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Self-reported pedestrian knowledge of safety by school children in cape coast metropolis, Ghana

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ABSTRACT

The incidence of a pedestrian crash is a leading cause of death among Ghanaian schoolchildren due to various factors including the lack of pedestrian walkways and zebra crossings. This study was a cross-sectional self-reported survey to investigate the means of transport by school children, the incidence of pedestrian crashes among school children and knowledge of pedestrian safety. The survey focused on three basic schools in the High and Medium-Income Residential Areas in the Metropolis and was administered to 230 school children with observations. Descriptive and pair-sampled t-test analyses were conducted to assess the differences in pedestrian safety knowledge by gender, age, education and the incidence of pedestrian crashes. The results revealed that transporting/dropping off by vehicles and walking were the major forms of travel for school children with the majority of those walking unaccompanied. Female, younger and lower primary school children were largely victims of pedestrian crashes because of low pedestrian safety knowledge. The findings have emphasized the need for evidence-based safety promotion and injury prevention in the high and medium-income areas of the Cape Coast Metropolis.

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1. Introduction

Globally, one-fifth of Road Traffic Injuries and Deaths (RTIDs) include children with about 262,000 deaths and 10 million injuries (Peden et al., 2008). Road Traffic Injuries (RTIs) is the third killer of children above 5 years old and is the tenth for children aged 1–4 years old (Toroyan & Peden, 2007). In general, about 20 percent of pedestrian deaths in Low and Medium-Income Countries (LMICs) involve children less than 16 years of age. Specifically, more than a quarter of pedestrian crashes involve children in Africa (e.g. Ghana, Nigeria, South Africa and Tanzania (Koekemoer et al., 2017; Zimmerman et al., 2012).

In LMICs (such as Ghana, India, Malaysia, and South Africa) children walk unaccompanied and thus constitute one of the vulnerable groups (with women and aged) (Burrows et al., 2010; Obeng-Atuah et al., 2017; Pruthi et al., 2012). As such the incidence of pedestrian crashes is a serious threat to their health and well-being (Dandona et al.,

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2011; Koekemoer et al., 2017; Mohamed et al., 2011; Obeng-Atuah et al., 2017). The lack of pedestrian facilities such as walkway and zebra crossings increase school children's risk of involvement in pedestrian crashes (Koekemoer et al., 2017).

Pedestrian crashes that involve children cause significant damage physically and emotionally(Sam, 2015). Poor judgment to select a safe place to cross the road result in the high incidence of pedestrian crashes among school children (Thomson et al., 1998). School children related to pedestrian crashes as a result of road crossing is a preventable health challenge (Schwebel et al., 2014). Besides, every parent/guardian prays to keep their wards safe and secure and trains them to develop their potentials (Ojo, 2018).

Schools have become a focal point of school children's ability and this has attracted several studies investigating the relationships between factors associated with schools and child pedestrian safety (Clifton & Kreamer-Fults, 2007; Yiannakoulias et al., 2002). School travel time, season, school neighborhood characteristics and the cluster of schools in an area have been contributing factors to the incidence of pedestrian crashes near schools (LaScala et al., 2004; Preston, 1989)

Owing to the associated challenges of school children pedestrian safety, governments in both some of the High-Income Countries (HICs) (such as Canada and the US) and LMICs (such as Ghana, India, Malaysia, and South Africa) have initiated Road Safety Education in primary schools (McComas et al., 2002). The two major obstacles to the teaching of Road Safety Education in the LMICs are- the lack of teaching resources and the lack of knowledge by teachers as to how to teach road safety and what should be taught. Therefore, there is an immediate need to raise the awareness of the child pedestrian crashes menace in these countries, provide teachers with effective materials and approaches for teaching road safety, and improve children's, teachers' and guardians' road safety knowledge and attitudes.

The low rate of vehicular ownership in LMICs makes walking the popular means of transport. This indicates that the majority of school children walk a distance to school and sometimes unsupervised (Obeng-Atuah et al., 2017; Pruthi et al., 2012). At times, the elderly children/siblings accompanied the younger ones going to and from school. Despite the risk that school children are exposed to in commuting to school in Ghana, there is limited research attention.

Existing studies including Porter et al. (2010), Yankson (2011), Porter et al. (2017), Ogunleye-Adetona et al. (2018), and Ojo (2018) focused on school children road safety. Specifically, Porter et al. (2010) explored young people's experiences and perceptions of mobility and mobility challenges in deprived Ghanaian urban areas. Furthermore, Porter et al. (2017) considered a school pupil's narrative experiences to the school. Yankson (2011) investigated the road use behavior of urban primary school children in Accra, whereas Ogunleye-Adetona et al. (2018) and Ojo (2018) investigated the use of child restraints by school children being transported/dropped off in primary schools in the Cape Coast Metropolis.

Although these studies provide good information on school children's road safety in Ghana, they failed to address the school children's self-reported pedestrian safety knowledge. Therefore, there is a knowledge gap that this study seeks to fill. The findings of the study will inform the management of basic schools and the National Road Safety Authority (NRSA) on how to educate school children on safe road crossing skills in the metropolis. Furthermore, the findings of the study will provide a guide to the Ghana

Urban Roads and the Cape Coast Metropolitan Assembly on the need to provide pedestrian facilities such as pedestrian walkways and zebra crossings in the metropolis.

2. Related literature

2.1. Socio-demographic characteristics of school children

School children in primary schools are mostly females and have a mean age of 9 years (Nakitto et al., 2008; Ojo, 2018). Female and school children aged 5–9 years are likely to be involved in pedestrian crashes while traveling to and from school in Low and Medium Income Countries (LMICs) (such as South Africa and Tanzania) and High-Income Countries (HICs) (such as Canada and the US) (Museru et al., 2002; Warsh et al., 2009). Primary school children are more likely to be involved in pedestrian crashes (Museru et al., 2002).

2.2. Means of transport of school children to school

School children have different means of transport to school including private cars, motorcycles, walking (walking alone or being accompanied) (LaScala et al., 2004; Nakitto et al., 2008; Ojo, 2018). School children from high-income and medium-income residential areas are mostly transported/dropped off in school in private cars (LaScala et al., 2004; Ojo, 2018). Meanwhile, their cohorts in the low-income residential areas largely walk to school either alone or accompanied. Supervision or accompanying younger school children may be a challenge to school children who may not have elderly siblings (LaScala et al., 2004).

2.3. Incidence of pedestrian crashes involving school children

A hospital-based study in Tanzania revealed that 73% of school children are involved in pedestrian crashes when walking to school (Museru et al., 2002). Another study in Uganda indicated that 90% of the school children walking to school are at risk of pedestrian crashes. invariably an average child in Kampala, Uganda is at risk of pedestrian crashes (Nakitto et al., 2008). The study shows the risk of pedestrian crashes for girls is the same as boys. However, studies such as Ojo (2018) show more boys being involved in pedestrian crashes than girls.

The incidence of pedestrian crashes is likely to be high near schools with a greater number of children walking (Warsh et al., 2009). However, the pedestrian 'safety in numbers' phenomenon previously reported, which states that a motorist is less likely to collide with a pedestrian if more people walk in that area, does not seem to compensate for the presumed increased exposure (Jacobsen, 2003).

2.4. Sources of data on the incidence of a pedestrian crash involving school children

There are two sources of reporting pedestrian crashes involving school children-police-report (secondary data) and self-report (primary data) (Ojo, 2018). Abdel-Aty et al.

(2007) used 5-year data on motor vehicle collisions involving school children in Toronto, Canada, and Florida, US. Museru et al. (2002) on the other hand used the self-reported incidence of pedestrian crashes from school children who reported at a health facility in Dar es Salaam. More attention has been given to police data. Similarly, Koekemoer et al. (2017) used the self-reported incidence of child pedestrian safety knowledge, behavior and road injury in Cape Town, South Africa. Hence the choice of self-report to have a piece of firsthand information from the victims.

2.5. Pedestrian safety knowledge

In Koekemoer et al. (2017), six multiple-choice items were used to assess pedestrian safety knowledge. Eventually, higher scores on the composite scale(Pedestrian Safety Knowledge) are an indication of higher levels of knowledge about pedestrian safety. Berry and Romo (2006) used eighteen items drawn from the Cyprus curriculum to assess children's pedestrian knowledge. Some of the questions were worded like " "We should walk in the same direction as the traffic, we should wear dark clothing at dusk, we should carry a flashlight when we walk in the rain. The composite scores were used a pedestrian safety knowledge.

3. Methods

3.1. Study design

The study made use of a cross-sectional, non-randomized self-report survey to investigate school children's pedestrian road safety knowledge as well as the incidence of pedestrian crashes and school children's characteristics. These measures were to consider school children's pedestrian safety domains (Koekemoer et al., 2017).

3.2. Study area

The study was conducted in the Cape Coast Metropolis (see Figure 1), the capital city of the Central Region in Ghana with a population of 143,015. Three basic schools were purposively selected in OLA (Medium Income; 2) and University of Cape Coast (High-Income Areas; 1) because of their large population and proximity to the highway (Cape Coast-Takoradi Highway) with a high incidence of pedestrian crashes).

Source: GIS Unit, Department of Geography and Regional Planning, University of Cape Coast.

The incidence of pedestrian crashes in the Ola and University area have often been fatal because of the Highway. The three basic schools are University Primary and Junior High School (managed by the University of Cape Coast), Pere-Plange School (managed by the Catholic Nuns) and Ola Presbyterian Primary and Junior High School (Ghana Education Service).

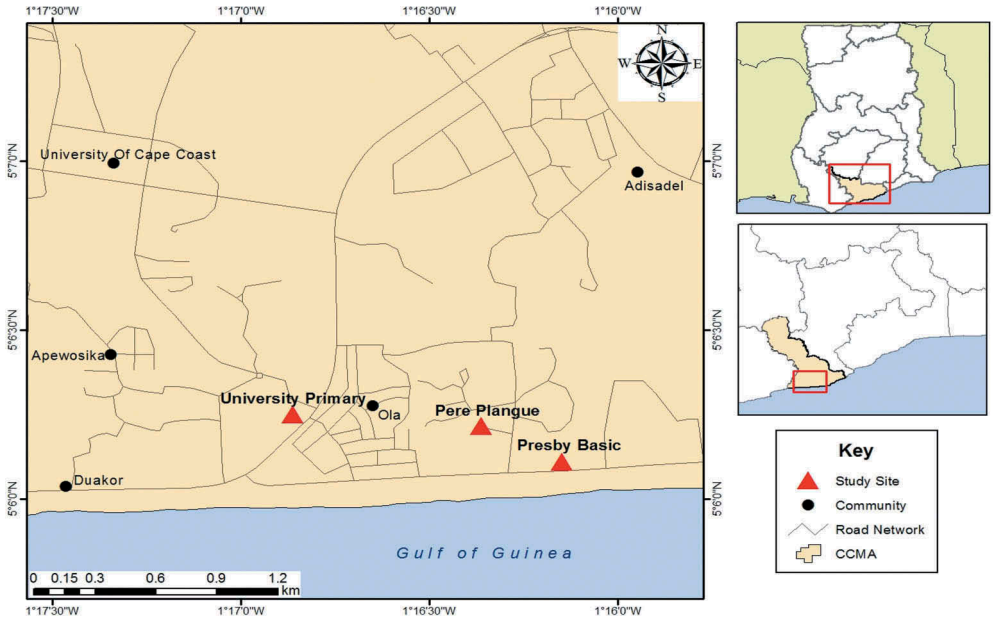

Figure 1. The map of the Cape Coast Metropolis showing the study sites.

3.3. Target population

The target population was the pupils from the University Primary and Junior High School (2,266), Pere-Plange School (676) and Ola Presbyterian Primary and Junior High School (587).

3.4. Sample size

The sample size using the Krejcie and Morgans table for sample size calculator is 351 as shown in Table 1.

3.5. Sampling procedure

The study employed an accidental sampling technique where the pupils were approached after school hours going home during the survey period.

Table 1. A sample size of the various.

Schools	Population	Sample Size
University Primary/JHS	2,664	238
Pere-Planque School	676	60
Ola Presbyterian Basic School	587	53
Total	3,927	351

3.6. Data collection

The study employed a mixed-method approach involving the use of questionnaires and observations. A recognizance survey was conducted in March 2018 to finetune the data collection instruments. The questionnaire was divided into two sections. Section A comprises the socio-demographic characteristics (such as gender, age, educational level, the incidence of pedestrian crashes and the last section contained eighteen (18) variables (including "it is better to look right and left before crossing the road, allow traffic slow down or stop before crossing the road) measured using a five Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) as shown in Table 2. The composite mean scores as used in Berry and Romo (2006) Koekemoer et al. (2017) were calculated to represent pedestrian safety knowledge.

Self-reported incidence of pedestrian represents the respondent's involvement in a pedestrian crash as a victim to school or from school. The observation checklists comprised the availability of pedestrian facilities (such as walkway or zebra crossing) on the road adjoining the selected schools.

3.7. Data analysis

The response rate for the study was 65.5% as 230 questionnaires were eventually found useful for the study. The data collected were analyzed using SPSS version 20 and the results presented in the form of frequencies and percentages and cross-tabulations. Pair sample T-test was used in addressing the differences in school children's pedestrian safety knowledge by their socio-demographic characteristics such as gender, age, and the incidence of being involved in pedestrian crashes at $p < 0.001$. The findings of the observations were presented using a plate to show how school children use the road.

Table 2. Safety knowledge items.

1. It is better to look right and left before crossing the road
2. One must make sure vehicle stops before using a pedestrian crossing
3. One should keep looking and listening until you get across the road
4. One should use a crossing monitor where there is one available
5. One should cross at a place that is well lit when it is dark
6. One should use lights on your bike when it is dark
7. One should wear a cycle helmet when riding a bike
8. One should walk facing the traffic on roads
9. one should Allow traffic slow down or stop to let you stop
10. One should walk in single file on roads without pavements
11. one should not cross from behind a stationary vehicle
I2. One should not cross whether traffic is coming or not, thinking the traffic should stop for you
I3. Do not cross when I cannot see both ways very well (like on a bend or a top hill)
14. If I cannot look at the sign of a vehicle I need not cross the road
15. Don't forget to look properly because I am talking to friends who are with me
16. Don't cross when I see a small gap in the traffic and 'go for it'
17. I cannot cross the road when I cannot see both ways of the roads very well
18 I cannot walk in the road rather than on the pavements

4. Results

4.1. School children pedestrian characteristics

Table 3 reveals that almost an equal number of male (49.6%) and female (50.4%) respondents were surveyed. More than half (59.6%) were 10–14 years old and were in Junior High School (56.5%). It was also revealed in Table 1 that more than a three-fourth (77.4%) of the respondents crossed the streets to/after school with less than a tenth (7.0%) being involved in a pedestrian crash. Plate 1 shows the non-availability of a pedestrian walkway in addition to how school children occupy the full stretch of the road.

Plate 1. School children after school in the metropolis.

4.2. Children crossing of streets to/from school and self-reported incidence of pedestrian crashes

Despite more males (78.1%) crossing the streets to/after school, more females(7.8%) were reportedly involved in pedestrian crashes (see Table 2). Table 3 further shows that, despite more than two-thirds of the respondents (87.5%) aged >19 years crossing the streets to/after school, the majority (14.5%) of the victims of pedestrian crashes were 15–19 years old. As shown in Table 4, More (79.7%) respondents in the Upper Primary crossed the streets to/after school but more (8.4%) of those involved in pedestrian crashes were in Junior High School

4.3. Means of transport to school and involvement in risks

As revealed in Table 5, the majority of the school children cross the street to and from school irrespective of the means of transport to school. Besides, the table showed that the majority (8.6%) of those accompanied were involved in pedestrian crashes the most followed by those who walk without being accompanied(7.6%).

Table 3. Socio-demographics by means of transport to school.

Socio-demographics		By what means of transport					
		F%	F/%	F%	F%	F%	
		In-vehicle	Walk to school alone	Accompanied	By motor-bike	By bicycle	Total
Gender	Male	63(55.3)	40(35.1)	10(8.8)	1(0.9)	0	**114(49.6)**
	Female	45(38.8)	52(44.8)	13(11.2)	5(4.3)	1(0.9)	**116(50.4)**
Age	5-9	4(25.0)	8(50.0)	3(18.8)	1(6.2)	0	**16(7.0)**
	10-14	71(51.8)	56(40.9)	6(4.4)	3(2.2)	1(0.7)	**137(59.6)**
	15-19	30(43.5)	23(33.3)	14(20.3)	2(2.9)	0	**69(30.0)**
	>19	3(37.5)	5(62.5)	0	0	0	**8(3.5)**
Educational background	Lower primary	8(38.1)	10 (47.6)	2(9.5)	1(4.8)	0	**21(9.1)**
	Upper primary	43(54.4)	24(30.4)	8(10.1)	3(4.0)	1(1.2)	**79(34.3)**
	JHS	57(43.8)	58(44.6)	13(10.0)	2(1.5)	0	**130(56.5)**

Table 4. Socio-demographics by crossing the street and the incidence of pedestrian crashes.

Socio-demographic Gender		Cross the street to/after school		The incidence of pedestrian crashes	
		Yes (F%)	No (F%)	Yes (F%)	No (F%)
	Male	89(78.1)	25(21.9)	7(6.4)	107(93.6)
	Female	89(76.7)	27(23.3)	9(7.8)	107(92.8)
Age	5-9	13(81.3)	3(18.7)	0	16(100)
	10-14	110(80.3)	27(19.7)	6(4.4)	131(95.6)
	15-19	48(69.6)	21(30.4)	10(14.5)	59(85.5)
	>19	7(87.5)	1(12.5)	0	8(100)
Educational background	Lower primary	15(71.4)	6(28.6)	1(4.7)	20(95.3)
	Upper primary	63(79.7)	16(20.3)	4(5.0)	75(95)
	JHS	100(76.9)	30(23.1)	11(8.4)	119(91.6)
Total		**178(77.4)**	**52(22.6)**	**16(7.0)**	**214(93.0)**

4.4. Differences in self-reported pedestrian safety knowledge

As shown in Table 6, schoolchildren who reported not being involved (3.38) in pedestrian crashes had a better knowledge of pedestrian safety knowledge even though there was no significant difference between their mean scores with that of those involved in pedestrian crashes at $p > 0.01$. Regarding gender, male school children had better pedestrian safety knowledge (3.40) but this was not statistically different from that of female school children (3.33) at $p > 0.01$. Older school children (>14 years) had significantly better knowledge of pedestrian safety than younger (6–14 years) at $p < 0.01$.

Table 5. Means of transport used and involvement in risks.

Means of transport to school		Cross the street to/after school		The incidence of pedestrian crashes	
		Yes (F%)	No (F%)	Yes (F%)	No (F%)
Means of transport to school	In-vehicle	69(63.9)	39(26.1)	6(5.6)	102(84.4)
	Walk to school alone	84(91.3)	8(8.7)	7(7.6)	85(91.4)
	Accompanied	19(82.6)	4(17.4)	2(8.6)	21(91.4)
	By motorbike	5(83.3)	1(16.7)	1(1.7)	5(98.3)
	Bicycle	1(100)	0	0	1(100)
Total		**178(77.4)**	**52(22.6)**	**16(7.0)**	**214(93.0)**

Table 6. Test of paired differences.

Construct	Knowledge of road safety	P.-value
Involved in a pedestrian crash(A)	3.14	
Not involved (B)	3.38	
(A-B)	**−0.24**	**0.10**
Male (C)	3.40	
Female (D)	3.33	
(C-D)	**0.07**	**0.06**
6-14 years (E)	3.24	
>14 years (F)	3.62	
(E-F)	**0.38a**	**0.01**
Primary (G)	3.33	
JHS	3.39	
(G-H)	**0.07**	**0.07**
Walking (I)	3.34	
Not walking (J)	3.41	
(I-J)	**−0.07**	**0.23**

aP < 0.01

4.5. Discussion

Despite growing concern with the safety of school children, there are only a few studies that have addressed the relationship between the self-reported incidence of pedestrian crashes, pedestrian safety knowledge and means of transport to and from school. We present the school children's means of transport to and from school, pedestrian safety knowledge of these school children vis-à-vis self-reported incidence of pedestrian crashes. Schools provide a focal point in a child's life and the areas adjoining the schools offer a distinctive pattern of movement for school child pedestrians that require special safety precautions (Clifton & Kreamer-Fults, 2007; Warsh et al., 2009).

The most significant socio-demographic characteristics predisposing the incidence of pedestrian crashes involving school children are gender and age (Museru et al., 2002). As revealed in the current study, the majority of the self-reported incidence of pedestrian crashes involved female school children and aged 5–9 years old which is similar to what was found out in a similar study in Dar es Salaam, Tanzania, Toronto, Canada, Florida, US (Museru et al., 2002; Warsh et al., 2009). The above incidence of more girl school-child being involved in a crash may be because the female children walk the more.

The higher knowledge of pedestrian safety by the male school children makes them cautious when using the road as reported in the current study. But studies show that males are more adventurous and more exposed to risks than females . Older school children have a significantly higher rate of exposure and intentionally engage in risky behavior(Koekemoer et al., 2017). But in the current study, older school children revealed a significant better pedestrian safety knowledge and would not engage in a risky crossing behavior.

This reveals that more attention should be given to younger child pedestrians (<14) as they are seen to be more vulnerable than the older school children. The accompanying older person should hold the hand of the child until they reach the age of >14, although allowance should be made for the capacities of the individual child. It should be noted, however, that although there is an agreement that the supervision of young children is necessary, there is little consensus on developmental milestones such as no longer

holding hands and allowing independent travel. However, their effectiveness in preventing crashes at school crossings has not been determined.

Active walking is the prominent means of transport in LMICs such as Ghana, India, and China because of low vehicle ownership for school children with other options such as the use of a bicycle, being transported/dropped at schools in private/commercial/government vehicles (Ojo, 2018; Pont et al., 2011; Porter et al., 2017; Sam, 2015). As evident in the study, almost half of the school children were being transported by vehicles. This is a reflection of the locations of the schools selected in the study in terms of socio-economic status (Ogunleye-Adetona et al., 2018; Ojo, 2018; Sam, 2015). As such, with relatively higher socioeconomic status, the parents/guardians transport/dropped off their wards in schools. The findings of the study are contrary to what was revealed in Cape Town, South Africa with the majority of the school children walking to school (Koekemoer et al., 2017).

School children transported/dropped off in school are always cautious in crossing the streets compared to their cohorts who spend more time walking to and from school (Koekemoer et al., 2017). This is because they may not be familiar with the road as compared to their cohorts that commute daily. Their familiarity with the route is dependent on their ages. Hence the need for relatively older school children to accompany the younger ones.

Schoolchildren cross the street to and after school unaccompanied or unsupervised irrespective of the means of transport used as revealed in the current study and supported by studies in Ghana, India, Malaysia, South Africa and the US (Koekemoer et al., 2017; Panter et al., 2010; Raj et al., 2011; Yankson, 2011). Unlike the study in Cape Town with 12% of school children being accompanied, 20% is being accompanied in the current study with the majority of them reporting more severe pedestrian crashes (Koekemoer et al., 2017)

Child pedestrian safety knowledge is required to cross the road to and after school because of the road use pattern and the risk factors especially in an LMICs like Ghana with narrow roads coupled with the lack of pedestrian facilities such as Zebra crossings and pedestrian walkway (Dandona et al., 2011; Mohamed et al., 2011; Schwebel et al., 2014a). The high incidence of school children walking to school unaccompanied is a call for concern as noted similarly by Yankson (2011). These school children have to cover a distance without supervision sharing the same narrow road that characterizes the metropolis with inadequate pedestrian facilities such as zebra crossings and pedestrian walkways predisposing the occurrence of pedestrian crashes (Odami, 2017). The riskier negligent behavior of school children even compounds the occurrence of pedestrian crashes (Koekemoer et al., 2017).

5. Limitations

The study had several limitations including the use of self-reported to measure schoolchildren's pedestrian knowledge and the incidence of pedestrian crashes. Although this method is extensively used in research involving children (Koekemoer et al., 2017;). Self-report is often affected by social desirability bias (Koekemoer et al., 2017). The use of naturalistic observational methods can as well assist in shedding more light on the pedestrian knowledge of road safety.

The study is also generalizability limited by the use of a convenience sample involving only school children in medium and high-income areas. Despite all, the study has provided ample information on pedestrian safety knowledge of school children in a Ghanaian metropolis.

6. Conclusion and recommendations

Three basic schools were surveyed in a Medium and High-Income Residential Areas of the Cape Coast Metropolis with the majority of the school children being transported/dropped off in school in vehicles or walking. The majority of the school children who walk to school were unaccompanied. The better pedestrian safety knowledge by the school children influences the low incidence of pedestrian crashes with most of the victims being females,<9 years old and in lower primary.

The management of the basic schools with teaching materials from NRSA should instill good pedestrian safety knowledge in female pupils, school children, aged <9 years old and those in lower primary. The management should also advise the parent/guardian to accompany their younger wards to and from school.

Disclosure statement

No potential conflict of interest was reported by the authors.

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