

Current Data on Road Traffic Fatalities in Bouake Epidemiological and Medico-Legal Aspects

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Abstract: To describe the epidemiological profile and forensic aspects of road traffic accident victims and to determine the relationship between the site of fatal injuries and the quality of road traffic accident victims in the commune of Bouake. This was a retrospective study with descriptive, conducted in the Forensic Medicine Unit of the University Hospital Center (CHU) of Bouake, over a period of 53 months (May 1, 2019 to October 31, 2022). The majority of the deceased were male (83.8%) with a sex ratio of 5.1. The age groups most affected were 21 to 30 years old (26.7%), with an average age of 29 years. The victims were most often not in school (49.6%). Fatal traffic accidents occurred most often on Sundays (17.5%), between 6 p.m. and 11:59 p.m. (47.9%). The majority of victims died at the scene of the accident (72.5%). Motorcycles were the most involved motor vehicles in the occurrence of fatal road accidents (37.5%) and motorcycle users were the most affected (50.5%) without helmets in 90% of cases. The mechanism of occurrence of these fatal accidents was dominated by collisions (80%). The victims died most often from traumatic injuries to the head (37.1%) or chest (10%). Road accidents are a major public health problem in the city of Bouake with a high mortality rate among users of two-wheeled vehicles.

Keywords: Road Accidents, Motorcyclists, Forensic Medicine, Bouake

1. Introduction

Traffic accidents are considered as public health issue in the world but especially in developing countries [1]. According to the World Health Organization, about 1.35 million people die from road traffic accidents each year [1]. These unwanted accidents, unplanned, and badly anticipated collision which break out on road network between machine and any other thing or person, fixed or mobile, cause human injuries and/or property damages [2]. Despite various road safety programs, the number of road victims remains high. According to the World Bank, traffic accident deaths were estimated at 24 per 100,000 inhabitants in Ivory Coast in 2019 [3]. According to National Road Safety Office

projections for 2016-2020, the number of road accidents in Ivory Coast, was estimated at 20,000 accidents for 2,371 "killed". Preventive actions have been taken by Ivorian Government to reduce road accident mortality [4]. But these actions have been ineffective. In Ivory Coast, Djodjo's study on extra-hospital deaths of road traffic victims in Abidjan over a period of 9 years reported 1420 cases of death [5]. Road traffic deaths accounted for 30% of forensic activity in Abidjan. According to some authors (Kpozehouen in Benin [6] and TEKPA in the Central African Republic [7]), mortality from road traffic accidents varied between 12% and 16.9% in hospitals. However, this mortality only considers victims who died in hospital after having their first aid there. While some victims die at the scene of accident. These victims who

die at the scene of accident are directly taken to the morgue and taken care of by the medical examiner (extra-hospital deaths). Most of the studies done on road traffic accidents have most often focused on hospital data. What about extra-hospital data on road traffic accident deaths? The objective was to identify the epidemiological profile of people who died during road traffic accidents. To describe the characteristics of these road accidents and determine the link between the seat of the fatal injuries and the quality of the victims of traffic accident treated by medical examiners in Bouake.

2. Materials and Methods

This was a descriptive and retrospective cross-sectional study on epidemiological and forensic data collected from forensic registers of the Forensic Medicine Unit of Bouake University Hospital. This study considered all subjects who died in a road traffic accident during the period from May 1,

2019, to October 31, 2022 (53 months) and who underwent an external forensic examination at the request of judicial authorities. People died in road traffic accident and whose death certificates were delivered by non-legal doctors or who have not undergone a forensic examination have been also excluded from this study. Epidemiological characteristics targeted in this study were age, sex, nationality, professional occupation, place of residence, period of death (year, month, season, and time of death), place of death and type of users. Forensic characteristics analyzed were requesting authority, type of forensic examination performed (external examination), accident mechanism, and seat of fatal injuries. Descriptive statistical analysis will be used to calculate means and standard deviations and numerical variables and frequencies of nominal or ordinal variables. Data was collected through questionnaires and then entered in an Excel sheet. The resulting database was transferred to SPSS (Statistical Package for Social Sciences) version 22 which was used for analysis.

3. Results

3.1. Epidemiological Characteristics

Table 1. Distribution of victims by sex, age group, marital status and level of education.

Sociodemographic characteristics	Sample (n)	Percentage (%)	P-value
Gender			
Female	39	16.2	0.000
Male	201	83.8	
Age group			
[0-10]	30	12.5	0.000
[11-20]	41	17.1	
[21-30]	64	26.7	
[31-40]	45	18.8	
[41-50]	30	12.5	
[51-60]	21	8.8	
[61 et plus]	9	3.6	
Marital status			
Single	105	43.8	0.000
In couple	135	56.2	
Level of education			
Unschoolled	119	49.6	0.000
Primary school	59	24.6	
Secondary school	31	12.9	
Higher study	31	12.9	
Place of death			
Scene of the accident	174	72.5	0.000
During the transfer to the Bouake University Hospital	66	27.5	
Total	240	100	

During the study period we recorded 2426 deaths including 321 cases of violent death. 240 of these cases were due to road traffic accidents. Our study showed that deaths from road traffic accidents accounted for 74.7% of violent deaths. In our study, the 240 cases of death by road traffic accidents accounted for 21.8 per 100,000 inhabitants. Since the population of Bouake was estimated at 1,353,900 inhabitants according to the last general population census of 2021. Most of the deceased were male (n = 201 or 83.8%) whose median was 29 years with (95% CI: 27.5 years-31.6

years). Women were estimated at 16.2% of our sample with a median age of 24 years with (95% CI: 22-36.6 years). The sex ratio was 5.1. Victims belonged to the age group of 21-30 years (26.7%) with extreme ages ranging between 1 month and 73 years. They were most often Ivorians (n = 196 or 81.7%), single (n = 105 or 43.8%), unschooled (n = 119 or 49.6%). 72.5% of deaths occurred at the scene of the accident. They were distributed as follows: 40.4% of accidents took place in Bouake and 32.1% in villages around (Table 1).

3.2. Time and Place of Death

Table 2. Distribution of victims according to the period of accident.

Period of death	Sample (n)	Percentages (%)	P-value
Days of the week			
Monday	32	13.3	0.000
Tuesday	31	12.9	
Wednesday	37	15.4	
Thursday	28	11.7	
Friday	31	12.9	
Saturday	39	16.3	
Sunday	42	17.5	
Time of death			
00:00 a.m. – 05:59 a.m.	31	12.9	0.000
06:00 a.m. – 11:59 a.m.	29	12.1	
12:00 a.m. – 05:59 p.m.	65	27.1	
06:00 p.m. – 11:59 p.m.	115	47.9	
Seasons			
Rainy season	79	32.9	0.000
Dry season	161	67.1	
Total	240	100.0	

Traffic accidents happened every day of the week. However, they were higher on Sundays (n = 42 or 17.5%) and Saturdays (n = 39 or 16.3%). These accidents generally occurred between 6 p.m. and 11:59 p.m. (n = 115 or 47.9%) and most often in the dry season (n=161 or 67.1%) (Table 2).

3.3. Characteristic of Fatal Traffic Accidents

Table 3. Distribution of victims according to the road users.

Type of users	Sample (n)	Percentages (%)
Rider	1	0.4
Vehicle driver	16	6.7
Cyclist	4	1.7
Motorcyclist	99	41.3
Motorcycle passenger	22	9.2
Vehicle passenger	40	16.7
Pedestrian	58	24.2
Total	240	100.0

All types of road users were affected by road traffic accidents. But most of them were motorcyclists (n=99 or 41.3%), followed by pedestrians (n=58 or 24.2%) (Table 3).

Table 4. Distribution of machineries involved in road accidents.

Categories	Machineries	Sample (n)	Percentages (%)
Goods transport vehicle	Truck	37	15.4
	Train	1	0.4
Others	Caterpillar	1	0.4
	Bus	19	7.9
	Minibus	22	9.3
Passenger transport vehicle	Picnic	8	3.3
	Taxi	14	5.8
	City bus	1	0.4
	Personal car	41	17.1
Two- and three-wheeled motor vehicles	Three-wheeled vehicle	6	2.5
	Motorbike	90	37.5
Total		240	100.0

Road traffic accidents most often involved two-wheeled vehicles, especially motorcycles (n= 90 or 37.5%), followed by four-wheeled vehicles, especially personal vehicles (n= 41

or 17.1%). Collisions were the most frequent (n= 192 or 80%), especially those involving motorbikes and vehicles transporting people or goods (n= 54 or 22.5%), followed by transport vehicle-pedestrian collisions (n= 26 or 10.8%) (Table 4).

3.4. Legal Medical Aspects

Table 5. Distribution of victims according to the site of fatal injuries.

Location of fatal injuries	Sample (n)	Percentages (%)
Single seat (n = 130, 54.2%)		
Hip	3	1.3
Neck	4	1.7
Limbs	10	4.2
Head	89	37.1
Thorax	24	10.0
Double seat (n = 103, 42.9%)		
Neck + Thorax	3	1.3
Head + Abdomen	5	2.1
Head + Neck	4	1.7
Head + Limbs	36	15.0
Head + Thorax	32	13.3
Thorax + Limbs	23	9.6
Triple seat (n= 7, 2.9%)		
Head + Neck +Thorax	1	0.4
Head + Thorax + Limbs	6	2.5
Total	240	100.0

External body examination was the medico-legal act performed for all deaths. No forensic autopsy was performed. In 54.2% of cases, fatal lesions concerned a single anatomical region, in particular head (n = 89 or 37.1%), then thorax (n = 24 or 10%) and finally limbs (n = 10 or 4.2%). As for the lesions concerning two anatomical regions: the head-limb pairs (n = 36 or 15%) and the head-thorax (n= 32 or 13.3%) (Table 5).

4. Discussion

Our study revealed that road traffic accidents are a major problem in Bouake. The frequency is 21.8 per 100,000 inhabitants. This rate is below that estimated by Djodjo for the city of Abidjan between 2004 and 2012 (35.5 per 100,000 inhabitants) [5]. This difference could be explained by the fact that Abidjan is the economic capital of Ivory Coast with a higher density of population and vehicles. This could lead to accidents and most often fatal. Majority of victims were Ivorians (81.7%), male (83.8%) with a sex ratio estimated at 5.1. The age group from 21 to 30 years old is the most affected (26.7%). The average age is estimated at 29 years with extremes of 01 month to 73 years.

Our results are similar to those of Mobasheri [8] in Iran (2015 and 2016) which showed a male predominance (75.4%) and a significant proportion of young adults whose age range varied between 21 and 30 years (23.4%). In addition, men would be the most affected because of their cultural role as head of household ensuring the needs of their families.

This cultural role makes them economically active people, therefore exposed to accidents, especially those of road

traffic [9]. Therefore, deaths of young adults would be considered as a tragedy because they play an essential role in the economy of their countries. Regarding the level of education of victims, 49.6% of the sample were uneducated. This could explain their poor knowledge of traffic laws. In accordance with studies carried out by Mobasheri in Iran [8] and Madougou in Benin [10]. Mobasheri had shown the influence school level could have on occurrence of a road traffic accident. According to this author, the more road users were educated, the less they caused road accidents.

Victims of road traffic accidents most often died at the scene of accident (72.5%) according to the study carried out by Mobasheri [8]. In our context, the high number of deaths at the scene of accident could be explained first by the seriousness of initial injuries presented by victims and second by the delay of rescue teams on the scene or the delay of the call for help by the first witnesses. Fatal accidents occurred every day of the week, with a high frequency on Saturdays (16.3%) and Sundays (17.5%). Most studies found a predominance of weekend deaths [5-11]. In general, working people take advantage of these times to travel to other localities. These numerous movements are factors exposing to road accidents. The accidents most often took place at night between 6 p.m. and 11:59 p.m. (47.9%). This time slot was also found by Madougou [10] in Benin. According to this author, this is certainly time when all workers return home, but especially the time when alertness and responsiveness drop after the working day. In our study, fatal traffic accidents occurred most often during dry seasons (67.1%). Our observation differs from that of Djodjo [5]. Indeed, Bouake is located in the center of Ivory Coast, a savannah zone, which could explain longer dry seasons. This is normal, because the study carried out in Abidjan, which is located in the south of the country in a forest zone [12]. Most accidents were collisions (80%) and most often caused by two-wheeled vehicles on public roads. This mechanism is highlighted by majority of authors [5, 8, 10, 13]. Due to the military-political crisis of 2002, a new form of transport using two-wheeled vehicles has been developed in this city. This means of transport is easy to maneuver for civil servants of all trades as well as pupils and students. Sometimes this machine is also used as a means of transporting people for commercial purposes. In our study, only 9 motorcycle taxis were counted out of 99 motorcyclists. Motorcycles are utility vehicles but expose users to traffic accidents. Thus, most of the machines involved in road accidents were motorcycles (37.5%) followed by personal vehicles (17.1%). The predominance of motorized two-wheeled vehicles was also found by Madougou in Benin [10] a country where there are also many motorcycle taxis. Contrary to our study, Barzegar in Iran [14] found a predominance of passenger transport vehicles, especially buses (38.5%). Most road users, whether passengers, drivers or pedestrians, were victims of road traffic accidents [11, 15, 16]. In our study, majority of victims were motorcyclists (41.3%). The same is true in Colombia, according to Rodriguez [16] the victims were mostly motorcyclists (69%). Pedestrians were victims in 24.2% of

cases. They most often died following a collision with a transport vehicle (10.8%) or a personal vehicle (8.8%). Indeed, they are the main victims of these collisions as reported by Djodjo [5]. It is at the request of the judicial authority that the medical examiner carries out an examination of bodies of victims of fatal road accidents, whether or not completed by a forensic autopsy. In our study, no death by road traffic accident was the subject of a forensic autopsy in accordance with Regulation R (99) of the Council of Europe [17]. The practice of an autopsy then has a triple interest: (i) a humanistic interest to help families mourn thanks to the determination of exact circumstances and causes of death; (ii) a legal interest: an autopsy makes it possible to establish everyone's responsibilities (driving under the influence of alcohol or narcotics). This is important for insurance coverage, and to better understand the mechanism of occurrence of the accident, the speed of the vehicle, etc. We can also distinguish between ante-mortem injuries (caused by shock) and post-mortem injuries (inflicted after the death of the victim); (iii) finally, autopsies have a public health interest. Because most of the statistics on road accidents come from gendarmerie brigades, police stations and the public highway service. However, they need to be confronted with forensic data and vehicle analysis in order to improve prevention [18]. The wealth of knowledge acquired during post-mortem investigations not only contributes to setting up an accurate database on all forms of mortality, but also makes it possible to introduce measures aimed at preventing these deaths or reducing their incidence. Many safety devices used today, such as seat belts, high-back seats with headrests, hard hats, etc. are results of these examinations [19]. Fatal injuries caused by road traffic accidents involved all parts of the body. In our study. Majority of victims died from head injuries ($n=89$ or 37.1%). Head is also the organ most affected during fatal road accidents in studies carried out by certain authors [5, 8-10, 20]. The reason could be related to the absence of protective helmets by motorcyclists (90%). This situation exposed them particularly to cranial lesions during accidents (falls, collisions or leaving the road). As far as pedestrians are concerned, head injuries occurred during a collision with a vehicle either by direct contact between the pedestrians' heads and the front windshield of the vehicle or during the projection phase which begins with a violent impact with the ground or by sliding [21]. The mechanism of production of cranial lesions concerning motorcyclists, particularly those who did not wear helmets, was identical to that of pedestrians [21]. Thus, the compulsory use of seat belts by vehicle occupants and the wearing of protective helmets by two-wheelers, combined with compliance with the speed limit, could contribute to reducing deaths on the roads.

5. Conclusion

Road traffic deaths affect young men, mostly out unschooled and most often occurring at the scene of accident. In general, two-wheeled vehicles, especially motorcycles, are

the most involved in fatal accidents in Bouake. Fatal lesions are most often located on the head. Faced with these deaths, the municipal authorities should set up educational measures on the highway code to promote a better awareness of road users.

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