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Trend Over Six Years of Incidence of Mortality Related To Road Traffic Accidents in Six Cities of the Democratic Republic of the Congo: A Retrospective Survey in Population Based

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Abstract

Background and Objective: Despite the reduction in the risks incurred, obtained thanks to the constant improvement of the road networks, the mortality rate by road accidents had doubled in 20 years in the world. The objective of this study is to evaluate the evolutionary trend of mortality due to road traffic accidents in 6 cities of the Democratic Republic of Congo.

Methods: This was an analytical cross-sectional study of road traffic accident data in 6 cities in the DRC over a period from 2011 to 2016, based on data from the police stations of these 6 cities. It took into account all the accidents on the public highway having been the subject of a report by the police officers. Mortality and injuries due to road accidents were the dependent variables while socio-demographic characteristics, behavioral and environmental determinants were the independent variables.

Results: A total of 4635 road traffic accidents were recorded during 6 years in six cities of the Democratic Republic of Congo. Road traffic accidents evolved linearly over the years with a high frequency in 2016 (1415 cases). The overall incidence of mortality in the six cities was 3.4/100P-Y. This incidence of mortality increased more and more over the years, going from 1.6/100PA in 2011 to 5.1/100P-Y in 2016. The incidence of mortality per year and per city, it is noted that mortality increased over the years in each city, with very high and significant mortality in Kinshasa and Lubumbashi.

Conclusion: These data have shown that road traffic accidents increased over the years and the incidence of mortality varied from one city to another.

Keywords: DRC; Incidence; Road Traffic Accident; Mortality; Trend

Introduction

Road accidents pose serious public health problems all over the world. Road fatalities, road accidents and disabilities are among the main concerns in this regard [1]. Traffic accidents refer to the number of people who have suffered bodily injuries in a traffic accident. The level of injury or property damage caused by a crash is referred to as “crash severity” in the road safety manual [2]. Every year more than 1.25 million people lose their lives in road accidents worldwide. As reported by the World Health Organization (WHO) in 2018, road accidents cost 3% of Gross Domestic Product (GDP) for most countries [3]. Studies in developing countries have shown that 85% of deaths and 90% of disabilities are related to road accidents. Accidents are expected to increase by 80% in developing countries [4, 5]. Therefore, the pattern of

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road traffic fatalities and injuries in developing countries will be different from that in developed countries, which require dedicated models and strategies to improve the accuracy of predictions [6]. In addition, the development of active intervention policies should be implemented as the main factor in reducing TMRs and RTIs [7]. Despite the reduction in the risks incurred, obtained thanks to the constant improvement of the road networks, the mortality rate by road accidents had doubled in 20 years in the world [8-11]. In a previous study, dealing with the evolution of mortality and morbidity due to traffic accidents, the authors had emphasized the reversal of the trend, thanks to the safety measures taken then and reinforced in favor of the oil crisis [12-16]. Without making the road a means of transport or even the road itself in other countries, these measures, taken in a favorable psychological context, had made it possible to reduce by more than a quarter the number of deaths in the "open countryside" [1]. If in the other countries the reversal and the new security measures had led to a drop in morbidity and mortality linked to road accidents, in the Democratic Republic of the Congo, the trend in this morbidity and mortality from road traffic accidents is not known. The objective of this study is to evaluate the evolutionary trend of mortality due to road traffic accidents in 6 cities of the Democratic Republic of Congo.

Material 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 was compiled in these different towns by the military service providing roadside checks. These reports of accidents came from two sources: the national police for accidents occurring in urban areas and the gendarmerie for accidents occurring in open country. Accident reports are drawn up by police officers from the autonomous district police stations in the various cities, who first register them at the police station level before transmitting them to the police headquarters, which compiles all the data. This accident data is actively collected by police officers on a weekly basis to collect this data in the registers and retrieve the report sheets. This was a cross-sectional study for analytical purposes that took place from 2011 to 2016 and focused on road traffic accidents that occurred in the 5 aforementioned cities. The

Table 1: General Characteristics of the Study Population.

Variables	Kinshasa	Lubumbashi	Goma	Matadi	Kananga	Mbandaka n=139
	n=1761	n=603	n=741	n=1113	n=278	
Age	33.8±16.1	34.2±15.8	33.9±16.2	34.1±15.7	33.6±16.4	35.9±15.5
1-10 years	60(3.4)	17(2.8)	27(3.6)	34(3.1)	9(3.2)	3(2.2)
11-20 years	329(18.7)	105(17.4)	139(18.8)	190(17.1)	60(21.6)	17(12.2)
21-30 years	483(27.4)	169(28.0)	197(26.6)	309(27.8)	71(25.5)	41(29.5)
31-40 years	341(19.4)	125(20.7)	142(19.2)	230(20.7)	46(16.5)	31(22.3)
41-50 years	229(13.0)	76(12.6)	100(13.5)	142(12.8)	41(14.7)	17(12.2)
51-60 years	194(11.0)	66(10.9)	83(11.2)	139(12.5)	32(11.5)	21(15.1)
>60 years	125(7.1)	45(7.5)	53(7.2)	69(6.2)	19(6.8)	9(6.5)
Gender						
Male	942(53.5)	321(53.2)	395(53.3)	595(53.5)	155(55.8)	72(51.8)
Female	819(46.5)	282(46.8)	346(46.7)	518(46.5)	123(44.2)	67(48.2)
Season						
Rain	1154(65.5)	339(56.2)	509(68.7)	685(61.5)	212(76.3)	56(40.3)
Dried	607(34.5)	264(43.8)	232(31.3)	428(38.5)	66(23.7)	83(59.7)
head and neck	857(48.7)	290(48.1)	362(48.9)	533(47.9)	131(47.1)	77(55.4)
Member and belt	699(39.7)	252(41.8)	285(38.5)	444(39.9)	101(36.3)	74(53.2)
Trunk	927(52.6)	296(49.1)	392(52.9)	571(51.3)	150(54.0)	74(53.2)
Death	349(19.8)	138(22.9)	139(18.8)	226(20.3)	42(15.1)	51(36.7)
Wound	1187(67.4)	405(67.2)	493(66.5)	739(66.4)	184(66.2)	107(77.0)
Fracture	200(11.4)	142(23.5)	87(11.7)	138(12.4)	91(32.7)	39(28.1)
Contusion	177(10.1)	53(8.8)	174(23.5)	141(12.7)	32(11.5)	3(2.2)
Sprain	44(2.5)	11(1.8)	21(2.8)	24(2.2)	10(3.6)	0(0.0)
Polytraumatized	596(33.8)	220(36.5)	248(33.5)	378(34.0)	76(27.3)	77(55.4)

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data was obtained from data from the census of all road accidents recorded in different police stations in 6 cities. Before the analysis, these data were cleaned by excluding the variables for which there were many missing data (missing data on the VPs). Were included in the study all the accidents having been the subject of a report by the forces of order.

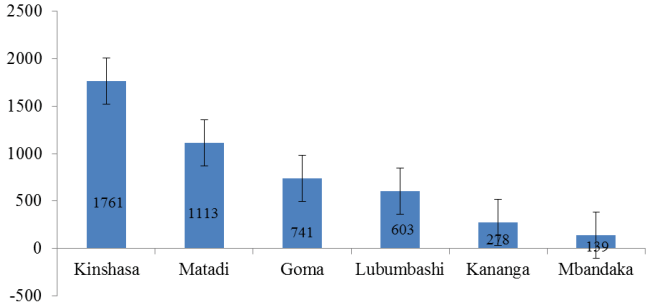

Figure 1: Frequency of Accidents per Year by City.

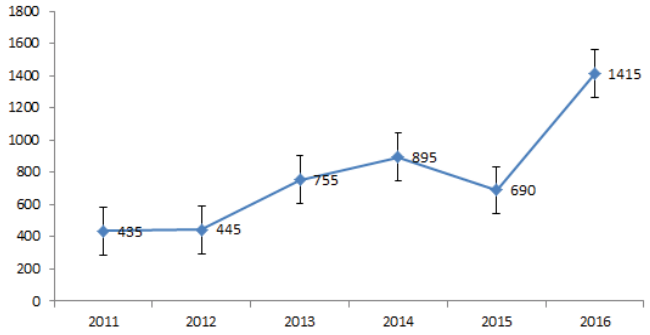

Figure 2: Evolution of Accidents over the Years.

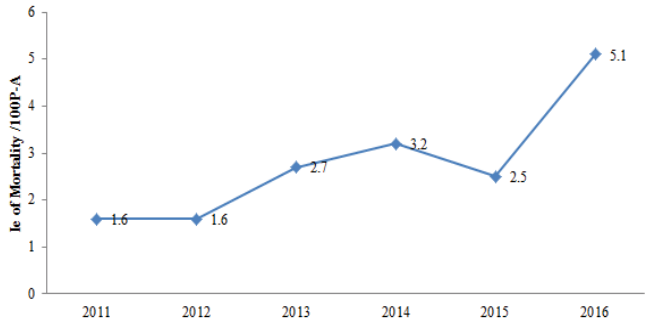

Figure 3: Overall 6-year Incidence of Mortality in the 6 Cities.

The variable of interest studied was the occurrence of a fatal road traffic accident. The explanatory variables were:

- socio-demographic characteristics (gender, age, season);
- the behavioral risk factors of road users (speeding, reckless driving, wrong manoeuvre, bad crossing and drunk driving)
- environmental risk factors (time of occurrence of the accident, type of road, road condition, category of machine, type of accident, accidents involving at least one pedestrian, in built-up areas, in open country, 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 Analyzes

Analyzes were performed on SPSS 21.0. The descriptive statistics consisted in calculating the mean and the standard deviation for the quantitative data and the proportions for the categorical data. Pearson's chi-square or Fisher's exact test was used to compare proportions. The value of $p<0.05$ was considered as the threshold of statistical significance.

Results

A total of 4635 road traffic accidents were recorded over 6 years in six cities of the Democratic Republic of Congo. The data relating to its distribution are analyzed in the following lines.

The incidence of mortality increased more and more over the years, going from 1.6/100P-Y in 2011 to 5.1/100PA in 2016.

Comparing the incidences of mortality by year and by city, we note that mortality increased over the years in each city, with very high and significant mortality in Kinshasa and Lubumbashi.

Discussion

The number of accidents has a considerably increasing trend over the years, going from 435 in 2011 to 1415 in 2016, probably due to non-enforcement of the traffic code and the harassment of police officers from the traffic on the roads as

Table 2: Comparison of Mortality *i*ncidences by City by Year.

Année	Kinshasa	Lubumbashi	Goma	Matadi	Kananga	Mbandaka	p
	Ie/100P-Y	Ie/100P-Y	Ie/100P-Y	Ie/100P-Y	Ie/100P-Y	Ie/100P-Y	
2011	6,0	4,1	2,7	2,8	1,2	3,0	0,012
2012	6,0	3,6	1,8	2,4	6,0	3,1	0,001
2013	13,2	6,1	5,2	5,8	2,4	5,3	<0,001
2014	12,0	6,6	6,3	6,6	3,6	6,4	<0,001
2015	9,6	6,6	4,0	5,7	2,4	4,5	<0,001
2016	14,4	11,1	11,2	10,5	9,6	10,6	0,159

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well as the lack of road safety campaigns by the national road safety council [17]. When interpreting this data, it should be noted that the DRC, like many other developing countries, does not have a reliable unified real-time system at the national level for recording injuries or reporting systems to a later stage. For example, the World Health Organization in its Global Road Safety Report [18] classifies the DRC as a country with no eligible death registration data. Research shows that for every traffic fatality, at least 20 people sustain non-fatal injuries [19]. So the numbers in the traffic police data would be much higher. The results of this study are consistent with those of other published reports which have shown that there is an overall increase in road traffic accidents in the African region or globally [18, 20]. Other reports indicate that there are countries that have actually succeeded in reducing the number of road traffic accidents, although this is not always the case [21, 22]. Mortality in the 6-year-old set has also increased and in each city as well. We observed a very high incidence of mortality in Kinshasa compared to other cities. This high incidence should challenge the authorities of the city of Kinshasa in order to find the causes of this high incidence compared to other cities in the country. If we refer to the data, such as the recent report by Kazeem (2019) [23], it can be seen that the mortality rates due to road traffic accidents in sub-Saharan Africa are always similar and evolve in the same way. This exponentially increasing mortality could be explained in our context by variations in traffic intensity. This can be seen by relating the latter to the monthly estimates of the number of vehicle-km traveled on the network of national roads and motorways. We find the general trend (indicated by the annual figures) of an increase in the risk incurred per km travelled. This increase is due to the constant improvement of the road network which allows drivers to drive at high speed without controlling their speed.

Limitations of the Study: Despite its local character, facilitating access to data, this study has some limitations. Biases in the reporting of data on accidents due to the refusal of a report by some users (amicable report) or the unavailability of the agents responsible for the reports, which meant that certain aspects were not addressed.

Conclusion

The intensification of road traffic in the DRC over the past six years in the 6 cities of the DRC, generates an exponential increase in the number of accidents and incidence of mortality in the 6 cities of the study. This documentary study, which consisted of a census of road accidents over a period of six years in six cities of the DRC, made it possible to show that, on the one hand, road traffic accidents increased over the years.

Declaration

Ethics Approval and Consent to Participate: The study protocol was approved by National Ethics Committee of the DRC (n°343/CNES/BM/PMMF/2022). The study has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Written informed consent was requested from the people at the beginning of the study. The informed consents included that data from the participants can be published in scientific journals in an anonymized format in which individual responses never are made visible or possible to identify.

Consent for Publication

This is not an experimental study but a transversal study and hence, no separate consent for publication is needed.

Availability of Data and Materials

The data the study is based on contains personal and intimate information that according to initial agreements with the participants from the start of the study cannot be transferred to third parties or outside the borders of Lubumbashi. Theoretically some subsets of data could on reasonable request be delivered but unfortunately, in most cases it probably would be evaluated as not possible along with this. The datasets used and analyzed during the current study are available from the corresponding author on reasonable request: nkodilaaliocha@gmail.com

Competing Interests

The authors declare no conflict of interest.

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Authors' Contributions

JMN and ANN designed and analyzed the statistical data for the study. MLN, DMK, LMB, GN, AKK, DMB and LMB supervised the study. All authors have read and approved the final and revised version of the manuscript.

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