Sindh Univ. Res. Jour. (Sci. Ser.) Vol.51 (2) 271- 274 (2019)
http://doi.org/10.26692/sujo/2019.6.44
SINDH UNIVERSITY RESEARCH JOURNAL (SCIENCE SERIES)

Effected Road Traffic Deaths over rising Vehicle Growth a Linear relation: A Case of KPK, Pakistan

S. SHAIKH[++], F. BAIG, S. KALWAR*

School of Transportation and Logistics, Dalian University of Technology, China

Received 5th January 2018 and Revised 19th March 2019

Abstract: Road safety accompanying the growing numbers of Road Traffic Deaths (RTDs), is an alarming issue of the present century which is also recognized in WHO agenda-2030. All countries across the globe are facing this issue, but it pertains in developing world where rapid motorization results into high mortality rates. This study considered Pakistan, a developing country from Global south to discuss the issue of RTDs and its relationship with rapid vehicle growth. The objective of the study is to highlight the present situation of road safety especially RTDs and develop models to identify the possible impacts of vehicle growth on RTDs. Linear Regression was performed to develop three models to explain RTDs vs registered vehicle, registered motor cars and registered motorcycles respectively. Descriptive statistics shows the increasing trend of all selected variables which further explained by liner regression equation. Results indicates that annual proportional change in RTDs explain by total registered vehicles, motor cars and motorcycles are 84%, 66% and 80% respectively and comparatively motor cars, motorcycles contributing more arise of RTDs. Study highlights the need of attention towards RTDs and provide models to predict increasing RTDs with vehicle growth. Study is significant as it highlights present situation of the road safety and guide the transportation planners in preparing prevention measures by considering vehicle growth impacts.

Keywords: Road safety, R-programming, Linear regression, Vehicle growth

1. INTRODUCTION

Road traffic deaths (RTDs) is an alarming health hazard, reaching 1.35 million deaths in 2016 around the world (World Health Organization, 2018). Whereas, approximately 90% of road traffic injuries occurred in low and middle-income countries making them a largest host of RTDs (Hung *et al.,* 2018). Rapid increases in motorization usage despite slow implementation of traffic safety laws might be the possible reason for lower middle-income countries, having such a large proportion of RTDs (Gupta *et al.,* 2018). Earlier literature evidenced the direct link among RTDs, vehicle growth and economic growth which is more dominant in third world countries (Ma *et al.,* 2015). Xie et al. discuss the motorization and its consequences on road traffic crashes and examine their links in a rapidly urbanizing cites in china (Xie*et al.,* 2016). Shenzhen. Barsi, Faergemann, and Larsen observe the relation between road traffic accidents and two wheeled motor vehicles and find increase in the annual incidence rate of injuries following road traffic accidents with two-wheeler motorcycles (Barsi, *et al.,* 2002). Likely, Pakistan is also facing the severe road traffic deaths, fatalities in Pakistan are 14.2 per 100,000 people, and ranked as 4th among countries included in "Eastern Mediterranean Region" where the road accidents cause highest deaths (world health Organization, 2017). A considerable amount of literature considering RTDs and Road Traffic Injuries can be found on Punjab and Sindh provinces of Pakistan (Batool, Hussain, Kanwal, and Abid, 2018; Tahir *et al.,* 2012), but negligible consideration is given on Khyber Pakhtunkhwa (KPK). Such issue leads to develop interest in studying and analyzing RTDs over time period in context of KPK, Pakistan. Considering World Health Organization agenda 2030 focus on road safety (World Health Organization, 2018), this study is significantly a step forward, which aims to drive a relation between RTDs and vehicle growth. This study generates the models to identify the impact of vehicle growth, number of private cars growth and motorcycle growth on RTDs. In this way, this study will help policy makers and planners to get an idea of present situation and predictions of growing loss of lives due to vehicle growth. Study helps transportation planners and other transportation related agencies to adapt the vehicle growth control strategy together with investment on road infrastructure in order to reduce the increasing mortality by road accidents

2. MATERIAL AND METHODS

This study, in a broad sense, undertakes an analysis of road traffic deaths on vehicle growth in KPK, province of Pakistan. According to national census report 2017, KPK has the inhabitants of 30,523,371 persons with an average annual growth rate of 2.89 (Pakistan Bureau of Statistics, 2017). Geographical location of KPK can be seen in **(Fig. 1).**

Despite of not having large portion of population of Pakistan, KPK shows second highest fatality rate per

[++]Corresponding Author: Email: sajanshaikh@mail.dlut.edu.cn & farrukhbaig0304@gmail.com
*Department of City and Regional Planning Mehran University of Engineering and Technology Jamshoro Sindh Pakistan

100,000 population after the Islamabad, capital of Pakistan which is at the highest in fatality rate per 100,000 population (Ministry of Communications Pakistan, 2018).

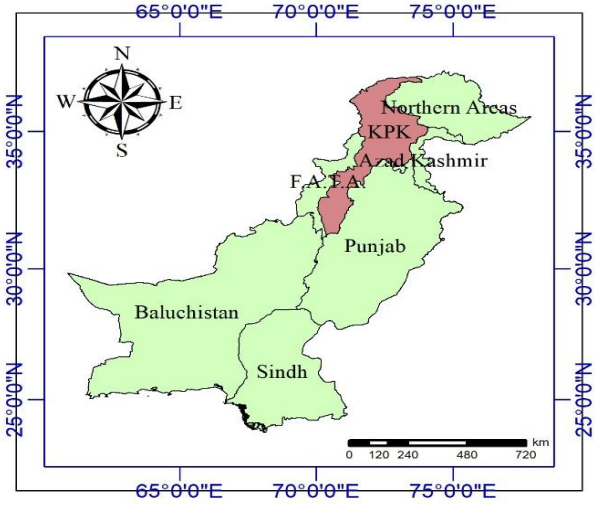

Fig.1. location map of KPK

This fact brings the attention of authors to examine the Road fatalities together with rapid vehicle growth with an aim of finding vehicle growth impact. RTDs and number of registered vehicles (Motor cars, Buses/minibuses, Trucks, motorcycles two-wheeler motorcycle rickshaw/motor rickshaw other three wheelers) were selected as variables for the preliminary analysis of the present research. To achieve the aim of study, year wise data of selected variables for the period of 18 years data (1999-2016) were collected from Pakistan statistical year books and reports on Development Statistics of KPK (Pakistan Bureau of Statistic, 2009; KPK Bureau of Statistic 2014; Pakistan Bureau of Statistics, 2016). R statistical package were utilized to develop several linear regression modelsbut only few which gives the significant results were discussed in this article. Models considering RTDs as depended variable and total registered vehicle, motor cars and moto cycle two-wheeler taken as independent variables were prepared respectively and general equation were derived to predict the impact of variables on road traffic deaths.

3. RESULTS AND DISCUSSION

Before using the extracted data for modeling, descriptive statistical measures were calculated by R statistical package and arranged in Table 1 in order to provide general perception regarding the available data. The average RTDs for 18 years is 1666 which rises from 1291 to 1382 deaths. The same time, 555947, 160788, 164105 are the averages for total registered vehicles, motorcycles and motor cars respectively which also have continuous increasing trend in past 18 years as shown in **(Table 1).**

Table 1. Descriptive statistical measures for traffic data

Statistics	Variables			
	Road Traffic Deaths	Total vehicle Registered	Motorcycle (two-wheeler)	Motor Cars
Min	1291	358777	77960	116082
1st Qu	1450	411539	81978	136500
Median	1612	489812	101231	160122
Mean	1666	555947	160788	164105
3rd Qu.	1778	626310	171934	191960
Max.	1382	1036163	512796	211023

By observing the minimum and maximum value of variable in **(Table 1),** It is clear that all variables have increasing trend. In order to develop relationship, linear regression analysis was performed by utilizing R studio version 1.1.463. Three models were created using RTDs as regress or variable, but the predictor variables were total registered vehicles, motor cars and motorcycles two-wheeler respectively. These three models were generated to explain overall relation between vehicles and their types. Motorcycles (two-wheeler) and motor cars are higher in number comparatively other types (Ahmed, 2007) so, study focus to explain which vehicle type (motor cars or motorcycle) more effects on RTDs. **(Table 2 to 4)** shows the results of linear models. The model-A has value of R2 is 0.84, this implies that proportion of variance in the RTDs explain by total registered vehicles is 84%. F-statistics was 83.9 that is high from model-B and model-C. Significant codes associated with estimates represents highly significant of p values in model-A as briefed in **(Table 2).** Hence it can be saying there exist a strong relation between RTDs and Registered vehicles.

Table 2. Summary of model-A

Multiple R-squar	P-value	F-statistic	Coefficients		
0.84	9.123e-08	83.9 on 1 and 16 DF	Estimate	Std. error	Pr (>|t|)
			9.613e+02	8.152e+01	2.65e-09 ***
			1.268e-03	1.384e-04	9.12e-08 ***
$RoadTrafficdeaths = 961.3 + 0.0012 * totalregisteredvehicles \ldots eq\ (i)$					

Significant Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' '

Table 3. Summary of model-B

Multiple R-squar	P-value	F-statistic	Coefficients		
0.66	4.187e-05	31.08 on 1 and 16 DF	Estimate	Std. error	Pr (>|t|)
			5.259e+02	2.083e+02	0.0225 *
			6.949e-03	1.246e-03	4.19e-05 ***
$RoadTrafficDeaths = 525.9 + 0.0069 * Motorcars \ldots eq(ii)$					

Significant Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 4. Summary of model-C

Multiple R-squar	P-value	F-statistic	Coefficients		
0.80	p-value: 3.713e-07	68.06 on 1 and 16 DF	Estimate	Std. error	Pr (>|t|)
			1.358e+03	4.753e+01	3.68e-15 ***
			1.915e-03	2.322e-04	3.71e-07 ***
$RoadTrafficDeaths = 1358.28 + 0.0019 * Motorcycles\ (two-wheeler) \ldots eq(iii)$					

Significant Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

The summary of table 3 explain a week relation between RTDs and Motor cars the R^2 for model-B is 0.66 this state that change in RTDs explained by Motor cars is 66%, less comparative to model-A and model-C. F-statistic was 31.08 and significant codes represents low significant of p-value unlike model-A and model-C.

Whiles the **(Table 4)** represents strong connection between RTDs and Motorcycles (two-wheeler). R2 for model-C is 0.80 it shows that percentage of RTDs explains by motorcycles comparatively motor cars is 80%. F-Statistic was also higher than model-B that is 68.06 and significant codes signifies higher p-value.

In general, the interpretation of the results in this this study showed an increasing number of RTDs with the increasing number of vehicle growths. The increasing number of mortalities contribute not only results in loss of human lives but also social and economic damages (Karpova and Julmukhamedova, 2017). Results also reveals motorcycles are highly associated (model-C) then motor cars (model-B). while literature suggest Motor cycle accidents lose an appraised 178 per 100,000 disability-adjusted life years, a rate has been ripening by nearly 10% since 1990 (Gupta *et al.,* 2018). Findings from other studies explain that motorcycles mostly effects on young generation (Chandran, *et al.,* 2012). In Pakistan the death ratios of riders on two-and three-wheeler vehicles and pedestrians are larger at 39% and 41% of deaths (Batool *et al.,* 2018). Navid Tahir in his research found that Motor cyclists were involved in 45% of crashes, with over-speeding (40%) found to be the major reason of road traffic accidents (Tahir *et al.,* 2012). By modeling vehicle growth (total number of vehicles, Cars, Motorcycles) with RTDs, this study helps in understanding the general situation of road safety

4. CONCLUSION

Road traffic deaths (RTDs) is an important issue which may comprise of various possible reasons but only vehicle growth is considered for this study. This limitation of study may overcome with future research by considering other factors that influence RTDs i.e., driver's carelessness, demographics, poor road infrastructure and lack of traffic management. Current study tried best in implying R-programming tool to do some linear regression modeling in order to explain the vehicle growth impact on RTDs. Study signifies the need of effective transportation policy which may control the rapid growth of registered vehicles in Asian countries as it is happening in developed world i.e., Singapore (Willoughby, 2001; Han, 2010). Meanwhile, models of this research can be used by transportation planners to predict RTDs which help in preparing some prevention measures and polices. Findings of this study shows the fastest growth of motorcycles in KPK results into the highest contributor of road accidents.

ACKNOWLEDGEMENT

Authors acknowledge the KPK Bureau of statistics for the availability of yearly statistics e-book on their website. Authors also thankful to Department of City and Regional Planning for their technical support.

REFERENCES:

Ahmed, A. (2007). Road safety in pakistan.National Road Safety Secretariat, Ministry of Communication of Pakistan. Retrieved from https://www.scribd.com/document/23962298/Pakistan-Road-Safety

Barsi, T., C. Faergemann, L. B. Larsen, (2002). Road traffic accidents with two-wheeled motor vehicles during a five-year period in Odense, Denmark. Traffic Injury Prevention, 3(4), 283–287 https://doi.org/10.1080/15389580214621

Batool, I. (2018) 'Identifying the factors behind fatal and non-fatal road crashes: a case study of Lahore, Pakistan', International Journal of Injury Control and Safety Promotion. Taylor & Francis, 25(4), 401–407. https://doi.org/10.1080/17457300.2018.1456466

Chandran, A., T. R. V. Sousa, Y. Guo, D. Bishai, F. Pechansky, (2012). Road Traffic Deaths in Brazil: Rising Trends in Pedestrian and Motorcycle Occupant Deaths. Traffic Injury Prevention, 13(SUPPL. 1),11–16. https://doi.org/10.1080/15389588.2011.633289

Gupta, S., K. Klaric, N. Sam, V. Din, T. Juschkewitz, V. Iv, K. B. Park, (2018). Impact of helmet use on traumatic brain injury from road traffic accidents in Cambodia. Traffic Injury Prevention, 19(1), 66–70. https://doi.org/10.1080/15389588.2017.1342821

Han, S. S. (2010). Managing motorization in sustainable transport planning: the Singapore experience. Journal of Transport Geography, 18(2), 314–321. https://doi.org/10.1016/j.jtrangeo.2009.06.010

Hung, Y., Y. J. Bababekov, S. M. Stapleton, S. Mukhopadhyay, S. Huang, M. Briggs, D. C. Chang, (2018). Science Direct Society of Asian Academic Surgeons Reducing road traffic deaths : where should we focus global health initiatives ? Journal of Surgical Research, 229, 337–344. https://doi.org/10.1016/j.jss.2018.04.036

Karpova, G., G. Julmukhamedova, (2017). Models for Estimating Human Capital Losses due to Traffic-Related Deaths. Transportation Research Procedia, 20(September 2016), 267–271. https://doi.org/10.1016/j.trpro.2017.01.016

KPK Bureau of Statistics (2014) Development Statistics of Khyber Pakhtunkhwa 2014. Retrieved from http://www.kpbos.gov.pk/public/uploads/publications/2014.pdf

Ma, H. W., J.Q. Cheng, X. J. Liu, Y. S. Wu, (2015). Mortality from road traffic accidents in a rapidly urbanizing Chinese city: A 20-year analysis in Shenzhen, (1994–2013). Traffic Injury Prevention, 17(1), 39–43. https://doi.org/10.1080/15389588.2015.1035370

Ministry of Communications Pakistan. (2018). National Road Safety Strategy 2018-2030-A strategy to save more than 6,000 lives by 2030. Retrieved from http://www.roadsafetypakistan.pk/download/Pakistan-National-Road-Safety-Strategy-2018-2030.pdf

Pakistan Bureau of Statistics (2009) Pakistan Statistical Yearbook 2009. Retrieved February 12, 2019, fromhttp://www.pbs.gov.pk/content/pakistan-statistical-year-book-2009

Pakistan Bureau of Statistics (2016) Pakistan Statistical Yearbook 2016. Retrieved February 12, 2019, fromhttp://www.pbs.gov.pk/content/pakistan-statistical-year-book-2016.

Pakistan Bureau of Statistics. (2017). Population Census 2017.

Tahir, N., R. Naseer, S. M. Khan, G. Macassa, W. Hashmi, M. Durrani, (2012). Road traffic crashes managed by Rescue 1122 in Lahore, Pakistan. International Journal of Injury Control and Safety Promotion, 19(4), 347–350. https://doi.org/10.1080/17457300.2011.628755

Willoughby, C. (2001). Singapore's motorization policies 1960-2000. Transport Policy, 8(2), 125–139. https://doi.org/10.1016/S0967-070X(01)00003-8

World Health Organization. (2018). Global Status Report on Road Safety 2018.

World Health Organization (2017) World Health Statistics 2017. Retrieved February 12, 2019, from https://www.who.int/gho/publications/world_health_statistics/2017/en/.

World Health Organization (2018) The Global Health 50/50 Report 2018. Retrieved February 12, 2019, from https://globalhealth5050.org/report/.

Xie, S. H., Y. S. Wu. X. J. Liu, Y. Fu, Bin, S. S., Li, H. W. Ma, J. Q. Cheng, (2016). Mortality from road traffic accidents in a rapidly urbanizing Chinese city: A 20-year analysis in Shenzhen, 1994–2013. Traffic Injury Prevention, 17(1), 39–43. https://doi.org/10.1080/15389588.2015.103537