DEATH DUE TO BICYCLE ACCIDENTS IN THE NORTHEAST REGION OF BRAZIL

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Fecha de publicación: 01/01/2015

MORTALIDAD POR ACCIDENTES DE BICICLETA EN LA REGIÓN NORESTE DE BRASIL

SUMARY: Introduction. **1.** Methods. **2.** Results. **3.** Discussion. Conclusion. References.

RESUMEN:

Objetivo: Evaluar la prevalencia de la mortalidad por accidentes de bicicletas en el Nordeste entre 2001 y 2010. Metodología: Este estudio se realizó en un enfoque cuantitativo descriptivo y analítico a través de datos secundarios. La muestra estuvo constituida por todas las declaraciones de la Muerte (DO) registrados en el Sistema de Informaciones sobre Mortalidad (SIM), Base de datos del Sistema Nacional de Salud (DATASUS), quienes reportaron accidentes de bicicleta entre 2001 y 2010. Medidas descriptivas fueron determinadas para todas las variables. Las variables sociodemográficas se cruzaron con la causa básica de defunción en busca de correlación estadística. Resultados: En el período que se examina se plantearon 2.763 declaraciones de muertes en las que ocurrieron

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en el noreste de Brasil se debieron a accidentes de bicicleta, lo que evidencia una mayor frecuencia en el sexo masculino, entre los 25-59 años, marrón, único y escolaridad 1-3 años. La edad promedio de las víctimas era 38,49 años (DE = 18.322). Conclusiones: El aumento en el número de accidentes mortales con señales bicicleta a la necesaria mejora de la infraestructura de transporte, el aumento de la oferta de ciclos de punto y los cambios legales eficaces para reducir este tipo de accidentes.

ABSTRACT

Objective: To evaluate the death prevalence due to bicycle accidents in the northeast region of Brazil between 2001 and 2010.

Methodology: This study was conducted with a descriptive quantitative and analytical approach through secondary data. The sample consisted of all Death Certificates (DC) registered over the Mortality Information System (MIS) of the Unified Health System Data Base that reported bicycle accidents between 2001 and 2010. Descriptive measures were determined to all variables. The sociodemographic variables were intersected with the basic cause of death to search a statistical correlation.

Results: Over the considered period of time, 2763 Death Certificates were brought up, where the deaths that occurred over the northeast region of Brazil were due to bicycle accidents, being evidenced a higher frequency to men, between 25-39 and 40-59 years old, with brown skin color, single and with 1-3 scholarity years. The victims mean age was 38,49 (DP = 18,322).

Conclusion: The increase in the numbers of fatal bicycle accidents show that a restructuration of the traffic infrastructure is needed, an increase on the cycling paths offer and effective legal changes to the reduction of this kind of accident.

Key words: Traffic accidents, cycling, external causes, mortality.

INTRODUCTION

Over the world, about 1,2 million people die every year on the highways, between 20 and 50 million suffer non-fatal injuries and about 90% of the traffic fatalities occur over underdeveloped or developing countries, such as Brazil[1].

Brazil occupies the fifth place on the mortality world ranking to this type of lesion and the most vulnerable users of the road system, in terms of

body exposure, are pedestrians, cyclists and bikers[2, 3]. Currently, is the sixth greater bicycle fleet of the world, estimated on 75 million units, being the fourth larger producer, behind China, India and Germany. Despite this, has only three thousand kilometers of cycling paths[4].

Bicycle is a popular transportation among several people all over the world since the XIX century[5]. By gathering qualities as low cost, operation simplicity, absence of chemical or noise pollution, reduced size, ability to offer the cyclist a good fitness, it is an important social inclusion instrument[6]. However its use to transportation, recreational or sports activities is not free of accidents[7] with few studies about its usage profile and consequences[8].

One of the main characteristics of the bicycle paths transportation is its flexibility on urban areas. Bicycle is available in almost every part of the city, not requiring large physical amount of space, although its routs are limited to 7,5km, a distance considered comfortable due to the physical effort[9].

Studies made over Pelotas – RS[8], Londrina – PR[3] and Belo Horizonte – MG[10] showed that although the absolute number of accidents is smaller than the motorcycles number, the percentage of death occurrences in bicycle accidents, many times surpasses the deaths of bikers.

A regional study was not yet developed and it is very important to understand this panorama at this level. Therefore, this study was developed in order to measure the prevalence of deaths in bicycle accidents that occurred on the Northeast Region over a ten years series starting in 2001.

1. METHODS

This was a quantitative, descriptive and analytical, study, generated by processing secondary data. All the Death Certificates (DC) registered over the Mortality Information System (MIS, DATASUS) database between 2001 and 2010 were studied.

The files concerning these years were acquired over the internet and the data processed using the Excel program (2010 version) and statistically analyzed with the program Statistical Package for Social Services (SPSS version 13.0).

The basic causes of death analyzed were: Collision with Pedestrian or Animal (CPA); Collision with Another Pedal Vehicle (CAPV); Collision with 2-3 Wheeled Motor Vehicle (C2-3WMV); Collision with Car, Truck or Auto truck (CCTA); Collision with Heavy Transportation or Bus (CHTB); Collision with Train or Rail Vehicle (CTRV); Collision with Another Vehicle, Non-Motorized (CAVNM); Collision with Fixed or

Stationary Object (CFSO); Non-Traffic Accidents (NTA); Non-Specific Accidents (NSA).

The sociodemographic variables (gender, age group, race, marital status and schooling) and the basic cause of death were intersected and analyzed with Pearson's chi-square test or Fischer exact test, when the first one was impractical. Measures of central tendency (median, mean and mode) were identified to the absolute age.

The spatial distribution used the administrative division available over the Statistics and Geography Brazilian Institute Website – IBGE (11), being the Northeast Region comprised by 9 Federal Units or States, namely: Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe.

2. RESULTS

Considering only the northeast territory, between the years of 2001 and 2010, 2.763 Death Certificates were brought up, where the deaths occurred due to bicycle accidents, being most frequent to men, between 25-39 and 40-59 years old, with brown skin color, single and with 1-3 scholarity years. The mean age was 38,49 years old, the median was 37 years old, the mode was 18 years old and the standard deviation (SD) was 18,322 (Table 1).

When considering the month of occurrence, the higher volume of cases was registered in August, and the lower in March and October. When considering the years, the higher casuistry occurred in 2010, which data are still preliminary, and the lower in 2004. Finally, when considering the quarters, the higher and lower percentage can be observed, respectively over the third and second quarters (Table 2).

The most prevalent basic cause of death was the non-specific accident, where the victim was a cyclist, but no additional information about the accident was related. The legal cause of death is listed as predominantly accident. The most frequent death site was the thoroughfare, indicating that most of the victims didn't survive to the rescue. The necropsy was held in 53,6% of the cases. The information source about the death was not informed on most cases (Table 3).

The deaths spatial distribution shows a higher concentration over the States of Ceará and Pernambuco. On the other tip of this scale, the lower occurrence happened over Alagoas, Paraíba and Rio Grande do Norte (Table 4).

Only 13 intersections between the basic cause of death and the sociodemographic characteristics showed statistical significance (50

intersections were tested). Scholarity was the sociodemographic characteristic that presented statistical significance with the higher number of causes (4 to 10, being: CPA, C2-3WMV and NTA), while marital status with the lower (1 to 10, C2-3WMV). Furthermore, gender presented itself statistically significant with the causes CCTA, CTRV and CFSO, age group with the causes C2-3WMV, CHTB and CFSO, and skin color with the causes CAPV and NTA. These intersections generally show the same distribution pattern of those presented to sociodemographic characteristics, except to the links below (Table 5):

- Scholarity and basic causes CHTB and CTRV: occurred mainly among the individuals with scholarity between 4-7 years;
- Scholarity and basic cause NTA: occurred at the same rate of scholarity between 1-3 and 4-7 years.

3. DISCUSSION

Accidents and violence represent the second main cause of death over Brazilian population in general[12]. Considering that Brazil is one of the countries with the most violent traffic of the world, policies have been developed to contain the high number of accidents, however the increase of the number of deaths and the maintenance of the mortality and hospitalization rates suggest that the prevention policies have not been effective[13].

From a study performed on a national level, the Northwestern region presented the lower regional specific death rate (5.78 deaths/100.000 inhabitants), however Piauí, Sergipe and Ceará presented unacceptable levels. An epidemiological and descriptive research developed at Pernambuco (which had a death coefficient of 6.52 deaths/100.000 inhabitants) presented an increasing linear trend, calculated from the data provided by the article and expressed by the equation "y = 46,26 + 0,987x", decreasing at the last year studied[17]. From these results, published in 2013, and served subsequently at a newspaper of relevance on the state (Diário de Pernambuco), policies encouraging the use of bicycle as a kind of transportation and recreational activity were developed, with the foundation of mobile cycling lanes in the various districts of the city of Recife. Partnerships with the private sector were made to create access points to bicycles, where people can rent them just paying a low cost tax for joining the project. These mobile cycling lanes are created on weekends by closing one lane of some streets that converge to a central point located at the

Historic Center of Recife, where there are attractions such as dance and music performances.

The Northeast Region occupies the third position on the occurrence of fatal accidents with cyclists considering the studied period of time (data not shown), a grievance that claimed 276,3 lives per year (which means approximately 23 deaths per month), predominantly men, single, adults, with brown skin color and low scholarity (consistent with incomplete basic education).

The economic growth of this Region has been accentuated from 1990 to today and since then the industrial production practically doubled (from 8,4% to 16,4%)[14]. This growth encouraged a disordered urbanization, globalization and social inequality – largely responsible for the increase of urban violence and, consequently, external causes[15].

The reality demonstrated in this study shows an increasing oscillation on the number of fatal accidents involving bicycle. The increase of the purchasing power and the phenomenon of facilitating the purchase of consumer goods (such as bicycle) can continue to feed this events growth.

Concerning the national studies performed and cited, it is worth mentioning that the one developed at Londrina – PR, verified that cyclists occupy the second place on the occurrence of traffic accidents[3]; the one from Belo Horizonte[10] showed the gravity of bicycle accidents without, however, sort them in an importance ranking. Other studies about accidents involving bicycles were developed. Nevertheless the findings produced by them couldn't be compared to those achieved here because of the methodological differences existing on the process of their obtainment.

The lack or limited disclosure of the data can help to maintain or increase the number of deaths in accidents involving bicycles. The vision of the bicycle as a form of leisure reduces the consciousness of the risk, therefore, accident prevention measures are taken only by a small portion of the cyclists.

Bicycle as a utility vehicle, with no recreational or sporting purpose, should be of primary interest on the perspective of a transport policy, because it is a way that has potential to substitute cars at short distances, due to its flexibility in shifting, or at places where cars cannot get in due to poor infrastructure[16]. Besides being a very effective alternative to reduce the pollutants emission on the local atmosphere and also reduce the greenhouse effect, providing a healthier life to its users as well, as physical activity cause effective reductions on cardiopulmonary problems[5].

Therefore, some measures must be taken in order to avoid such accidents, since traffic accidents do not just happen. In most cases, they happen due to roads or vehicles deficiencies and human errors[17]. There is a need to install an adequate infrastructure, such as bike lanes, bicycle tracks or similar. Another important issue is the use of helmets and self-protection equipment which, despite the proven efficiency, are not correctly used[5]. Only the use of helmets among cyclists can reduce between 63% and 88% the risk of head trauma in this group[2].

CONCLUSION

Due to economic and social growth, Brazilian Northeast Region has returned to be highlighted on the world scenario. However, harm arising from social inequalities and poor income distribution reflect directly on the urbanization. With a first world health level and urban and social problems of the third world, violence gradually gains more strength and its direct and immediate reflect is over the external causes and, mainly, over the aggressions and traffic accidents. Bicycle accidents, as a cause of death, are becoming a growing social problem and this study indicates an urgent need of restructuring the existing infrastructure, expansion of cycling paths and effective legal measures to reduce these types of traffic accidents.

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TABLE 1

Sociodemographic characteristics of the fatal victims due to accidents with cyclists/bicycles, Northeast Region, 2001-2010.

Variable		N	%
Gender			
	Male	2.489	90,1
	Female	274	9,9
Total		2.763	100,0
Age group[1]			
	0 – 11 years old	128	4,6
	12 – 17 years old	215	7,8
	18 – 24 years old	370	13,4
	25 – 39 years old	803	29,1
	40 – 59 years old	832	30,1
	60 years old or more	413	14,9
	Undetermined	2	0,1
Total		2.763	100,0
Skin color			
	White	411	14,9
	Black	155	5,6
	Brown	1.899	68,7
	Yellow	6	0,2
	Indian	5	0,2
	Not informed	287	10,4
Total		2.763	100,0
Marital status			
	Single	1607	58,2
	Married	924	33,4
	Ignored	102	3,7
	Not informed	130	4,7
Total		2.763	100,0
Scholarity			
	No	437	15,8
	1 - 3 years	646	23,4
	4 - 7 years	580	21,0
	8 - 11 years	199	7,2
	12 years or more	56	2,0
	Ignored	393	14,2
	Not informed	452	16,4
Total		2.763	100,0

[1]Mean = 38,49; Median = 37; Mode = 18; DP = 18,322
Source: MIS/ Mortality Information System of the Unified Health System Data/Ministry of Health, 2012.

TABLE 2
Temporal distribution of deaths due to cyclists/bicycle accidents, Northeast Region, 2001-2010.

Variable		N	%
Month[1]			
	January	245	8,9
	February	229	8,3
	March	209	7,6
	April	222	8,0
	May	223	8,1
	June	219	7,9
	July	235	8,5
	August	262	9,5
	September	250	9,0
	October	209	7,6
	November	226	8,2
	December	234	8,5
Total		2.763	100,0
Quarter[2]			
	First	683	24,8
	Second	664	24,0
	Third	747	27,0
	Fourth	669	24,2
Total		2.763	100,0
Year[3]			
	2001	236	8,5
	2002	265	9,6
	2003	234	8,5
	2004	217	7,9
	2005	274	9,9
	2006	278	10,1
	2007	317	11,5
	2008	294	10,6
	2009	309	11,2
	2010*	339	12,3
Total		2.763	100,0

[1]Deaths by month = 23,025; [2]Deaths by quarter = 69,075; [3]Deaths by year = 276,3; *Preliminary data. Source: MIS/ Mortality Information System of the Unified Health System Data/Ministry of Health, 2012.

TABLE 3
Basic Cause and other death data due to cyclists/bicycle accidents, Northeast Region, 2001-2010.

Variable	N	%
Basic cause of death		
Collision with Pedestrian or Animal (CPA)	41	1,5
Collision with Another Pedal Vehicle (CAPV)	62	2,2
Collision with 2-3 Wheeled Motor Vehicle (C2-3WMV)	313	11,3
Collision with Car, Truck or Auto truck (CCTA)	573	20,7
Collision with Heavy Transportation or Bus (CHTB)	437	15,8
Collision with Train or Rail Vehicle (CTRV)	5	0,2
Collision with Another Vehicle, Non-Motorized (CAVNM)	9	0,3
Collision with Fixed or Stationary Object (CFSO)	49	1,8
Non-Traffic Accidents (NTA)*	509	18,4
Non-Specific Accidents (NSA)	765	27,7
Total	2.763	100,0
Legal cause of death		
Accident	2.653	96,0
Unknown	110	4,0
Total	2.763	100,0
Place of occurrence of the death		
Hospital	1.160	42,0
Another death establishment	6	0,2
Residence	54	2,0
Thoroughfare	1.396	50,5
Other	124	4,5
Ignored	20	0,7
Not informed	3	0,1
Total	2.763	100,0
Necropsy execution		
Yes	1.482	53,6
No	351	12,7
Ignored	75	2,7
Not informed	855	30,9
Total	2.763	100,0
Information source		
Accident report	805	29,1
Hospital	311	11,3
Family	465	16,8
Another source	105	3,8
Ignored	68	2,5
Not Informed	1009	36,5
Total	2.763	100,0

*Non-Traffic Accidents: accidents occurredinside garages, farms andconstruction sites or areas not open to the public (18).Source: MIS/ Mortality Information System of the Unified Health System Data/Ministry of Health, 2012.

TABLE 4
Spatial distribution of the deaths due to cyclists/bicycle accidents, Northeast Region, 2001-2010.

Variable	N	%
States from the Northeast Region		
Alagoas	97	3,5
Bahia	241	8,7
Ceará	688	24,9
Maranhão	392	14,2
Paraíba	122	4,4
Pernambuco	517	18,7
Piauí	399	14,4
Rio Grande do Norte	131	4,7
Sergipe	176	6,4
Total	2.763	100,0

Source: MIS/ Mortality Information System of the Unified Health System /Ministry of Health, 2012.

TABLE 5 – Intersection between basic cause of death and sociodemographic characteristics

Variables	Basic cause of death																			
	CPA		CAPV		C2-3WMV		CCTA		CHTB		CTRV		CAVNM		CFSO		NTA		NSA	
	N	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Gender	p=0,409		p=0,419		p=0,386		p=0,034		p=0,541		p=0,024		p=0,319		p=0,003		p=0,442		p=0,172	
Male	38	92,7	55	88,7	284	90,7	530	92,5	390	89,2	3	60,0	9	100,0	38	77,6	460	90,4	682	89,2
Female	3	7,3	7	11,3	29	9,3	43	7,5	47	10,8	2	40,0	0	0,0	11	22,4	49	9,6	83	10,8
Total	41	100,0	62	100,0	313	100,0	573	100,0	437	100,0	5	100,0	9	100,0	49	100,0	509	100,0	765	100,0
Age group	p=0,914		p=0,568		p=0,002		p=0,118		p=0,001		p=0,801		p=0,728		p=0,000		p=0,436		p=0,072	
0-11	1	2,4	2	3,2	6	1,9	20	3,5	32	7,3	0	0,0	0	0,0	5	10,2	30	5,9	32	4,2
12-17	2	4,9	9	14,5	20	6,4	60	10,5	36	8,2	1	20,0	1	11,1	5	10,2	33	6,5	48	6,3
18-24	7	17,1	8	12,9	39	12,5	79	13,8	74	16,9	1	20,0	1	11,1	10	20,4	66	13,0	85	11,2
25-39	12	29,3	15	24,2	76	24,3	167	29,2	135	30,9	0	0,0	1	11,1	12	24,5	142	27,9	243	31,8
40-59	11	26,8	20	32,3	105	33,5	168	29,2	110	25,2	2	40,0	5	55,6	11	22,4	166	32,6	234	30,6
60 or +	8	19,5	8	12,9	67	21,4	79	13,8	50	11,4	1	20,0	1	11,1	5	10,2	72	14,1	122	15,9
Undetermined	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	1	2,0	0	0,0	1	0,1
Total	41	100,0	62	100,0	313	100,0	573	100,0	437	100,0	5	100,0	9	100,0	49	100,0	509	100,0	765	100,0
Skin color	p=0,435		p=0,017		p=0,574		p=0,853		p=0,961		p=0,402		p=0,981		p=0,656		p=0,000		p=0,280	
White	4	9,8	6	9,7	26	8,3	60	10,5	47	10,8	0	0,0	1	11,1	3	6,1	77	15,1	63	8,2
Black	11	26,8	16	25,8	54	17,3	93	16,2	65	14,9	2	40,0	1	11,1	10	20,4	49	9,6	110	14,4
Yellow	2	4,9	2	3,2	20	6,4	29	5,2	24	5,5	1	20,0	0	0,0	1	2,0	32	6,3	44	5,8
Indian	0	0,0	0	0,0	1	0,3	2	0,2	1	0,2	0	0,0	0	0,0	0	0,0	0	0,0	2	0,3
Brown	24	58,5	37	59,7	211	67.4	388	67,7	300	68,6	2	40,0	7	77,8	35	71,4	351	69,0	544	71,1
Not informed	0	0,0	1	1,6	1	0,3	1	0,2	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	2	0,3
Total	41	100,0	62	100,0	313	100,0	573	100,0	437	100,0	5	100,0	9	100,0	49	100,0	509	100,0	765	100,0
Marital status	p=0,659		p=0,369		p=0,050		p=0,823		p=0,175		p=0,308		p=0,100		p=0,750		p=0,128		p=0,450	
Single	25	61,0	40	64,5	172	55,0	332	57,9	273	62,5	5	100,0	8	88,9	32	65,3	281	55,2	439	57,4
Married	14	34,1	16	25,8	123	39,3	196	34,2	136	31,1	0	0,0	0	0,0	13	26,5	173	34,0	253	33,1
Ignored	0	0,0	4	6,5	6	1,9	22	3,8	12	2,7	0	0,0	1	11,1	2	4,1	26	5,1	29	3,8
Not informed	2	4,9	2	3,2	12	3,8	23	4,0	16	3,7	0	0,0	0	0,0	2	4,1	29	5,7	44	5,8
Total	41	100,0	62	100,0	313	100,0	573	100,0	437	100,0	5	100,0	9	100,0	49	100,0	509	100,0	765	100,0
Scholarity	p=0,047		p=0,574		p=0,021		p=0,021		p=0,176		p=0,188		p=0,173		p=0,616		p=0,000		p=0,127	
No	4	9,8	9	14,5	69	22,0	86	15,0	65	14,9	3	60,0	0	0,0	9	18,4	71	13,9	121	15,8
1-3 years	8	19,5	18	29,0	67	21,4	156	27,2	98	22,4	0	0,0	3	33,3	15	30,6	98	19,2	183	23,9
4-7 years	4	9,8	13	21,0	63	20,1	127	22,2	111	25,4	1	20,0	1	11,1	10	20,4	97	19,2	153	20,0
8-11 years	7	17,1	7	11,3	28	8,9	49	8,6	22	5,´0	0	0,0	0	0,0	4	8,2	32	6,3	50	6,5
12 years or more	0	0,0	0	0,0	4	1,3	12	2,1	10	2,3	0	0,0	0	0,0	0	0,0	9	1,8	21	2,7
Ignored	9	22,0	8	12,9	34	10,9	69	12,0	60	13,7	1	20,0	4	44,4	7	14,3	75	14,7	126	16,5
Not informed	9	22,0	7	11,3	48	15,3	74	12,9	71	16,2	0	0,0	1	11,1	4	8,2	127	25,0	111	14,5
Total	41	100,0	62	100,0	313	100,0	573	100,0	437	100,0	5	100,0	9	100,0	49	100,0	509	100,0	765	100,0