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Research Article

## A RESEARCH STUDY ON DIFFERENCES IN RISK-ADJUSTED OUTCOME OF ROAD TRAFFIC INJURIES IN TERTIARY CARE CENTERS OF PAKISTAN

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**Abstract:**

**Objective:** Assessment of the contrasting factors in road injury survival including three tertiary care hospitals of an urban area.

**Methods:** In Lahore, during October 2015 to November 2018, a study-based survey was held which consists of all road traffic injury victims representing the three health care centers. In this survey complete record of the patient is maintained including gender, mode, age and any delay in approaching hospital. Data was stratified by hospital of presentation. A logistic regression model was formed, and survival possibility was evaluated after balancing different risk factors, comprising patient data and severity of injury.

**Results:** The study comprised of 93,657 victims, but there is a lack of complete information in 6,458(6.89%) study subjects, counting the information about survival. Generally, 83,837(89.5%) were males; 64,269(74%) were aged between 16 and 45 years; 84,016(95%) had injury severity score of  $\geq 15$ ; however, the survival rate was 84,141(96.5%).

**Conclusion:** In Lahore, Remarkable variations were found in risk-adjusted survival of road injury victims representing public hospitals. These variations underlined the differences in chances for improvement and the process of care.

**Keywords:** Surveillance, Survival, Road traffic Injuries, trauma system, Outcome.

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## INTRODUCTION:

Rate of traffic accidents is accelerating in Countries with low or middle economy termed as (LMICs) and as a resultant it acts as a great threat to social and economic progress of the country. [1,2] Moreover, the rising load of trauma and lack of medical facilities indicating death and disability resulting from road injury are confronting their delicate medical systems. [3] Developed countries having high income termed as (HICs) have enhanced their consequences resulting from road injury through evolving integrated systems of trauma directing the care spectrum from roadside rescue to social therapy. [4-6] Among these healthcare involvements, distinguishable developments have been made in trauma care based on facilities which proved that patients suffering trauma have high rate of survival at selected trauma centers than in case of non-selected centers.[4,5] The variation exists in results of equally selected centers of trauma which presents a considerable difference in quality concerning delivery of trauma care.[7,8]The obligation of occurrence of quality cleft would act as a crucial step in the direction of minimizing the gap through computing and determining variances in results of risk familiar injuries in the trauma centers and then utilizing these variances for repairing the deficits of system. [9,10] There is a lack of proper record for such evaluations in under developed countries. [10] The present study was deliberated to determine the variation in survival rate of patients with road injuries that were reported to three urban health care medical centers of Lahore.

## SUBJECTS AND METHODS:

The study was held in Lahore and contained data regarding all patients suffering from road accident injuries irrespective of gender and age reported to three health care centers from Lahore, during October 2015 to November 2018. The patients that were found to be Dead on Arrival (DOA) were not included. The study utilized the observatory data of the Road Traffic Injury Research & Prevention Center (RTIR&PC). This signifies the major RTI observatory system of the country, including 5 largest centers of trauma 24 hours a day. These are the 5 tertiary healthcare centers providing basic facilities. Government is supporting 3 centers while the other 2 were funded by private trusts. These institutions have less defined catchment areas containing variable facility services depending on the type and nature of injury in order to direct the patients with head injuries to center 1 having efficient neurosurgical unit.

For data procurement, patients along with their visitors, accident observers, police, ambulance and health center records act as main resources of information. The department in EDs of all the health

centers gathered the information while information of patients admitted in hospital is collected to conclude their 30-day outcome. The information gathered comprised of patient background, details of crash concerning injured people, types of vehicle affected by crash, reason and area of accident. The structural and biological specifications of injuries were determined through Abbreviated injury scores (AIS), [11] the respiratory rate (RR), Systolic blood pressure (SBP) and Glasgow coma score (GCS). The data was collected from health center records, doctors treating victims, Scores of injuries severity and scores of revised trauma to evaluate the extent of accidental damage. The data regarding vehicle used and time interval during accident and arrival at health center was also noted. The information of health centers comprised of all the procedure from start till end. It elaborates the patient condition, type of treatment given, duration of stay and discharge from the hospital.

For study determination, result was explained as death in 30 days or successful discharge from the hospital. For detailed analysis, the patients were divided into 3 age groups. The patients having age above 45 were subdivided in order to clarify the variations in case of survival. Codes were used to recognize health centers to confirm secrecy. The arrival of patients at health centers was characterized on transport basis either through rescue teams, police or public transport like taxi or any other vehicle. The time interval between accident and appearance at hospital was also divided into groups representing arrival in 1 hour after accident and after 1 hour. The evaluation of victims injured and categorization of injuries depending on the area of body was performed by ISS. The extent of injury severity was grouped as: 1-15, 16-25, and >25.

The assessment of risky results concerning survival was performed among public health care centers, that provide sources for care regarding trauma than other 2 private health care centers. Logistic reversion was utilized to evaluate the relationship among variables for study and their results, leading to the survival of patient after the accident. For inquiry of the variation among results of three health centers, two situations were formed using logistic reversion model; 1 having greater possibility of survival in comparison to the other. The first situation defined a patient of age 15-25 years, RTS>7 and ISS <15, reached health center in one hour after the accident in a taxi. The 2nd situation describes a patient of greater than 65 years of age, RTS<4 and ISS>25, reached the health care center in police van after one hour of the accident.

These situations were accustomed for severity of injuries depending upon which body part is affected.

Data analysis is performed by utilizing SPSS 16.

### RESULTS:

The system collected information for a period of 38 months on 93,657 patients suffered road accident to 3 hospitals which was utilized for further analysis. There was a lack of proper information in 6,458 (6.89%) subjects which consists of information about survival. Center 1 has huge number of victims of about 40,903 (43.6%). The study has 83,837(89%) male victims and 64,026(74%) of them have ages between 16-45 years. The injuries of first group (ISS score  $\leq 15$ ) contributes 84,016 in the total. The victims that reached hospital by means of private vehicles are 65,148 (74.7) cases; while 70,046 (74.8) RTI patients reached in 1 hour after accident irrespective of the transport. Total 156,024 injuries were reported, 78,236 (50.14%) were cured at Center 1. Center 2 & 3 took care of 40,746 (26.1%) and 37,042(23.8%). The rate of external injuries is higher about 46,174 (29.6%) including facial and head injuries of about 23,920 (15.3%) and 25,605 (16.4%). The extremity and pelvic injuries represent a huge population of about 1,28788(36.8%) and 3,16008 (43.2%) directed towards the first center. Center 2 monitor

16098(39.5%) patients with external injuries. Ignoring the non-reported data, the result of survival rate is 84141(96.5%) patients. (Table-1).

Through regression analysis, evaluation of survival variance in elder patients is made. Patients above the age of 45 years was further grouped into 45-64 and greater than 65 years. Center 2 & 3 possesses greater survival chances (Odds Ratio [OR]:1.7; Confidence Interval [CI] 1.5-1.8) than first center. This variation improved after alteration for severity of injury, age, gender, structural regions and mode of transport to reach hospital and time interval and survival chance were 4.4 times improved (CI:3.4-5.7) for 2nd center and 4.2 (CI:3.3-5.4) for 3rd center than Center 1. Age and mode of transport to reach hospital are some factors that determine the survival chances. Neglecting other factors, patients of age group (1-15 years) than (16-25) gave 1.3 times higher survival rate. The survival rate is lesser in all other groups. The survival rate is greater in victims arriving through taxis or other private transports (OR 10.9; CI: 10.1-11.9) than using ambulance. Time duration to reach Emergency Department is not linked directly to the survival rate by ignoring other differences ( $p=0.359$ ) (Table-2). During this study duration, 3,058(3.5%) deaths occurred their circulation design among differences were considered (Table-3).

Table-1: Basic characteristics of road traffic victims presenting to the three tertiary care centers of Lahore, Pakistan.

Centre	1 n (%)	2 n (%)	3 n (%)	Total n (%)
Total registered	40,903(43.6)	28,302 (30.2)	24,452 (26.1)	93,657
<b>Gender</b>				
Males	36,740 (89.8)	24,784 (87.6)	22,313 (91.3)	83,837(89.5)
Females	4,163 (10.2)	3,518 (12.4)	2,139 (8.7)	9,820 (10.5)
<b>Age(Years) n=86,468</b>				
0-15	4,448 (11.9)	3,280 (12.5)	2,639 (11.5)	10,367(11.98)
16-45	27,493 (73.8)	19,135 (72.9)	17,398 (75.7)	64,0269 (74.0)
>45	5,308 (14.25)	3,830 (14.6)	2,937 (12.8)	12,075 (13.9) 84,016
<b>Injury Severity Score N=87,199 1-15</b>				
16-25	35,732 (95.3)	25,835(97.2)	22,449 (97.2)	(96.3)
>25	803 (2.1)	248(0.9)	169 (0.7)	1,220 (1.4)
	974 (2.6)	500 (1.9)	489(2.1)	1,963 (2.25)
<b>Mode of arrival n=87,199</b>				
Ambulance	8,107 (21.6)	3,564 (13.4)	5,862 (25.4)	17,533
Police	797 (2.1)	388 (1.5)	345(1.5)	1,530 (1.75)
Private	27,349(72.9)	21,517 (80.9)	16,282 (70.5)	65,148(74.7)
Public & Others	1,256 (3.3)	1,114 (4.2)	618 (2.7)	2,988 (3.42)

Time of presentation n=87,199		70,046		
<1 hr	28,648 (76.4)	22,672 (85.3)	18,726 (81)	(74.8)
<1 hr	8,861 (23.6)	3,911 (14.7)	4,381 (19)	17,153 (18.31)
<b>Distribution of injuries</b>	78,236 (50.14)	40,746 (26.16)	37,042 (23.78)	156,024
Head Injury (n=25,605)	13759 (17.5)	6287 (15.4)	5649 (15.3)	25,605 (16.4)
Facial Injury (n=23,920)	11967(15.3)	6287 (15.4)	5657 (15.3)	23,920 (15.3)
Chest Injury (n=2,068)	882 (1.1)	479 (1.2)	707 (1.9)	2,068 (1.32)
Abdominal Injury (n=2,164)	1164 (1.4)	379 (0.9)	621 (1.7)	2,164 (1.38)
External Injury (n=46,174)	21676 (27.7)	16098 (39.5)	8400 (22.7)	46,174 (29.6)
Extremity/ pelvic Injury (n=56,102)	28788 (36.8)	11306 (27.7)	16008 (43.2)	56,102 (35.9)
<b>Survival n=87,199</b>				
Expired	1,693 (4.5)	730 (2.7)	635 (2.7)	3,058 (3.5)
Survived	35,816 (95.5)	25,853 (97.3)	22,472 (97.3)	84141 (96.5)

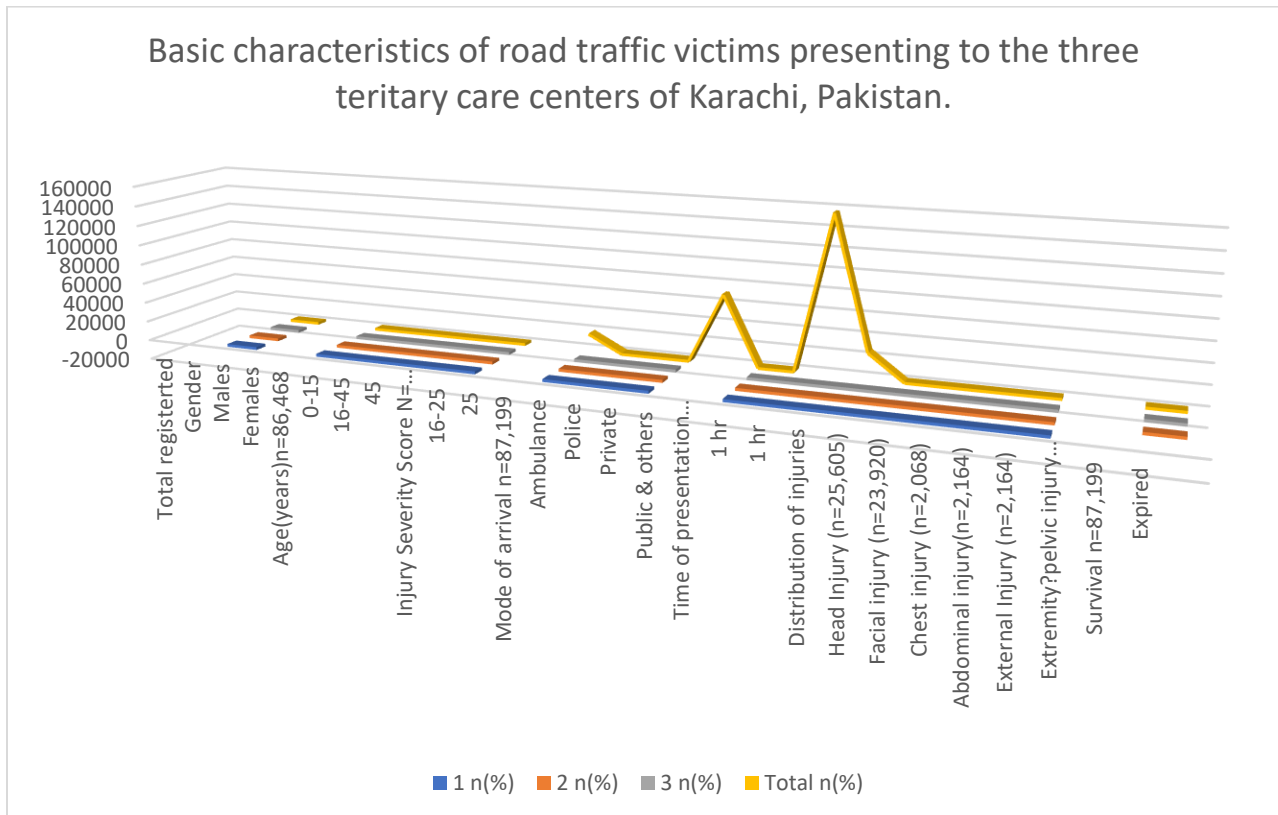


Table-2: Regression model- Survival Probability in Public-sector hospitals.

Centre	Unadjusted OR (95% CI)	OR	p-value	Adjusted OR (95% CI)	p-value
1	(ref)			(ref)	
2	1.7 (1.5-1.8)		<0.001	4.4 (3.4-5.7)	<0.001
3	1.7 (1.5-1.8)		<0.001	4.2 (3.3-5.4)	<0.001
<b>Age (Years)</b>					
0-14	(ref)			(ref)	
15-25	1.3(1.2-1.5)		<0.001	0.98 (0.71-1.4)	0.92
26-45	0.75 (0.66-0.85)		<0.001	0.62(0.45-0.85)	0.003
46-65	0.43 (0.37-0.49)		<0.001	0.36 (0.25-0.51)	<0.001
>65	0.27 (0.22-0.34)		<0.001	0.16 (0.09-0.26)	<0.001
<b>Mode of arrival</b>					
Ambulance	(ref)			(ref)	
Police Vehicle	0.8 (0.68-0.93)		<0.001	1.1 (0.74-1.7)	0.585
Private Vehicle	10.9 (10.1-11.9)		<0.001	1.5 (0.91-2.1)	<0.001
Public & Others	1.4 (1.2-1.6)		<0.001	0.95 (0.66-1.4)	0.797
<b>Time of presentation</b>					
<1hr	(ref)			(ref)	
>1hr	0.64 (0.59-0.69)		<0.001	0.91 (0.74-1.11)	0.359

+Also adjusted for Injury Severity score, Revised Trauma Score, and type of injury. OR: Odds Ratio. CI: Confidence interval.

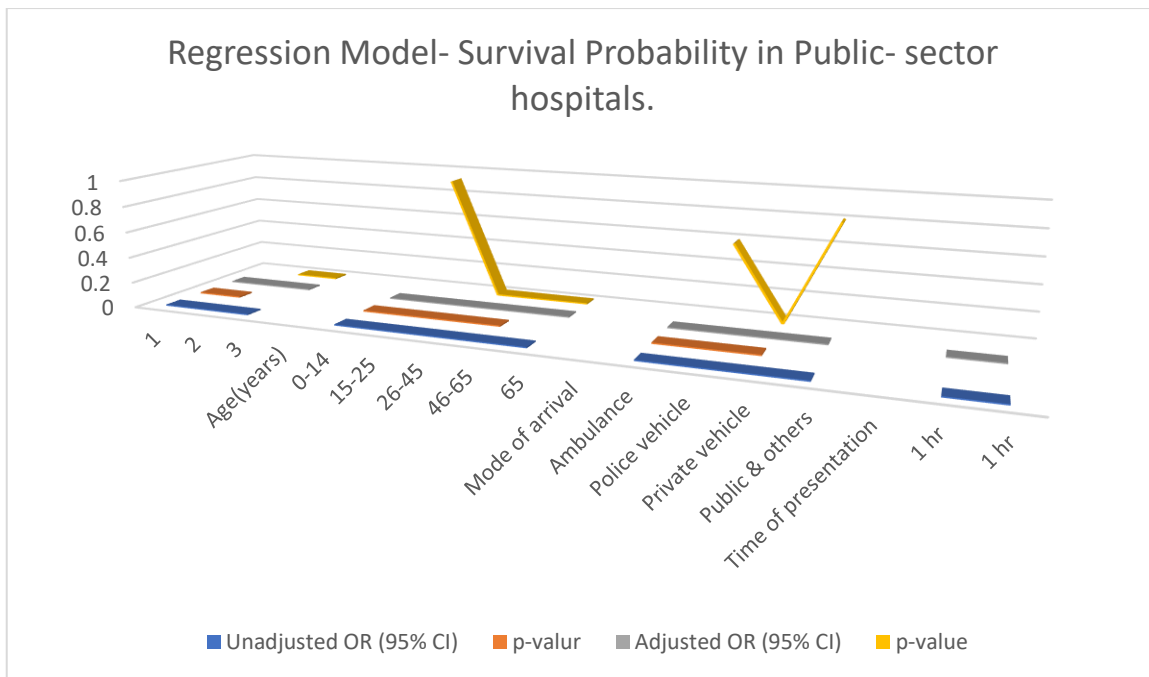


Table-3: Characteristics of patients who died in public sector hospitals with probability of survival (Trauma Injury Severity score)>50%

Distribution among public sector hospitals	Centre 1			Centre 2		Centre 3	
	N	N	%	N	%	N	%
	457	352	77%	53	11.60%	52	11.30%
<b>Age (in Years)</b>							
1-15	42	35	9.9%	1	1.9%	6	11.5%
16-45	289	218	61.9%	32	60.3%	39	75.0%
>45	126	99	28.1%	20	37.7%	7	13.4%
<b>Head Injury</b>							
No	54	31	8.8%	11	20.8%	12	23.1%
Yes	403	321	91.2%	42	79.2%	40	76.9%
<b>Facial Injury</b>							
No	201	142	40.3%	30	56.6%	29	55.8%
Yes	256	210	59.7%	23	43.4%	23	44.2%
<b>Chest Injury</b>							
No	421	328	93.2%	46	86.8%	47	90.4%
Yes	36	24	6.8%	7	13.2%	5	9.6%
<b>Abdominal Injury</b>							
No	427	331	94.0%	51	96.2%	45	86.5%
Yes	30	21	6.0%	2	3.8%	7	13.5%
<b>Extremity/Pelvic Injury</b>							
No	255	200	56.8%	21	39.6%	34	65.4%
Yes	202	152	43.2%	32	60.4%	18	34.6%
<b>External Injury</b>							
No	174	114	32.4%	32	60.4%	28	53.8%
Yes	283	238	67.6%	21	39.6%	24	46.2%

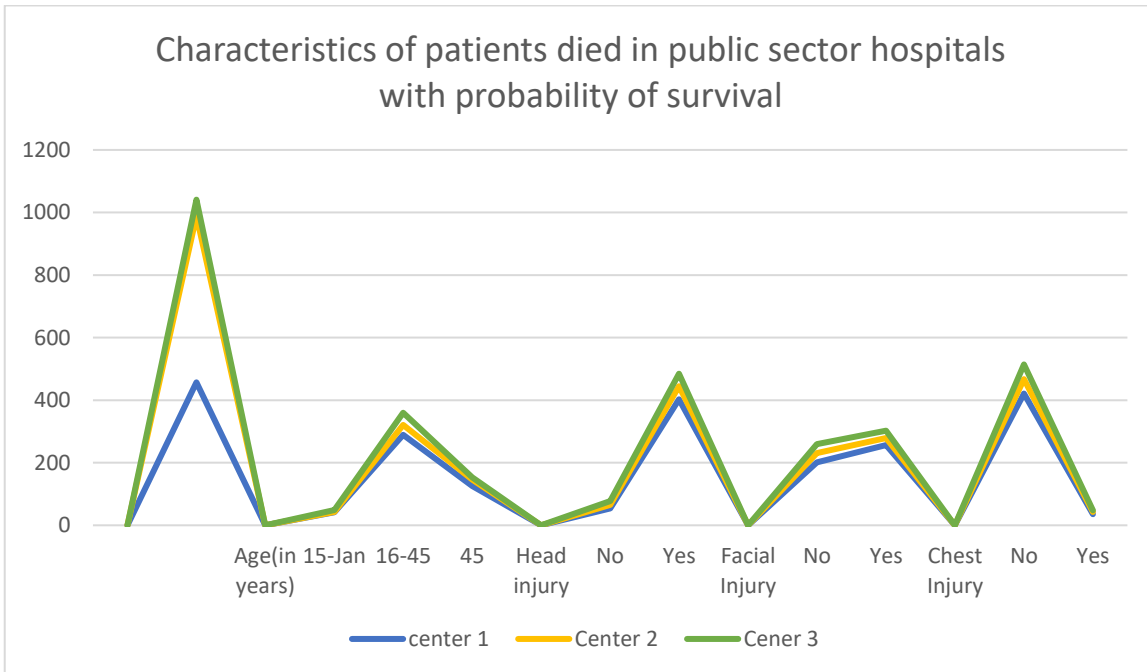
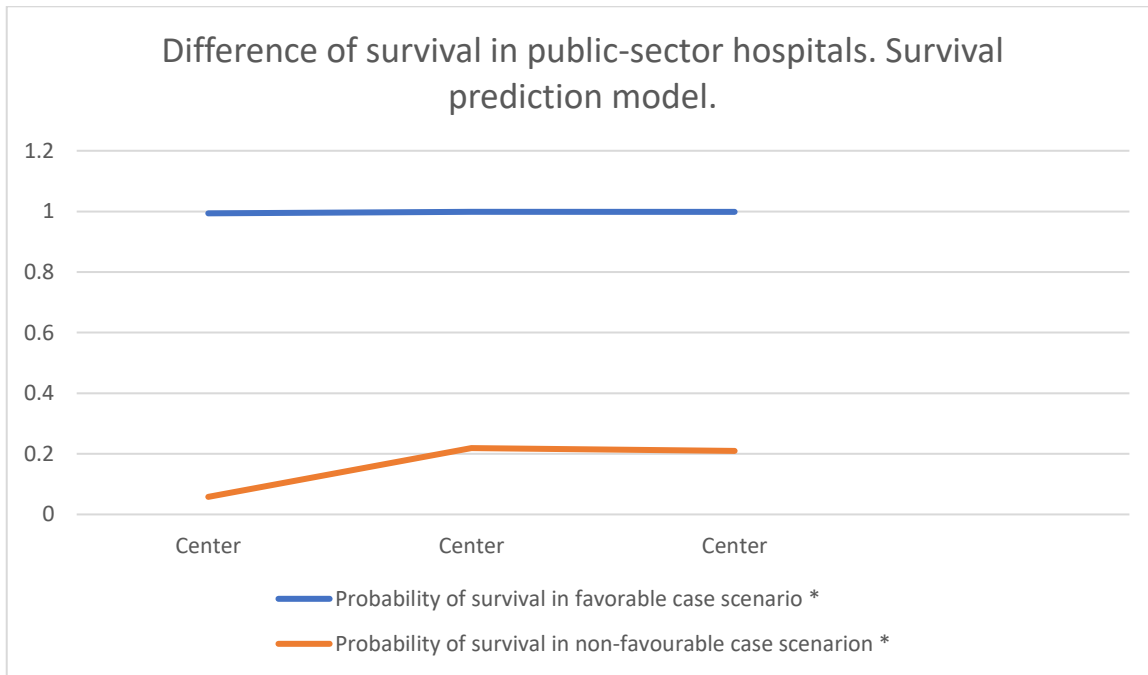


Table-4: Difference of survival in public-sector hospitals. Survival prediction model.

Centre	Probability of survival in favorable case scenario *	Probability of survival in non-favorable case scenario *
Centre	0.9936	0.058
Centre	0.9986	0.219
Centre	0.9985	0.21



### DISCUSSION:

Through utilizing the model of survival prediction, it was observed that a victim of age group 15-25 years, having RTS greater than 7 and ISS less than 15, arrived at hospital in 1 hour of accident using a taxi (Case 1) has greater chances of survival than victim of age greater than 65 years, having RTS <4 and ISS >25, reached at hospital by police in 1 hour after accident (Case 2) (Table-4). This perception was found to be same in case of head injuries. In comparison of this model to 3 public health care centers, the results obtained highlighted that survival of young victims having less injuries was equal among all, having possibility of survival greater than 99%. In Case 2, the chances of survival found to be less in hospital with more patients. The expected rate of survival was 5%, 22%, and 21% for 1st, 2nd, 3rd Centers.

IN spite of the division of trauma care centers into various regions, improved quality in health care centers gave better results of trauma in HICs. [5,12,13] The absence of proper information minimizes the judgement trauma care in countries having greater injury load. [10,14,15] This survey of

3-year duration represents the primary RTI result of urban area health center in under developed country.

In Pakistan, healthcare is not expensive and a huge amount of RTI patients (>93,000) receive medication in public health care centers, while 43% were found at public tertiary health care station (Center 1). The discussion represents that the load of RT is representing tertiary health care centers to the maximum and also highlights the drawbacks. According to researchers, trauma care based on facility act as one of the essential causes of survival. [5,6,16] This survey showed that health care centers are the essential factors for survival after regulating time duration after accident, age, injury type and extent of severity and type of vehicle used to bring victims in the hospital. By evaluating the possibility of survival, it was observed that results are poor for hospitals having huge number of patients (Table-2). This variation is highlighted in victims having minimum possibility of existence (Table-4).

This data lack proper trauma care procedures for further analysis. Survey of HICs recommend that differences exists in method of care and results of



minor injuries among health care centers which might be the outcome of variation from standard of care and unnecessary errors. [8,17,18] Various factors were thought to play a part in variations among results of subjects for study representing various contributing centers. The greatest death rate due to severe injuries was found in center having huge number of patients. These centers of trauma play a vital part in its description and certification, improvement in survival among victims suffering from severe injuries. This survey showed that heavy load of patients in hospitals effect their ability to perform successfully. This difference was observed prior to survey that better results were obtained from centers having normal number of patients whereas death rate was greater in centers having maximum or very less number of victims. [18,19]

The survival rate was found to be minimum in victims having head injuries (Table-3). This factor was considered as the leading cause of deaths. [20] This survey showed that maximum number of victims having head and facial injuries were found at Center 1, as it acts as the main section for cure of neuro-spinal trauma. This center acts on the "non-rejection" criteria and has to admit all the victims that suffered from major injuries which in turn leads to increased load of victims there. [21] This situation creates an environment of favoritism among victims leading to bad results. This situation highlighted that good survival results can be obtained with reasonable number of victims in the hospitals. [22]

The survival model form two perceptions, that clearly highlighted the variations between public health care centers, particularly for victims having uncomplimentary risk factors. The main cause for deprived survival at health center could be diverse, but time duration to reach hospital, inappropriate first aid facilities, lack of expertise doctors and improper supervision are considered the primary factors for lower survival results of victims. [20,23] Few studies suggested the application of in-hose treatments for better care of the victims, regulating efficient work of the housing medical staff reducing intervals for critical risk stages. But this suggestion still needs attention to be applied properly. [24]

The variation among health centers should be observed under the light of greater cases, huge number of ISS score, and major head injuries. This suggests the results among hospitals rely upon health care facilities, severity of injuries in patients. The severity of injury and the area of body affected should coordinate with the health care resources available at

the hospital. There are a huge number of policy suggestions for our survey concerning this history. Distribution of appropriate care facilities among hospitals and hiring well experienced staff are the most important factors for successful survival of patients in the hospital which must be complemented by progress of the health care systems. Application of cohesive systems for trauma is much efficient than improving the skills of workers. [25]

A repeated series of assessment with steady calculation to determine worth of trauma care executed with effective trauma care is necessary. More emphasis is required for detailed evaluation of quality displays, as the record of trauma care gives good evaluation of the quality. Observatory data was utilized due to restriction issues that does not contain quality parameters concerning quality. This survey does not represent the data for those victims who left the Emergency Department.

### CONCLUSION:

Notable variation is found in survival of victims faced road accidents that were arrived at three main public health centers of Lahore. These variations highlight the procedure of cure and treatment, moreover, the trauma center due to huge number of patients might become less effective in representing the survivors. The survival rate can have enhanced by improving health care facilities and effective approach of RTI in main hospitals. Incorporating the factors of trauma care instead of emphasis on care facilities gave better results in weak health care systems.

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