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Determinants of fatal road traffic accidents in the democratic republic of Congo from 2011 to 2016

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Abstract
Background and purpose: In many low-income countries, the increase in the number of vehicles is likely to have an impact on road traffic fatalities. The purpose of this study was to identify the determinants of fatal road traffic accidents in the Democratic Republic of Congo.
Methods: This was an analytical cross-sectional study on data from road traffic accidents in 6 cities of the DRC over a period from 2011 to 2016, using data from the police stations of these 6 cities. It took into account all accidents on the public road (AVP) that were the subject of a report by police officers. Fatal traffic accident was the dependent variable while socio-demographic characteristics, behavioral and environmental determinants were the independent variables.
Results: In six years, 4,635 accidents have been notified which have caused 945 fatal accidents, an overall frequency of 20.4%. After adjustment in multivariate analysis, the dry season (aOR: 1.66 95% CI: 1.41-1.96), public transport (aOR: 7.11 95% CI: 5.58-9.05), wrong maneuver (aOR: 2.93 95% CI: 2.22-3.87), the wrong crossing (aOR: 3.91 95% CI: 2.59-5.92) and drunk driving were (ORa: 4.32 95% CI: 3.56-5.23) were the independent determinants of fatal accidents.
Conclusion: The fatal accident was linked to human and environmental factors, hence the need for behavior change awareness campaigns.

Keywords: Fatal accidents, determinants, police station, DRC

Introduction
Modernism, which implies a mechanization of all sectors of the economy and above all a more and more extensive development of road traffic, generates an exponential increase in the number of road traffic accidents, thus posing a major public health problem [1]. Data from the World Health Organization (WHO) indicate that in 2019, nearly 1.2 million people died worldwide from road traffic injuries [2]. The total annual cost of road traffic accidents for low- and middle-income countries is estimated at US $ 65 billion, which is more than the amount of development aid [3]. African countries continue to pay a heavy price for this social scourge. For example, the risk of a fatal accident is higher in Tanzania and Kenya where it is around 60 fatalities per 10,000 vehicles [4]. In Côte d'Ivoire, a study carried out by the Road Safety Office (OSER) identified 158,104 traffic accidents over a period of 32 years (from 1970 to 2001), i.e. an average of 4,940 accidents per year, with 10,111 wounded and 593 killed [5]. In Kinshasa hospitals, a study carried out in the city of Kinshasa by Moba *et al.*, showed that road traffic accidents are on the rise [6]. But this study did not determine the factors associated with fatal traffic accidents in Kinshasa. Thus, it seems opportune to conduct this study, the objective of which was to determine the prevalence of road traffic accidents and to identify the factors associated with fatal road traffic accidents in the DRC.

2. Materials and methods
Our study took place in 6 cities in the DRC. These are the city of Kinshasa, Goma, Matadi, Mbandaka, Lubumbashi and Kananga. The data were compiled in these different towns by the military service providing road control. These accident reports came from two sources: the national police for accidents in urban areas and the gendarmerie for accidents in the countryside. Accident reports are drawn up by police officers from the Autonomous District police stations in the various towns, who first register them at the police station before passing them on to the

police headquarters, which compiled all the data. These accident data are actively collected by police officers on a weekly basis to collect this data in the registers and retrieve the report cards. This was a cross-sectional, analytical study that took place from 2011 to 2016 and focused on road traffic accidents that occurred in the aforementioned 5 cities. The data were obtained from data obtained from the census of all road accidents recorded in various police stations in 6 towns. Prior to analysis, these data were cleared by excluding variables for which there was a lot of missing data (missing PV data). All accidents reported by law enforcement officials were included in the study. The variable of interest studied was the occurrence of a fatal road traffic accident. The explanatory variables were:

- socio-demographic characteristics (sex, age, season);
- the behavioral risk factors of road users (speeding, careless driving, wrong maneuver, bad crossings and drunkenness at the wheel)
- environmental risk factors (time of accident, type of road, condition of the road, category of vehicle, type of accident, accidents involving at least one pedestrian, in built-up areas, in open countryside, accident according to the day of the week, accident according to the type of day, accident according to the month, accident according to the year).

Statistical analysis

Analyzes were performed on SPSS 21.0. Descriptive statistics consisted of calculating the mean and standard deviation for quantitative data and proportions for categorical data. Pearson's chi-square test or Fisher's exact test was used to compare the proportions, on the other hand Student's t test compared the means. The search for the determinants of fatal accidents was carried out by the logistic regression test in univariate analysis. When differences were observed between the fatal accident and the independent variables, the effect of potential confounders was investigated by logistic regression fitting in multivariate analysis. Finally, the ORs and their 95% CIs were calculated to determine the degree of association between the fatal accident and the independent variables. The p-value <0.05 was considered to be the threshold of statistical significance.

Ethical considerations

The data was collected anonymously and confidentially. The privacy and personality of the respondents were safeguarded. The three fundamental principles of ethics were respected at the time of the study: the principle of respect for the person, that of beneficence and that of justice.

3. Results

3.1. Overall frequency of accidents

In six years, 4,635 accidents have been notified which have caused 945 fatal accidents, for an overall frequency of 20.4% (Figure 1).

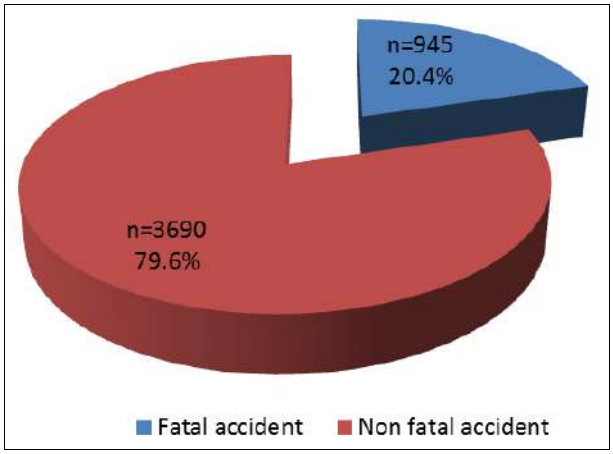

Fig 1: Global frequency of fatal accidents

3.2. Fatal accident frequencies per year

The frequency of fatal accidents increased linearly per year but the difference was not statistically significant with a slightly high frequency in 2016 (21.2%) (Table 1).

Table 1: Frequencies of fatal accidents per year

Year	Number of accident	Non fatal accident		Fatal accident	
		n	%	n	%
2011	435	350	80.5	85	19.5
2012	445	360	80.9	85	19.1
2013	755	600	79.5	155	20.5
2014	895	715	79.9	180	20.1
2015	690	550	79.7	140	20.3
2016	1415	1115	78.8	300	21.2

3.3. Frequency of fatal accidents by age

The distribution of fatal accidents was evenly distributed with a high frequency among passengers over 60 (23.4%) (Figure 2).

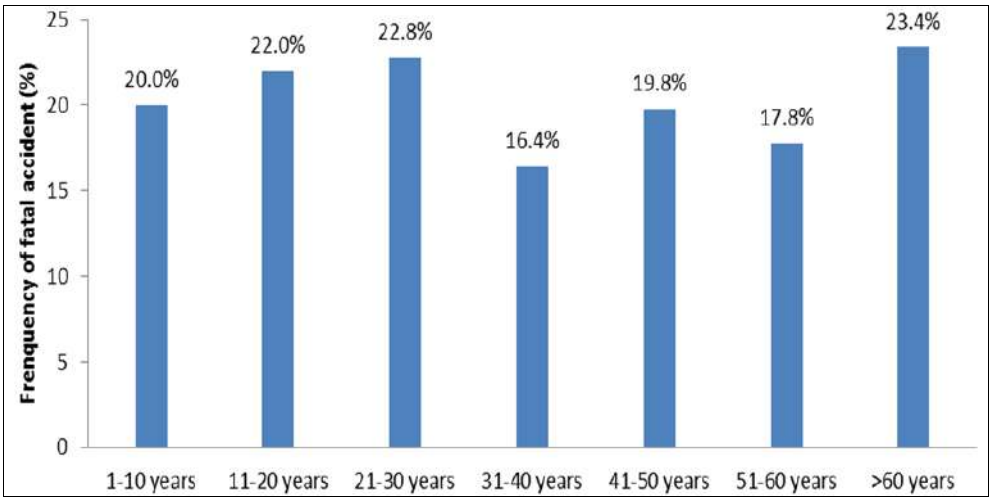

Fig 2: Frenquency of fatal accident (%)

3.4. Frequency of fatal accidents by sex

Figure 3 indicates that women had significantly more fatal accidents than men (22.5% vs. 18.5%, p = 0.001) (Figure 3).

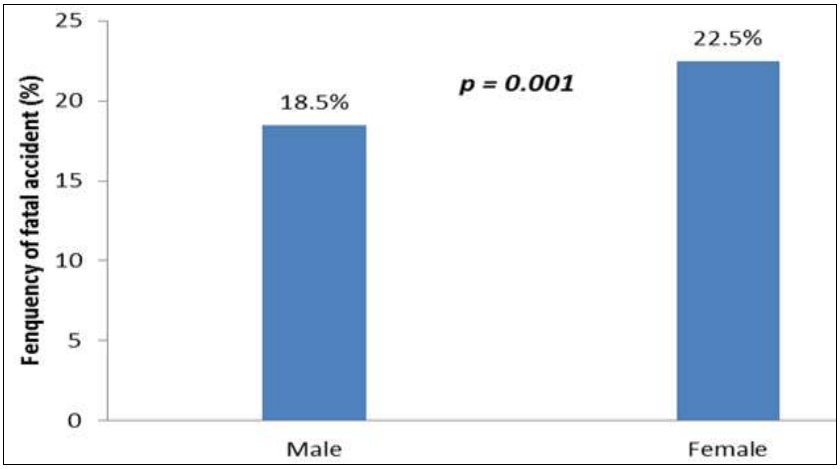

Fig 3: Distribution of fatal accidents by sex

3.5. Factors favoring accidents

From the table of factors favoring fatal accidents, this table indicates that women were significantly more exposed to fatal accidents (p = 0.001). In addition, the factors significantly favoring fatal accidents were the dry season, public transport, speeding, careless driving, wrong maneuver, bad crossing and drunk driving (p <0.05) (table 2)

Table 2: Breakdown of fatal accidents

Variables	Non fatal accident n=3690	Fatal accident n=945	p
Age	34.1±15.7	33.6±16.8	0.200
1-20 years	775(21.0)	215(22.8)	
21-40 years	1745(47.3)	440(46.6)	
40-60 years	925(25.1)	215(22.8)	
>60 years	245(6.6)	75(7.9)	
Gender			0.001
Male	2020(54.7)	460(48.7)	
Female	1670(45.3)	485(51.3)	
Season			<0.001
Rain	249(67.5)	465(49.2)	
Dried	1200(32.5)	480(50.8)	
Time of accident			0.097
6-18 hours	1710(46.3)	415(43.9)	
18-6 hours	1980(53.7)	530(56.1)	
Type of transport			<0.001
Public transport	1730(46.9)	765(81.0)	
Motorbike	760(20.6)	60(6.3)	
Personal vehicle	1200(32.5)	120(12.7)	
Speeding	1860(50.4)	530(56.1)	0.001
Careless driving	1670(45.3)	355(37.6)	<0.001
Wrong growth	285(7.7)	115(12.2)	<0.001
wrong crossing	55(1.5)	60(6.3)	<0.001
Drunk driving	575(15.6)	355(37.6)	<0.001

3.6. Determinants of fatal accidents

In univariate analysis, the dry season, public transport, speeding, wrong maneuver, bad crossing and drunk driving were the determinants of fatal accidents. After adjustment in multivariate analysis, the dry season (ORa: 1.66 95% CI: 1.41-1.96), public transport (ORa: 7.11 95% CI: 5.58-9.05), wrong maneuver (ORa: 2.93 95% CI: 2.22-3.87), the wrong crossing (ORa: 3.91 95% CI: 2.59-5.92) and drunk driving were (ORa: 4.32 95% CI: 3.56-5.23) were the independent determinants of fatal accidents.

Table 3: Determinants of fatal accidents in logistic regression analysis

Variables	Univariate analysis		Multivariate analysis	
	p	OR (95% CI)	p	aOR (95% CI)
Season				
Rain		1		1
Dried	0.000	2.14(1.85-2.47)	<0.001	1.66(1.41-1.96)

Type of transport				
Motorbike		1		1
Public transport	0.000	4.42(3.60-5.43)	<0.001	7.11(5.58-9.05)
Personal vehicle	0.151	0.79(0.57-1.09)	0.423	1.17(0.80-1.71)
Speeding				
No		1		1
Yes	0.002	1.26(1.09-1.45)	0.073	1.18(0.98-1.41)
Wrong growth				
No		1		1
Yes	0.000	1.66(1.32-2.08)	<0.001	2.93(2.22-3.87)
Wrong crossing				
No		1		1
Yes	0.000	4.48(3.09-6.51)	<0.001	3.91(2.59-5.92)
Drunk driving				
No		1		1
Yes	0.000	3.26(2.78-3.82)	<0.001	4.32(3.56-5.23)

4. Discussion

This study showed that the frequency of fatal traffic accidents was 20.4% in the 6 cities during the 6 years. This result is different from those of studies conducted by Moshiro in Tanzania (5.98%) [7], Labinjo in Nigeria (41%) [8] and Kobusingye in Uganda (38.9%) [9]. Road traffic fatalities were close to the rate reported by Peden in Africa (28.3%) which was one of the highest in the world [10]. This shows the scale and severity of accidents affecting the most active population, resulting in heavy losses for the families of the victims and the states. In the absence of death, these accidents can lead to permanent disability-type sequelae, with loss of productivity as demonstrated in the study by Juillard *et al*. in Nigeria, which showed that 13.5% of the injured were unable to return to work [11]. The subjects involved in fatal traffic accidents are 22.5% females vs. 18.5% males. This female predominance was also observed by Coulibaly in Mali and Wu in China with 75 and 76.6% [12, 13] as well as Privat and Rougier in France with respectively 83.3% and 88% [14, 15]. This could be explained in part by the fact that the women on the journey are reckless and distracted to save themselves in the event of accidents. Moreover, more than half of fatal traffic accidents occurred between 6 p.m. and 6 a.m. despite the insignificant difference. This period coincides with the end of work time (rush hour) so that it causes traffic jams favoring the occurrence of traffic accidents and more after 10 pm the roads are open causing a speeding of the road. Share of drivers. This could be justified on the one hand, by driver fatigue due to the weight of the work performed during the day with a reduced level of vigilance and sometimes disturbed by drowsiness; on the other hand, poor visibility in the event of insufficient or no public lighting, defective or damaged vehicle lights. This result is comparable to those found in Kenya, Ghana and England [9, 16, 17]. After adjustment in multivariate analysis, the dry season (ORa: 1.66 95% CI: 1.41-1.96), public transport (ORa: 7.11 95% CI: 5.58-9.05), wrong maneuver (ORa: 2.93 95% CI: 2.22-3.87), the wrong crossing (ORa: 3.91 95% CI: 2.59-5.92) and drunk driving were (ORa: 4.32 95% CI: 3.56-5.23) were the independent determinants of fatal accidents. This trend has been confirmed by the work of Madani in Algeria and Afukaar in Ghana [18, 19]. Our results also corroborate those of Odero in Kenya which showed that the human factor was responsible for the causes of fatal road accidents [20]. In Pakistan, the majority of crashes occurred on asphalt roads where drivers tend to speed excessively, causing human and material damage [21].

Limitations of the study

Despite its local nature, facilitating access to data, this study has some limitations. Bias in the reporting of accident data due to the refusal of a finding by certain users (amicable finding) or the unavailability of the agents responsible for the findings which meant that certain aspects were not addressed.

Conclusion

The intensification of road traffic in the DRC over the past six years has resulted in an exponential increase in the number of fatal accidents. This documentary study, which consisted of a census of road accidents over a period of six years, showed that, on the one hand, fatal accidents occurred more between 6 p.m. and 6 a.m. The human factor, through non-compliance with the Highway Code (season, speeding, drunkenness and dangerous overtaking) was incriminated in the occurrence of fatal accidents. Faced with these results, the State must take measures aimed at reducing traffic accidents through the adoption and application of laws taking into account the risk factors and carry out user awareness campaigns through various media. Communication. In addition, it is necessary to strengthen the control of the application of the Highway Code by setting up a camera surveillance system on the road networks and the installation of speeding control radars, and to strengthen training in driving schools with the involvement of specialists in psychology.

Conflict of Interest

The authors declare no conflict of interest

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