50 km and Level II at every 100 km on the Highway.
- Healthcare facilities in these trauma centers to the appropriate level in terms of Infrastructure, Equipment & Manpower.
- Advanced Life Support Ambulances at Trauma center to transfer of patients to higher level of medical care center.
- Integrated communication network to enable the public to reach the Trauma Care System and for the various components of the System Viz. Trauma Centers, Ambulances, etc. to interface with each other.
- Appropriate skill training to various Human Resources I.e. Doctors, allied health professionals, nurses and Paramedics, etc. working in the Trauma Center.
- To develop a National Injury Surveillance System & Trauma Registry.
- To spread awareness regarding injury prevention and road safety.
- Revision of requirement of human resource and equipment for trauma care facilities by Technical Resource Group.

5.3.2.1 Level IV Trauma Center

This is very basic level facility of trauma care system which includes the ambulances or mobile hospitals for transfer of patients and to provide basic life support in a pre-hospital setup.

5.3.2.2 Level III Trauma Center

Level III trauma center is a very small level of trauma center which offers basic healthcare facilities i.e. initial evaluation and stabilization to the trauma victims. This level of care has limited levels of facilities like diagnostic, intervention and rehabilitation facilities. Those patients required small level of surgical or orthopedic interventions and have maximum chances of stabilization with low level care are treated here. Which require comprehensive medical and surgical attention is referred to definitive or specialized healthcare centers.

5.3.2.3 Level II Trauma Center

Level II trauma center provides definitive care for critical trauma victims. All consultants like surgeons, Orthopedics, physicians, and Anesthetists are there and available to the trauma patients at the time of arrivals of victims in emergency department. Gynecological surgeons, neurosurgeons and pediatricians should be available on call in the setup round the clock. The trauma center should be equipped with emergency department, intensive care unit, blood bank, rehabilitation services, broad range of comprehensive diagnostic capabilities, and supportive services.

5.3.2.4 Level I Trauma Center

Level I trauma center have all the medical care facilities which other trauma centers have not. Complex injuries are cured in the setup with highest level of definitive and comprehensive

trauma care. All types of consultants including neurosurgeons, gynecological surgeons, pediatricians and plastic surgeons available in the emergency department to the trauma patients immediately on their arrival. This type of trauma centers has all types of definitive healthcare facilities that is why it normally included in teaching institutions as specialized healthcare setup. And it should be available minimum at the distance of less than 300 to 400 km.

5.3.3 Structural requirements/Resources of Trauma Center plan

Initial proposal of establishment of trauma centers with respect to levels for the strength of 2796 km is as follow:

- Total 28 Level II Trauma centers at the distance of 100 km.
- Total 28 Level III Trauma centers at the distance of km.
- Total 5ambulances for every trauma center which are termed as Level IV every trauma center also.

Table 5.3.3.1: Structural requirements for Level II Trauma Center

Sr. No	Facility	Quantity
1.	Wards	03 1 for Surgery 1 for Orthopedics 1 for burn management
2.	Operation theater	2 table major OT 2 table minor OT
3.	Beds	5 beds for each ward
4.	Blood Bank	1
5.	Laboratory	1
6.	Radiology	1 ultrasound 1 X-ray machine

Table 5.3.3.2. Structural requirements for Level III Trauma Center

Sr. No	Facility	Quantity
1.	Wards	03 1 for Surgery 1 for Orthopedics 1 for burn management
2.	Operation theater	2 table minor OT
3.	Beds	05 beds for each ward

Table5.3.3.3. Core areas in a trauma center

Sr. No	Core facilities	Definitive areas
1.	Patient access	Ambulance entrance Walking entrance Security
2.	Patient care areas	Triage & Reception area Resuscitation area Treatment area Ambulatory care area Waiting Area Observation Ward Isolation rooms
3.	Facilities for patient's relatives	Waiting Area

		Communication Room Toilets Refreshment Area
4.	Clinical Support Services	Lab Services Radiology Blood Bank Pharmacy Communications
5.	Staff facilities	Staff changing rooms Staff shower and toilets Staff dining area
6.	Office accommodation	Administrative support Staff offices

5.3.4. Human Resource requirements of Trauma Center plan

Human resource includes in this only clinical staff which is required of essential trauma care services.

Table 5.3.4.1. Human resource requirements for Level II Trauma Center

Sr. No	Facility	Quantity
1.	General surgeon	01
2.	Orthopedic surgeon	01
3.	Anesthetist	01
4.	Medical officer	02
5.	Women medical officer	02
6.	Emergency Technologist	02
7.	Laboratory Technologist	02
8.	OT Technologist	01
9.	Anesthesia Technologist	01
10.	Radiology Technologist	01
11.	Nurses	02 at each station
12.	Emergency, OT, laboratory, Anesthesia and Radiology Technician	01 at each station
13.	Dispensers	01 at each station

Table 5.3.4.2. Human resource requirements for Level III Trauma Center

Sr. No	Facility	Quantity
1.	Medical officer	01
2.	Women medical officer	01
3.	Emergency Technologist	01
4.	OT Technologist	01
5.	Nurses	1 in each station
6.	Emergency and OT Technician	1 in each station
7.	Dispensers	1 in each station

REFRENCES

Aiker Jr, G. J., Oh, Y. S., Leslie, E. V., Lehotay, J., Panaro, V. A., & Eschner, E. G. (1975). Postmortem radiology of head and neck injuries in fatal traffic accidents. *Radiology, 114*(3), 611-617.

Ainuddin, S., & Routray, J. K. (2012). Institutional framework, key stakeholders and community preparedness for earthquake induced disaster management in Balochistan. *Disaster Prevention and Management: An International Journal, 21*(1), 22-36.

Asensio, J. A., & Trunkey, D. D. (2008). *Current Therapy of Trauma and Surgical Critical Care E-Book*: Elsevier Health Sciences.

Bešenski, N. (2002). Traumatic injuries: imaging of head injuries. *European radiology, 12*(6), 1237-1252.

Beshah, T., & Hill, S. (2010). *Mining Road Traffic Accident Data to Improve Safety: Role of Road-Related Factors on Accident Severity in Ethiopia.* Paper presented at the AAAI Spring Symposium: Artificial Intelligence for Development.

Bickell, W., Wall, M., & Pepe, P. (2011). Trauma in developing countries. *Textbook of Adult Emergency Medicine E-Book, 254*, 74.

Boing, A. F., & Rossi, T. F. (2007). Temporal trend in and spatial distribution of lung cancer mortality in Brazil between 1979 and 2004: magnitude, regional patterns, and gender-related differences. *Jornal Brasileiro de Pneumologia, 33*(5), 544-551.

Callen, M., Gulzar, S., Hasanain, A., Khan, A. R., Khan, Y., & Mehmood, M. Z. (2013). Improving Public Health Delivery in Punjab, Pakistan Issues and Opportunities.

Çelik, A. K., & Senger, Ö. (2014). Risk factors affecting fatal versus non-fatal road traffic accidents: the case of Kars province, Turkey. *International Journal for Traffic and Transport Engineering, 4*(3), 339-351.

Celso, B., Tepas, J., Langland-Orban, B., Pracht, E., Papa, L., Lottenberg, L., & Flint, L. (2006). A systematic review and meta-analysis comparing outcome of severely injured patients treated in

trauma centers following the establishment of trauma systems. *Journal of Trauma and Acute Care Surgery, 60*(2), 371-378.

Chang, K., Wu, C.-C., & Ying, Y.-H. (2012). The effectiveness of alcohol control policies on alcohol-related traffic fatalities in the United States. *Accident Analysis & Prevention, 45*, 406-415.

Cooper, D. J., McDermott, F. T., Cordner, S. M., & Tremayne, A. B. (1998). Quality assessment of the management of road traffic fatalities at a level I trauma center compared with other hospitals in Victoria, Australia. *Journal of Trauma and Acute Care Surgery, 45*(4), 772-779.

Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical assessment, research & evaluation, 10*(7), 1-9.

Curtis, K., & Ramsden, C. (2015). *Emergency and trauma care for nurses and paramedics*: Elsevier Health Sciences.

Day, J. M., Melnyk, S. A., Larson, P. D., Davis, E. W., & Whybark, D. C. (2012). Humanitarian and disaster relief supply chains: a matter of life and death. *Journal of Supply Chain Management, 48*(2), 21-36.

Deen, S. (2015). Pakistan 2010 floods. Policy gaps in disaster preparedness and response. *International journal of disaster risk reduction, 12*, 341-349.

DeGennaro Jr, V., DeGennaro, V. A., Bitar, M., Bitar, J., & Thaller, S. (2015). Building advanced surgical capacity at a hospital in Port-au-Prince, Haiti. *Journal of Craniofacial Surgery, 26*(4), 1042-1047.

Dente, C. J., Shaz, B. H., Nicholas, J. M., Harris, R. S., Wyrzykowski, A. D., Patel, S., . . . Rozycki, G. S. (2009). Improvements in early mortality and coagulopathy are sustained better in patients with blunt trauma after institution of a massive transfusion protocol in a civilian level I trauma center. *Journal of Trauma and Acute Care Surgery, 66*(6), 1616-1624.

DeVivo, M. J. (1997). Causes and costs of spinal cord injury in the United States. *Spinal cord, 35*(12), 809.

Dick, W. F. (2003). Anglo-American vs. Franco-German emergency medical services system. *Prehospital and disaster medicine, 18*(1), 29-37.

Dunn, M., Gwinnutt, C., & Gray, A. (2007). Critical care in the emergency department: patient transfer. *Emergency medicine journal, 24*(1), 40-44.

Ehlers, A., Hackmann, A., Steil, R., Clohessy, S., Wenninger, K., & Winter, H. (2002). The nature of intrusive memories after trauma: The warning signal hypothesis. *Behaviour research and therapy, 40*(9), 995-1002.

Esposito, T. J., Rotondo, M., Barie, P. S., Reilly, P., & Pasquale, M. D. (2006). Making the case for a paradigm shift in trauma surgery. *Journal of the American College of Surgeons, 202*(4), 655-667.

Fanelli, G. C., & Edson, C. J. (1995). Posterior cruciate ligament injuries in trauma patients: part II. *Arthroscopy: The Journal of Arthroscopic & Related Surgery, 11*(5), 526-529.

Friedman, G., Silva, E., & Vincent, J.-L. (1998). Has the mortality of septic shock changed with time? *Critical care medicine, 26*(12), 2078-2086.

Ghaffar, A., Hyder, A. A., & Masud, T. I. (2004). The burden of road traffic injuries in developing countries: the 1st national injury survey of Pakistan. *Public health, 118*(3), 211-217.

Ghajar, J. (2000). Traumatic brain injury. *The Lancet, 356*(9233), 923-929.

Greenwald, R. M., Gwin, J. T., Chu, J. J., & Crisco, J. J. (2008). Head impact severity measures for evaluating mild traumatic brain injury risk exposure. *Neurosurgery, 62*(4), 789-798.

Grimm, M., & Treibich, C. (2013). Determinants of road traffic crash fatalities across Indian states. *Health economics, 22*(8), 915-930.

Guha-Sapir, D., Hargitt, D., & Hoyois, P. (2004). Thirty Years of Natural Disasters 1974-2003: The Numbers. 2004. *Belgium: Presses Universitaires de Louvain*.

Hazzard, W. R. (2000). The department of internal medicine: hub of the academic health center response to the aging imperative. *Annals of internal medicine, 133*(4), 293-296.

Heeley, E. L., Wei, J. W., Carter, K., Islam, M. S., Thrift, A. G., Hankey, G. J., . . . Anderson, C. S. (2011). Socioeconomic disparities in stroke rates and outcome: pooled analysis of stroke incidence studies in Australia and New Zealand. *Med J Aust, 195*(1), 10-14.

Herttua, K., Mäkelä, P., & Martikainen, P. (2008). Changes in alcohol-related mortality and its socioeconomic differences after a large reduction in alcohol prices: a natural experiment based on register data. *American journal of epidemiology, 168*(10), 1110-1118.

Hrymak, V., & Perezgonzalez, J. (2007). The Costs and Effects of Workplace Accidents: 20 Case Studies from Ireland.

Huang, T.-R., Zhang, S.-W., Chen, W.-Q., Deng, W., Zhang, C.-Y., Zhou, X.-J., & Zhai, R.-H. (2012). Trends in nasopharyngeal carcinoma mortality in China, 1973-2005. *Asian Pacific journal of cancer prevention, 13*(6), 2495-2502.

Huggett, R. (1990). Multiple Bar Charts *Graphs and Charts* (pp. 19-22): Springer.

Hulka, F., Mullins, R. J., Mann, N. C., Hedges, J. R., Rowland, D., Worrall, W. H., . . . Trunkey, D. D. (1997). Influence of a statewide trauma system on pediatric hospitalization and outcome. *Journal of Trauma and Acute Care Surgery, 42*(3), 514-519.

Jamali, A. R. (2008). Trauma care in Pakistan. *JOURNAL-PAKISTAN MEDICAL ASSOCIATION, 58*(3), 102.

Jevons, W. S. (1877). *The principles of science: A treatise on logic and scientific method*: Classworks.

Jiang, C., Lu, L., Chen, S., & Lu, J. J. (2016). Hit-and-run crashes in urban river-crossing road tunnels. *Accident Analysis & Prevention, 95*, 373-380.

Jick, T. D. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative science quarterly, 24*(4), 602-611.

Khan, F., Amatya, B., Sayed, T. M., Butt, A. W., Jamil, K., Iqbal, W., . . . Abbott, G. (2017). World Health Organization Global Disability Action Plan 2014–2021: Challenges and Perspectives for Physical Medicine and Rehabilitation in Pakistan. *Journal of rehabilitation medicine, 49*(1), 10-21.

Kinnear, P., & Gray, C. (2006). *SPSS 12 made simple*: Psychology press.

Kothari, C. R. (2004). *Research methodology: Methods and techniques*: New Age International.

Kraus, J. F., Black, M. A., Hessol, N., Ley, P., Rokaw, W., Sullivan, C., . . . MARSHALL, A. (1984). The incidence of acute brain injury and serious impairment in a defined population. *American journal of epidemiology, 119*(2), 186-201.

Kristiansen, T., Lossius, H. M., Rehn, M., Kristensen, P., Gravseth, H. M., Røislien, J., & Søreide, K. (2014). Epidemiology of trauma: a population-based study of geographical risk factors for injury deaths in the working-age population of Norway. *Injury, 45*(1), 23-30.

Kwon, O. H., Rhee, W., & Yoon, Y. (2015). Application of classification algorithms for analysis of road safety risk factor dependencies. *Accident Analysis & Prevention, 75*, 1-15.

Labaree, R. (2013). LibGuides. Organizing Your Social Sciences Research Paper. Writing a Field Report.

Li, J., Shi, W., Li, M., Wang, Z., He, H., Xian, J., . . . Yan, F. (2014). Time-dependent diffusion tensor changes of optic nerve in patients with indirect traumatic optic neuropathy. *Acta radiologica, 55*(7), 855-863.

MacGillivray, I., Spitz, B., De Wel, M., & Van Assche, A. (1989). Maternal mortality and morbidity in Belgium. *Neonatology, 55*(1), 30-33.

MacKenzie, E. J., Hoyt, D. B., Sacra, J. C., Jurkovich, G. J., Carlini, A. R., Teitelbaum, S. D., & Teter Jr, H. (2003). National inventory of hospital trauma centers. *Jama, 289*(12), 1515-1522.

MacKenzie, E. J., Rivara, F. P., Jurkovich, G. J., Nathens, A. B., Frey, K. P., Egleston, B. L., . . . Scharfstein, D. O. (2006). A national evaluation of the effect of trauma-center care on mortality. *New England Journal of Medicine, 354*(4), 366-378.

Masel, B. E., & DeWitt, D. S. (2010). Traumatic brain injury: a disease process, not an event. *Journal of neurotrauma, 27*(8), 1529-1540.

McMillan, J. H., & Schumacher, S. (2010). Research in Education: Evidence-Based Inquiry, MyEducationLab Series. *Pearson.*

McNicholl, B. (1994). The golden hour and prehospital trauma care. *Injury, 25*(4), 251-254.

Ming Tse, K., Liu, J., P.W. Shim, V., Chong Teo, E., & Lee, P. (2017). *The Neck: Neck Injuries in Military Scenarios*.

Mock, C. (2004). *Guidelines for essential trauma care*: World Health Organization.

Mock, C., Kobusingye, O., Anh, L. V., Afukaar, F., & Arreola-Risa, C. (2005). Human resources for the control of road traffic injury. *Bulletin of the world Health Organization, 83*, 294-300.

Museru, L., Mcharo, C., & Leshabari, M. (2002). Road traffic accidents in Tanzania: a ten year epidemiological appraisal. *East and Central African Journal of Surgery, 7*(1).

Nantulya, V. M., & Reich, M. R. (2002). The neglected epidemic: road traffic injuries in developing countries. *Bmj, 324*(7346), 1139-1141.

Nathens, A. B., Jurkovich, G. J., Cummings, P., Rivara, F. P., & Maier, R. V. (2000). The effect of organized systems of trauma care on motor vehicle crash mortality. *Jama, 283*(15), 1990-1994.

Neff, K. (2003). Self-compassion: An alternative conceptualization of a healthy attitude toward oneself. *Self and identity, 2*(2), 85-101.

Norusis, M. J. (1993). *SPSS: SPSS for Windows, base system user's guide release 6.0*: SPSS Inc.

Odero, W., Garner, P., & Zwi, A. (1997). Road traffic injuries in developing countries: a comprehensive review of epidemiological studies. *Tropical Medicine & International Health, 2*(5), 445-460.

Peden, M., McGee, K., & Krug, E. (2002). *Injury: a leading cause of the global burden of disease, 2000*: World Health Organization.

Peden, M., Oyegbite, K., & Ozanne-Smith, J. (2008). World Report on Child Injury Prevention. Geneva: WHO and UNICEF.

Peleg, K., Aharonson-Daniel, L., Michael, M., Shapira, S., & Group, I. T. (2003). Patterns of injury in hospitalized terrorist victims. *The American journal of emergency medicine, 21*(4), 258-262.

Ramirez, M., & Peek-Asa, C. (2005). Epidemiology of traumatic injuries from earthquakes. *Epidemiologic reviews, 27*(1), 47-55.

Rathore, M., Rashid, P., Butt, A., Malik, A., Gill, Z., & Haig, A. J. (2007). Epidemiology of spinal cord injuries in the 2005 Pakistan earthquake. *Spinal cord, 45*(10), 658.

Razzak, J. A., Baqir, S. M., Khan, U. R., Heller, D., Bhatti, J., & Hyder, A. A. (2013). Emergency and trauma care in Pakistan: a cross-sectional study of healthcare levels. *Emerg Med J*, emermed-2013-202590.

Rotondo, M., Cribari, C., Smith, R., & Trauma, A. C. o. S. C. o. (2014). Resources for optimal care of the injured patient. *Chicago: American College of Surgeons, 6*.

Sánchez-Triana, E., Enriquez, S., Larsen, B., Webster, P., & Afzal, J. (2015). *Sustainability and Poverty Alleviation: Confronting Environmental Threats in Sindh, Pakistan*: The World Bank.

Sanga, P., Giesecke, A. H., Wilson, W. C., & Sutcliffe, A. J. (2007). History of trauma. *Trauma: Emergency Resuscitation, Perioperative Anesthesia, Surgical Management. Informa Healthcare USA, Inc*, 1-23.

Sar, V., & Ozturk, E. (2006). What is trauma and dissociation? *Journal of Trauma Practice, 4*(1-2), 7-20.

Simonsen, J., Bærenholdt, J. O., Büscher, M., & Scheuer, J. D. (2010). *Design research: Synergies from interdisciplinary perspectives*: Routledge.

Stone, C. K., & Humphries, R. L. (2004). *Current emergency diagnosis & treatment*: McGraw-Hill.

Theodore, N., Hadley, M. N., Aarabi, B., Dhall, S. S., Gelb, D. E., Hurlbert, R. J., . . . Walters, B. C. (2013). Prehospital cervical spinal immobilization after trauma. *Neurosurgery, 72*(suppl_3), 22-34.

Veenema, K. R., & Rodewald, L. E. (1995). Stabilization of rural multiple-trauma patients at level III emergency departments before transfer to a level I regional trauma center. *Annals of emergency medicine, 25*(2), 175-181.

Villaveces, A., Mutter, R., Owens, P., & Barrett, M. (2006). Causes of Injuries Treated in the Emergency Department, 2010: Statistical Brief# 156.

Warren, J., Fromm, R. E., Orr, R. A., Rotello, L. C., & Horst, H. M. (2004). Guidelines for the inter-and intrahospital transport of critically ill patients. *Critical care medicine, 32*(1), 256-262.

Wilcox, S. R., Ries, M., Bouthiller, T. A., Berry, E. D., Dowdy, T. L., & DeGrace, S. (2017). The importance of ground critical care transport: A case series and literature review. *Journal of intensive care medicine, 32*(2), 163-169.

Winslade, W. J. (1999). *Confronting traumatic brain injury: Devastation, hope, and healing*: Yale University Press.

Zhao, Z. (2011). Adult mortality in Asia *International Handbook of Adult Mortality* (pp. 133-150): Springer.