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Establishment and evaluation of Pakistan's trauma registry: Insights from a public sector trauma institute

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***Abstract*---**Background: The need for a trustworthy Trauma Registry (TR) to enhance patient care and direct trauma prevention strategies has been recognized for a very long time. Objectives: This research sought to establish, develop, and assess Pakistan's first Digital TR at SMBB Institute of Trauma. Methods: Using U.S. DIv5 TR model as starting point, locally adapted digital TR was developed, and several methodologies were used to analyze prevalence, characters, and first- aid care of trauma, as well as the feasibility of establishing a national TR. The research was conducted at SMBBIT for the period from November 2016 to December 2022. Results: A total of 15,217 patient records were entered into the TR of whom Majority of patients suffering trauma were youthful 46% and predominantly male 86%, according to the demographic analysis. Direct admission from the accident scene was common 68%, and the preponderance of incidents involved 59% road accidents. In the majority of cases, 64% family members provided primary care. The leading causes of injury were 75% blunt force trauma and 59% automobile collisions. Orthopedic 35%, neurosurgical 22%, and oro-maxillofacial 12% injuries were the most common. In terms of assault-related injuries, gunshot wounds were a prominent cause of trauma. Majority of 78% patients presented with a mild GCS score, mortality rate was 13%, and the vast majority 64% of patients were recovered. Practical implications: Important implications for trauma management, prevention strategies, policymaking, and health education were derived from this study. In regions with a high rate of road traffic accidents, policymakers and urban planners should prioritize enhancing road safety measures. Prioritize adequate training and resources for emergency medical services in trauma care and secure patient transport. Conclusion: This study provided valuable insights into the demographics, injury patterns, treatments, and outcomes of trauma patients based on the extensive data compiled in TR. The findings emphasized the significance of pre-hospital trauma care and need for targeted interventions, safety measures, and healthcare education. These findings had practical implications for policymakers, city planners, healthcare professionals, and public health advocates, and will guide efforts to enhance trauma care and prevention strategies.

***Keywords*---**database creation, digital health care, Pakistan, public health, trauma registry.

Introduction

Trauma is a major cause of morbidity and mortality worldwide, especially in low- and middle-income countries (LMICs) such as Pakistan, where road traffic accidents, falls, burning, and violence are prevalent. These situations necessitate prompt, efficient, and coordinated medical responses. Unfortunately, systemic obstacles such as resource constraints, infrastructure deficits, and a lack of strategic

planning based on accurate and pertinent data frequently impede the ability to respond effectively and provide adequate care.[1-2]

According to the World Health Organization (WHO), trauma is the leading cause of mortality worldwide, accounting for over five million deaths annually. This alarming number is projected to increase by the year 2030, primarily due to the growing prevalence of road traffic injuries, which, as of 2012, are the eighth leading cause of disability-adjusted life years (DALYs).[3-4] Notably, the burden of such injuries falls disproportionately on those in their productive years, resulting in substantial economic consequences.[5-6] In Asia, injuries account for one out of every ten fatalities. Compared to countries with a high standard of living, Southeast Asia has double the DALYs per 100,000 individuals.[5] This is a consequence of accelerated economic development and urbanization in developing nations, which are accompanied by an increase in injury-related mortality and morbidity.[7-8]

Pakistan, which is 2018-2019 registered approximately two million vehicles annually, is at the epicenter of this public health crisis.[9] According to current statistics, a traffic-related fatality occurs every five minutes, with a predicted 77% increase in incidents for 2020 and a 200% increase by 2030. This not only results in approximately 27,500 deaths and 500,000 injuries annually on Pakistan's roads but also a 3% decline in GDP. The 15-29 age bracket is substantially affected by road traffic accidents.[8] A robust TR is a crucial tool that has proved effective in addressing these issues in many developed nations. A TR is a structured system for acquiring, storing, and analyzing standardized data on hospitalized injured patients. This information can provide an abundance of knowledge regarding the nature and cause of injuries, the care provided, and patient outcomes. TRs can inform evidence-based practice and policy, quality improvement initiatives, injury prevention strategies, and trauma research, thereby enhancing patient outcomes and decreasing the burden of trauma on society.[10-11]

Established in 2016 in Karachi, Shaheed Mohtarma Benazir Bhutto (SMBB) Institute of Trauma recognized the imperative need for a trauma registry to effectively respond to this escalating crisis. Trauma registries are systematic, exhaustive databases that document the hospital care provided to trauma patients.[12] In addition to providing a valuable tool for evaluating patient care and monitoring hospitalization outcomes, they also provide invaluable data for enhancing the quality of trauma care in institutions.[13] Despite their benefits, trauma registries can be difficult to maintain, especially in low- and middle- income countries like Pakistan. Inadequate funding, infrastructure, and trained personnel are obstacles, as is the complexity of software acquisition. Even after registry data have been established, regular internal audits are

necessary to ensure their accuracy, completeness, and case relevance.[14-16]

Incredibly, to our knowledge, the SMBB Institute of Trauma is the first public institution in Pakistan to establish a digital Trauma Registry, despite the absence of a National Trauma Registry. This study seeks to describe the development process of the Trauma Registry at the SMBB Institute, analyze initial patient data to gain a better understanding of the population served, and evaluate the data quality of the registry. It aims to guide government bodies, trauma institutes, and public and private health policymakers in Pakistan and other developing nations. Our overarching objective is to enable the Trauma Registry to serve as a paradigm

for establishing national and provincial registries throughout Pakistan, thereby enhancing trauma care throughout the country.

Methodology Study design

This study presented a comprehensive narrative of the establishment and development of a locally adapted Trauma Registry (TR) based on a United States- based model. It is based on a descriptive cross-sectional analysis of trauma patients from November 2016 to December 2022. The TR data integrity was thoroughly evaluated and documented in terms of case and data exhaustiveness.

Study location

The investigation was conducted at Shaheed Mohtarma Benazir Bhutto (SMBB) Institute of Trauma, a large government tertiary care hospital. The institute offers specialized services in emergency care, cardiothoracic surgery, neurosurgery, oro-maxillofacial, vascular surgery, orthopedics, plastic surgery, ophthalmology, and infectious diseases in collaboration with the hospital's numerous departments.

Original U.S. DIV5 Trauma Registry

In 2016, the SMBBIT acquired the U.S.-based DIV5 Trauma Registry for $3000 per year. This desktop application-based computer software had a database design constituted of data fields with drop-down menus that captured a patient's journey from the time of injury, through hospitalization, to the outcome, as well as readmission data for each patient. Each variable's alternatives were coded following the International Classification of Diseases (ICD).

Initially, a senior surgeon was tasked with supervising the Trauma Registry and assembling a team consisting of a registered nurse and computer operators. In 2019, additional personnel, including a data scientist researcher, another registered nurse, and a computer operator, were hired. Due to budget constraints, the U.S.-based

company did not provide formal training on the software, ICD classification, terminology, or analysis; however, data entry proceeded consistently with the Institute of Trauma covering the salaries and operational costs of the TR team.

In November 2016, the DIv5 TR began recording data, and systematic data input commenced in January 2017. While the SMBBIT TR team was unable to access data analysis through this software, they frequently requested data analysis from DIv5 analysts in the United States. Although these analysts were supportive, financial constraints prevented SMBBIT from conducting a thorough analysis. SMBBIT initiated the adaptation of U.S. DIv5 to a regional TR in 2021. As a result of the rupee's rapid depreciation against the dollar, the U.S.-based TR had become prohibitively costly. In addition, the local adaptation had to include additional variables and exclude others from the U.S. Technical Report to better serve our local needs. The objective was to develop a succinct, user-friendly,

locally applicable, and streamlined TR that could be adopted by other trauma centers in the province and country, including less developed regions than Karachi. Between November 2016 and December 2021, the U.S.-based DIv5 TR recorded a total of 12,801 patients. The relevant information from these entries was transmitted securely to the local institution's TR.

Institutional Trauma Registry Development and Creation

The procedure began with the identification of the trauma patient and the inclusion and exclusion criteria. Due to a blunt or penetrating injury, the definition centered on patients confronting a significant risk of loss of life or limb, or significant permanent disfigurement or disability.

Inclusion criteria

All major trauma patients who presented to the Emergency Department within 72 hours of the injury, regardless of whether they came directly from the injury site, via another facility, or from the outpatient department, and who were admitted or retained in ER for >24 hours for admission, met the inclusion criteria. Patients who perished after receiving any type of evaluation or treatment at the hospital were included, as well as those who were deceased upon arrival.

Exclusion criteria

It included patients with minor injuries that did not necessitate admission, near- drowning patients, and those whose injury occurred more than 72 hours prior unless specifically referred to the institute for further care. Patients with spontaneous fractures older than 65 were also excluded.

Defining the variable

Using the exhaustive DIv5 as a guide, the team endeavored to construct a valid data set that was easy to collect and accounted for local conditions. At SMBBMIT, a TR Core Committee comprised of senior physicians representing their departments, IT experts, and TR team members was established. The committee was tasked with selecting and defining each data point meticulously, bearing in mind the reason for data collection and the predetermined key performance indicators. The goal was to strike a balance between insufficient data, which would undermine the registry's purpose, and excessive data, which would contribute to inefficiency and be time-consuming and expensive.

Our institution's incident report included demographic information that reflected the provinces and ethnic diversity of Pakistan, information on the mechanism of injury, concise pre-hospital information, the facility that referred the patient, and the mode of arrival at our ED. Our database included the medications administered in the emergency department, the admitting service, patient tracking, use of a ventilator, blood and blood products, laboratory and radiologic testing, diagnosis, procedures performed, medications administered during admission, final patient outcome, and potential for rehabilitation upon discharge.

The ICD-10 coding language was difficult to comprehend, despite our understanding of the need to record and designate codes to the injury event, treatment, and outcomes. For the convenience of the data entry operator, we chose to evaluate and select pertinent codes from the 95 thousand ICD-10 codes. The Trauma Registry of SMBBIT named “Pakistan Trauma Registry” was officially registered and completed on January 1, 2022, and data input of new patients commenced. Analyses of patient data transmitted between November 2016 and December 2022 were based on variables identified during the development of the registry.

Trauma Registry Application

The trauma registry is a web-based application that facilitates the collection and management of data on traumatic injuries by healthcare professionals. This application was developed with PHP and MySQL on the backend and HTML, CSS, JS, and jQuery on the front end to securely store and analyze data on patient demographics, injury mechanisms, treatments, outcomes, and other relevant factors.

Using PHP, a popular server-side scripting language, and MySQL, a popular open- source relational database management system, the application can capture and store large amounts of data efficiently and securely. The application's front end is designed to provide an intuitive and user-friendly interface that facilitates data access and input for healthcare professionals. Enhancing the application's security are

features such as user authentication, data encryption, and access controls. The distribution of missing data across trials was evaluated, and no significant differences were observed.

Statistical analysis

The registry data were collected and entered in SMBB's trauma registry and also double check in Excel spreadsheets, with the mean, median, and frequencies indicated.

Results

In total, 15,217 patients were recorded between November 2016 and December 2022 at SMBBIT during 06 years of study. The new institutional TR enabled a thorough analysis of injury patterns, patient demographics, treatments, and outcomes, revealing valuable insights that could inform future clinical, administrative, and policy decisions. The goal was to strike a balance between insufficient data, which would undermine the registry's purpose, and excessive data, which would contribute to inefficiency and be time-consuming and expensive. The demographic features of 15217 patients indicated that majority of patients, 7028(46%); fell within the age range of 18 to 35 years, revealing a clear bias toward younger individuals. 2813(19%) of the patient population was comprised of those between the ages of 36 and 50 years. Those over the age of 65 years were the least represented age group, accounting for only 579(4%) of the total. Regarding gender, data reveal a significant masculine preponderance. Male patients accounted for eighty-six percent, while females account for only fourteen percent. Their geographic distribution revealed that overwhelming majority 13152(86%) were from Sindh, whereas only a small percentage were from Punjab 213(1%), Khyber Pakhtunkhwa (KPK) 76(0.5%), and Balochistan 1764(12%). Other places contributed a negligible 12(0.08%) to the total. Analyzing the type of patient transported from showed that majority of patients 10340(68%) were admitted directly from the scene (accident site). A sizeable percentage 4869(32%) was referred from other health facilities and the ground ambulance 8016(53%) was the most used mode of transportation. Regarding accident location(site), majority 11917(78%) occurred on road. Other locations, such as highways, villages, workplaces, and unidentified sites, accounted for lesser proportions of the total number of accidents. The pluralities of patients' caregivers were family members, accounting for sixty-four percent of the total. Unrelated accounted for 26% of the total, while unknown attendants accounted for 11%. Information regarding day and time trauma patients arrived at SMBB Institute of Trauma were also analyzed and distribution of data across the seven days of the week was relatively uniform, ranging from 12.9% to 15.5%. Sunday and Monday appeared to be the busiest days, with 16.5% and 15.2% of total arrivals, respectively, while Saturday appeared to be the least active day, with 12.9% of the total patient count. Arrival times of the patients showed that majority of patients 6755(44%) appeared in

the evening (16:00-23:59), followed by the afternoon (08:00-15:59), which accounted for 5096(34%) of total arrivals. The morning hours (00:00-07:59) saw the fewest patients, with 3366(22%) of all arrivals occurring during this time. (Table I)

Table II depicted that characteristic of trauma patients at SMBB, including the category of injury, the mechanism of injury, and the diagnosis of injury of patients. Beginning with injury type, blunt trauma was the most prevalent, accounting for nearly 11407(75%) of all injuries. Penetrating injuries accounted for 2313(15%) of all injuries, while burns accounted for only a minor portion 331(2%). Other injuries accounted for 235(2%) of the total. The mechanism of injury provided insight into the causes of these injuries. Over half of the injuries 8334(59%) were caused by road traffic accident (RTA), while falls accounted for 3274(23%). Assaults and burn accounted for approximately 997(7%) and 331(2%) of injuries, respectively. Suicides, explosives, and building collapses were extremely uncommon causes of injury. The "Others" category accounted for 8% of the cases. Of 5224 patients involved in motorcycle accidents, there was documentation regarding helmet use found in 2832(54%) records. Of these, 101 (4%) reported wearing helmets. Of 1,268 motor vehicle collisions (MVC), documentation regarding safety belts was found in 518 records, of which only 9 (2%) individuals reported wearing them, whereas data on airbags was documented in 329 records of MVCs, with no vehicle reporting that any airbags were deployed/available. The breakdown of injury diagnosis revealed that trauma orthopedics 5282(35%), neurosurgery 3380(22%), and oro-maxillofacial injuries 1841(12%) were the most prevalent diagnoses. Other disciplines accounted for 2920(19%) of cases, while general surgery accounted for 1794(12%) of diagnoses.

Many patients had poly-trauma with multiple injuries and a total of 21717 injuries were recorded in 15,217 patients over the study period. However, for the purposes of this study, only the first trauma diagnosis entered for each of the 15217 patients was analyzed with orthopedic injury diagnosed in 5282 (24%), neurosurgical in 3380 (16%), and oral-maxillofacial in 1841(9%). Comprehensive breakdown of the types of diagnoses made for trauma center patients across four main diagnostic areas Orthopedic, Neurosurgery, Oro-maxillofacial surgery, and General surgery. A total of 5282(35%) patients, were diagnosed with orthopedic injuries. In this category, the most common injuries were femoral fractures in 1592(30%) patients, and tibia fractures in 1566(30%) patients, followed by radius ulna fractures in 562(11%) patients, and humerus fractures in 668(13%) patients. The remaining percentage consisted of injuries such as metatarsal or metacarpal fractures, clavicle, patella, pelvic, and other unidentified fractures. In neurosurgery, a total of 3380(22%) patients were treated. The preponderance of these patients 2917(86%) had brain injuries. Spinal injuries were also observed, albeit at a much lower frequency 263(8%) patients, and there were also cases of "Others brain injuries" 200(6%)

patients. The most frequent injury among the 1841(12%) patients treated in this category was a fracture of the sinus fracture in 983(53%) patients, followed by zygomatic fractures in 366(20%) patients, and mandible fractures in 300(16%) patients. Lefort fractures and other facial fractures were uncommon. General surgery treated 1,794(12%) patients, prevalent being hemo-pneumothorax in 728(41%) patients, followed by rib fractures in 207(12%) patients, and free fluid in 154(9%) patients. In addition, there were cases of liver injury, splenic injury, emphysema, and other injuries that were not specified (Table II).

Of all traffic collisions; accidents involving motorcycles accounted for 5,224(63%) of the cases. This demonstrated that motorcyclists were particularly vulnerable group in traffic and were more prone to accidents. With 1,268(15%) cases, motor vehicle collision (MVC) accidents were the second most common. Despite the anticipation that car occupants may be more protected due to the structural design of automobiles, these numbers indicated that car accidents continue to be major cause of trauma. Only 52(0.6%) instances of bicycle collisions have been documented. It is important to observe that this could indicate either a genuinely lower risk or an underrepresentation due to factors like low bicycle usage or underreporting of accidents. With 1,548(19%) cases, pedestrians were also substantially affected by road traffic accidents. This emphasized the dangers pedestrians encountered in traffic environments, especially in regions with high vehicle speeds or inadequate pedestrian infrastructure. Finally, "Others" category accounted for 242(3%) cases. This data highlighted the significant contribution of road traffic accidents to trauma, with various categories of injuries. (Figure 1)

Assault-related injuries observed at the trauma center were separately categorized. With 48(5%) incidents, knife-related assaults were the least frequent category. Despite their rarity, knife wounds potentially caused severe trauma, particularly when vital organs or major blood vessels were affected. With 371(37%) cases, gunshot wounds were significant source of assault-related trauma. Due to the high energy of the bullet impact, extensive tissue damage was seen and affected multiple organ systems, these wounds were extremely severe. 199(20%) incidents were caused by glass-related injuries. Injuries caused by bites were extremely uncommon, with only four incidents recorded. The others category of assault contains 375(38%) cases, signifying a variety of additional assault methods not specified in the given categories. This could include blunt force trauma, other weapon-related injuries, or even strangulation (Figure 2).

Burn injuries treated at the trauma center were also categorized. Electrical injuries were the most common, with 218(66%) reported cases. These wounds were caused by direct contact with an electrical current and resulted in severe injuries due to the electrical current's path through the body, which can affect internal organs and tissues.

Only 18(5%) cases of thermal burns, typically caused by exposure to heat sources such as fire, heated surfaces, and hot liquids or steam. Thermal burns necessitated extensive treatment and a protracted recovery time, despite their relatively low incidence in this data set. 65(20%) cases of chemical burns were caused by contact with corrosive substances, such as strong acids and alkalis. "Others unknown burns" category includes 30(9%) cases of burns from unidentified or other sources. These may be the result of causes not enumerated here, such as radiation or friction burns (Figure 3).

Initial patient evaluation was based on Glasgow Coma Scale (GCS) score. Majority of patients 78% presented with a mild GCS score (13-15), representing 9807 of cases. Moderate cases (GCS 9-12) accounted for 1078(9%), while severe cases (GCS 3-8) accounted for 1693(14%). At presentation, the median systolic and diastolic blood pressures were 119 and 75, respectively. Radiological procedures were the most prevalent, accounting for Seventy-six percent of the total number of procedures 50326. Among these was CT head scans 8052(16%), X-ray Chest 13684(27%), and other radiological procedures were 28590(57%). Surgical procedures accounted for 8,541(15%) percent of total procedures. ORIF was the most common surgical procedure 1728(20%), followed by wound debridement 1028(12%), craniotomy 613(7%), chest tube insertion 645(6%), amputation 283(3%), and other surgical procedures 4244(50%). A total 135,532 medications were administered during hospitalization. Of these, 15565 (12%) were antibiotics, of which the most prescribed was Ceftriaxone, 5242 (32%), followed by amoxicillin-clavulanate, 3986 (26%). (Table III)

The average patient hospitalization lasted 12+14 days, average duration at ICU or high dependency unit was 2±4 days. In addition, patients were on a ventilator for a mean duration of 3±5 days. In terms of patient outcomes, 13% of patients (1887 individuals) died as a result of their injuries, which represented the mortality rate. In addition, a significant proportion of patients (18% or 2,766) were already deceased upon arrival at the hospital. Positively, majority of patients (64 percent, or 9599 individuals) were discharged from the hospital. The rehabilitation potential was documented by providers that temporary disability expected to return to previous level of function in 6838(51%) patient records. A small number of patients (4 percent or 619 people) decided to depart against medical advice (LAMA). The time of death ≥ 24 hours was 965(51%) recorded. Total 4932 (32%) Brought dead (BD)were reported in ED from the period of 2019 to 2022, and 2766(56%) were trauma BD cases. (Table IV).

The quality of the data was assessed, and case completeness was found in 79.8%. Data completeness for registry variables, 84% date and time of arrival, 100 % for demographics, 85% for injury date and time and place, 84% for protective devices, 80% for whether injury work-related, 99% for the mechanism of injury. For data completeness from referring facility to SMBBIT, it was 99% for facility location, 88%

for a mode of transportation, In the case of the initial ED assessment, data completeness was 89% for vital signs, 94% for GCS. Patient tracking data was complete for location services in 90%, ventilator use in 98%, and blood in 89%. Data completeness regarding procedures was 93% and for diagnoses was 93%. In the case of outcome data, completeness for discharge status was 88%, duration of ICU stays 98%, ventilator days 96%, and total hospitalization 95%.

Table I: Demographic of trauma patients presented to SMBB Institute of Trauma

Variables	Frequency	%
Age in years (Median, range)	27 (1-99)	
Age Group		
1-12	1742	11.4
13-17	1511	9.9
18-35	7028	46.2
36-50	2813	18.5
51-65	1544	10.1
>65	579	3.8
Gender		
Male	13124	86.2
Female	2093	13.8
Province		
Sindh	13152	86.4
Punjab	213	1.4
Khyber Pakhtunkhwa (KPK)	76	0.5
Balochistan	1764	11.6
Unknown	12	0.08
City		
Within Karachi	10757	70.6
Outside Karachi	4393	28.8
Unknown	67	0.4
Transported from		
Direct from scene (Site) to SMBB	10340	68.0
Referred from Health Facility	4869	31.9
Unknown	8	0.05
Mode of Transport		
Counts	15173	99.7
Ground ambulance	8016	52.8
Private vehicle	5030	33.2
Walk-In	215	1.4
Police	110	0.7
Helicopter Ambulance	6	0.03
Unknown	1796	11.8
Arrival Day		

Monday	2323	15.3
Tuesday	2060	13.5
Wednesday	2227	14.6
Thursday	2002	13.2
Friday	2274	14.9
Saturday	1970	13.0
Sunday	2361	15.5
Arrival Time (Hours)		
00:00-07:59	3366	22.1
08:00-15:59	5096	33.5
16:00-23:59	6755	44.4
Location (Site) of Accident		
Home	983	6.5
Road	11917	78.3
Highway	335	2.2
Village	1125	7.4
Workplace	546	3.6
Others	23	0.2
Unknown	288	1.8
Patients Accompanied		
Counts	14170	93.1
Immediate family member	9023	63.7
Unrelated	3618	25.5
Unknown	1529	10.8

Table II: Breakdown of trauma patients, characteristics and diagnosis

Variables	Frequency	%
Type of Injury		
Counts	15217	100.0
Blunt	11407	74.9
Penetrating	2313	15.2
Burn	331	2.2
Other	235	1.5
Unknown	931	6.1
Mechanism of Injury		
Counts	14190	93.3
Road Traffic Accident (RTA)	8334	58.8
Fall	3274	23.1
Assault	997	7.0
Burn	331	2.3
Suicide / Self harm	31	0.2
Cylinder/battery Blast	39	0.3
Bomb Blast	32	0.2
Building Collapse	13	0.1
Domestic Violence/Physical Abuse	19	0.1
Others	1120	7.9

Usage of Productive Devices		
Helmet use	5224	
Counts	2832	54.2
Wearing Helmet	101	3.6
Not wearing helmet	2731	96.4
Seat belt use	1268	
Counts	518	40.9
Wearing Seat belt	9	1.7
Not wearing seat belt	509	98.3
Airbags use	1268	
Counts	329	25.9
Airbags deployed	0	0.0
Not deployed	329	25.9
First Injury Diagnosis Entered	21717	
Trauma Orthopaedic	5282	24.3
Femoral fractures	1592	30.1
Tibia Fibula	1566	29.6
Humerus fracture	668	12.6
Metatarsal & Metacarpal	187	3.5
Clavicle Fracture	170	3.2
Patella	110	2.1
Pelvic Facture	136	2.6
Radius Ulna	562	10.6
Other Orthopaedic fractures	291	5.5
Trauma Neurosurgical	3380	15.5
Brain Injury	2917	86.3
Spine injury	263	7.8
Other	200	5.9
Trauma Oral Maxillo Facial Surgery	1841	8.5
Mandible Fracture	300	16.3
Zygomatic Fracture	366	19.8
Lefort fracture	128	6.9
Sinus Fracture	983	53.4
Other Facial Fracture	64	3.4
General Surgery	1794	8.3
Hemo-Pneumothorax	728	40.6
Rib fracture	207	11.5
Free fluid	154	8.6
Liver injury	138	7.7
Spleen Injury	95	5.3
Emphysema	69	3.8
Other general surgery procedure	403	22.5
Other Injury Diagnosis	9420	43.4

Table III: Clinical presentation and management of trauma patients

Variables	Frequency	%
Initial Assessment		
GCS Score	12578	
Mild (13-15)	9807	78.0
Moderate (9-12)	1078	8.5
Sever (3-8)	1693	13.5
Comorbid		
Blood Pressure Blood Pressure	13493	88.7
Systolic (Median, range)	119(20-269)	
Diastolic (Median, range)	75 (16-191)	
Procedures performed	66674	
Radiological Procedure	50326	75.5
X-Ray Chest	13684	27.2
CT Brain	8052	15.9
Other Radiological Procedure	28590	56.8
Surgical Procedure	8541	
Open Reduction Internal fixation (ORIF)	1728	20.2
Wound Debridement	1028	12.0
Craniotomy	613	7.2
Chest Tube insertion	645	7.5
Amputation	283	3.3
Other Surgical Procedure	4244	49.7
Medications		135532
Other medication	119967	88.5
Antibiotics	15565	11.5

Table IV: Clinical outcomes of the trauma patient treated at SMBB Institute oftrauma

Variables	Frequency	%
Hospital Length of Stay in days Mean(S.D)	12±14	
ICU Length of Stayin days Mean(S.D)	2±4	
On Ventilators in days	3±5	
Outcome	15044	98.6
Discharged	9599	63.8
Died	1887	12.5
Left Against Medical Advice	619	4.1
Shift to another Services	41	0.3
Shift To Edhi Home	8	0.05
Shift to Jail Ward	6	0.04
Unknown	2884	19.2
Time to Death	1887	

< 24 hours	922	48.9
≥ 24 hours	965	51.1
Brought Death (BD)	4932	
Trauma BD	2766	56.1
Non-Trauma BD	2166	43.9

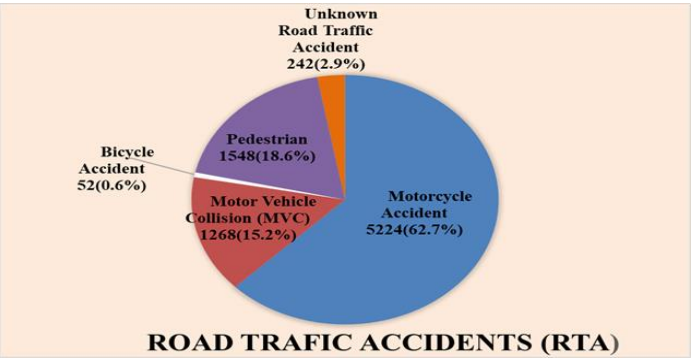

Figure 1: Breakdown of road traffic accidents (RTA) of 8334(59%) patients presented at SMBB Institute of Trauma

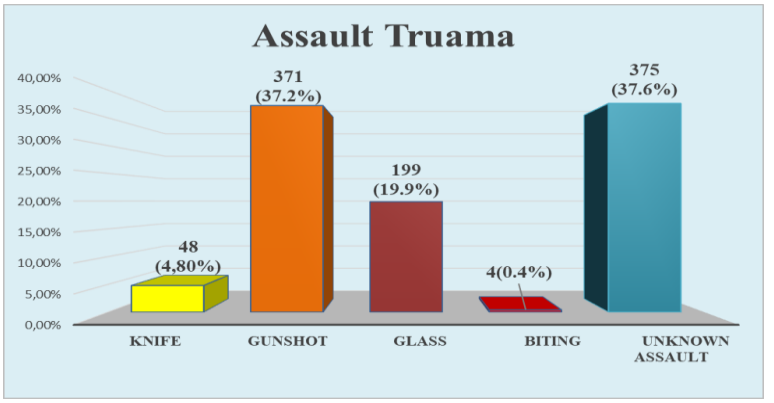

Figure 2: Breakdown of assault trauma of 997 patients presented at SMBB Institute of Trauma

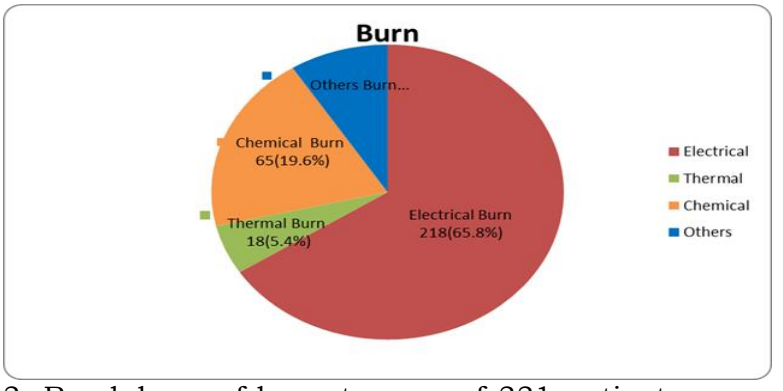

Figure 3: Breakdown of burn trauma of 331 patients presented at trauma center

Discussion

This research paper focuses on the findings of the first trauma registry in a metropolitan city of Pakistan, which aims to enhance emergency care and trauma management. Trauma, a leading cause of death and disability worldwide, requires efficient data collection and analysis to enhance medical response and save lives. With this pioneering initiative, the city aims to revolutionize its emergency healthcare system by establishing a comprehensive database of trauma incidents, allowing medical professionals to gain invaluable insights and implement evidence-based practices. The study observed high data completeness percentages for various registry variables. Most importantly, first in-hospital physiological observations were reported in around eighty percent of the population. In a recent study from neighboring country India, these observations are reported as major indicator for prediction of mortality in patients attending emergency departments.[17] Another study has reported that clinical and calculated variables, such as GCS are difficult to collect in trauma registries.[18] These findings are also important in predicting 30-days survival in severely injured traumatic patients.[19] However, in the current study, missing values were limited. These findings indicate the overall robustness and high level of completeness of the data, establishing a solid foundation for comprehensive analysis and meaningful research conclusions.

In this study, an analysis of a comprehensive dataset encompassing over fifteen thousand patients who sought treatment at a trauma center over a span of six years was included. The median age of the patients was determined to be 27 years, highlighting the predominance of trauma incidents affecting the younger population. Additionally, a significant gender disparity was observed, with males constituting the majority, accounting for 86% of the cases. Previous international studies findings from trauma registries also reported younger age group and males as predominant individuals.[18,20] However, a study conducted in England has reported older age people in majority who attended trauma centers.[21] A possible reason behind this increase age in this study is that the mechanism of injury reported in majority of the patients in England was fall. However, among the cases examined, falls accounted for 23% of the total incidents in the current study.

Blunt trauma emerged as the most prevalent type of injury, accounting for 75% of the cases analyzed in this study. Road Traffic Accidents (RTAs) constituted the primary injury mechanism in 59% of the cases, with motorcycle accidents comprising 63% and motor vehicle collision injuries contributing to 15% of the cases. Notably, a strikingly low percentage of individuals (only 0.07%) were found to be wearing seat belts at the time of the incident, while the deployment of airbags was absent across all vehicles examined. Similar findings were also reported in previous studies as well.[18,22-24] A systematic review of trauma registries findings from low and middle income countries have also

reported findings similar to the current study.[25] These findings underscore the urgent need for enhanced road safety measures, emphasizing the importance of promoting seat belt usage and exploring opportunities to increase airbag deployment in vehicles to mitigate the severity of injuries resulting from road accidents.

Among the patients included in the current study, ground ambulance emerged as the predominant mode of arrival, accounting for 53% of cases, indicating its crucial role in timely transportation for emergency care. Analysis of the data also revealed that roads were the most common location of injury, representing 78% of all cases, underscoring the urgent need for targeted road safety measures. Various previously published studies from Karachi have also stated serious concern on the road traffic injury in Karachi due to the poor road conditions.[26-28] Notably, the emergency department recorded the presence of 32% of patients who were brought in deceased, and of these cases, 56% were classified as traumatic brought dead cases. In an international study, death on arrival was reported in 1.3% patients which is remarkably low compared to the current study finding.[20] These findings shed light on the significant challenges faced in pre-hospital care and emphasize the importance of effective emergency response strategies to improve patient outcomes.

As for the patient outcomes analyzed in this research, it was found that 64% were discharged from the hospital, while 13% unfortunately succumbed to their injuries. Somewhat similar mortality was also reported in previous studies as well.[29,30] The average duration of stay in the ICU was 2 days, with an average of 3 days on a ventilator, and a total hospital stay duration of 12 days. Among the patients who were discharged to their homes, it was documented by healthcare providers that temporary disability was expected in 51% of the patient records, with the potential for a return to their previous level of function. This highlights the importance of rehabilitation services in supporting patients' recovery and facilitating their reintegration into their daily lives. These findings underscore the significance of ongoing medical management and rehabilitative interventions to optimize functional outcomes for a substantial proportion of discharged patients. The research paper assessed the quality of the data and found a case completeness rate of 79.8%.

It is important to acknowledge and address certain limitations that may affect the interpretation and generalizability of the current study findings. First, this trauma registry typically focuses on specific variables of interest related to trauma care and outcomes. While this allows for in-depth analysis within the designated scope, it may limit the ability to explore other potential factors or outcomes that are not captured in the registry. Secondly, trauma registry data is typically collected within a specific time period. This temporal limitation may restrict the analysis to a particular timeframe and may not capture

long-term outcomes or changes in practice over time. Lastly, this trauma registry is based on one trauma center of Karachi city. Although, SMBB is one of the largest trauma centers of Karachi, however, as this is a densely populated city, inclusion of data from larger healthcare center could increase the authenticity and generalizability of the findings. Despite these limitations, the current study has several strengths. The study findings have filled a critical gap in knowledge by providing insights into the epidemiology, patterns, and outcomes of trauma in this specific population. This information can enhance our understanding of the unique challenges and factors influencing trauma care in densely populated urban areas. The findings from the trauma registry serve as a foundation for evidence-based decision making in trauma care. One of the important points is the application of trauma registry in a low middle income country as reported in previous literature that For decades, trauma registries have been used in wealthier countries for injury surveillance and clinical governance, but their adoption has lagged in low-income and middle- income countries.[31,32] Policymakers, healthcare providers, and administrators can utilize this information to develop targeted interventions, allocate resources effectively, and implement preventive strategies to improve the quality and efficiency of trauma care services in densely populated cities like Karachi. In addition, the study findings recommend further research and innovation in the field of trauma care. Researchers can build upon the initial findings to explore more specific research questions, investigate novel interventions, and develop evidence-based guidelines tailored to the unique needs of densely populated urban areas. The study findings serve as a catalyst for future studies that contribute to the advancement of trauma care knowledge and practice.

Conclusion

Our research highlighted the significance of trauma registry in understanding the dynamics of trauma care, particularly in Pakistan. Our investigation of various locally implemented and developed trauma registries revealed their significant potential for collecting detailed injury epidemiology, facilitating decisions based on evidence, and driving quality improvements in trauma care. In addition, our research has revealed critical voids in data collection and patient care during transport, highlighting the need for standardized data collection tools and improved emergency medical services. We advocated for the widespread implementation of trauma registries, not only as instruments for data collection and research but also as instruments that can provide crucial insights into injury prevention and management. National trauma registries should be further developed and standardized, as they would shed light on the specific challenges our society is facing in providing high-quality trauma care. Lastly, collaboration between healthcare providers, policymakers, and researchers is necessary to ensure the effective utilization of these registries in influencing the future of trauma care in Pakistan. Moreover, data revealed that transport

accidents were the leading cause of death in Karachi, particularly among the youthful population. Ambulances and other emergency medical services must be upgraded to improve patient transportation. Trauma patients required the establishment of emergency medical care facilities (including emergency trauma centers) at the district and subdivision levels to receive high-quality care.

Conflict of interest

None.

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