Driver compliance and pedestrian safety at zebra crossings in the Cape Coast Metropolis, Ghana

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ABSTRACT

Vehicle-pedestrian interactions predispose pedestrians to road traffic crashes because of the importance of pedestrian trips for geographical mobility and spatial interaction which may be effectively reduced by zebra crossings. This study guided by the Safe System Approach assessed drivers’ compliance and pedestrian safety at zebra crossings in the Cape Coast Metropolis. The study investigation data were from observational checklists and pedestrian crash data from the Building and Road Research Institute. Findings showed that 336 pedestrian crashes were recorded between 2007 and 2016 with 35.4% and 15.2% of the victims being hospitalized or dead respectively. More than 70% of the pedestrian crashes occurred at places, not a junction. The findings further showed that there were 23 zebra crossings in the metropolis with low drivers’ compliance rate. The relevant stakeholders such as the Department of Urban Roads of the Ministry of Roads and Highways, National Road Safety Commission, officials of the Motor Transport and Traffic Department of the Ghana Police Service should identify short- and long-term measures to improve pedestrian safety and driver compliance at zebra crossings in the metropolis.

1. Introduction

There exists considerable pedestrian travel in Low- and Medium-Income Countries (LMICs) for geographical mobility and spatial interaction due to low vehicular ownership (Damsere-Derry et al., 2010; F. K. Afukaar et al., 2003). The everyday lives of pedestrians are at a higher safety risk owing to a general lack of dedicated pedestrian infrastructure (Damsere-Derry et al., 2010; F. K. Afukaar et al., 2003; Obeng-Atuah et al., 2017; WorldHealth Organization, 2013). Annually, 400,000 pedestrian fatalities are recorded accounting for one-fifth of all Road Traffic Deaths (RTDs) worldwide (Damsere-Derry et al., 2010). Many stricken pedestrians die unattended at the crash scene in what is popularly called a hit-and-run in Ghana. Pedestrian crashes have adverse effects on the survivors, their families, friends and other caregivers.
A zebra crossing or pedestrian crossing is one of the pedestrian safety measures meant to reduce pedestrian crashes. A zebra crossing ‘is a point on a road where pedestrians traverse the road. Pedestrian or zebra crossings sometimes referred to as crosswalks, may be found at intersections or along road stretches. Marked crossings are designated by markings on the road, commonly white stripes’ (World Health Organization, 2013). Zebra crossings are usually placed at traffic intersections or crossroads but are occasionally used at mid-block locations where pedestrian generators are present such as at transit stops, schools, retail, or housing destinations (Sideris & Liggett, 2005). Therefore, the provision of zebra crossings in a metropolis depends on these different land uses.

In Ghana, Section 20, of the Road Traffic Act (Peden et al., 2004) stipulates that a person (driver) who parks a motor vehicle wholly or partly on a pedestrian crossing commits an offence and is liable to a term of imprisonment not exceeding 12 months. Further, Regulation 154 of the Road Traffic Regulation (Salifu & Ackah, 2012) indicates that a pedestrian shall cross a road at a pedestrian crossing, intersection or a distance no further than fifty meters from the pedestrian crossing or intersection or at an authorized place.

Drivers’ compliance at zebra crossings accounts for low pedestrian crashes compared to intersections or at a distance no further than fifty meters from the zebra crossing (Guéguen et al., 2015; Obeng-Atuah et al., 2017). Drivers’ compliance at a zebra crossing is a function of the type of treatment, weather conditions, pedestrian approach location, reduced speed school zones and site characteristics (DeVeauuse et al., 1999; Lacoste, 2015).

The concept of ‘drivers’ compliance’ as used in this study refers to the situation where a pedestrian is waiting at a zebra crossing and the approaching vehicle stops and gives way to the pedestrian or when a driver yields to a pedestrian waiting to cross the roadway (Lacoste, 2015). A zebra crossing as a precursor to pedestrian safety has not attracted much attention in LMICs and Ghana is no exception (DeVeauuse et al., 1999; Obeng-Atuah et al., 2017).

Zebra crossings in Ghana are largely unsignalized with a total disregard for their use as drivers don’t stop for pedestrians to cross the roads with the assumption that roads are for vehicles and not necessarily for pedestrians. Officials of the Motor Transport and Traffic Department (MTTD) of the Ghana Police Service (GPS) also did not arrest either the pedestrian who refuses to use or the drivers who refuse to stop for pedestrians at zebra crossings. Officials of GPS or private security firms sometimes assist pedestrians in crossing the busy road (not always at zebra crossings).

In an attempt to address pedestrian safety at the zebra crossing, Obeng-Atuah et al. (2017) assessed pedestrian crossing in urban Ghana by looking at the condition and utilization of zebra crossings and pedestrians’ perceptions of zebra crossing located at different land uses. Pedestrian behavior was found to be central to the numbers and extent of pedestrian crashes.

This current study seeks to provide information on the compliance rate at a zebra crossing as a pedestrian safety facility to inform the National Road Safety Authority (NRSA) and the MTTD of the Ghana Police Service on the sensitization of the general public (drivers and pedestrians) on pedestrian safety at zebra crossings. The findings of
the study will also be useful for road safety education in other LMICs. The study will also offer the Department of Urban Roads (DUR) of the Ministry of Roads and Highways (MRH) on the need to make zebra crossings visible in Ghana. In addition, the study will provide a platform for city managers in other LMICs to formulate policies on pedestrian safety at zebra crossings.

The paper is divided into eight sections: following this section is the literature review and section 3 with the conceptual framework. The fourth section presented the data and methods. The fifth section contained the results with the sixth section dwelling on the discussion. The last but one section contained the conclusion and policy implications. The last section presented the limitations to the study and further studies.

2. Related literature

2.1. Pedestrian crashes in cities

As automobile transportation is increasing in cities globally, so are pedestrian crashes in LMICs where road traffic laws are poorly enforced (Zegeer & Bushell, 2012). This is because cities in LMICs accommodate a large number of pedestrians with fewer pedestrian facilities such as zebra crossings, pelican crossings and footbridges. The different land uses in cities offering unique resources and opportunities are often ‘black spots’ for pedestrian crashes (Dai et al., 2010). Most pedestrian crashes in cities results in a fewer fatality compared to those on rural roads because of speeding (Damsere-Derry et al., 2010).

In terms of socio-economic characteristics (income level and level of education), three residential area categories are proposed: low, medium and high with a very thin transitive line in between them (Ogunleye-Adetona et al., 2018; Ojo, 2018). Pedestrian travels are notably higher in the low-income residential areas and are attributable to low vehicle ownership, dense population, little economic, educational and social amenities (Dai et al., 2010). The medium-income residential areas lie in between and share characteristics of low- and high-income residential areas. University campuses are classified as high-income residential areas and face unique pedestrian safety challenges (Dai et al., 2010). Their street networks are densely packed and are associated with high student numbers that navigate them to influence the occurrence of pedestrian crashes.

2.2 Locations and number of zebra crossings in cities

The ubiquitous high pedestrian traffic in cities is supposed to attract a corresponding presence of zebra crossings. Yet, pedestrians have to transverse networks of streets to access economic activities (market, shopping mall), educational facilities (basic, secondary schools, tertiary schools), recreational/social centres (football park) and religious buildings (church, mosque, shrine) which predispose them to pedestrian crashes (Noora et al., 2016; Obeng-Atuah et al., 2017; Sideris & Liggett, 2005). Accordingly, zebra crossings are expected at these places (Damsere-Derry et al., 2010; F. K. Afukaar et al., 2003).
The provision of zebra crossing should be planned and designed to the maximum extent possible, instead of the minimum in a city (State of Vermont Agency of Transportation, 2002). Several factors including the size of the city, the volume of pedestrian travel and the presence of economic activities and educational facilities influence the number of zebra crossings in a city (Noora et al., 2016; Obeng-Atuah et al., 2017; Sideris & Liggett, 2005).

2.3. Drivers compliance at a zebra crossing

Drivers’ compliance at zebra crossings is noted to be low in some of the LMICs such as Ethiopia (Tulu et al., 2013). However, zebra crossing compliance by drivers in high-income countries such as Australia and New Zealand is more than half (Harré & Wrapson, 2004; Lacoste, 2015). Drivers compliance at zebra crossings may differ in low-, medium- and high-income areas. According to Piff, Stancato, Côté, Mendoza-Denton, and Keltner (2012) higher social class predicts increased unethical behavior such as speeding, non-seatbelt use and low compliance at zebra crossings. As such the drivers observed at zebra crossings in the high-income residential areas may exhibit these unethical behaviors. Contrarily, road users in high-income residential areas will want to be law-abiding because of their socio-economic characteristics such as higher education and income (Ogunleye-Adetona et al., 2018; Ojo, 2018).

Male drivers are daring and as such would not comply compared to the female drivers who are risk-averse (Cunill et al., 2004; Ojo, 2018). Older drivers are expected to be law-abiding and as such engage in less risky driving behavior as against the young drivers (Afukaar et al., 2010). Younger drivers are adventurous (Beg & Langley, 2000). Vehicle type and usage are of prime importance in driver’ behavioral studies because of the importance placed on the value of the vehicle and the associated challenge with the responsibility of the drivers. Commercial drivers will see complying at zebra crossings as time-wasting as they are scouting for passengers on the routes. Private drivers may not exhibit these attributes.

3. Theoretical framework

The Safe System Approach (SSA) as adopted in the study indicates the risk factors and interventions involving road users (such as pedestrians), vehicles and the road environment in an integrated way, accommodating more effective preventive measures including zebra crossings (Davis, 2001). Globally, this approach has been proven to facilitate road safety gains.

The SSA reveals the importance of transport to society and admits that travel has to be safe for all road users associated with the road–vehicular interaction to facilitate movement. SSA seeks to reduce road traffic injuries and Deaths (RTIDs) through the provision of a safe transport system that is forgiving of human error and recognizes pedestrians’ vulnerability to serious injuries. This is achieved through a policy focus on road infrastructure, vehicle and travel speeds, in conjunction with road safety education, behavioral change, regulations, enforcement and penalties (Davis, 2001).
4. Data and methods

4.1. Study area

Cape Coast Metropolis as shown in Figure 1 is bordered by the Gulf of Guinea to the South, Komenda-Edina Eguafo Abirem Municipality to the West, Abura Asebu Kwanmanke to the East and Twifo Lower Denkyira to the North. According to the 2010 Population and Housing Census, the population of the Cape Coast Metropolis, is 169,894 which is 7.7 percent of the total population of the Central Region. The metropolis is home to prominent secondary schools such as St. Augustine’s College and Holy Child School and also two universities (the University of Cape Coast and Cape Coast Technical University). There are 20 residential areas in the metropolis including Abura, Ekon, UCC, Cape Coast Township and Pedu (Figure 1). There are more basic schools in the metropolis than in any urban area in the region.

The study area was divided into three residential areas: low-, medium- and high-income residential areas (see Table 3). How the houses are arranged, population density and the socio-economic characteristics (education and income) of residents were used in the classification of the residential areas (Ojo, 2018; Ogunleye-Adetona et al., 2018).

4.2. Research design

This research is a blended exploratory and descriptive study on pedestrian safety and drivers’ compliance at zebra crossing aimed to provide information on the phenomenon and possibly inform future studies.

Figure 1. Map of Cape Coast Metropolis. Source: GIS Unit of the Department of Geography and Regional Planning, UCC.
4.3. Sources of data

Two data sources (primary and secondary) were used in the study. The primary data was obtained using observational checklists while the secondary data was obtained from the Building and Road Research Institute (BRRI). The secondary data from BRRI was the incidence of pedestrian crashes in the metropolis from 2007 to 2016 (10-year period).

4.4 Pilot study

The research team piloted the structured observational checklist at selected two zebra crossings in the metropolis (not the ones used in the main study). An average of 75 observations hourly were successfully made at the selected sites for the pilot study.

4.5. Target population and sample size

All vehicles using the selected stretch of roads having zebra crossings were eligibly observed. It is always difficult to generate a sample frame for studies of this nature owing to the lack of data on vehicle movement in the metropolis.

Based on the experiences from the pilot study, 75 observations were targeted at the zebra crossings in the selected areas. Eventually, 2,410, 2,066 and 1,728 observations (6,204 observations) were successively made between February and March 2018 at high-, medium- and low-income areas respectively.

4.6. Sampling procedure

The study adopted a purposive sampling technique for the primary data by observing only the vehicles approaching the zebra crossings. Four zebra crossings in each of the three residential areas were purposively sampled.

4.7. Research instruments

Two forms of structured observational checklists for the collection of the primary data were deployed. The first structured observational checklist comprised the socio-demographic characteristics of the drivers (gender (male and female), vehicle type (car, SUV, taxi, minibus, and truck), vehicle usage (private, commercial, company and government), compliance rate (yes or no), and presence of pedestrians at the zebra crossing (yes or no). The second structured observational checklist was used to identify the locations and number of zebra crossings in the metropolis among others. Three residential areas – Cape Coast township (low-income), Pedu (medium-income) and UCC (high-income) – were selected because of the road and population densities and concentrations of economic and educational activities.
4.8. Method of data collection

Fourteen (14) research assistants (RAs) trained in a classroom environment were stationed at about 50 feet to observe the phenomenon from 11:00 am-1:00 pm and 3:00 pm –5:00 pm at selected zebra crossings in the metropolis between February and March 2018. These RAs were positioned inconspicuously to all road users in order not to alter their behaviors. It was a bright day throughout the data collection period and the moderate traffic flow in the metropolis was appropriate for the conduct of this study.

4.9 Reliability and validity

The use of observational checklists using similar methods of data collection has been extensively used in behavioral research in Ghana (F. K. Afukaar et al., 2003; Obeng-Atuah et al., 2017; Ojo, 2018; Ogunleye-Adetona et al., 2018). Therefore, its adoption lends credence to the study. The Cron-Bach value of 0.70 indicates the internal consistency of the study. A pilot test was carried out at a zebra crossing to fine-tune the structured observational checklist.

The secondary data from BRRI is noted to have two challenges: under-reporting and under-recording (Damsere-Derry et al., 2010). Under-reporting comes about when the residents do not officially report all RTCs to the GPS such that assigned BRRI personnel can retrieve the data. Under-recording occurs when the assigned BRRI personnel are unable to retrieve all the crash data through the police files because the GPS may be hesitant in providing the files if the case is still pending in court. In the last 10 years, there has been a gradual decline in the incidence of under-reporting and under-recording in Ghana (Salifu & Ackaah, 2012). Officials of the GPS are always been trained on the need for accurate record-keeping on crashes (Damsere-Derry et al., 2010).

4.10 Data analysis

The primary data were coded and entered in Statistical Package for Service Solutions (SPSS) v 21. The analysis was also conducted using SPSS v 21. Similarly, the secondary data covering the last 10 years was also analyzed using SPSS v21. Descriptive statistics such as frequency and percentage were used to present the results. Probit regression was used to determine the relationship between socio-demographic characteristics (such as gender, age group) and compliance rate.

5. Results

The results are presented – trend analysis of pedestrian crashes from 2007 to 2016, number and locations of zebra crossings and drivers’ compliance at zebra crossings in the metropolis.
5.1. A general overview of the study

Three hundred and thirty-six (336) pedestrian crashes were recorded between 2007 and 2016 with almost half of the victims injured but not hospitalized (49.4%). The majority of the incidence of pedestrian crashes occurred between 2010 and 2015 (Figure 2 and Table 1). More than 70% of the pedestrian crashes occurred at not a junction. There were 23 zebra crossings in the metropolis.

According to Table 2, 6,204 observations were successfully made in the metropolis. Drivers’ compliance rate was 22.2% with the majority of the drivers being males (92.6%). Most of the vehicles were private cars (24.3%) and taxis (45.4%) and were for private (37.7%) and commercial uses (52.3%). More observations were made at zebra crossings in the high-income residential areas (38.8%), medium (33.3%) and low (27.9%) in that order.

5.2. Trend analysis of pedestrian crashes in the Metropolis

As shown in Figure 2, between 2007 and 2016, more than half of the victims of pedestrian crashes were either hospitalized (35.4%) or dead (15.2%). Besides, more pedestrian crashes occurred between 2010 and 2013. Generally, the incidence of pedestrian crashes reduced noticeably in 2016 compared to the previous years. Most (70.2%) of the pedestrian crashes over the 10 years were at ‘not a junction’ followed by the ones at a junction as shown in Table 1.

5.3. Number and locations of zebra crossings in the metropolis

There were 23 zebra crossings in the metropolis. The majority (12) of the zebra crossings were in medium residential areas.

The table further shows that there were two main locations of zebra crossing – Junction and crossroad. However, the majority (13) of the zebra crossings were at crossroads.

Figure 2. Incidence of pedestrian crashes from 2007–2016. Source: BRRI, 2018
| Year | RTC severity       | Not at junction | Crossroads | T/Junction | Staggered Crossroad | Y/Junction | Roundabout | Other | Total |
|------|-------------------|-----------------|------------|------------|--------------------|------------|------------|-------|-------|
| 2007 | Fatal             | 4(100%)         | 0          | 0          | 0                  | 0          | 0          | 0     | 4(25.0%) |
|      | Hospitalized      | 6(75.0%)        | 0          | 2(25.0%)  | 0                  | 0          | 0          | 0     | 8(50.0%) |
|      | Injured not-hospitalized | 4(100%)     | 0          | 0          | 0                  | 0          | 0          | 0     | 4(25.0%) |
| 2008 | Fatal             | 0               | 0          | 1(100%)   | 0                  | 0          | 0          | 0     | 1(7.1%)  |
|      | Hospitalized      | 4(66.7%)        | (16.7%)    | 1(16.7%)  | 0                  | 0          | 0          | 0     | 6(42.9%) |
|      | Injured not-hospitalized | 6(85.7%)   | 0          | 1(24.3%)  | 0                  | 0          | 0          | 0     | 7(50.0%) |
| 2009 | Fatal             | 2(40.0%)        | 0          | 2(40.0%)  | 1(20.0%)           | 0          | 0          | 0     | 5(20.0%) |
|      | Hospitalized      | 7(58.3%)        | 1(8.3%)    | 4(33.3%)  | 0                  | 0          | 0          | 0     | 12(48.0%) |
|      | Injured not-hospitalized | 5(62.5%)   | 0          | 2(25.0%)  | 1(12.5%)           | 0          | 0          | 0     | 8(32.0%) |
| 2010 | Fatal             | 6(60.0%)        | 0          | 4(40.0%)  | 0                  | 0          | 0          | 0     | 10(22.7%) |
|      | Hospitalized      | 7(53.8%)        | 1(7.7%)    | 5(38.5%)  | 0                  | 0          | 0          | 0     | 13(29.5%) |
|      | Injured not-hospitalized | 17(81%)     | 1(4.8%)    | 2(9.5%)   | 0                  | 0          | 0          | 0     | 21(47.7%) |
| 2011 | Fatal             | 5(71.4%)        | 0          | 1(14.3%)  | 1(14.3%)           | 0          | 0          | 0     | 7(12.7%)  |
|      | Hospitalized      | 11(61.1%)       | 1(5.6%)    | 6(33.3%)  | 0                  | 0          | 0          | 0     | 18(32.7%) |
|      | Injured not-hospitalized | 23(76.7%)  | 0          | 5(16.7%)  | 0                  | 0          | 0          | 0     | 30(54.5%) |
| 2012 | Fatal             | 6(75.0%)        | 0          | 2(25.0%)  | 0                  | 0          | 0          | 0     | 8(22.2%)  |
|      | Hospitalized      | 8(80.0%)        | 0          | 0          | 2(20.0%)           | 0          | 0          | 0     | 10(27.8%) |
|      | Injured not-hospitalized | 14(77.8%)   | 0          | 3(16.7%)  | 0                  | 0          | 0          | 0     | 15(38.1%) |
| 2013 | Fatal             | 8(80.0%)        | 0          | 2(20.0%)  | 0                  | 0          | 0          | 0     | 10(27.0%) |
|      | Hospitalized      | 12(00.0%)       | 0          | 0          | 0                  | 0          | 0          | 0     | 12(32.4%) |
|      | Injured not-hospitalized | 13(86.7%)  | 0          | 2(13.3%)  | 0                  | 0          | 0          | 0     | 15(40.5%) |
| 2014 | Fatal             | 0               | 0          | 0          | 0                  | 0          | 0          | 0     | 0       |
|      | Hospitalized      | 12(75%)         | 1(6.3%)    | 3(18.7%)  | 0                  | 0          | 0          | 0     | 16(51.6%) |
|      | Injured not-hospitalized | 13(86.7%)  | 0          | 2(14.3%)  | 0                  | 0          | 0          | 0     | 15(48.4%) |
| 2015 | Fatal             | 1(100%)         | 0          | 0          | 0                  | 0          | 0          | 0     | 1(10.0%)  |
|      | Hospitalized      | 10(66.7%)       | 1(6.7%)    | 4(26.7%)  | 0                  | 0          | 0          | 0     | 15(28.8%) |
|      | Injured not-hospitalized | 17(62.9%)  | 3(11.1%)   | 5(18.5%)  | 2(7.0%)            | 0          | 0          | 0     | 27(62.8%) |
| 2016 | Fatal             | 4(80%)          | 0          | 0          | 0                  | 0          | 0          | 0     | 1(20.0%)  |
|      | Hospitalized      | 5(45.5%)        | 1(9.1%)    | 2(18.2%)  | 0                  | 0          | 3(27.3%)  | 0     | 8(33.3%)  |
|      | Injured not-hospitalized | 6(54.5%)   | 0          | 2(18.2%)  | 0                  | 0          | 3(27.3%)  | 0     | 11(45.8%) |
|      |                   | 242(72.02%)     | 13(3.9%)   | 62(18.5%) | 8(2.9%)            | 2(6%)      | 5(1.4%)    | 0     | 336     |

Source: BRRI, 2018.
Drivers’ compliance at zebra crossings

Respectively, compliance in high- and medium-income residential areas was 16.5% and 22.0% less likely to occur than when compared with low-income residential areas. Men were 3.2% less likely to comply compared to females with taxi drivers less likely to comply compared to private car drivers (32.8%).

Robust standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.10.
6. Discussion

The study used crash data from BRRI and observational checklists to analyze driver compliance and pedestrian safety at zebra crossings in the Cape Coast Metropolis. This was guided by the SSA approach. It was revealed that most pedestrian crashes occurred at ‘not a junction’ with fatalities occurring between 2010 and 2013. The results further showed that 23 zebra crossings were in the Cape Coast Metropolis with low driver compliance prevalent at medium – and high-income residential areas. Male drivers and taxi drivers largely revealed a low compliance rate in the metropolis.

As revealed in the Safe System Approach, pedestrians are entitled to safer travel in metropolitan areas for geographical mobility and social interaction (Southworth, 2005; Tulu et al., 2013). But this pedestrian travel is confronted with the lack of pedestrian facility (such as zebra crossing) predisposing pedestrian crashes.

The zebra crossing as a pedestrian facility should be planned and designed to the maximum extent possible, instead of the minimum in a city for safer roads more forgiving of human error (State of Vermont Agency of Transportation, 2002). Its provision should minimize vehicular-pedestrian interaction. The number and locations of zebra crossings depend on the different land use in a metropolis in addition to the size of the metropolis. Twenty three zebra crossings were identified in the Cape Coast Metropolis unlike Paris with more than 200 zebra crossings. The nature of the road networks in most of the low-income residential areas account for the non-existence of zebra crossings in their neighborhoods.

Neighborhoods with a high population, high traffic volumes and a large concentration of educational facilities and commercial/retail and multi-family residential land use without zebra crossings have a higher propensity for pedestrian crashes (Sideris & Liggett, 2005). The Cape Coast township as a low-income residential area accommodates the largest number of residents in the metropolis. It also houses the majority of economic activities, tourist sites and religious buildings in the metropolis. This primary position calls for an increasing number of zebra crossings as against the sultry number evident in the study. This sheer number of zebra crossings in the township predisposes pedestrians to the vicissitude of higher vehicular-pedestrian interactions. In an attempt to reduce the incidence of pedestrian crashes, the Department of Urban Roads (DUR) of the Ministry of Highways have mounted road ramps in the township. Residents in the township (mostly fisher folks) have also mounted improvised road ramps on the streets along the coast.

The majority of the streets hosting educational facilities (more than 124 and 20 basic and second cycle schools respectively) in the Cape Coast Township do not have zebra crossings. The available zebra crossings are located in the Aboom district. Hardly do pupils use the existing ones (i.e. if not faint). Rather they cross farther from the zebra crossing (Noora et al., 2016; Obeng-Atuah et al., 2017). A primary one pupil was killed by an inconsiderate driver who refused to recognize that he was in an educational zone with a zebra crossing (adjacent Jubilee Boys School) on the 27th of February, 2018.

There are also no zebra crossings very close to the three main market centers in the metropolis (Kotokuraba which is the main market, Abura market and Anafo Market) and along the commercial streets of the metropolis. This makes pedestrians cross the roads haphazardly. The locations of zebra crossings in the medium- and high-income
residential areas are perceived places with very high vehicular-pedestrian interactions such as Pedu junction and the University main road leading to the Sam Jonah Library.

To understand pedestrian crashes and risks, BRRI collects data from the MTTD. But the available data from BRRI did not contain any information on pedestrian crashes at zebra crossings which are contrary to a similar study conducted in Israel revealing the incidence of pedestrian crashes at locations including zebra crossing. But the current study revealed that the majority of the zebra crossings were at a crossroad in the metropolis. Any incidence of pedestrian crashes may not be as fatal compared to places without zebra crossings (Damsere-Derry et al., 2010). However, as evident in the study, the majority of the pedestrian crashes resulted in either fatality or with the victims being hospitalized. The effect is not only felt by the victims (that is if he/she survives) but by the victims’ family and friends, and the society (Ojo, 2018).

Fewer pedestrian crashes are expected at zebra crossing because, drivers are aware of the pedestrian right of way law and are encouraged to stop or wait for pedestrians to use the zebra crossing (Guéguen et al., 2015; Obeng-Atuah et al., 2017). On approaching zebra crossings drivers are mandated to maintain safer speeds and should be tolerant of pedestrians.

In the current study, drivers’ compliance at zebra crossings was observed to be low. This finding is inconsonant with what was observed in some of the LMICs like Ethiopia against that of high-income countries such as Australia and New Zealand which is more than half (Harré & Wrapson, 20044; Tulu et al., 2013; Lacoste, 2015).

The low compliance rate in the current study is a result of poor enforcement of the Road Traffic Act (Peden et al., 2004) in Ghana in particular and LMICS in general. Pedestrians will have to wait for a significantly long time before a driver is willing to stop or wait until there are no more vehicles close enough (headways). This is a result of the misunderstanding on the use of the right of way by both pedestrians and drivers. Pedestrians could reduce this misunderstanding and increase their safety by using appropriate non-verbal signals towards drivers (Guéguen et al., 2015).

As found out in the study, drivers’ compliance at a zebra crossing is dependent on the type of residential areas where the zebra crossings are located. Drivers’ compliance is best at zebra crossings in the low-income areas residential area which is contrary to the findings in similar studies conducted in the metropolis (Ogunleye-Adetona et al., 2018; Ojo, 2018). The fear of mob attack by the driver after knocking down a pedestrian compels them to be considerate (Damsere-Derry et al., 2010). This causes a high compliance rate and depends on socio-demographic characteristics like gender, age, the type of vehicle being used by the driver.

Female drivers are generally risk-averse. Thus, they will obey zebra crossings law or any road traffic regulations as against their male counterpart which is incongruent with international comparisons (Guéguen et al., 2015; Lacoste, 2015; Tulu et al., 2013). Taxi drivers are less likely to comply with the zebra crossing law. The commercial nature of their makes them impatient and always in a haste to find or hail passengers. Hence the low compliance rate.
7. Conclusion

Based on the objectives set for the study, there were 336 incidents of pedestrian crashes in the Cape Coast metropolis between 2007 and 2016 with the majority of the victims either being hospitalized or killed. Further, most of these pedestrian crashes occurred at a place, not a junction. There were 23 zebra crossings in the metropolis which is grossly inadequate concerning the volume of economic activities, educational centres, recreational/social centres. The sheer number of zebra crossings with the low drivers’ compliance rate increases the exposure of residents to the risk of RTIDs. Male drivers especially those driving taxis are less likely to comply irrespective of the location of the zebra crossings. Drivers operating in high- and medium-income residential areas are less likely to comply compared to those in the low-income areas.

These findings may not be peculiar to Ghana but to other LMICs. The city managers in collaboration with DUR as in the case of Ghana should increase pedestrians’ accessibility be it signalized or unsignalized zebra crossings which reflect the different land uses and demand patterns. The NRSA should carry out periodic campaigns in the metropolis to educate road users especially drivers and pedestrians on the zebra crossing law and its benefits. The officials of the MTTD of the GPS should ensure the adherence to the Road Traffic Act 683 (Peden et al., 2004) by drivers and pedestrians respectively. Offenders are to be fined or prosecuted as stipulated in the Act and Regulation.

The officials of BRRI and the GPS should segregate the data on pedestrian crashes according to the different residential areas. Furthermore, they should also collect data on pedestrian crashes at zebra crossings in the Metropolis.

8. Limitations and further studies

One major limitation of the study is the 10 years used to analyse the incidence of pedestrian crashes in the metropolis. Although, the main primary data involving the use of observational checklists were served in 2018. By the time of data collection, there was no secondary data for 2017. Hence the choice of 2007–2016. Further studies can use the same methodology to assess the phenomenon under review up to 2020.

The current study did not take into consideration the waiting time of pedestrians at zebra crossings in the metropolis. Therefore, future studies adopting similar methods of data collection can assess the waiting time distribution for pedestrians. Waiting time is the difference in time between pedestrian arrival at a zebra crossing and the beginning of actual crossing.

The current study also fails to consider the drivers’ speed behaviour on approaching zebra crossings. Further studies can be conducted to determine drivers’ speed behaviour at zebra crossing approaches. The combination of these two studies and the current one can offer adequate information on driver compliance at a zebra crossing in the metropolis. Studies can be conducted to ascertain the perception of drivers and pedestrians on the use of zebra crossing concerning pedestrian behaviour.
Disclosure statement

No potential conflict of interest was reported by the author(s).

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