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Road Traffic Accidents (RTAs) in Bahawalpur City, Pakistan: A Comparative Injury Analysis

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Abstract. Road traffic accidents (RTAs) hold a top and rising contributor to the regional and global casualties and deaths particularly in countries like Pakistan. The main objective of this research was make a comparison of the RTAs took place in Tehsil Bahawalpur city and to identify the main causes and victims during 2015-2019. Data is collected from Punjab rescue emergency service 1122 Bahawalpur and manipulated and re-arranged as per objective of the study. It is analyzed in SPSS 17 by applying descriptive statistics and Chi-square Test as an inferential statistics to find out the relationship of RTAs with selected variables. Results showed that, during the last few years the numbers of road traffic accidents are increased. The root causes of RTAs observed were including care lessness of drivers (42.22% and 43.10% in 2015 and 2019 respectively) over speeding (39.92% and 33.89% in 2015 and 2019 respectively) over taking and violation of traffic rules. Most of the victims in RTAs were drivers (32.89% and 34.91% in 2015 and 2019 respectively). The youngsters (aging 21-30) were the leading victims of 1,848 (29.14%) in 2015 to 2,410 (28.69%) in 2019 due to the ever increasing registrations of the motor bikes as the main source of RTAs (69.05% and 72.91% in 2015 and 2019 respectively). Most of the RTAs caused fractures and minor injuries (33.39% and 33.78% in 2015 and 2019 respectively). Chi-square results also show that there is close association between the care lessness and the bike accidents (P-value > 0.05). Lastly, the spatial hotspots identification maps of RTAs done with the aid of GIS visualize that severe accidents were occurred on cross roads, chowks and inter-city roads i.e. Hasilpur road, Yazman road, Ahmadpur road others. Lastly, it is hoped that this research would be beneficial for the society in many ways from understanding of the RTAs nature to adopting preventive measures.

Keywords: road traffic accidents, causes, victims, Bahawalpur, Pakistan

Introduction

A road traffic accident (RTA) is an event concerning as a one road vehicle causing one or more persons to injured or killed. Deaths from road accidents occur due to collision between vehicles, pedestrians or any roadside billboards. The data particularly related with the modeling and analyzing of RTAs for well recognition and measure the accidents causes and their effects is more valuable (Bokaba *et al*., 2022). It is estimated that 1.2 million people are died in road accidents and not less than 50 million people are get injured (Worley, 2006). By the year of 2030, RTAs are possibly to be the 7th leading reason of death. Additionally the WHO specified that the RTAs reason the death to vulnerable road users. Upto the half (54%) of the people killed on the roads are cyclists, motorcyclists and pedestrians (INSEE, 2020). From that statistics, 30% to 70% of victims are lying on orthopedic beds in developing countries hospitals (Edward and Naeema, 2011). Road traffic accidents (RTAs) hold a top and rising contributor to regional and global disease burden. RTAs are expected to turn into the 3rd largest contributor to the burden of global diseases by 2020 (Ameratunga *et al*., 2006). RTAs are the 2nd chief cause of death for youngsters aging 5 to 29 and 3rd top cause for individuals between 30 and 44 (WHO, 2012). The road traffic accidents losses and disabilities in low and average income countries are over 85% and 90% respectively (WHO, 2013). These less developed countries experience higher share of checkable causalities and injuries from road accidents in these countries (Labana *et al*., 2015). The foremost reasons of the RTAs are over speeding, alcohol and mobile use, while deaths from RTAs vary and distress countries differently. These are 24.1, 18.4 and 9.2 per 100,000 in low-income, middle-income and high-income countries respectively (WHO, 2015). Therefore, the avoidance of RTAs has become an important goal in the better management of transportation worldwide (Makaba and Gatsheni, 2019).

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Pakistan is a developing country and ranked as a 5th most populous country in the world with an estimated population of 226,125,422 in 2021 (WPR, 2021). It is found that the annual average numbers of serious and non-serious accidents are 43.3% and 56.7% respectively (Imran and Nasir, 2015). The raw approximated cost concerned to traffic accidents in low, average and rich countries is 1%, 1.5% and 2% of gross national product (GNP) respectively (Afukaar *et al*., 2003). In Pakistan, this cost is approximately 2% of the Pakistan's gross domestic product (NHA, 2006). The annual road traffic fatalities in Pakistan are estimated about 25,781. Similarly, the approximated mortality rate per 100 thousand populations in Pakistan is 14.2 (WHO, 2015). The economic cost of road accidents and fatalities in the country is stipulated to over PKR 100 billion (Ahmed, 2007). This worse situation of road crashes is witnessed in many big cities of Pakistan. For instance, the biggest city of Pakistan, Karachi stands 4th as the top road accident losses perceiving cities of the world with above 28,000 road accidents and resulted 35,000 fatal injuries recorded in the year 2012 (Zubair *et al*., 2014). Further, in 2012, a fatal passenger van crashed accident into a pick-up truck in Bahawalpur took place killing all 26 people in the van including women and children (Daily Dawn, 2012). It is manifesting that the imposition of road safety and traffic rules laws is not discouraging the worst situation on roads. This is possibly because of the less awareness of traffic rules and regulations and road safety benefits in Pakistan (Ijaz *et al*., 2021). In Pakistan, the research work for the lessening of RTAs is financed at a surprisingly low level in than other health problems and is counted a work of private or transport avenue rather than issue of public health. Therefore, all such noted factors are making Pakistani roads as one of the unsafe roads in world (NH and MP, 2015). Though, through multiple lucid strategies, these accidents are envisaged and highly checkable to save lives (Ali *et al*., 2016). The main objective of this research was to make a comparison of the road traffic accidents took place in Tehsil Bahawalpur city and to identify the main causes and victims of road traffic accidents during 2015-2019. The present research would be beneficial for the society in terms of awareness about road traffic accidents, injuries severity, victims and core causes of the RTAs. Moreover, the hotspot identification of the RTAs prone areas would be helpful for transport regulation authorities for taking necessary steps to reduce the RTAs occurrences.

Material and Methods

Study area. The study area Bahawalpur city is located in the Punjab province of Pakistan as shown in Fig. 1, and ranked the 11th largest city in Pakistan with an estimated population of 798,509 (GOP, 2017). It is situated between the latitude of 27°-80' to 29°-50' north latitudes between 70°-54' to 72°-50' east longitudes. The city is bounded on the north by Lodhran and district, on the east by Bahawalpur sadder, on the south tehsil Yazman on the west Bahawalpur sadder and Ahmadpur east Tehsil.

Data collection. Current study is relies on the secondary data derived about the RTAs and their main contributing causes and victims from Punjab rescue emergency service 1122 Bahawalpur, for the Bahawalpur city. The data is collected in the hard form comprising different variables of the RTAs i.e. causes, victims of RTAs, their age groups, nature of injuries etc. These variables varied in numbers therefore the simple random sampling employed. The collected data spanned from the two time periods i.e. 2015 and 2019 in order to make a

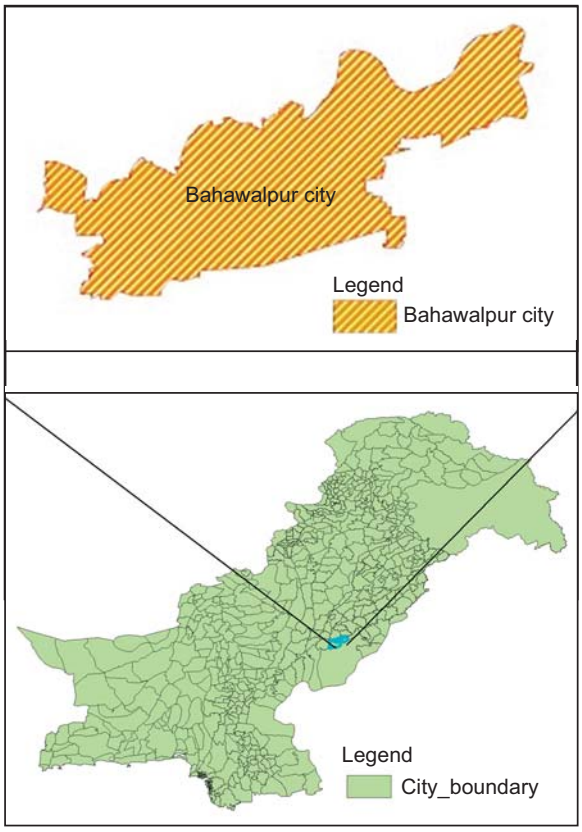

Fig. 1. Study area map.

better comparison and analysis of the severity of RTAs during this time period.

Data analysis. The obtained data was in raw and hard form. It is coded, processed, rearranged, tabulated and presented in tables to depict the results. The data was descriptive and needs to convert it in categorical and tabular form. After manipulating it in required form it is analyzed in SPSS 17 and MS Excel software by applying descriptive statistics (frequency, percentages) and Chi-square test.

Hotspots identification. For making severity hotspots maps for the years of 2015 and 2019, Arc map in ArcGIS 10.3 software was used to determine the areas with number of RTAs occurrences in these two time periods. The generated maps of RTAs were prepared to visualize the severity of road traffic accidents by identification of the hotspots. The intensity of the RTAs displayed in these maps is based on the values or number of road accidents in corresponding areas/ hotspots. These are displayed in weighted points form on the maps (Zahid *et al*., 2020).

Application of Chi-square test. Bike accidents are perhaps the leading RTAs and causalities and injuries caused mainly by the carelessness. Therefore, the Chi-square test was used to measure the carelessness and bike accidents as assumed to have a close connection and the linkage of both variables. It is based on cross-tabulation of two variables where 'bike accidents' was dependent and 'carelessness' was independent variable and have been tested in order to find out the relationship between them.

Results and Discussion

Road traffic accidents (RTAs) is an increasing public health issue in major urban centers in Pakistan and has a deep concern for public health authorities. The findings of the study are discussed below:

Causes of RTAs. The total 5,909 cases were registered of RTAs in 2015 that were increased to 8,452 in 2019 as indicated in Table 1. Among, the leading cause of the RTAs in the Bahawalpur city was carelessness that was 2,495 (42.22%) in 2015 and increased to 3,643 (43.10%) in 2019. Over speed of the vehicles was the second major cause which was 2,359 (39.92%) in 2015 and decreased to 2,865 (33.89%) in 2019 due to better management and control of traffic police. The other miscellaneous causes (use of mobile, failure of breaks, fatigue etc.) of the RTAs were third which were 711 (12.03%) in 2015 and increased to 1,389 (16.43%) in 2019. Apart few other causes of the RTAs were wrong-turn, U-turn, tyre burst and one wheeling with varying ratio. Violent and unsafe driving exercises are reflected a core sign for traffic clashes accident happening with increase their intensity (Zahid *et al*., 2020). Many factors are reported by Malik (2017) which are responsible for RTAs concerned with over speed, rash driving, violation of traffic laws, failure of brakes, steering system, tyre burst, carelessness, fatigue, alcohol, sleep, inadequate width of shoulders, unfavourable weather conditions (fog, mist), indecent curve design, indecent traffic control devices and insufficient lighting etc. A recent study conducted in Bahawalpur city to recognize the reasons and safety measures of RTAs by using descriptive statistics and road accident risk index (RARI) revealed that the major reasons of RTAs in the city were included population increase (62.66%), bike drivers (69.33%), overtaking of the vehicles (51.33%), over speed and hustle to reach the destination (34.66%), causalities of teenage drivers (52%), violation of the traffic rules (25.33%). RARI analysis also showed the close association between the victims and the RTAs (Nazeer *et al*., 2021). Further, it is indicated in a study that in the causation of accidents, lane violation has contributed large followed by tyre burst, fatigue, over speeding, mechanical fault and others like the poor enforcement of traffic laws on seat-belt and helmet wearing in Pakistan (Khan and Shah, 2019; Hussain *et al*., 2011). The intervening factors of traffic rules violation are linked with the drivers social and demographic aspects, seasonal weather changes (fog, rain, storm etc.), time of the day (peak time or not), highway type and the nature of the built-up surroundings (Alver *et al*., 2014; Shi *et al*., 2014). Alarmingly, the unsafe driving and

Table 1. Causes of RTAs

Causes	2015	%	2019	%
Over speed	2,359	39.92	2,865	33.89
Carelessness	2,495	42.22	3,643	43.10
Wrong-turn	152	2.57	136	1.60
U-turn	145	2.45	375	4.43
One wheeling	04	0.06	08	0.09
Tyre burst	43	0.73	36	0.42
Other	711	12.03	1,389	16.43
Total	5,909	100	8,452	100

Source: Punjab Rescue Emergency Service, Bahawalpur (2019).

violations of traffic rules is an ongoing trend in the world and there is no tangible way to evade them fully. According to World Health Organization (WHO) the full imposition of traffic rules and regulations in true sense just found in 35 countries throughout of the world (WHO, 2015).

Victims of RTAs. The victims of RTAs as shown in Table 2 were totaled 12,716 in 2015 which include 5,017 (39.45%) males, 1,324 (10.41%) females, 855 (6.72%) pedestrians, 1,303 (10.24%) passengers, 4,183 (32.89%) drivers and 34 (0.26%) under age drivers. In coming years, though the victims of underage drivers were decreased immensely because of enforcement of traffic rules in Bahawalpur city. Similarly, an increasing trend in victims of RTAs was observed on yearly basis. In 2019 a massive increase in male victims 6,839 (40.62%) was also witnessed, while the female victims were slightly increased 1,560 (9.26%). Drivers as victims were also increased during 2019 as the figure was increased to 5,878 (34.91%). It is manifested that over 90% road traffic accidents cases are belonged to drivers (Ullah *et al*., 2019), while numbers of pedestrians of 803 (4.76%) were slightly decreased on yearly basis. Passengers' victims were recorded 1,718 (10.20%) Underage drivers were 37 (0.22%) during 2019 as number of school and college boys used to ride bikes and cars which resulted in high number of victims. The impact of RTA find Mphela (2011) which is considerably linked with the sufferer and their families and especially for the developing national economy. A study conducted in Rawalpindi, Pakistan concluded that the motor cyclists are the most vulnerable users of road with less safety and involved in RTAs frequently (Ijaz *et al*., 2021). Additionally, in a study, it is noted that 602 (69%) causalities and 1,782 (59%) injuries of overall road traffic accidents during the studied time were borne by pedestrians (Shah *et al*., 2018).

Age grouping of victims. Victims of RTAs as listed in Table 3 in perspective of age showed the increasing trend as number of victims having age of less than 10 years have been increased from 424 (6.69%) to 537 (6.39%) in 2019 which includes under age drivers and passengers. Age group of 11 to 20 were immensely increased from 1,465 (23.10%) to 2,089 (24.87%) as young drivers do not bother the traffic rules and their lives because of aggression and rash driving which results in high number of injuries and accidents. These are one of the leading causes of death among productive age group (Khan and Fatmi, 2014). Similarly, the age groups of 21-30 were the leading victims of 1,848 (29.14%) in 2014 to 2,410 (28.69%) in 2019. It is manifested that drivers having age greater than 25 and 30 get experience with the passage of times so they drive carefully to avoid any kind of injury. Road traffic injuries (RTIs) are the leading cause of death among young people, aged 15-29 years (WHO, 2012). Likewise, age group 31-40 also increased from 1,108 (17.47%) in 2015 to 1,544 (18.38%) in 2019. Though the number of age group of 30 to 40 has been increased but the reason of this increase was due to enhancing accidents of passengers and pedestrians.

Nature of RTAs/ type of vehicles involved in RTAs. In urban areas like Bahawalpur most of the people generally use bikes as a cheap source of transportation in and out of the city (Mohsin, 2014). So, that time could be saved which result in high number of accidents. Total 8,773 accidents in 2015 were recorded as shown in Table 4 out of which 6,058 (69.05%) were motor bike accidents. This figure was increased to 9,529 (72.91%) in 2019 because of increase in purchasing

Table 2. Victims of RTAs in Bahawalpur city

Victims	2015	%	2019	%
Male	5,017	39.45	6,839	40.62
Female	1,324	10.41	1,560	9.26
Pedestrian	855	6.72	803	4.76
Passengers	1,303	10.24	1,718	10.20
Drivers	4,183	32.89	5,878	34.91
Under age driver	34	0.26	37	0.22
Total	12,716	100	16,835	100

Source: Punjab Rescue Emergency Service, Bahawalpur (2019).

Table 3. Victims age group

Victims Age Group	2015	%	2019	%
Age 01-10	424	6.69	537	6.39
Age 11-21	1,465	23.10	2,089	24.87
Age 21-30	1,848	29.14	2,410	28.69
Age 31-40	1,108	17.47	1,544	18.38
Age 41-50	813	12.82	958	11.40
Age 51-60	422	6.65	526	6. 26
Age above 60	261	4.12	335	3.98
Total	6,341	100	8,399	100

Source: Punjab Rescue Emergency Service, Bahawalpur (2019).

Table 4. Nature of RTAs in Bahawalpur city

Nature	2015	%	2019	%
Bike	6,058	69.05	9,529	72.91
Car	692	7.88	1,061	8.12
Truck	200	2.28	156	1.19
Rickshaw	755	8.61	1,162	8.89
Bus	75	0.85	43	0.33
Van	191	2.18	196	1.50
Tractor trolley	-	-	136	1.04
Other vehicles	802	9.14	787	6.02
Total	8,773	100	13,070	100

Source: Punjab Rescue Emergency Service, Bahawalpur (2019).

Table 5. Nature of injury in RTAs

Nature of injury	2015	%	2019	%
Spinal injury	46	0.36	53	0.31
Head injury	801	6.32	928	4.77
Single fracture	1,089	8.59	1,183	5.52
Multiple fracture	170	1.34	57	0.34
Minor	4,235	33.39	6,178	33.78
Dead	35	0.28	47	0.28
Alive & stable	2,046	16.13	4,255	25.33
Alive & unstable	4,260	33.59	4,097	24.39
Total	12,682	100	16,798	100

Source: Punjab Rescue Emergency Service 1122, Bahawalpur (2019).

and registration of bikes. Numbers of car accidents were increased from 692 (7.88%) into 1,061 (8.12%) in 2019. City traffic police has implemented the law not to enter the heavy vehicle in urban area due to which numbers of accidents of truck were decreased. Rickshaw accidents were also increased from 755 (8.61%) in 2015 to 1162 (8.89%) in 2019. It is observed that ladies used rickshaw as a medium for transportation whereas number of parents have hired the rickshaw to carry the children to their schools. These factors have increased the demand of said vehicle in urban areas result of which was increase in accidents during 2019. A decreasing trend of using buses has been observed as a medium of within city transportation in Bahawalpur city due to which accidents of these vehicles were decline on yearly basis whereas vans have taken place for transportation. The other vehicles including tractor trolley were not allowed in 2015 to 2017 but due to increased constructional works these vehicles were allowed and the result was in increased accidents found by Savolainen *et al*. (2011). The traffic accidents and crashes might cause property loss, casualties and have a high financial cost every year. Reducing accident rates and injury severities has long been a major attention for highway department.

Nature of injury in RTAs. The nature of the RTAs as shown in Table 5 those were 12,682 in 2015 to 16,798 in 2019. Number of minor injured persons has a higher percentage than other severe nature of injuries and the total number of minor injuries were 4,235 (33.39%) in 2015 to 6,178 (33.78%) in 2019. The people those alive and unstable in accidents were 4,260 (33.59%) in 2015 and dropped to 4,097 (24.39%) 2019. Alive and stable injuries were increased greatly between these five years. These were recorded 2,046 (16.13%) and enhanced to 4,255 (25.33%). Single fracture, head injury, spinal injury was also recorded in RTAs with slight increase. Fortunately, the death share in RTAs was not alarming and remained 0.28% in both periods because of safety measures taken and implemented by the traffic police so, that life of people could be safeguarded. As the number of bikes increase their accidents were also increased and the nature of injured persons was worst as increased number of head and spinal injury was reported. It is also found in a study that most of the accidents were borne by two wheelers i.e. cyclists and motor cyclists (37.2%) followed by pedestrians (35.80%) (Jooma and Shaikh, 2016).

Chi-square results. The Chi-square test as shown in Table 6 was used to measure the carelessness and bike accidents as assumed to have a close connection and the linkage of both variables. It is based on cross-tabulation of two variables' dependent (bike accidents) and independent (carelessness) that have been tested in order to find out the relationship between them. Carelessness is observed as the main reason of bike accidents followed by the over speed. Chi-square test result shows that the value of Chi-square is 43.879 (X^2 =43.879), as shown in Table 6, while the degree of freedom is 9 and P-value is 0.01 which is less than 0.05 ($P<0.05$). P-value explains that there was a significant association between both the independent and dependent variables.

Table 6. Chi-square of carelessness and bike accidents

Category	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-square	43.879[a]	9	0.01
Likelihood ratio	41.61	9	0.01

Further, the Fig. 2 and 3 portrays the RTAs in Bahawalpur city and their intensity. It is exhibited that the main inter-city roads, chowks and cross roads are more vulnerable to RTA. Among these, Multan road, Jail road, Ahmadpur road, Yazman road, Railway road and Hasilpur road were more dangerous and risky for RTA. Most of the accidents took place within or near these roads on chowks or cross roads. So, there is need to pay special attention of transport authorities to ensure the enforcement of traffic rules and regulations and continuous watching and installment of traffic signals (on many chowks these are installed but need to properly follow). Because it is reported that traffic rules violations are to have a massive impact on road traffic crashes

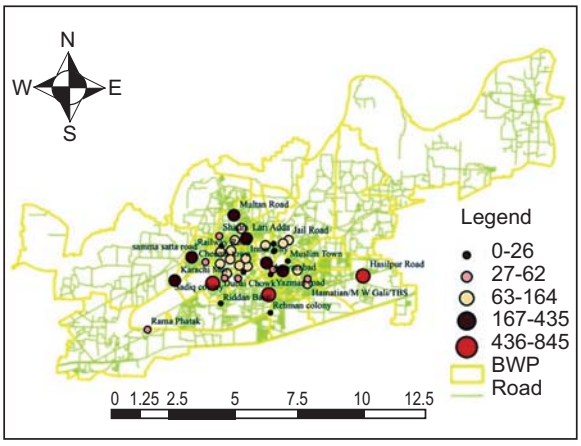

Fig. 2. Road traffic accidents hotspots in Bahawalpur in 2015.

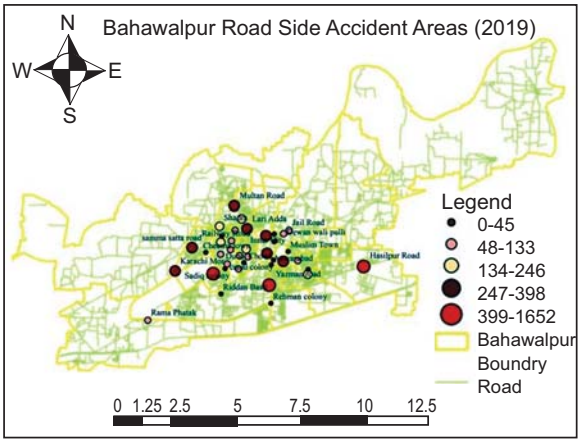

Fig. 3. Road traffic accidents hotspots in Bahawalpur in 2019.

associated with accident severities (Morrow and Crum, 2004). So, that by imposing these rules the ratio of RTAs could be minimize to save lives.

Conclusion

The results of this study showed that, the RTAs in the Bahawalpur are increasing over the time and reflected the serious implications about the causes, vehicles, victims and nature of injuries. The root causes of RTAs observed were including carelessness of drivers, over speeding, overtaking and violation of traffic rules. The two wheeler vehicles (motor bikes) were involved in road traffic accidents (RTA) where youngsters (aging 21-30) having risky and unsafe driving was badly victims of fatal road traffic accidents. Therefore, the motor bikes were the main source of RTAs as their registrations are increasing, road traffic clashes are also enhancing tremendously. Most of the RTAs cause fractures and injuries minor to severe (head, spinal). The Chi-square results also verify that there was a strong association between carelessness and the motor bike accidents. The spatial hotspot identification maps of RTAs occurrences prepared with the aid of GIS also visualize that severe accidents were occurred on cross roads, chowks and inter-city busy roads i.e. Hasilpur road, Yazman road, Ahmadpur road, Multan road and others. In the light of the findings of the study and intervening factors of RTAs, the certain measures could be considered preventive from the occurrence of road accidents including reduction in speed limit, following the traffic signals, rigorous licensing, awareness about traffic rules and regulations, training of drivers to follow the traffic rules implemented by the local government and transport authorities.

Conflict of Interest. The authors declare that they have no conflict of interest.

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