**Crash characteristics of underage adolescent drivers versus adolescents of legal driving age by using surveillance data from hospitals, Karachi, Pakistan**

Adolescents have the highest burden of road traffic deaths.[1] Underage adolescents’ drivers are involved in fatal crashes three times more often compared with adults.[2] There is a difference of 30 versus 5 crashes per million miles driven for adolescents and adult drivers respectively.[3] Adolescents are vulnerable to road traffic crashes due to limited experience of driving and their risky behaviours. The speeding, violation of safety rules, drink driving and use of cell phones are some of the common risky behaviours of adolescents’ drivers [4-6].

In most countries the minimum driving age is 18 years but some adolescents start to drive earlier than the legal age. A growing desire to be independent, experience adventure, and peer pressure are some reasons for underage driving.[7] Graduate driving license is a program to countermeasure the traffic hazards for young drivers by restricting their traffic exposure.[8] Such programs are successful in reducing fatal crashes in young drivers.[9-13]

Behaviours, consequences, demographic and socioeconomic factors for crashes by young drivers were studied in high- income countries (HICs). In HICs, the road built environment is safer, road traffic rules stricter and obtaining a driver’s license is linked to training of both driving and traffic rules.[5,14]

A whopping 90% of Road traffic injuries in adolescents is borne by low and lower-middle-income countries (LMICs).The road traffic system in most LMICs is very different with unsafe built environment, traffic rules that are not followed, obtaining license through bribes and lack of helmet and seat belt use. Our aim is to determine proportion of underage adolescent drivers of age 10 to 17 years and adolescent of legal driving age 18 and 19 years with injuries and deaths and to assess their demographic and crash characteristics in Karachi, Pakistan, a low-middle income country.

**Methods**

Design

The study is cross-sectional design during 2007-2014.

Setting

The study setting is Karachi, a large urban area of Pakistan (about 3,530 square kilometers), with an estimated population of 18 million and a total length of the road network of over 8,000 kilometers.

Injury data were extracted from an ongoing road traffic injury surveillance project based on emergency department (ED) from all of the three government trauma centers in the city, and the two private tertiary care hospitals. The detailed methods have been described previously.[15]

These hospitals receive nearly all major trauma cases from the city. The data collectors of the surveillance project gather demographic information on the injured patients and details of the crash by asking victims, their relatives, ambulance drivers or any eyewitnesses. The system was piloted in late 2006 and formally launched in 2007.

Ethical approval of study methods were approved from the Institutional Review Board of the Jinnah Post Graduate Medical Center, which is center of this road surveillance project.

Participants

Road traffic crash victims of age 10-19 years who are drivers of four wheelers and motorcycles visiting emergency departments of participating hospitals with injuries.

Outcome

Injury severity score and deaths

Exposure

Age groups 10-17 years and 18-19 years

Study variables

Gender, vehicle of driver injured, time and location of the crash, days of the week, type of vehicle involved in crash, helmet use and type of location (intersection or midblock).

Data analysis

We performed the analysis using R.[16] The categorical variables are described using frequencies and percentages (age, gender, injury patterns, vehicle type etc). Chi-square tests were used to assess crash characteristics associated with drivers of motorcycles versus other drivers. Logistic regression models to assess whether drivers of age 10-17 years or 18-19 years are likely to suffer severe injury (AIS ≥ 3) to a specific body region.

**References**

1. Li Q, Alonge O, Hyder AA. Children and road traffic injuries: can't the world do better? *Archives of disease in childhood.* 2016;101(11):1063-70.

2. Walshe EA, Ward McIntosh C, Romer D, Winston FK. Executive function capacities, negative driving behavior and crashes in young drivers. *International journal of environmental research and public health.* 2017;14(11):1314.

3. Banz BC, Fell JC, Vaca FE. Focus: Death: Complexities of Young Driver Injury and Fatal Motor Vehicle Crashes. *The Yale journal of biology and medicine.* 2019;92(4):725.

4. Boulagouas W, García-Herrero S, Chaib R, Febres JD, Mariscal MÁ, Djebabra M. An investigation into unsafe behaviors and traffic accidents involving unlicensed drivers: a perspective for alignment measurement. *International Journal of Environmental Research and Public Health.* 2020;17(18):6743.

5. Bates LJ, Davey J, Watson B, King MJ, Armstrong K. Factors contributing to crashes among young drivers. *Sultan Qaboos university medical journal.* 2014;14(3):e297.

6. Jewett A, Shults RA, Bhat G. Parental perceptions of teen driving: Restrictions, worry and influence. *Journal of safety research.* 2016;59:119-23.

7. Alderman EM, Johnston BD. The teen driver. *Pediatrics.* 2018;142(4).

8. Tefft BC, Williams AF, Grabowski JG. Driver licensing and reasons for delaying licensure among young adults ages 18-20, United States, 2012. *Injury epidemiology.* 2014;1(1):1-8.

9. Shope JT. Graduated driver licensing: review of evaluation results since 2002. *Journal of safety research.* 2007;38(2):165-75.

10. Dee TS, Grabowski DC, Morrisey MA. Graduated driver licensing and teen traffic fatalities. *Journal of health economics.* 2005;24(3):571-89.

11. Begg D, Stephenson S. Graduated driver licensing: the New Zealand experience. *Journal of safety research.* 2003;34(1):99-105.

12. Foss RD. Improving graduated driver licensing systems: A conceptual approach and its implications. *Journal of Safety Research.* 2007;38(2):185-92.

13. McKnight AJ, Peck RC. Graduated driver licensing: what works? *Injury Prevention.* 2002;8(suppl 2):ii32-ii8.

14. Hanna CL, Hasselberg M, Laflamme L, Möller J. Road traffic crash circumstances and consequences among young unlicensed drivers: a Swedish cohort study on socioeconomic disparities. *BMC Public Health.* 2010;10(1):1-8.

15. Razzak JA, Shamim MS, Mehmood A, Hussain SA, Ali MS, Jooma R. A successful model of road traffic injury surveillance in a developing country: process and lessons learnt. *BMC public health.* 2012;12(1):1-5.

16. Team R Core. R: a language and environment for statistical computing [Internet]. Vienna, Austria: R Foundation for Statistical Computing; 2020. In:2017.