Road crash by public transport: Analysis from a bus accident case in Benin in 2019

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Research note

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Abstract

Objective : Although public transport is not the highest contributor to road crashes in Benin, the morbidity and mortality associated with such accidents are very high. The work aimed to analyze a road crash involving an intercity bus that occurred on February 23, 2019 in Benin.

Results : Mortality rate was 21.2%. The median age of patients admitted to the hospital was 36 years (27-45). The primary areas affected by the accident were the cephalic pole (51%) and more than 20% had a high injury severity score. The main risk factor contributing to the accident was speeding. Wearing a seatbelt was a factor found to impact the severity of the injuries endured. In order to implement intervention aimed at prevention, there needs to be sufficient research to identify the most pressing risk factors involved in accidents occurring on public transportation.

Introduction

Road traffic accidents (RAs) are a major public health and development problem in low-income countries, particularly in Africa, which has the highest continental mortality rate, estimated at over 26.6 deaths per 100,000 people [1]. The costs associated with RAs are extremely high both directly for the victim and family as well as for the state [1–3] ; In France, these costs were estimated at €50.8 billion, or 2.2% of GDP in 2017 [4]. Coaches, buses, and minibuses are typically considered the safest modes of transport after travel by airplane and train [5]. While involved in minimal RAs, public transport by bus can cause significant material damage and is associated with a high burden of morbidity and mortality [6]. Accidents involving buses were responsible for 0.4% of road deaths in France in 2017, yet 54% of those killed or injured were third parties (i.e. non bus occupants) [4]. In Benin, due to the lack of functional public transit by rail, most passenger travel occurs on the road. Over long distances, road traffic mainly consists of buses that connect Benin's major cities, particularly the Septentrion and the Coastal Region. There is such a high number and frequency of buses on the roads due to the importance of trade between the coast and the North, connecting Benin with its neighboring landlocked countries. In 2015, buses and minibuses were involved in 3.4% of accidents reported by police forces; they accounted for 4% of deaths and 3.7% of reported injuries resulting from such accidents [7]. Documentation on road accidents involving public transportation is non-existent in Benin; as a result of this information gap, no interventions have been developed to reduce road accidents. In order to contribute to reducing this gap, the objective of this work is to analyze through a case study approach the epidemiological characteristics of a bus accident that occurred in Benin in 2019.

Methods

Study setting

This is a case of a bus accident that occurred on February 23, 2019 in the municipality of Tchaourou, which is located 400 km from Cotonou, the economic capital of Benin. The Interstate National Road

(RNIE) No. 2 traverses this commune, linking Cotonou to Parakou, the largest city in the north, as well as to Benin's neighboring countries (Figure 1). Tchaourou is located in the Borgou department; it is the largest municipality in Benin, covering an area of 7256 km² with a population of 256,057 inhabitants. The municipality has a reference hospital with the technical capacity of a 2nd level healthcare structure. It's located 55 km from the regional reference hospital, the Centre Hospitalier Universitaire Départemental du Borgou (CHUDB), in the city of Parakou.

Type of study, population and sampling

This is an observation-based case study. The study population included accident victims, with the primary targets being those who were injured following the accident. We included injured victims who were admitted to the Tchaourou zone hospital and to the CHUDB. The secondary targets were i) the health workers at the Tchaourou and CHUDB hospitals who cared for the victims; ii) the local populations at the accident site; iii) the police forces who observed and secured the area; iv) the victims' relatives, and v) the transportation company managers. We employed exhaustive sampling for the primary targets and used convenience sampling for the secondary targets.

Data collection, variables and analysis

We used a mixed quantitative and qualitative methods approach. Observation was conducted through clinical examination and we used document review. We conducted semi-structured interviews, using an interview guide, with all secondary targets. Study variables included age, sex, occupation, type of injury, location of injury, number of injuries (multiple injury/single injury), severity of injury, and survival post-accident. We also investigated the cause of the accident and whether seatbelt wearing contributed to outcomes for the victims. The severity of the injuries was assessed using the Maximum Abbreviated Injury Scale (MAIS), which is based on the severity and location of an injury. Ratings range from a minor injury (rated 1) to an extreme, major injury (rated 6). The injury is considered serious if its corresponding MAIS score is greater than or equal to 3 [8, 9]. Quantitative data were entered into an Excel spreadsheet and analyzed with Stata 15 software. For the qualitative component, we conducted a content analysis and triangulation of data, synthesizing the results into salient themes.

Results

Record of bodily damage and losses resulting from accident

As a result of this accident, 57 people were involved, all of whom had been riding the bus; no bystanders or pedestrians outside the vehicle were affected. At the site of the accident, 7 deaths were recorded and 5 people were unable to be located in the accident assessment by the police. In the study's 2 hospital sites, 45 victims were recorded, with 4 deaths occurring during hospitalization. The overall mortality rate as a result of the accident was 21.15% (11/52) and the intra-hospital mortality rate was 8.89% (4/45).

Sociodemographic features of victims who were hospitalized

The median age of inpatients was 36 years (27–45) with 66,7% in the 15–44 age group. Subjects under 15 years of age represented less than 7%. Men were more represented than women, making up 60% of patients, with a Male to Female sex ratio estimated at 1.5. The most common occupations of the victims were shopkeepers/resellers (26.19%), students (21.4%), and craftsmen (16.7%).

Description of injuries

In terms of injury location, the most frequently affected site was the cephalic pole (51% of patients). 5 patients, or 11.11%, were diagnosed with a head injury. 38% and 22% of patients, respectively, had damage to their thoracic and lower limbs. 22% of patients had damage to their thorax and 18% had pelvic damage. The most common injury was damage to soft tissue, which occurred in 56% of victims; in addition, 33% of victims had at least one fracture. 64% suffered multiple injuries as a result of the crash. The MAIS severity score was ≥ 3 in 22% of patients, indicating in these patients the presence of a severe Traumatic Brain Injury (TBI) or an open fracture.

Circumstances of the accident and facilitating factors.

According to various sources, the accident was caused by the failure of another vehicle arriving in the opposite direction to comply with the highway code. Based on this information, the main factor contributing to the accident would be the bus driver speeding in order to avoid a frontal collision with the oncoming vehicle. The lack of lateral safety guards facilitated the fall of the vehicle, which ended up landing in a large ravine. Inside the coach, no passengers were wearing seat belts; however, the various sources interviewed noted that there were no functional seat belts inside the bus. The bus driver did not receive an ethylo test or a test for the use of other psychoactive substances. These latter tests were not available from police units and the current legislation does not require such tests in cases of RA.

Discussion

The results of this study on a road accident involving public transit demonstrate that those most affected are young people. The diversity of injuries suffered, as well as the severity of injuries, contributed to high mortality. The most salient factors that contributed to the accident were speeding and lack of seatbelt use.

The predominance of young victims corresponds to results from the literature review, which is consistent with research across the African continent for the past several decades, showing that young people ages 15–44 years old are the age group most affected by RAs. The same is true regarding the predominance of men as RA victims, which is well documented [1, 4]. In a hospital-based study in Ethiopia, covering all patients admitted for road traffic injuries, Seid et al report different findings related to victim occupation. Students were the most represented (12%) after workers (41%) [10]. The predominance of merchants and students in our sample can be explained by the context of our study. Indeed, the road is very frequently used in the context of trade between the South and North of the country as well as neighboring countries. In addition, the city of Parakou, the next stop along the bus route, is home to the country's second largest

university and students often travel by bus between Cotonou and Parakou [11]. This study's finding that the cephalic pole is the most common site of injury is confirmed by several studies in Saudi Arabia, as well as in Africa [10, 12]. Although the characteristics of the study populations are not comparable, this similarity around injury site confirms the frequency of head injury, and demonstrates the need for implementing prevention-focused interventions. The distribution by type of injury noted in this work is fairly close to the results reported by studies in Cameroon and Ethiopia with a high frequency of soft tissue injuries in similar proportions [10, 13]. The severity of injuries reported in a study of a 2014 bus accident in Sweden is lower than in our study. Indeed, the 12% of serious injuries with a MAIS score of greater than or equal to 3 reported in the Sweden accident are well below our figures. This difference can be explained by the fact that nearly 8 out of 10 victims wore their seat belts in the accident in Sweden, unlike what occurred in our study [14]. Such a difference in injury outcomes confirms the protective nature of seat belts against severe injuries in the event of AR [15, 16]. The overall mortality reported by this work is high (as expected), because this type of RA involved a significant number of victims including bus passengers and third parties [4, 14]. Because of the high mortality, specific interventions aimed at the prevention of this type of RA should be implemented. Such interventions should require transit companies to comply with certain standards in order to guarantee passenger safety. Examples of such safety standards include enforcing compliance by public transit companies with international standards for road safety, as well as ensuring that drivers are in good health (e.g. through regular check-ups and medical assessments) prior to getting on the road. Intra-hospital mortality in this study was lower than that previously reported in a series of hospitals in Benin [17]. Levels of mortality within the hospital are connected to quality of care; in the face of this type of accident where a significant burden of disease is likely, care facilities must be rapidly informed of the situation so that they can quickly mobilize all the necessary resources for the immediate reception and care of patients. To reduce the potential for intra-hospital mortality, there needs to be a model developed around financing emergency care for these patients in a context where patients are expected to pay out of pocket prior to receiving care.

Speeding is the risk factor most frequently contributing to the occurrence of RAs [1, 4, 12], and it has also been identified as a factor affecting the severity of injuries [18]. The results of this study appear to be in line with the literature, however, they could be combined in an analytical analysis with other relevant studies. Nevertheless, speeding alone cannot be blamed for both the occurrence and the severity of the RA. The lack of side railings, the absence of seat belts in the vehicle and human behavior were other contributors. The results of our case study emphasize the difficulty of attributing a single cause for both the accident itself and its level of severity; our study also demonstrates the need to conduct a thorough investigation of each RA, particularly those affecting a large number of victims. Our road safety policies do not allow for sufficient investigations of RAs, which are necessary in order to improve our practices and guarantee the safety of the population.

Limitations

The limitations of this study lie in its cross-sectional nature, which does not allow for the establishment of a causal relationship between the various explanatory factors suggested, in particular between the

factors precipitating the severity of the injuries and the mortality level.

Declarations

Ethics approval and consent to participate

The work was approved by CLERB (Local Ethics Committee for Biomedical Research) of University of Parakou. Written consent was obtained from patients after they were stabilized and from secondary targets before information was collected. Data were processed with strict respect for anonymity and confidentiality. Prior to collecting data, we also obtained authorization from the administrative authorities of both hospitals.

Consent to publication

Not applicable.

Availability of data and materials

The dataset used and analyzed during the current study are available from the first author on reasonable request.

Competing interests

The authors declare they have no competing interests.

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None reported.

Authors' contributions

YGA and DD: conception, design, acquisition, data collection, analysis and interpretation of data and drafting. AK and HBD critically reviewed the design, analysis, interpretation and the drafted manuscript. KQ and MB participated in data collection, analysis, and interpretation. AL supervised all the process and reviewed the manuscript. All authors read and approved the final manuscript.

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References

1World Health Organization. Global status report on road safety 2018. Geneve: WHO; 2018. 424 p.

- 2Urua U, Osungbade K, Obembe T, Adeniji F. A cost analysis of road traffic injuries in a tertiary hospital in south-west Nigeria. *Int J Inj Contr Saf Promot*. 2017;24:510–8.
- 3Kumar GA, Dilip TR, Dandona L, Dandona R. Burden of out-of-pocket expenditure for road traffic injuries in urban India. *BMC Health Serv Res*. 2012;12:285.
- 4Observatoire National Interministériel de la Sécurité Routière. La sécurité routière en France- Bilan de l'accidentalité de l'année 2017. Paris: ONISR; 2018. 192 p.
- 5European Union Agency for Railways. Railway Safety in the European Union-Safety overview 2017. Luxembourg: European Union Agency for Railways; 2017. 52 p.
- 6Luby S, Hassan I, Jahangir N, Rizvi N, Farooqi M, Ubaid S, et al. Road traffic injuries in Karachi: the disproportionate role of buses and trucks. *Southeast Asian J Trop Med Public Health*. 1997;28:395–8.
- 7Centre National de Sécurité Routière. Annuaire des statistiques des accidents de la voie publique, Bénin. Cotonou: CNSR; 2015. 192 p.
- 8Ferreira S, Amorim M, Couto A. Risk factors affecting injury severity determined by the MAIS score. *Traffic Inj Prev*. 2017;18:515–20.
- 9Nunn J, Barnes J, Morris A, Petherick E, Mackenzie R, Staton M. Identifying MAIS 3+ injury severity collisions in UK police collision records. *Traffic Inj Prev*. 2018;19:S142-s4.
- 10Seid M, Azazh A, Enquselassie F, Yisma E. Injury characteristics and outcome of road traffic accident among victims at Adult Emergency Department of Tikur Anbessa specialized hospital, Addis Ababa, Ethiopia: a prospective hospital based study. *BMC Emerg Med*. 2015;15:10.
- 11Allode AS, Mensah E, Tchaou B, Savi KM, Boni S, Padonou J. Les urgences traumatologiques par accident sur la voie publique dans le Service de Chirurgie Générale du CHDU de Parakou (Bénin). *Rev CAMES - Série A*. 2008;6:49.
- 12Mansuri FA, Al-Zalabani AH, Zalat MM, Qabshawi RI. Road safety and road traffic accidents in Saudi Arabia. A systematic review of existing evidence. *Saudi Med J*. 2015;36:418–24.
- 13Bulto LN, Dessie Y, Geda B. Magnitude, causes and characteristics of trauma victims visiting Emergency and Surgical Units of Dilchora Hospital, Eastern Ethiopia. *Pan Afr Med J*. 2018;30:177.
- 14Doohan I, Bjornstig U, Ostlund U, Saveman BI. Exploring Injury Panorama, Consequences, and Recovery among Bus Crash Survivors: A Mixed-Methods Research Study. *Prehosp Disaster Med*. 2017;32:165–74.
- 15Abu-Zidan FM, Abbas AK, Hefny AF, Eid HO, Grivna M. Effects of seat belt usage on injury pattern and outcome of vehicle occupants after road traffic collisions: prospective study. *World J Surg*. 2012;36:255–9.

16Fouda Mbarga N, Abubakari AR, Aminde LN, Morgan AR. Seatbelt use and risk of major injuries sustained by vehicle occupants during motor-vehicle crashes: a systematic review and meta-analysis of cohort studies. BMC Public Health. 2018;18:1413.

17Kpozèhouen A, Paraïso M, Glele Ahanhanzo Y, Azandjèmè C, Agueh V. Issue des accidents de la voie publique : analyse à partir de données hospitalières, Bénin. Rev Epidemiol Sante Publique. 2016;64:S215-S6.

18Abu-Zidan FM, Eid HO. Factors affecting injury severity of vehicle occupants following road traffic collisions. Injury. 2015;46:136–41.

Figures

Figure 1

Benin map, Major cities and et Interstate National Road n°2, 2019