

# Spatial Framework for the Assessment of Road Traffic Accidents in Karachi

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**Abstract:** Karachi, the most populous city of Pakistan, is entangled by an ever increasing health problem of Road Traffic Accidents (RTAs) in the recent past with ranked 4<sup>th</sup> in the world stats of highest road fatalities cities. The most devastating problem is that it is affecting the most productive age group. Nearly 300 RTA victims were interviewed last year and questioned about different socio-economic aspects of road crashes. This has demonstrated that the RTAs cases were observed between the age group of 18-45 years in Karachi. The problem is not only resulting financial losses but also social burden as well as pain, grief, psychological trauma in many cases and suffering for the effects which is certainly an irreparable damage. The prime objective of this study is to highlight the spatial variation most affected age group under threat of road traffic accidents in Karachi. This has been achieved by using a stratified random sampling technique and targeting the effects of RTA. Information was collected and analyzed and spatial pattern of RTAs in terms of accident location has been displayed with high and low RTA cases caused injuries and fatalities. Town based Road Accidents maps were developed in ArcGIS 10.1 to show the spatial patterns of road accidents. This study approaches with emphasis the miserable outcome of road accidents on the specific age grouped people because they are mostly involved in road crashes and also the future prospect of the country.

**Keywords:** GIS, RTAs (Road Traffic Accidents), productive age group, RTA victims, dilemma, spatial pattern.

## INTRODUCTION

Road traffic accidents are a serious health problem for people all across the globe. The problem is affecting the global economy in general and low-income and middle income countries in particular. Because more than 90% of the world's fatalities due to road crashes occur in these countries, containing 48% of the world's vehicles. Moreover, Road Traffic Injuries are the first and second leading cause of death in the age group of 15-19 years and 20-24 years respectively. Considering these worrisome facts about Road Traffic Accidents provoke the authors to study the local scenario of Road Crashes.

## STUDY OBJECTIVES

The core objective of the study is to identify the victims of RTA who are the people of the most productive age group of the society in Karachi. In addition, the mapping of the spatial distribution of high and low RTA incident spots is documented. Moreover, it is also aimed to highlight the seriousness of this problem by showing the possible outcomes over the affected families that would be a matter of real concern for authorities to take into consideration the precautionary measure especially for the young people who are a real asset for the country.

Some of the possible consequences of the people involved in RTA, belong to productive age groups are loss of labor to different economic sectors, loss of helping hands (family supporters) to bread earner of the family, loss of future assists of the country, loss of breadwinner of families, triggering child labor, shattering the lives of dependants (psychological trauma), increase social disparities, triggering of many social evils in the society (e.g., Crimes, beggars, prostitutes etc), deficiency to male counterpart for marriage, over burden to family in case of disability, increase in the number of dependants, intangible Pain Grief and Suffering in form of loss of permanent disability of young person.

## METHODOLOGY

Following steps were taken to reach the outcome of the study:

## LITERATURE REVIEW

RTAs are one of the most consistent and frequently studies in engineering and medicine publications. However, the focus of spatial sciences towards studies of RTAs is very recent [1].

Road Traffic Accidents are the 9<sup>th</sup> leading cause of death in the world in general and 8<sup>th</sup> leading cause of death amongst age under 25 in particular, harming most intensely younger age people and is the 1<sup>st</sup> leading cause of death among the age group of 15-19 and is the 2<sup>nd</sup> leading cause of death amongst the age group of 10-14 and 20-24 years [2]. This dilemma is not

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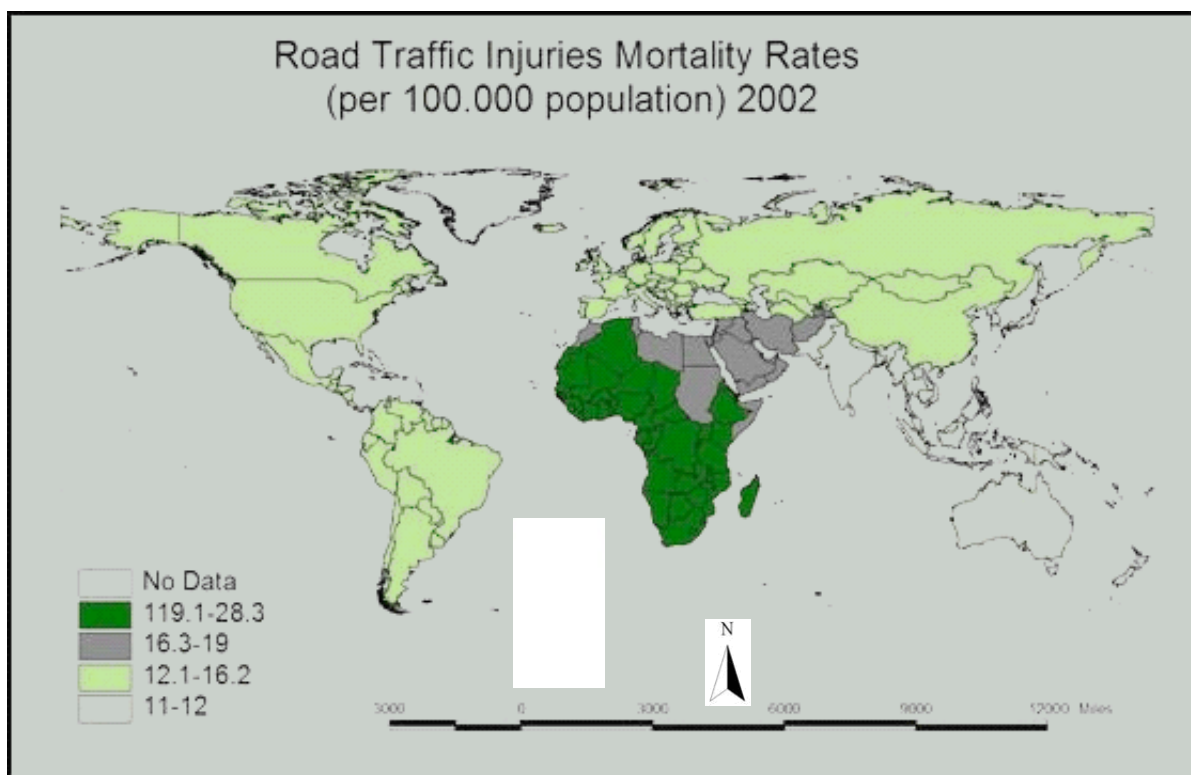


Figure 1: World, Road Traffic Injuries Mortality Rates (per 100,000 population) 2002.

Table 1: Change in Rank for the 10 Leading Causes of the Global Burden of Diseases

1990	2020
1. Lower Respiratory infections	1. Ischaemic heart disease
2. Diarrhoeal diseases	2. Unipolar major depression
3. Conditions during Perinatal period	3. Road Traffic Injuries
4. Unipolar major depression	4. Cerebrovascular disease
5. Ischaemic heart disease	5. Chronic obstructive pulmonary disease
6. Cerebrovascular disease	6. Lower respiratory infections
7. Tuberculosis	7. Tuberculosis
8. Measles	8. War
9. Road Traffic Injuries	9. Diarrhoeal diseases
10. Congenital abnormalities	10. HIV

Source: Peden (2004).

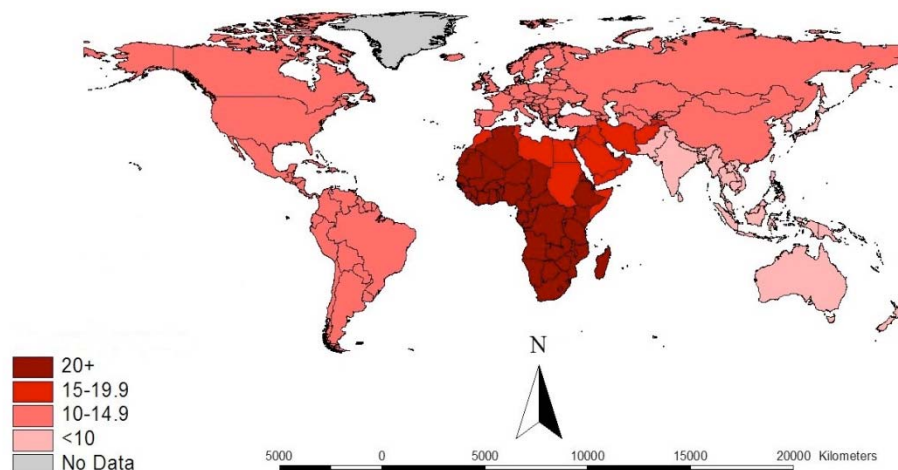
only adversely affecting the world presently but will hurt the world in the future with more disastrous impact as prognosticated by Peden (2004) that this cause of death would become the 3rd leading cause of death by 2020 if not controlled.

The problem of road Traffic accidents is subjected to a serious threat to middle income and low income countries [2] account more than 90% global road fatalities in these parts of the world [3]. Denting further, teenagers are considered as the most vulnerable to

road accidents because of more exuberance and developmental immaturity made them more vulnerable to road crashes [2].

It must be kept in mind that in a decade youth and children are the drivers or riders not only of the vehicle but also of the economy [4]. Globally nearly 30% of all the fatal and injury cases belong to less than 25 years age children [5]. Almost three-quarter of the road accidents take place among the most productive age group of the people [3]. Children and elderly people are

## Death Due to RTA per 100,000, age Under 25 Year, 2002



**Figure 2:** Death due to RTA per 100,000 age under 25 Years, 2002.

Source; After WHO (2004).

considered as the most vulnerable due to the inexperience behavior of children and declining task capability of elderly people [6]. Only in European region nearly 32000 people younger than 25 years died every year [5]. moreover road traffic accident is the leading cause of death between the age group of 20-24 years people in the EU region. It is also noticed that young age people found it convenient to have a motorcycle as their vehicle because of the fact that it is easy and inexpensive to use making them more vulnerable to road accidents. The young age propel these people to take more risk to increase the chances of road accidents. Road accidents Injury peak incidence were observed between the age of 17-19 in motorcycle riding [7].

In most of the Asian countries high proportion of fatal accident cases and injury accident cases were observed in young age [8].

In Pakistan, in last 15 years road traffic accidents cases has increased to epidemic proportion [9] and also harming the most productive age group. In Pakistan more than half of the vulnerable road users belong to the age group of 15-44 years [10].

Karachi is the second most populous city in the world [11] and is the fourth leading road accident receiving city in the world [12], making it a worrisome place to live. In the city most of the commuter belongs to most productive age group and also involved in road

traffic accidents to a higher extent. This problem requires serious attention and needs immediate action to be controlled. It is also required to be addressed at various platforms especially to youth so the loss as well as its off-putting impacts can be curtailed.

### Study Area

Aerial extent of the city is more towards north than other three sides due to the topographical limitation. In its south Arabian Sea restricts the expansion and from other two sides hilly terrain limits its expansion. The city grew tremendously in term of population as well as aerial due to its versatile feature. Karachi was divided into 18 Towns and 178 UCs (Union Councils) administrative divisions between 2000 till 2011[13]. On 11<sup>th</sup> July 2011 Sindh Government has restored the division system in Karachi according to which the city is divided to five divisions namely Karachi Central, Karachi East, Karachi South, Karachi West and Malir. Moreover substantial proportion of the city comes under cantonment administered by Armed forces [14].

### Economy of the City

The city maneuvers 95% of country's foreign trade and engaged 40% of total national employment in large scale manufacturing sector. In term of jobs share the city holds the highest proportion of employment of the province with 71.6% of labor force is employed only in large scale industrial sector [15].

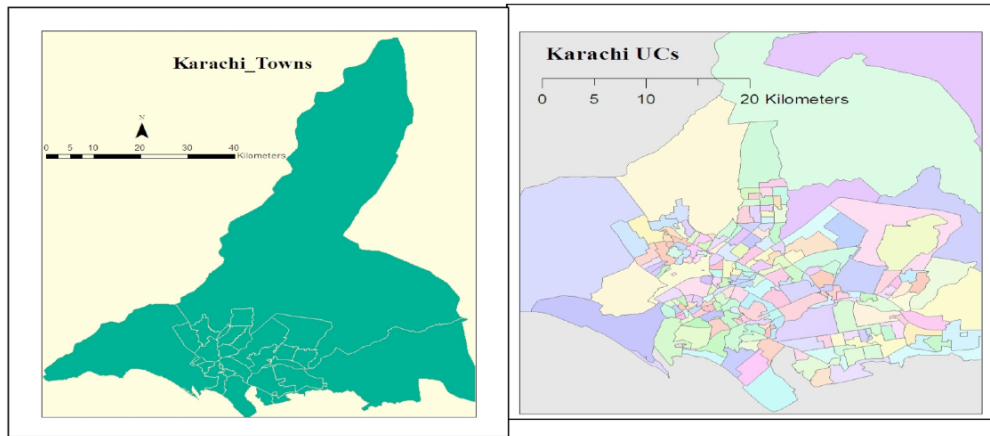


Figure 3: Study Area, Karachi.

**Transportation of the City**

The city is having total road length of nearly 9500 Km which accommodates nearly 1.81 million vehicles [15]. The increasing number of vehicles with not much road side accessories increasing the number of road accidents in Karachi. Road conditions of the city were extremely awful till 2000 after the devolution of the new local government the landscape of the city has changed appreciably with the rapid development and widening of roads, construction of flyover underpasses, signal free corridors, road side accessories etc has improved the flow of road traffic along with road accidents has increased to alarming rate. According to yearly records collected by RTIPC in 2009 total number of Road injuries occurred in Karachi were 31051 and road accidents were 25813 [16] and in the next year of 2010 the number of Road Injuries were raised to 31567 and Road accidents were 26315 [17].

**Incidents of RTA Karachi-Towns**

According to the accident data published by RTIPC in 2011 [18], Shah Faisal Town conceived minimum

number of road traffic accidents including injury cases and fatal cases. This could be due to the fact that the town contains minimum area of 11.76 Km<sup>2</sup> with total population only 335,823 (1998 census) [17] and total number of road accidents injuries were reported 374 (RTIPC-2011) and fatal cases were only 5 [18] in number. Road density of the town is also very less 0.125519/Km. This town does not meet any major artery of the city and the commercial structure of the town is not as dense as some of the other towns having shops of grocery mostly that could be the reason of meager incidents of injury and fatality cases another possible reason is Shah Faisal Town is away from city center and most of the RTA victims that are not taken to any of the Five RTI centers which are located to some distance and nearby hospital of Malir are preferred by the people taken to the victims immediately there. Maximum number of Injury cases were reported from Saddar town 3731 (RTIPC-2011) having total area 20.4391 Km<sup>2</sup> with a total population 616,151 [15] and road density 0.5701747/Km. The town is enriched with multidisciplinary commercial activities as well as a pivotal point of road traffic of the

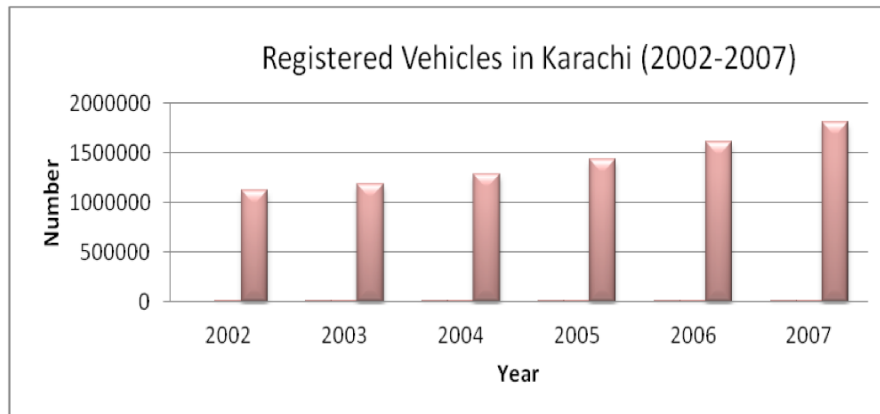
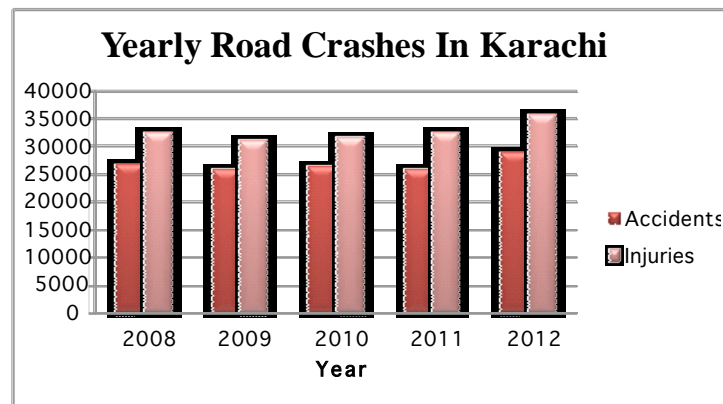


Figure 4: Number of Vehicles registered (2002-2007).



**Figure 5:** Karachi Road Network.



**Figure 6:** Yearly Road Crashes In Karachi.

city. Thousands of commuters come to this town on a daily basis. Since the town has head offices of many commercial units.

Including industries and bank moreover the Karachi stock exchange, one of the largest stock exchanges of Asia is found here. Saddar town has major roads including M.A Jinnah Road as well as Shahr-e-Faisal that causes serious inflow of traffic resulting maximum number of injury cases especially traffic condition become worse in rush hours. Highest number of Fatal cases have been reported from Korangi Town 121 [9] with total area 41.156 Km<sup>2</sup> with a total population 546,504 (1998 census) [19] having road density 0.1509787 /Km. Korangi town is another important place for commercial activities having many industries. This Town is an important industrial place of the city well known as K.I.T.E (Korangi Industrial Trading Estate), The town is a hub of many simple and complex industries. Pakistan Steel mills that hold thousands of employees. Other than this number of other industries

attract thousands of commuters on a diurnal basis. Fast and wide roads with heterogeneous traffic resulted in maximum number of fatal road accidents in the town. Making its most vulnerable especially for the industrial worker of the productive age group.

#### Data Collection

Collection of first hand information was made between the months of January till June 2012. For this purpose 300 questionnaires were filled using stratified random sampling technique, focusing only affected people of Road Traffic Accidents either admitted or follow up cases at various government and private hospitals of Karachi then the collected data were manipulated according to the desired objectives. The questionnaire included some personal information as well as other related socio economic and spatial information about road accident that were further plotted and manipulated according to the need of the study. Questionnaires were filled from different



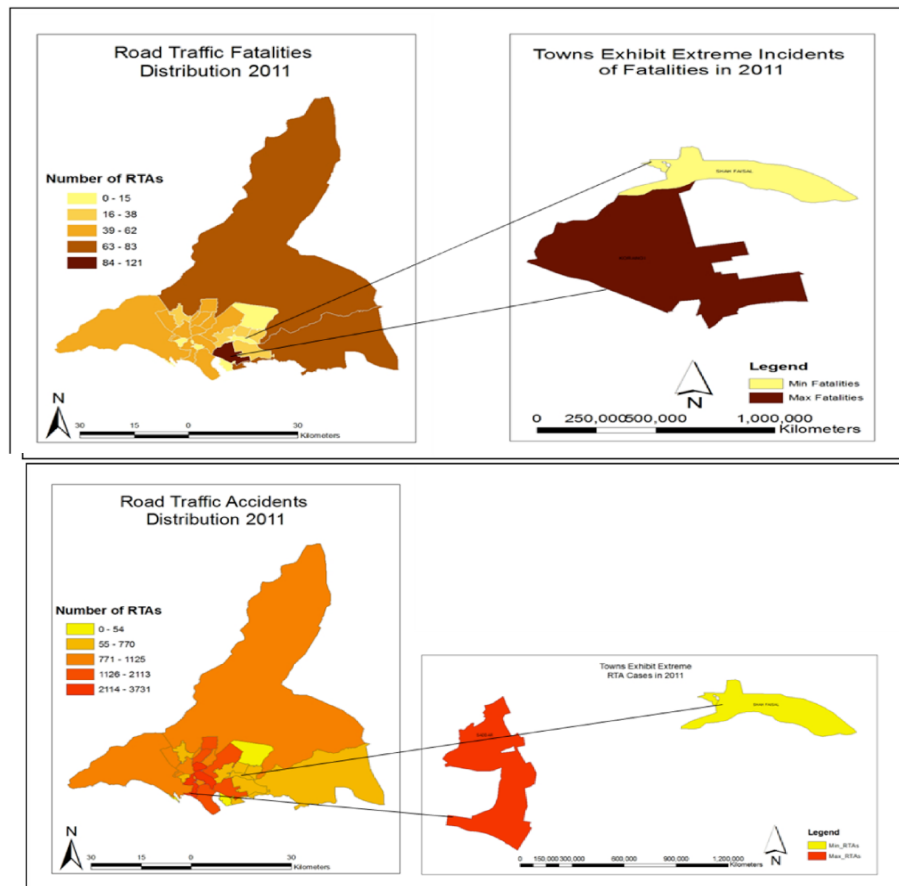


Figure 7: Town wise Incidents of Road Crashes.

hospital/clinics and also from the people of personal contacts. It was observed that most of the Accident victims were young and bike riders some of the old age people were either pillion rider or travelling in any public or private vehicle.

**Measures**

For this particular study variable information was gathered especially to the road accident victims. The information collected includes personal information that included, age, sex, profession, monthly income, clinic/hospital from the victim being taken immediately or treated afterward, status at the time of the accident, the number of road accidents faced by the victim, immediate as well as after accidents affect in case of follow up and the type of injury. Most of the people responded positively and showed interest while answering, realizing the seriousness of road accidents and its impact. Socio-economic as well as location information related to road accident were also collected. The victims were also asked about the time they spent away from work and the time taken for recovery from injury.

**Analysis**

Respondent were asked about accident related information from various places including government and private hospitals/clinics. They were also belonged to various age groups. Road users were also of variable types. The place where they met the road accidents were variable.

**RESULTS**

**Socioeconomic Analysis**

A total of three hundred respondents was questioned from January 2012 till June 2012. Out of a total of 300 respondents 295 were male and only 5 were female. The most concerning aspect that the author needed to highlight was the involvement of age groups. The most productive age groups were the most vulnerable in term of road traffic accidents. More importantly higher proportion of road accident victims were doing the job, belong to middle income and lower middle income group of the society. Their injury not only caused burden over the family but also resulted to burdensome for the victim afterward many of them

found it very difficult to get back to the work or to find a new job in case of severe long term injury.

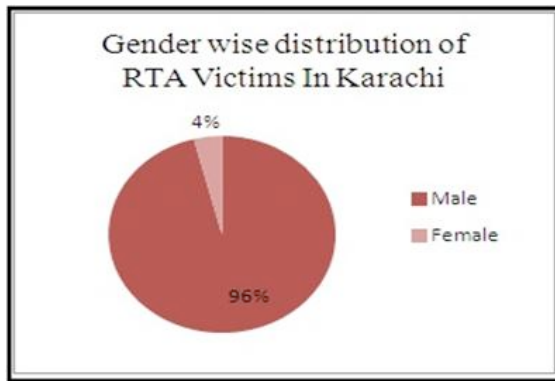


Figure 8: Male female proportion of RTA victims.

Gender wise distribution clearly depicts that proportion of male involvement in road traffic accidents are high in number due to many reasons. One reason is that the society is male dominant that is why most of the working people are men and women choose to work as a house wife. The second reason is that the most of the workers in factories as well as other middle and lower middle income sector hire young male members to work efficiently. The third reason is privately owned vehicle especially motorcycle which is one of the most commonly used vehicles in the city are owned by male youth whereas cultural norms do not allow female to use this easy and flexible vehicle for commuting.

Highest number of RTA cases are found between the age group of 20-35 years. This is the most vulnerable age group and also the most risk taking group. The graph showed a declining trend with the increase of age may be due to the more maturity in attitude. Most of the victims belong to middle income group or lower income group. The collected values depicts that nearly 32% of the effecties of RTAs had

monthly average income between 10 thousand PKR to 30 thousand PKR and nearly the same proportion of people earn less than 10 thousand per month involved in road traffic accidents. This portrays the importance of the young age group of the society and their vulnerable impacts not only to themselves but also to their families and also to the society.

**GIS Analysis**

Choropleth map made by using ARC GIS 10.1 depicts the highest values of fatalities as well as injuries in economically high productive areas of the city. These high accident receiving places is also near the city center endorsing the influence of economically most productive age group of the society.

**DISCUSSION**

The study gives quantitative estimates of most vulnerable age group involved in Road Crashes in Karachi. Unfortunately, high proportion of people involved in Road Traffic Accidents belong to young age group of around 20 to 35 years and are considered as supporting pillar for the families.

**Suggestion and Recommendations**

It is suggested that the concern authorities should implement the laws for every citizen on equity basis because it has been observed that most of the road accidents happen due to the voilation of traffic rules. Road infrastucture should be designed to accommodate motobikes and public transport because mass proportion of people in Karachi commute through public transport. It is recommended that more resources should be employed for the research of Road Traffic Accident. Data collection and data sharing among different organization should be made possible.

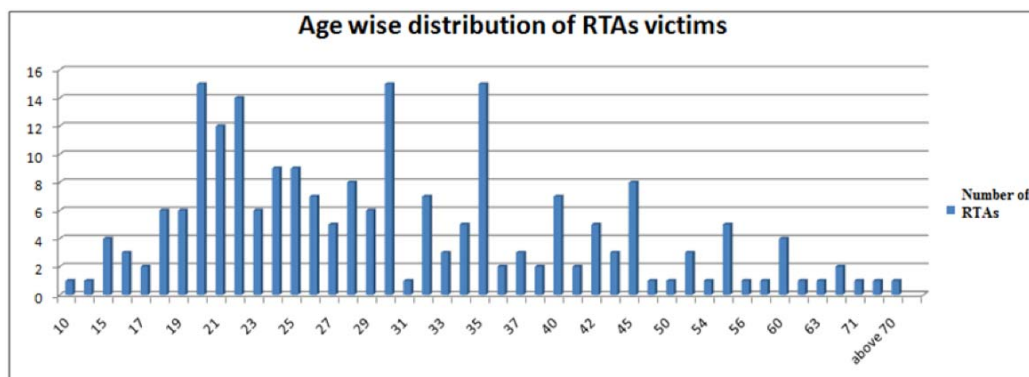


Figure 9: Age wise distribution of RTA Victims.

## Limitations

Generally, RTA data in Pakistan are not well maintained and quite difficult to obtain. Nevertheless, in Karachi, Yearly Road Accident data as well as road traffic injury data are well maintained by the RTIPC center developed at Jinnah Post Graduate Medical Center. No other reliable source is available in the city to monitor the accident cases. Police reporting is very poor in the city and people usually avoid police documentation process. Moreover, primary data collection at times difficult in the city and people seem reluctant to share their information especially personal and socio-economic information. Political conditions of the city become worse at times so values of road accidents were taken from the annual published report of RTIPC 2011 and also data collected from field by the authors.

## CONCLUSION

A Road Traffic Accident event is turning out to be a disaster for the society denting thousands of people lives. Moreover, the ever increasing trend of road crashes not only making a negative impact on the life of individuals but also hurting the dependants and the loved once as after effects. The spatial presentation of RTAs data in the form of maps is quite helpful in the analysis of accidents. It has been revealed from the study, the youthful age groups of people are most vulnerable to road crashes causing economic losses, loss labor output and more importantly intangible loss in term of pain grief and suffering for the related once. The most concerning part of this study is that the highest proportion of age group involved in RTA is the one that is most productive in term of economy and otherwise shaping the society into more vulnerable condition. Infrastructure as well as transportation policies needs to be designed more public friendly rather than vehicle friendly to minimize the impact of this trauma.

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