AMJ Australasian Medical Journal [AMJ 2017;10(3):238–245]

Epidemiological study of fatal road traffic accidents in Ecuador

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RESEARCH

Algora-Buenafé AF, Suasnavas-Bermúdez PR, Merino-Salazar P, Gómez-García AR. Epidemiological study of fatal road traffic accidents in Ecuador. AMJ 2017;10(3):238–245.
https://doi.org/10.21767/AMJ.2017.2951

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ABSTRACT

Background
Traffic accidents represent a priority for public health since they are responsible for high mortality tolls, elevated economic costs and a significant social impact. Ecuador ranks as the seventh country in the World with a higher mortality rate.

Aims
To describe the main epidemiologic characteristics of deaths caused by traffic accidents from a time and space perspective.

Methods
Transversal and descriptive study was conducted using the data from National Transit Agency. The data includes all deaths due to traffic accidents in Ecuador registered from January to December 2016. An analysis of percentages and frequencies of the traffic accident fatalities was performed based on demographic, temporal and geographic components. In addition, Gross Mortality Rates (x100,000) and adjusted (x1,000) per province were calculated.

Results
From 1,976 fatalities registered in Ecuador in 2016, 81.1 per cent corresponded to men and 18 per cent to women. Mortality Rate resulted as 13.6 per 100,000 inhabitants. With respect to men, the major portion of deaths correspond to drivers (52.1 per cent), when as for women, it correspond to passengers (51 per cent). Saturdays (21 per cent) and Sundays (23.1 per cent) correspond to the days with greater percentage of deaths. The incidence was greater in highways of Guayas (23.3 per cent) and Pichincha (17.1 per cent). Selected by type, cause and implicated vehicles, the accidents that outstand are frontal side collision (28.5 per cent) and pedestrian-motor vehicle collision (22.6 per cent), in addition to traffic law violations (46.9 per cent) and motorcycle incidents (29.55) respectively.

Conclusion
The current study provides us, for the first time, a global perspective of the epidemiologic characteristics of fatal car accidents in Ecuador, contributing with better information for the design of national road safety regulations.

Key Words
Traffic accidents, fatalities, developing country, epidemiology

What this study adds:

1. What is known about this subject?
Fatalities caused by traffic accidents are a current public health issue, especially for developing countries.

2. What new information is offered in this study?
This study is the first epidemiologic study on fatal traffic accidents in Ecuador.

3. What are the implications for research, policy, or practice?
The results allow the evaluation and formulations of road safety policies nationwide.

Background

According to the World Health Organization (WHO) each year approximately 1.25 million people die as consequence of traffic accidents worldwide; making this issue a priority for public health due to rising mortality rates,[1,2] economic costs (518 billion dollars) and social impact produced in the last years;[3–5] mainly in developing countries.[6] For 2030, fatal traffic accidents will become one of the seven main causes of death in the World.[7]

Road traffic accidents are a major problem in the densely populated Asian Countries and in Latin-American countries.[8,9] In Latin-American it causes annually over 5 million injuries and 142,252 fatalities on people between 5 and 44 years old. Ecuador holds the seventh place when measuring mortality rates due to traffic accidents worldwide.[2]

Based on statistics of the National Transit Agency of Ecuador, between 1998 and 2015, 373,265 traffic accidents were registered, provoking 244,183 injured people and 29,148 fatalities, which present a rising tendency for the years to follow, despite of road safety campaigns and regulations.[10]

In the last decade, the interest to characterize traffic accidents in developing countries[11–13] from an epidemiologic, temporal and spatial perspective has risen, especially in Latin America and the Caribbean.[14–16] Thus, providing information needed to take the corresponding actions to reduce the forecasted data, according to the World Decade Plan of Action for Road Safety proposed by the WHO for 2020.[17,18]

Even if there are estimations on this issue,[1,8,19] there is a current lack of updated and published studies in Ecuadorian context. In addition, current legal framework for Road Safety and Education dates of 2014. Prior to this date, regulations were not strong and people behind the wheel or pedestrians had little or no road safety awareness; making accidents a common factor in the country. Because of this, the object of the current research study was to describe the main epidemiologic characteristics of fatal traffic accidents in Ecuador from a time and space perspective.

Method

It is a descriptive, cross-sectional study on fatalities caused by road traffic accidents (RTAs) that were registered in Ecuador from January 01st until December 31st 2016.

Data was gathered through statistics of ground transportation and road safety belonging to the National Transit Agency,[9] registered by traffic agents working for the National Agency of Traffic Control and Road Safety, the Traffic Commission of Ecuador and local autonomous government from the different provinces of the country.

The first phase of the study started with debugging the quality of the data to permit the analysis of grouped variables into the following components: (i) Demographics: sex and age group of fatalities resulting from traffic accidents, classification of the deceased user (driver, passenger, pedestrian); (ii) Traffic Accident Characteristics: factors according to type, causes and involved vehicle in the fatalities; (iii) Temporal: year quarter, day of the week, time of accident; and (iv) Geographic Area: area[20,21] (urban and rural) and regions of Ecuador:[22] Amazon (Morona Santiago, Napo, Orellana, Pastaza, Sucumbíos, Zamora Chinchipe), Andean Range (Azuay, Bolívar, Cañar, Carchi, Chimborazo, Cotopaxi, Imbabura, Loja, Pichincha, Tungurahua), Pacific Coast (El Oro, Esmeraldas, Guayas, Los Ríos, Manabí, Santa Elena, Santo Domingo de los Tsáchilas) and Galapagos Islands.

The statistical analysis was done using the distribution of absolute frequencies (n) and relative frequencies (per cent), simplifying the calculation of the Gross (x100,000 habitants) and Adjusted per province (x10,000) Mortality Rates based on the Population Census performed by the National Institute of Census and Statistics,[23] which allowed to summarize the information correctly. SPSS software version 23 was used for data analysis and Power View from Microsoft Excel for the geospatial representation.

Results

Table 1 shows the demographic characteristics of RTAs by sex, age group and user. In 2016, 1967 fatalities were registered due to traffic accidents in Ecuador, with a Mortality Rate of 13.6 per 100,000 inhabitants (results are not shown), prevailing more in men (22.2; 7,177,683 inhabitants) than in women (4.9; 7,305,810 inhabitants)

From the total fatalities, 1,597 (81.1 per cent) are men and 355 (18 per cent) are women. The age group mainly had adults between 25 and 64 years old. Young population, from 0 to 17, and elder population comprised of people over 65 years old represent 10.9 per cent of total deaths caused by traffic accidents respectively. In 16 cases (0.8 per cent) the sex of the victim is unknown and in 277 (14.1 per cent) the age of the victim is not known as well.

With respect to the type of user, for men we have a major concentration of the fatalities when they were drivers (52.1 per cent) while for women (51 per cent) when they were passengers; pedestrian fatalities correspond to (40.8 per cent).

Proportionally, no differences were evident when evaluating timing in terms of day/night and quarter of the year for the registered fatal traffic accidents in the country, finding an average of 164±16 deceased people monthly. The fourth quarter of the year stands out with 543 deaths (27.6 per cent) corresponding to the months of October (n=183) and December (n=189) as the months with greater victim registration, Table 2.

With respect to the day of the week, we can see that Saturdays and Sundays (n=867; 44.1 per cent) correspond to the days with higher fatal traffic accident incidence; being Thursday the one with the lower number. A rising tendency is seeing as the weekend approaches (r^2=0.720), no results are shown.

In terms of the geographic distribution, RTAs in the country occurred mainly in highways located in rural areas of the Pacific Coastal Region (Guayas=23.3 per cent; Manabí=7.0 per cent) and the Andean Region (Pichincha=17.1 per cent; Los Ríos=6.9 per cent), as shown in Table 3.

Figure 1 shows in a color scale, the geographic distribution of fatalities caused by traffic accidents in Ecuador in 2016.

Table 4 represents the distribution by type, causes and type of vehicle involved in traffic accidents resulting in deaths in 2016.

According to the typology of the traffic accident that originated the casualty, frontal-side collisions stand out with 28.5 per cent and pedestrian-motor vehicle collisions with 22.6 per cent; followed by loss control on road (16.0 per cent) and other type of unknown accidents (12.2 per cent) according to the registered reports filed by transit agents.

The main cause of death (46.9 per cent) corresponds to the noncompliance of traffic rules (missing regulatory traffic signs, not following yield of trail to vehicles and not paying attention to road traffic conditions). Reckless driving represents 26.2 per cent due to other diverse causes (not keeping a safe distance with respect to other vehicles, passing other vehicles on dangerous areas, driving on the wrong side of the road or sudden lane changes, primarily); 13.5 per cent for exceeding speed limits and, the remaining 8.2 per cent correspond to not giving the right of way to pedestrians.

Finally, in order of importance and according to the type of vehicle involved in fatal accidents the following stand out: motorcycles, vehicles, trucks, buses and other special vehicles (trailers, dumpers, tankers) as seen in Table 4.

Conclusion - Discussion

The current work is the first research that describes the main epidemiologic characteristics of fatalities due to traffic accidents in Ecuador. RTAs constitute a major public health problem in developing countries;[1,2] mainly in Latin America due to the auto park circulation increase, which is proportional to the mobility and mortality rates.[14]

The distribution of the deceased is very different in terms of sex; the predominance can be tied to a greater exposure for men, which drive more frequently,[24] with a rate of 28.6 male drivers dead per every woman.

When analyzing mortality by age, we can see that the most affected age groups correspond to people between 25–64 years of age. This result coincides with similar studies and world statistics,[2,19] In this sense, the economic active Ecuadorian population is the most affected by fatalities in traffic accidents.

It is worth noting that the deceased groups between the ages of 0–17 and 18–24 correspond in the first case to pedestrians and in the second case as young inexperienced drivers mainly due to the lack of road education and the scarce individual risk perception tied to their age as road users.[25]

Our study found that 41.1 per cent of fatalities due to traffic accidents occurred during weekends, data that match the population's habits related to fun, leisure, and high transit circulation and traffic jams found in similar Latin American studies.[14] The incidents were usually reported during the night between 18:00 and 05:59 hours.[26,27] Even if there are no significant differences based on the quarter distribution of the fatalities, the last months of the year stand out with a greater number of victims, especially October and December.

In terms of geographic distribution, rural areas (62 per cent) of the provinces of Guayas and Pichincha registered the major number of deaths in the country. This finding is closely related to the population density, Auto Park and greater traffic flow of the country. At the same time, it can

also be attributed to the detrimental infrastructure of peripheral roads and connection to other provinces.

Classifying RTAs by typology, we have frontal-side collision with 28.5 per cent and pedestrian-motor vehicle collision with 22.6 per cent. These results match the outcome of other studies performed in Bolivia and Peru,[16,28] due to the noncompliance of transit rules and regulations and to not granting pedestrians or vehicles with the right of way as the main causes.

Multiple factors must be considered during traffic accidents, as shown in Table 4 (Others: 26.2 per cent). There is a broad diversity of causes that originated RTAs; driver (drowsy driver or driving under bad physical conditions); pedestrian (not using sidewalks or designed safety areas); vehicle (mechanical failure); environmental conditions (rain, fog); and road conditions (lighting, design, landslides).

Opposite to mentioned studies,[16,28] alcohol consumption does not represent the main cause of fatalities caused by traffic accidents in Ecuador (3.9 per cent).

For 20.6 per cent of the cases, the vehicle involved in the registered fatalities is unknown. We believe that this fact is due to drivers that run away from the responsibility to assist their victims immediately. Sanctions for this action corresponds to liberty deprivation for ten to twelve years accordingly.[10] There are approximately two hit and runs for every 10 fatalities.

Reducing the number of victims per traffic accidents is a need that requires a multiple factor analysis. Even if road safety policy needs to be imposing sanctions, it cannot disregard the denominated human factor.[6,13]

Despite the 5.5 per cent decrease of fatalities related to traffic accidents in the country since 2014 (2,322) until 2016 (1,967), this descent does not reflect an effective reduction of the problematic. In the year of this study, 30,269 accidents occurred causing 21,458 injured victims. For every 100 registered traffic accidents there were 71 injured people (harmfulness) and 6 fatalities (lethality) in 2016.

The legal framework currently in place is insufficient to guarantee road safety to the Ecuadorian society. It becomes evident to the decentralized autonomous governments to establish awareness programs and campaigns for drivers and pedestrians to generate a road safety culture and consciousness that results in the reduction of traffic accidents in the next years, following the World Decade Plan of Action for Road Safety proposed for 2020.[17,18]

It is necessary to point out that the main limitation of the study relies on the scarce information published by the National Transit Agency,[9] which prevented a more in depth epidemiologic analysis.

The results of the current studies have implications on the evaluation of the regulations of road safety in Ecuador. The need to pay close attention to the problem becomes evident. Furthermore, measures must be adopted to improve such areas and roads of the country where the mortality toll due to traffic accidents is higher.

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ACKNOWLEDGEMENTS

We greatly recognize the support provided by Dr. Enrique Barrios Queipo, Research and Innovation Director of SEK International University and Ximena Fiallo, Language Institute Coordinator, for the translation of this work.

PEER REVIEW

Not commissioned. Externally peer reviewed.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

FUNDING

Financed by the Research Program on Occupational Safety and Health Conditions of SEK International University.

ETHICS COMMITTEE APPROVAL

The ethics approval was obtained from the Editorial Committee of SEK International University, Ecuador.

Table 1: Demographic Characteristics of the fatalities caused by traffic accidents, Ecuador 2016

	Men (%)	Women (%)	Total (%)
User			
Driver	831 (52.1)	29 (8.2)	860 (43.7)
Passenger	332 (20.8)	181 (51.0)	513 (26.1)
Pedestrian	433 (27.1)	145 (40.8)	578 (29.4)
Undetermined	-	-	16 (0.8)
Age (years)			
0-17	150 (11.0)	64 (19.9)	214 (10.9)
18-24	275 (20.1)	44 (13.7)	319 (16.2)
25-64	788 (57.6)	155 (48.1)	943 (47,9)
≥ 65	155 (11.3)	59 (18.3)	214 (10.9)
Undetermined	-	-	277 (14.1)

Table 2: Temporal Characteristics of the fatalities caused by traffic accidents, Ecuador 2016

	n	n%
Timeframe		
Daytime[a]	921	46.8%
Nightime[b]	1,046	53.2%
Day		
Monday	219	11.1%
Tuesday	199	10.1%
Wednesday	193	9.8%
Thursday	199	10.1%
Friday	290	14.7%
Saturday	413	21.0%
Sunday	454	23.1%
Quarter		
January-March	486	24.7%
April-June	486	24.7%
July-September	452	23.0%
October-December	543	27.6%

Table 3: Geographic Distribution of the fatalities caused by traffic accidents, Ecuador 2016

	n	n%
Area		
Rural	1,219	62.0%
Urban	748	38.0%
Region		
Amazon	133	6.8%
Andean Range	858	43.6%
Galapagos Islands	1	0.1%
Pacific Coast	975	49.6%

Table 4: Distribution of fatalities according to typology causes and type of vehicle

	n	n%
Typology		
Pedestrian Impact	125	6.4%
Pedestrian Run Over	445	22.6%
Frontal Collision	292	14.8%
Side Collision	269	13.7%
Crash	179	9.1%
Road Control Loss	314	16.0%
Overturn	103	5.2%
Others[a]	240	12.2%
Causes		
Alcohol	76	3.9%
Unforeseen Cases	28	1.4%
Over the Speed Limit	265	13.5%
Others[b]	515	26.2%
Other Violations	161	8.2%
Violation of norms	922	46.9%
Involved Vehicle		
Bicycle	39	2.0%
Bus	160	8.1%
Vehicle	298	15.1%
Jeep	78	4.0%
Motorcycle	581	29.5%
Others[c]	76	3.9%
Truck	123	6.3%
Pick-up Truck	207	10.5%
Undetermined	405	20.6%

[a]Other type of unknown traffic accidents.
[b]Reckless Driving or Pedestrian negligence. Environmental Conditions and Road Conditions.
[c]Trailer, especial (transportation vehicle for valuables, town truck, etc.), dumper, wagon and tankers.

Figure 1: Distribution of fatalities caused by traffic accidents, Ecuador 2016