Original article

# Profile of work-related road traffic accident victims recorded by sentinel health units in Pernambuco, Brazil, 2012-2014*

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## Abstract

**Objective:** to describe the profile of work-related road traffic accident (RTA) victims, reported by Road Traffic Accident Information Sentinel Units in the state of Pernambuco, Brazil, from 2012-2014. **Methods**: descriptive study of fatal and non-fatal work-related road traffic accident victims, reported by 21 RTA Information Sentinel Units in Pernambuco. **Results**: 87.8% of the 10,691 cases reported occurred among males; 69.0% of all records were related to the 20-39 age group; the sectors with more injured workers were Transport (24.4%) and Trade (21.3%); most of the victims were drivers (82.0%) and motorcycles were the most used vehicle at the time of the accident (77.0%). **Conclusion**: victims were predominantly young male motorcyclists; findings may serve to inform intersectoral actions to prevent work-related RTAs, appropriate to the profile of the victims.

**Key words:** Accidents, Traffic; Epidemiological Surveillance; Accidents, Occupational; Epidemiology, Descriptive.

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## Introduction

Road traffic accidents are an important Public Health issue, because of their great impact on the population's profile of morbidity and mortality. There is an estimative of 1.24 million deaths and 50 million injuries every year due to accidents in public roads all over the world.[1]

From 2004 to 2013, Brazil registered a progressive growth in mortality due to road traffic accidents; most of the victims were men, in the 20-39 age group, and motorcyclists.[2]

In 2012, the state of Pernambuco registered 1,997 deaths due to road traffic accidents.[3] Some studies point out that the Transport sector registers most of the work-related accidents, such as those involving delivery-service motorcyclists, and bus and truck drivers, and these facts prove the risks that are present in the cities' traffic, transforming those workers into victims.[4] In survey carried out to estimate the annual occurrence of work-related accidents with motorcycle-taxi drivers registered in the Municipal Office of Transport and Traffic of Feira de Santana-BA, Amorim et al.[5] identified that 10.5% of the 267 surveyed individuals had already suffered a work-related accident.

> *Studies point out that the Transport sector registers most of the work-related accidents.*

In Brazil, a work-related accident (WA) is defined as accidents that occur during the work shift for the company or during the work shift of an insured person, according to the article 11 of Law No. 8,213, dated 24/07/91, and which cause physical injury or functional disorder that results in death or loss or reduction, permanent or temporary, of the work capacity.[6] A work-related accident is classified as (i) occupational – related to the characteristic of the activity performed by the injured professional; and (ii) commuting – when it occurred in the way between the worker's house and the work place and vice versa.[6] In Brazil, in 2013, 3,867 workers died due to external causes.[2] In 2001, the Ministry of Health published the National Policy for Reduction of Morbidity and Mortality from Accidents and Violence.[7] Then, in 2002, the Ministry proposed the 'Project for Reduction of Morbidity and Mortality from Road Traffic Accidents – mobilizing the society and promoting health',[8] aiming at promoting surveillance and monitoring the risk and protection factors related to injuries and deaths in traffic. This intervention initiative was initially developed in five cities – São Paulo, Goiânia, Belo Horizonte, Recife and Curitiba –, then it expanded to other municipalities with the Ministry of Health's technical and financial support, and got stronger with the implementation of the National Network of Units for the Prevention of Violence and Promotion of Health, in 2004, and the National Policy of Health Promotion, in 2006.

In 2010, in order to increase knowledge on the profile of non-fatal victims of road traffic accidents in Pernambuco, the State Department of Health established the reporting of cases treated in 10 urgency and emergency traumatology and/or orthopedics services, naming it 'Road Traffic Accident Information Sentinel Units'. These notifications were regulated by the Ordinance SES No. 219, dated 11/04/2011,[9] which added road traffic accidents to other diseases and conditions on the List of Compulsory Notification in Sentinel Units, Annex III of the Ordinance MS/GM No. 104, dated 21/01/2011, valid at that moment. Still in 2011, the strategy was expanded to more than ten sentinel units and in 2012 one more unit was included, totalizing the current number of 21 Sentinel Units in Pernambuco.[10]

Because it is a new health information system, which includes non-explored information, such as the risk and protection factors for the occurrence of road traffic accidents, the analysis proposed in this study will contribute to a bigger visibility of occupational and commuting work-related accidents that, according to literature, are underreported.[11] By considering the real situation of road traffic accidents in Brazil and in the world and their relation with working, besides their impact on productivity and economy, also striking the victim's relatives, this study aims to describe the profile of work-related road traffic accident victims, reported by Road Traffic Accident Information Sentinel Units in the state of Pernambuco, Brazil, from 2012 to 2014.

## Methods

This is a descriptive study on reported cases of (fatal and non-fatal) work-related road traffic accidents in

21 Road Traffic Accident Information Sentinel Units in Pernambuco State, Brazil.

Pernambuco has a territorial area of 98,149,119km$^2$ and a population of 9,277,727 inhabitants, and is composed by 184 municipalities and the Island of Fernando de Noronha.[12] It is administratively divided in 12 Health Regions, where the reported sentinel units are distributed. Each municipality's central office of the Regional Administration of Health (RAH) – from the II to the XI Region – has sentinel units; in Health Region I, situated in the state's capital, Recife, there are ten sentinel units.

This study analyzed all the records of road traffic accident victims, including fatal and non-fatal victims, reported by 21 Road Traffic Accident Information Sentinel Units, which were identified as work-related accidents from January 1, 2012 to December 31, 2014.

The Information System for Road Traffic Accidents adopts the definitions of the International Statistics Classification of Diseases and Problems Related to Health – Tenth Revision (CID-10-Chapter XX). The selected variables were related to the victim's and accident's characteristics, and factors on the victim's risk and protection:

a) Victims' data
- sex (male; female);
- age group, in years (16-19, 20-29, 30-39, 40-49, 50-59 and ≥60); and
- occupation;

b) Accident data
- weekday of the event;
- area of occurrence (urban; rural);
- type of victim (driver, pedestrian, passenger, person driven inadequately [transport situations: not using the proper place for passengers or driver; or occupying the place destined for cargo]);
- victim's mode of transport at the moment of the accident (motorcycle, automobile, bicycle, on foot (pedestrian), bus/similar, ambulance/ Mobile Urgency Care Service (SAMU)/rescue, animal-powered transport, heavy vehicle or other [including train/subway]);
- nature of the injury (running over, collision with inanimate object, collision, fall on/from a vehicle, rollover, or others [reported by the informant]);
- the other party involved in the accident (same options of the victim's mode of transport) or no other party involved ('not applicable', in cases of rollover);
- work-related accident (since August 2013, the option register of work-related accident was divided into 'Occupational' or 'Commuting');

c) Factors related to the accident and the victim's protection
- risk factors related to the driver (high speed, consumption of alcoholic beverages, tiredness);
- victims' protection factors (use of seat belt/retaining equipment and use of helmet).

After selecting the work-related accident cases, the database was classified (cleansing), by excluding multiplicity, through probabilistic method, using the RecLink III. In the duplicity stage, the options PBloc, Ubloc and sex were used for blocking, and the variables name and date of birth were the comparison fields. After that, we used the Excel to identify, manually, the pairs signaled in RecLink during the duplicity stage, by comparing variables such as the date of the accident, date of the medical care, type of victim, mode of transport, other party involved in the accident, occupation, etc. The pairs in which these variables were identical were considered true, allowing multiple occurrences of an individual to remain in the analysis.

The existence of more than one report on the same victim for the same event/accident was considered as multiplicity. The occurrence of different accidents with the same victim was not considered multiplicity. In order to avoid distortions in the distribution of the frequency of occupations, the occurrences for which the occupation had not been informed or the described activities did not fit as an occupation were excluded.

The victims' occupations were grouped according to the sector of economic activity, regarding the National Classification of Economic Activities (CNAE) – Subclasses, version 2.2. CNAE is an instrument that standardizes the economic activities' codes nationwide, and is broadly used by many Tax Management departments.[13]

The resources of the dynamic table from Microsoft Excel 2010 and the tool for analysis of the Statistical Package for Social Sciences (SPSS), version 13.0, were also used.

This study was submitted to the Committee of Ethics in Research of the Medicine Institute Professor Fernando Figueira (*IMIP*), and was approved as presented in the Certificate of Ethical Analysis (*CAAE*) No. 43031715.8.0000.5201.

## Results

From January 2012 to December 2014, 131,607 cases of victims from road traffic accidents were

reported in 21 Road Traffic Accident Information Sentinel Units of Pernambuco; 19,570 of these cases were identified as work-related road traffic accidents, i.e., 14.9% of the records (Figure 1). During the process of database cleansing 308 records were excluded for being multiplicities, and 8,879 reports of work-related accidents were also excluded: either because the nature of the occupation was not informed (8,292), or because the described activities did not fit as an occupation (587). Thus, the sample of the study was formed by 10,691 cases (Figure 1).

Out of the 10,691 reports, 87.8% of the victims were males and more than half of the cases involved individuals in the 20-39 age group (69.0%) (Table 1).

The sectors that individually presented the highest notification proportions were: Transport, Storage and Courier (23.4%) and Trade and Repairing of Vehicles (21.3%) (Table 2). In these sectors, the occupations that registered more victims were: delivery-service motorcyclists (motoboys and motorcycle-taxi drivers: 55.4% of the cases) and salespeople (26.4%). The Agriculture, Cattle Farming, Forestry, Fishing and Aquaculture sectors were the third most frequent sectors reported (18.2%): in almost all those cases, the victims were temporary agriculture workers (98.4%) (Table 2).

According to the characteristics of the event, most of the reported cases occurred in the urban area (72.4%) and on Mondays (17.1%). The main victims were drivers (82.0%); the motorcycle was identified as the most frequent vehicle at the time of the accident (77.0%); collisions were identified in 52.0% of the reports; and the car was most frequently reported as being the other party involved in the accident (31.0%) (Table 3).

Regarding the type of work-related accident, the analysis of the accidents was restricted to 5,054 cases, because this specification was only included in the system analyzed in August 2013, and 69.8% of the cases were related to commuting (Table 3).

Concerning the risk factors that led to the occurrence of the accidents, in 9.4% of the cases the driver was reported to be in high speed; consumption of alcoholic beverages, use of cellphone while driving or tiredness represented, respectively, 3.7%, 0.8% and 1.8% of the cases.

Regarding the victim's use of protection equipment, 88.0% of the motorcyclists reported to be wearing a helmet at the time of the accident and 44.0% of the

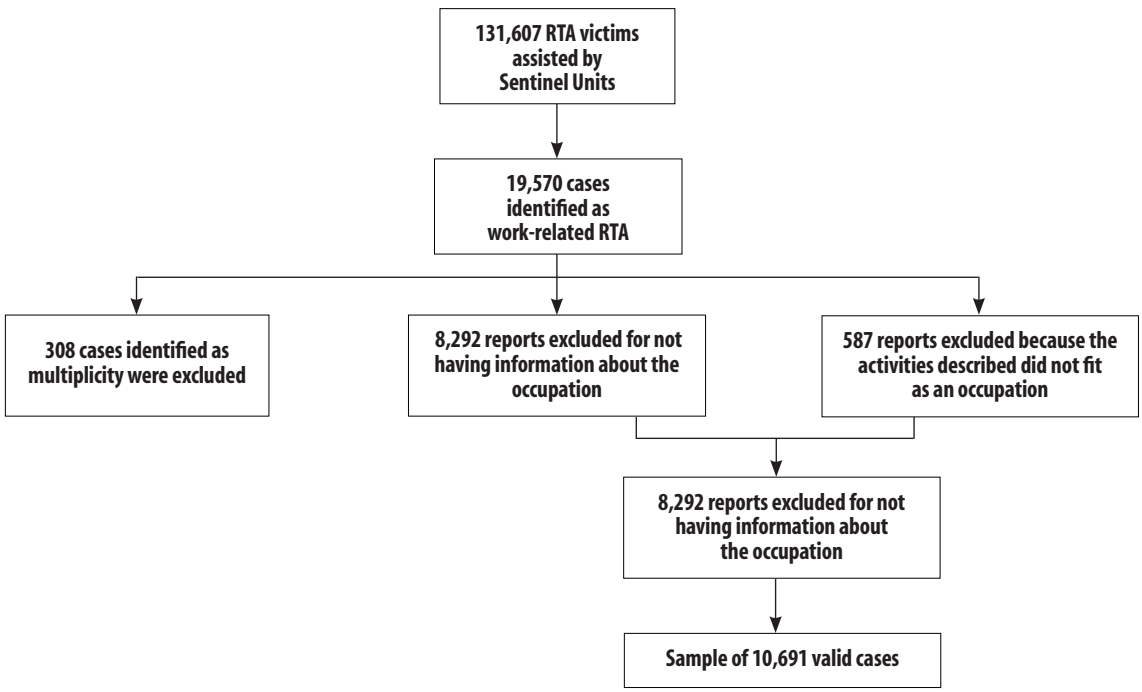


**Figure 1 – Flowchart of the data cleansing process on the profile of work-related road traffic accident (RTA) victims in the state of Pernambuco, 2012-2014**

victims were passengers of the car or bus/similar or heavy vehicle and reported to be using seat belt at the moment of the accident (Table 4).

## Discussion

Among the workers that suffered a work-related road traffic accident and were notified in sentinel units in Pernambuco, young (20-29 age group) male adults were the most frequent victims. Motorcyclists were also among the main victims. Bastos *et al*.[14] reported similar results when analyzing the profile of road traffic accident victims that were rescued by the pre-hospital care service in the city of Londrina-PR. These findings, in general, have similar results concerning studies on road traffic accident victims whose damages affect, mainly, young individuals, in productive phase.[14]

The occurrence of road traffic accidents related to the Transport and Trade sectors, and that affects mainly delivery-service motorcyclists and salespeople,

**Table 1 – Number and percentage of reports on victims from work-related road traffic accidents (N=10,691), according to sex and age group, Pernambuco, 2012-2014**

| Variables | N | % |
|---|---|---|
| **Sex** | | |
| Male | 9,392 | 87.8 |
| Female | 1,299 | 12.2 |
| **Age group (years)** | | |
| 16-19 | 493 | 5.0 |
| 20-29 | 4,067 | 38.0 |
| 30-39 | 3,286 | 31.0 |
| 40-49 | 1,691 | 16.0 |
| 50-59 | 760 | 7.0 |
| >60 | 258 | 2.0 |
| Not informed | 136 | 1.0 |

**Table 2 – Number and percentage of reports on victims from work-related road traffic accidents, according to activity sector and most frequent occupations, Pernambuco, 2012-2014**

| Activity sector | N | % | Most frequent occupations | N | % |
|---|---|---|---|---|---|
| Transport, Storage and Courier | 2,502 | 23.4 | Delivery-service motorcyclist | 1,385 | 55.4 |
| | | | Driver of small and medium vehicles | 617 | 24.7 |
| Trade and Repairing of vehicles and motorcycles | 2,273 | 21.3 | Salesperson | 599 | 26.4 |
| | | | Self-employed | 307 | 13.5 |
| Agriculture, Cattle Farming, Forestry, Fishing and Aquaculture | 1,946 | 18.2 | Agriculture employee | 1,915 | 98.4 |
| | | | Agricultural producer | 21 | 1.1 |
| Administrative activities and complementary services | 1,356 | 12.7 | Security Guard | 360 | 26.5 |
| | | | Administrative assistance | 233 | 17.2 |
| Construction | 901 | 8.4 | Construction worker | 471 | 52.3 |
| | | | Construction worker's assistant | 314 | 34.9 |

**Table 3 – Number and percentage of reports on victims from work-related road traffic accidents (N=10,691), according to the characteristics of the accident and the victim, Pernambuco, 2012-2014**

| Variables | N | % |
|---|---|---|
| **Weekday of the accident** | | |
| Sunday | 893 | 8.4 |
| Monday | 1,830 | 17.1 |
| Tuesday | 1,573 | 14.7 |
| Wednesday | 1,773 | 16.6 |
| Thursday | 1,656 | 15.5 |
| Friday | 1,651 | 15.4 |
| Saturday | 1,305 | 12.2 |
| Missing data | 10 | 0.1 |
| **Area of the accident** | | |
| Urban | 7,737 | 72.4 |
| Rural | 2,718 | 25.4 |
| Missing data | 213 | 2.0 |
| Blank field | 23 | 0.2 |
| **Type of victim** | | |
| Driver | 8,763 | 82.0 |
| Passenger conducted adequately | 1,374 | 12.8 |
| Pedestrian | 457 | 4.3 |
| Person conducted inadequately | 29 | 0.3 |
| Missing data | 65 | 0.6 |
| Blank field | 3 | 0.0 |
| **Victim's vehicle** | | |
| On foot (pedestrian) | 465 | 4.3 |
| Ambulance/SAMU[a]/Rescue | 19 | 0.2 |
| Automobile | 920 | 8.6 |
| Bicycle | 380 | 3.6 |
| Motorcycle | 8,232 | 77.0 |
| Bus/similar | 155 | 1.4 |
| Heavy vehicle | 315 | 3.0 |
| Animal-powered transport | 56 | 0.5 |
| Others (including train/subway) | 113 | 1.1 |
| Missing data | 33 | 0.3 |
| Blank field | 3 | 0.0 |
| **Nature of the accident** | | |
| Running over | 807 | 7.5 |
| Collision with inanimate object | 218 | 2.0 |
| Collision | 5,557 | 52.0 |
| Rollover | 2,837 | 26.5 |
| Fall on/from vehicle | 837 | 8.0 |
| Other (specified by the informant) | 357 | 3.3 |
| Missing data | 72 | 0.6 |
| Blank field | 6 | 0.1 |

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**Table 3 – Conclusion**

| Variables | N | % |
|---|---|---|
| **Other involved party** | | |
| Animal | 462 | 4.3 |
| Automobile | 3,294 | 31.0 |
| Bicycle | 155 | 1.4 |
| Motorcycle | 1,733 | 16.2 |
| Inanimate object | 477 | 4.5 |
| Bus/similar | 217 | 2.0 |
| Pedestrian | 34 | 0.3 |
| Animal-powered transport | 16 | 0.1 |
| Heavy vehicle | 391 | 3.7 |
| Not applicable | 3,209 | 30.0 |
| Missing data | 440 | 4.1 |
| Other (including train/subway) | 228 | 2.1 |
| Blank field | 35 | 0.3 |
| **Type of work accident (N=5,054) [b]** | | |
| Occupational | 1,524 | 30.2 |
| Commuting | 3,530 | 69.8 |

a) SAMU: Mobile Urgency Care Service
b) Specified in the system from August 2013 on

respectively, points to a similar direction to Lacerda *et al*. study[15] on fatal work-related accidents in Salvador-BA, where most of victims were workers in the trade, construction, real state, lodging and food, transport and stocking sectors. Another study conducted by Lacerda *et al*.[16] also presents the occurrence of road traffic accidents with workers in public roads; in that study, both the occupational and commuting accidents were identified. These findings may reflect the workers' vulnerability, the lack of traffic security and the deficiency of the transports used for commuting and in situations where the work is performed in a public road.

It is also important to highlight that agriculture temporary workers represented almost all cases of the Agriculture, Cattle Farming, Forestry, Fishing and Aquaculture sectors that were notified by health sentinel units. Alves *et al*.[17] found similar results in mortality due to work-related accidents in the state of Tocantins, for the period 2000-2010, when there was a high mortality number among workers in occupations related to the Agriculture and Civil Construction sectors. Those authors also analyzed common causes of death, observing that the most frequent were those of the W group (Other injuries from external causes) and V group (Commuting accidents) of ICD-10.

It is possible that the involvement of agriculture workers, observed in the aforementioned studies, is related to commuting accidents, because the commuting conditions of these workers is usually precarious. Some studies also state that the disrespect for traffic laws, bad conditions of roads, lack of preventive maintenance of vehicles and not using equipment for individual protection may contribute to the occurrence and severity of those accidents.[18]

Pordeus *et al*.[19] stated that the use of motorcycle by workers of small Brazilian towns or in rural areas, as a work instrument to replace horses or donkeys in the transport of people and goods, have reverberated on the profile of emergency care in larger cities, for example, in the emergency care service of a hospital in Fortaleza-CE. This replacement may be attributed to the quickness, easy commute and low cost of these vehicles.

The highest frequency of commuting accidents is possibly connected to the use of motorcycles from the residence to work and vice versa. Strengthening this scenario, according to the National Traffic Department (*Denatran*), along the years there was a growth in the number of motorcycles, in relation to other vehicles.[20]

The results on vehicles used at the time of the accident strengthened *Denatran*'s data, showing that most victims

**Table 4 – Number and percentage of notification on victims from work-related road traffic accidents (N=10,691), according to the factors related to the accident and the protection of the victims, in Pernambuco, 2012-2014**

| Variables | N | % |
|---|---|---|
| **High speed** | | |
| No | 8,224 | 76.9 |
| Yes | 1,005 | 9.4 |
| Missing data/no information | 1,462 | 13.7 |
| **Use of cellphone by the driver** | | |
| No | 9,102 | 85.1 |
| Yes | 86 | 0.8 |
| Missing data/no information | 1,503 | 14.1 |
| **Consumption of alcoholic beverages** | | |
| No | 9,138 | 85.5 |
| Yes | 395 | 3.7 |
| Missing data/no information | 1,158 | 10.8 |
| **Driver's tiredness** | | |
| No | 8,902 | 83.3 |
| Yes | 192 | 1.8 |
| Missing data/no information | 1,597 | 14.9 |
| **Use of seat belt by the victim (N=1,409)** [a] | | |
| Yes | 619 | 44.0 |
| No | 462 | 32.8 |
| Not applicable (person conducted in an inadequate place) | 112 | 7.9 |
| Missing data/no information | 216 | 15.3 |
| **Use of helmet by the victim (N=8,232)** [b] | | |
| Yes | 7,239 | 88.0 |
| No | 693 | 8.4 |
| Missing data/no information | 300 | 3.6 |

a) Use of seat belt by the victim in vehicles such as automobile, bus, heavy vehicle and ambulance.
b) Use of helmet by the victim when the vehicle is a motorcycle.

were using motorcycles at the moment of the accident. This finding is similar to the one of Barros *et al*.,[21] who verified the registers from police reports on the victims of traffic accidents in Pelotas-RS. Legay *et al*. also confirmed this finding, highlighting the motorcycle as the most reported vehicle in the occurrences of traffic accidents with victims in Vitoria-ES, Rio Branco-AC and Palmas-TO.[22]

It is evident that the motorcycle occupants are more vulnerable when involved in traffic accidents, suffering, most of the time, more serious injuries comparing to individuals that are in other types of vehicles.[14] Specific measures are highly necessary in order to reduce the amount of victims in the country.

Collisions involving cars appeared as the most frequent accidents, which is similar to the data found by Almeida *et al*.,[23] when describing that the main traffic accidents in Fortaleza-CE, in the period 2004-2008, where collisions involving cars/pickup were the most frequent. Validating the discoveries of that research, the present study also identified the drivers as the main reported victims.

The fact that most accidents occurred in working days (Monday and Wednesday) is possibly related to the habit of concentrating working activities on weekdays. This result should be used as an indicator for the creation and implementation of intersectoral

actions, with the goal of preventing the occurrence of traffic accidents and consequent harm to the health of workers.

Most accidents occurred in urban areas, and similar results were found by Marín-Leon *et al*.[24] in an analysis of the social distribution of fatal traffic accidents in Campinas-SP, from 1995 to 2008, which observed higher occurrence of accidents in urban areas and in roads that pass through the city of Campinas.

With regard to the accidents' risk factors, most victims denied having consumed alcoholic beverages, being in high speed, using the cellphone while driving or being tired. A similar result was reported by Silva *et al*.,[25] in a research carried out with motoboys in the state of Parana, in 2005-2006: most of them denied having consumed alcoholic beverages before driving, as they also denied high speed and the use of cellphone/ radio communicator. However, concerning tiredness while driving, according to the same study, most of the interviewees assumed that they still drive even when they are tired.

Although most motorcyclists that were victims of work-related RTA were wearing a helmet, approximately 1/5 of them were not wearing this equipment of protection at the moment of the accident. A study conducted by Dutra[26] in Porto Alegre-RS, in 2012-2013, recorded that: 51.6% of the victims of accidents with motorcycle said that they were wearing a helmet at the time of the accident; 17.6% were not wearing it adequately, admitting that the equipment had fallen at the time of the accident; 6.4% were wearing it; and in 24.5% of the cases, there was no register of the use of helmet.

In the analysis of the variable use of the seatbelt by the victim at the time of the accident, there was little difference between victims that were using the seatbelt and those who were not using it at the time of the accident. In a study conducted by Yokota *et al*.[27], in 2010, in Brazilian capitals and the Federal District, more than 70% of the victims said they were using seatbelt in the front seat and 40% in the back seat.

The present analysis revealed that the Information System on Road Traffic Accidents is a useful source of information, although it presents some limitations. Despite the fact that this study is not an evaluative research, it identified limitations in the filling of the variable occupation. The study suggests that filling this field in the report should be mandatory. Especially when the road traffic accident is reported as work-related accident, it is important to establish the casual link between the circumstances of the accident and the nature of the occupation.

The findings presented here confirm the importance of the knowledge on the profile of illness and death related to recording workers victims of road traffic accidents. Such information contributes and supports the organization of surveillance services and health assistance for workers, decision-making, planning of health actions, in addition to guiding policies for the prevention of accidents in the intersectoral context, involving urban planning, road safety, social security and assistance. These actions should be directed specially to men, young adults, workers in Transport and Trade sectors, especially motorcyclists, to search for mechanisms that enable the reduction of road traffic accidents in Pernambuco and in Brazil.

## Authors' Contributions

Souto CC, Souza SLB and Bertolini RPT contributed to the design of the study, analysis and interpretation of data, discussion of the results and drafting.

Reis FKW and Lins RSMA contributed to the interpretation and discussion of the results and critical revision of the manuscript.

All the authors approved the manuscript's final version and declared to be responsible for all aspects of the work, ensuring its accuracy and integrity.

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