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Child Restraint use and Seating Position in Motor Vehicles: An Observational Survey in Ibadan Metropolis, Nigeria

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abstract

This paper examined child restraint use by child passengers in motor vehicles and factors influencing its use and non-use. Observational surveys were conducted to determine the number of child passengers restrained, the type of restraint and its correct use at nursery and primary schools in Ibadan metropolis, Nigeria. Questionnaire was administered to drivers to obtain information on demographic characteristics, child restraint use, reasons for use and non-use, and barriers to their use. Multivariate logistic regression was used to analyse data. A total of 3,175 vehicles were observed. Most (62.3%) of the drivers used seat belt while only 6.8% of the 3,175 children observed were restrained. Out of the 215 children restrained, 56.9% of the child restraint seats were not placed properly in the vehicles while 43.1% were correctly placed in the rear middle position. Restraint misuse was indicated by premature adult seat belt use (11.9%). Factors associated with child restraint use include age of the child, vehicle type and driver seat belt use. Parents whose children use child restraint cited safety and safety as reasons for use of restraint. Reasons for non-use of child restraint include parental beliefs. Barriers to use of child restraints seats include child's unwillingness and cost.

Introduction

Globally, road traffic crashes (RTC) is the eighth leading cause of death accounting for 2.5% (1.35 million) of total deaths among all ages in 2016 (WHO, 2018). Road crashes is the leading cause of death among children and adolescents aged 5-19 years. It is also the second leading cause of death for children aged 5-9 years and 10-14 years. (UNICEF, 2022). Road traffic injuries account for the death of 220,000 children and adolescents aged 0-19 years every year worldwide. Most of those deaths occur in low-income (30%) and lower middle-income (48%) countries particularly in sub-Saharan Africa region. In 2019, road traffic death rate among children aged 0-19 years in sub-Saharan Africa region (19.07 per 100,000 population) was the highest globally compared with 2.96 per 100, 000 population in Europe and Central Asia. In Nigeria, of the 5,574 and 35,981 deaths and persons injured in road crashes in 2020, 7.1% (399) and 6.4% (2,150) respectively were children. (Federal Road Safety Corps-FRSC, 2020). Children are more vulnerable to the impact of road crashes due to their anatomical and physiological characteristics, limited cognitive and visual processes, and risk-taking behaviour (Brolin et al., 2015). 2017; Lattof, 2018; Zhang et al., 2017).

Previous studies that examined child passengers injured in motor vehicle crashes reported that head and neck injuries were the most common severe injuries responsible for deaths (Singh et al., 2016). This is due to contact with the car interior such as the back of the front seat, door panel or the window and emergency manoeuvre like braking and steering (Bohman et al, 2007). The larger and heavier head coupled with slender neck and large portion of cartilage in the vertebrae of children predispose them to head and neck injuries compared with adults. Besides death, life-changing disabilities and injuries, children and adolescents involved in crashes develop post-traumatic stress symptoms and other trauma symptoms including depression, anxiety or dissociation (Schäfer et al., 2006).

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Effective measures of reducing the incidence or severity of injuries sustained by child passengers include correct use of age-appropriate restraints and being seated in the rear of the vehicle. Based on biomechanical perspective, children are best protected using rearward facing seats up to four years of age and thereafter the vehicle seat belt together with a belt positioning booster (Brolin et al., 2015). Studies indicate that forward-facing restraints, rear-facing restraints and booster seats significantly reduce the risk of severe injury and death of children in motor vehicle crashes (Will and Geller, 2004; Arbogast et al., 2004; Elliot et al., 2006). However, non-use and inappropriate and/or incorrect use of child restraint seat (CRS) have been reported in various observational surveys (Ferguson et al., 2000; Ebel et al., 2003; Decina and Lococo, 2007).

Installation errors and misuse of CRS (such as incorrectly routed seatbelt, harness strap errors, missing or incorrect fitting gated buckle/locking clip) undermine its effectiveness during crashes. Analysis of children involved in motor vehicle crashes indicate that most of the children killed or that suffered fatal injuries were either not restrained or used inappropriate and/or incorrect child restraint (Sherwood et al., 2003; Bilston et al., 2007). Factors associated with non-use and incorrect use of CRS include discomfort in children (Bohman et al., 2007), awareness/knowledge, risk perception, parenting style (Simpson et al., 2003), child resistance, cost, child's size, incompatibility between the restraints and vehicle seat designs, changing requirement as children grow and variations among seat belts (Sherwood et al., 2003).

Furthermore, sitting position of children influence injury patterns during crashes. It is recommended that children aged 12 and below sit in the rear seat of passenger vehicles because rear seats are associated with reductions in risk of serious injury (Durbin et al., 2004). Previous studies indicate that children in the front seat were at greater risk of injury compared with those in the rear seat (Durbin et al., 2005).

Although low- and middle-income countries account for high rate of child injuries and fatalities due to motor vehicle crashes, there is surprisingly limited research on the use of CRS and seatbelt in these countries. Most of the studies have focused on developed countries where the rate of CRS use is high. Perez-Nunez et al. (2013) noted that the rate of use of child restraint seat in Nigeria and Mexico was 18.6% and 17.4% respectively compared with Australia (92%) and Canada (91%). Very limited information on CRS use in

Nigeria is available from previous studies and most of this information is based on victims of RTC presented in hospitals (Osifo et al.,2012) and parents report of the child's use of restraints (Ndu et al., 2016) rather than actual observation (Sangowawa et al., 2006; Olufunlayo et al., 2018).

This study 1) examine prevalence of child restraint use by child passengers aged less than 10 years in motor vehicles, 2) determine factors that influence child restraint use, 3) assess reasons for child restraint use and non-use, and 4) identify barriers to use of child restraint in Ibadan metropolis, Nigeria. Understanding the level of use of CRS will guide public health agencies, policymakers, road safety agencies and the Police in the formulation and implementation of strategies that will improve knowledge/awareness and correct use of CRS so as to reduce child deaths and injuries due to road traffic crashes.

Literature Review

Several research on the prevalence and factors influencing use of child restrains are reported in the literature. Chen et al. (2021) investigated the prevalence of child restraint use and factors influencing child restraint practice in Shanghai, China. The observational study was conducted near children's hospitals, kindergartens, entertainment places and shopping malls. Of the 12,061 children in vehicles that were observed, 6.42% used child restraint. Results of logistic regression model indicated that likelihood of child restraint use was higher in children younger than five years compared to those aged 5-12 years, children who sat in rear seat compared to those in front seat, children observed near entertainment places or shopping malls compared to those near children's hospitals and vehicles observed in the morning compared with afternoon.

Lee et al. (2019) examined appropriate use of CRS by children aged 0-3 years using data from Fatality Analysis Reporting System over the period 2011-2015. Characteristics of the child, driver, vehicle and trips of 648 children involved in crashes were investigated. Findings indicated that only 48% of the fatally injured children were appropriately restrained in a CRS. In addition, premature use of seat belt by children was observed. Results of multivariable log-binomial regression analysis showed that likelihood of use of appropriate CRS was highest in younger children while children who are black, children in pickup truck and those whose drivers were not restrained in a seat belt were less likely to be restrained appropriately.

The use of child restraints, seating position of children, driver restraint and vehicle overloading in Bloemfontein was assessed by Hallbauer et al. (2011). The researchers observed children in selected pre-primary or primary schools. A total of 512 children in 374 vehicles were assessed. Of these, 88% children and 17.4% drivers used restraints. Also, 14.1% of the children were seated on other people's laps on the front seat. Proportion of children restrained was higher if the driver was restrained versus not restrained.

Prevalence of child restraint use in Shantou, China over the period 2012 to 2017 was examined by Yan et al. (2020). Observations were conducted at selected hospitals, kindergartens, primary and secondary schools. Data was analysed using Chi-square tests and logistic regression. A total of 9,858 commuting children were observed. In 2017, 24.6% of children aged 0-5 sat on adult's lap, 14.2% used a restraint and sat in the rear row. Furthermore, 2.4% of children aged 6-11 used a restraint. Huang et al. (2019) compared the use of rear facing restraint by children under two years pre and post recommendations by American Academy of Pediatrics (AAP). Data from Fatality Analysis Reporting System from 2008 to 2015 showed that 6.7% of infants and toddlers were unrestrained, and mortality was higher (40.0%) among this group compared to those who were restrained (13.7%). Predictors of non-use of restraint by infants aged less than one year old and toddlers include unrestrained driver, driver aged less than 20 years, driver alcohol use, center seated infant, and weekday crash. Use of rear facing restraint increased after AAP guidelines.

Bendak and Alkhaledi (2017) investigated the prevalence of CRS use and demographic characteristics that affect its use in United Arab Emirates. Roadside observations and questionnaire survey were conducted in two emirates. Results showed that 16.7% of 494 parents restrained their children while driving. Young, less educated and male parents reported low rate of CRS use and disbelief in the importance of CRS use for reduction of crash severity.

In another study, Chakraborty et al. (2022) conducted an observational survey to identify factors influencing proper child restraint use and child passengers seating position in Michigan over the period 2015 and 2018. Results of bivariate probit model showed that the age of the child, number of child passengers in the vehicle, driver seat belt use, driver's gender, age, and race, vehicle type, stratum, weather and the time of day and week influenced proper use of child restraint. Hall et al. (2018) employed qualitative approach to examine perceived barriers and motivators of correct child restraint use in Sydney, Australia. Information from focus group discussion indicated that barriers to correct restraint use include difficulty interpreting instructions and labels, remembering and attending to correct use information, lack of information and behavioural feedback on how to correctly install and use a child restraint, and low confidence in ability to install and use child restraint correctly. Cai et al. (2021) examined the use of CRS and its associated factors in Shenzhou. A total of 3,768 parents who had at least one child aged 0-6 and owned a car completed the questionnaire. Results of multivariable logistic regression showed that children aged below 3 years, drivers using expensive cars, and wearing seatbelts, and parents with higher knowledge and attitude scores had higher likelihoods to use CRS. Only 22.8% of parents used CRS for their child passengers.

In the African context, Monteiro et al. (2013) analysed the use of child safety restraint by drivers and children in Gaborone, Botswana. Results revealed that while 21.4% of the children were restrained, 78.6% were unrestrained. Also, male drivers and children of commercial vehicles were more likely to have an unrestrained child compared with female and private vehicle drivers. Hunter et al. (2020) conducted qualitative interviews with 13 expects from government, academic and medical institutions in South Africa to determine factors influencing child restraint use in South Africa. Findings showed that a child restraint programme was necessary. Puvanachandra et al. (2020) assessed rates of child restraint use in Cape Town, South Africa. The authors found that only 7.8% of child passengers observed were properly restrained. Reasons for non-use of restraints include high cost and the belief that seat belts were a better alternative.

Few studies have examined the use of child restraint by child passengers in Nigeria. Sangowawa et al. (2006) examined child seating position and restraint use in Ibadan metropolis. A total of 796 children in 440 vehicles in selected primary schools were observed. Restraint use by driver and children was 48.0% and 4.1% respectively. Also, 38.6% of the children aged 1-4 years were seated in the front seat. Children in vehicles in which the driver was restrained were more likely to use child restraint. Olufunlayo et al. (2012) investigated child safety practices among children aged 0-8 years in two Local Government Areas of Lagos state- Eti Osa and Ikeja. Children in eight schools were observed as they were dropped off in the morning. Restraint use was 10.8% in Eti Osa and 4.2% used restraint appropriately. In Ikeja, 7.0% of the observed children used restraint and 1.8% used it appropriately. Child restraint use decreased with increasing age of children. In addition, 9.4% of children in Eti Osa and 17.5% in Ikeja were seated in the front seat. Factors which influenced restraint use include number of child passengers in the car, and driver's seat belt use. Child's seating position was associated with driver's gender and relationship to the child.

City profile

Ibadan, a traditional city, is the capital and most populous city in Oyo State, south-western Nigeria. The city covers a total area of 3,080 square kilometres; hence, it is the largest city in Nigeria. Ibadan is located 128 kilometers inland northeast of Lagos which is the commercial centre of Nigeria. The population of the city was estimated at 3,874,908 with over 6 million people in the metropolitan area in 2022 (UN World Urbanization Prospects, 2022). Administratively, there are 11 Local Government Areas (LGAs) in Ibadan, with five in the urban (Ibadan North, Ibadan North-East, Ibadan North-West, Ibadan South-East, and Ibadan South-West) and six in the peri-urban areas. Figure 1 shows the local government areas in the urban part of Ibadan metropolis. The city has developed and expanded spatially overtime due to increase in economic activities and migration. Ibadan is linked through highways with Lagos in the South West; Ijebu Ode and Shagamu in the South; Abeokuta in the West, Oyo, Ogbomosho, Offa and Ilorin in the North; Ife, Ado Ekiti, Osogbo, Ilesha, Akure, Okene, Auchi and other cities towards the East. This facilitates movement of people and goods from different parts of the country to and from Ibadan.

Vehicle ownership is low (NBS, 2018), hence, a high proportion of the population in Ibadan depend on informal public transport services (minibus, motorcycle, taxi, and tricycle) for intra-urban trips. These commercial vehicles were involved in majority of the road crashes in Oyo state in 2020 (FRSC, 2020). Most of the roads are narrow, winding, lack pedestrian walkways, and are in terrible state of disrepair. Akinyemi and Olumoyegun (2020) revealed that Oyo state recorded the highest number of children killed in road crashes in south-western zone of Nigeria during the period 2013-2017. Korter et al. (2013) noted that the LGAs in the urban areas of Ibadan had very high number of children injured and killed in road crashes compared to other LGAs in Oyo State. Furthermore, in 2020, Oyo State had the highest number of children killed (71) in road crashes in the south-west zone. The number of deaths was high (71) compared with Lagos State (12) which has higher population density and registered vehicles. Since, Ibadan has the highest population, vehicles and road casualties compared with other cities in Oyo State, it was selected for the observational study.

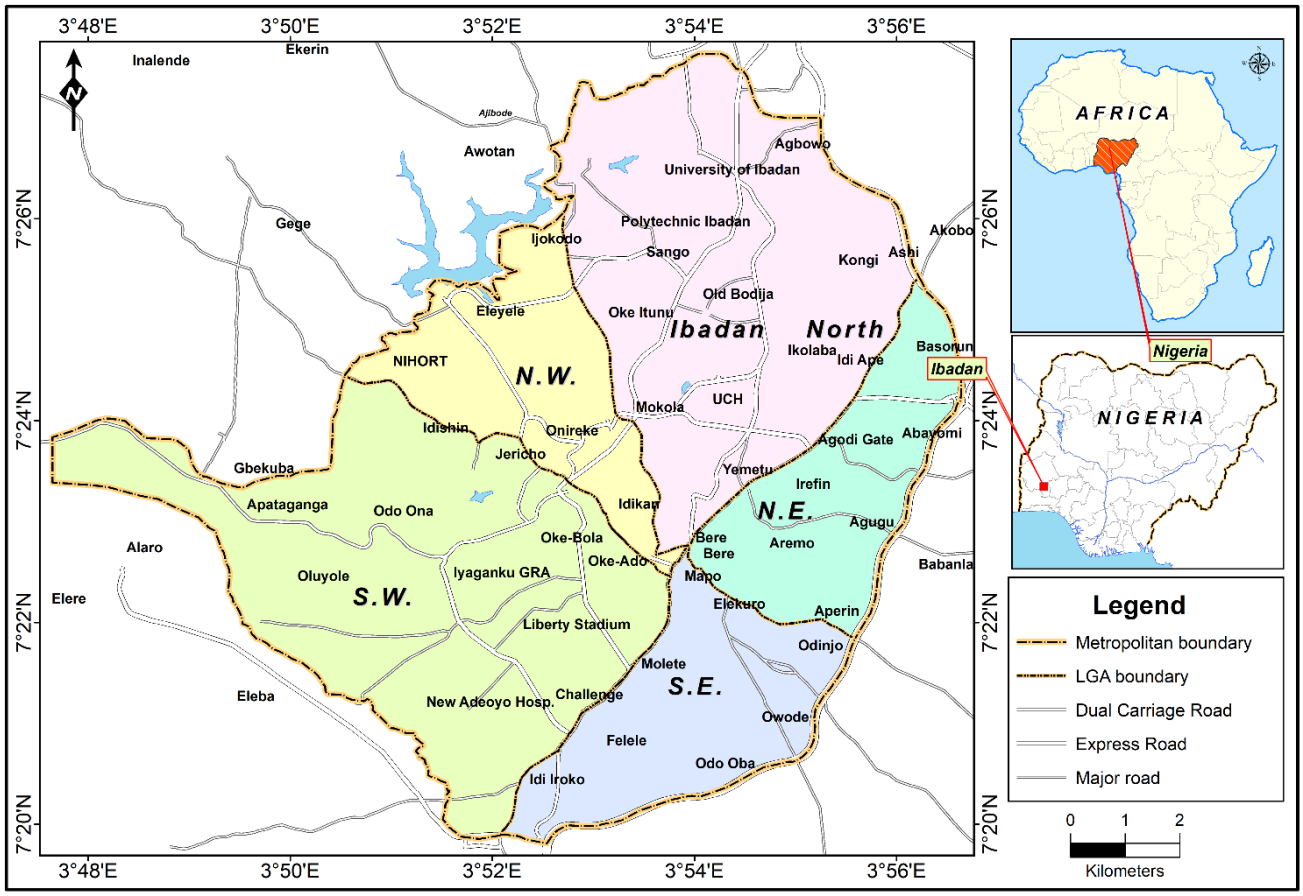

Figure 1. Urban area of Ibadan metropolis

Material and Methods

Cross-sectional observational and questionnaire survey methods were used to obtain data on child restraint use and non-use. The surveys were conducted in five nursery and primary schools in Ibadan metropolis, Oyo State, Nigeria. Each school is located in each of the five Local Government Areas in the metropolis. The schools are those whose proprietors/ principals consented to participate in the survey out of the selected eight schools. Schools were chosen as study sites because they contain high concentration of children aged less than 10 years compared to shopping centres and amusement parks which usually have few children.

We conducted a pilot observational study to determine the feasibility of the survey and modify the checklist. The observational surveys were conducted for one week simultaneously in all the schools. Observers were recruited and trained on the information to be recorded and method of data collection. To ensure that a vehicle was observed once, observers were stationed at only one entrance of the school and at locations where drivers were forced to slow down while moving on a bump or collecting a gate pass. Observations were recorded during drop-off (7-9am) and pick-up (2-5pm) times. Observers recorded information on the gender and age of the driver, vehicle type, driver's seat belt use, child's gender, child restraint use and position, type of child restraint, and child's sitting position in vehicles. Only one child was observed in each vehicle and vehicles without a child aged 0-10 were excluded. For the purpose of this study, appropriate child restraint type was classified as rear-facing infant restraint, forward-facing child seat, high-backed booster seat, and low-backed booster seat while the use of adult seat belt by children less than eight years old is considered inappropriate (Schaik, 2008). A child was considered unrestrained when the child was not wearing any restraint, for example, sitting or lying on an adult's lap, standing up, and sitting in the middle of the front seats.

A questionnaire was used to obtain information on child restraint seat use, and barriers hindering its use from drivers. The questionnaire was distributed to drivers during drop off and pick up times. Questions in the questionnaire sought information on demographic characteristics of drivers and children, ownership of child restraint seat, use and non-use, reasons for use and barriers to restraint use. The number of respondents in each school was not determined prior the survey because the number of children that use private vehicles to school could not be ascertained.

Statistical analysis of the data was conducted using SPSS version 25.0 software. Descriptive statistics was presented using frequency and percentage. Multivariate logistic regression analysis was used to determine factors associated with use of restraints. The outcome variable was child restraint use while the independent variables include driver's seat belt use, gender, and vehicle type.

Results

A total of 3,175 vehicles comprising cars (68.1%), SUV (18.4%) and van (13.5%) with children aged 0- 10 were observed during the survey. However, not all the drivers agreed to participate in the questionnaire survey. Out of the 3,175 drivers that were approached, 1,946 agreed to participate. The response rate (61.3%) is low because drivers were often in a hurry to leave. Table 1 shows the number of vehicles observed and respondents in each LGA. Child, driver and vehicle characteristics are presented in table 2. Findings from the observational survey show that male drivers (50.4%) were more than female (49.6%) drivers. Although there is an existing regulation relating to seat belt use and it is enforced by the Federal Road Safety Corps, only 62.3% (1978) of the drivers used seat belt. Most of the drivers were aged 39-48 years (49.3%) followed by 29-38 years (23.0%) age group. Many of the drivers (76.6%) had tertiary level education. About 27% of the drivers had monthly income less than 80,000 naira.

In terms of ownership of child restraint seats, while 24.8% of the drivers reported that they have child restraint seats, 75.2% do not.have restraint seats. Of the 483 drivers who have child restraint seats, 9.0% (175) use it always while 2.1% (41) rarely use it. Most of the children in the vehicles are aged 1-4years (27.3%). This is followed by children aged above six years (24.6%) and those aged between four and six years (23%). Ninety-eight per cent of the drivers were parents.

Table 1. Number of drivers observed and respondents in each LGA

Locality	LGA	Vehicles Observed	Number of respondents
University of Ibadan.	Ibadan North.	1015	591
Molete.	Ibadan South East	415	370
Ring road	Ibadan South West	565	300
Eleyele	Ibadan North West.	640	390
Oluyole	Ibadan North East	540	295
	Total	3175	1946

Table 2. Characteristics of driver and child

Characteristics	Observational survey		Questionnaire survey	
	n= 3175	%	n=1946	%
Driver's sex				
Male	1650	50.4	882	45.3
Female	1575	49.6	1064	54.7
Vehicle type				
Cars	2162	68.1	1193	61.3
SUV	584	18.4	504	25.9
Van	429	13.5	249	12.8
Driver seatbelt use				
Belted	1978	62.3		
Unbelted	1194	37.7		
Relationship to child				
Parent			3108	97.9
Others			67	2.1
Driver's age (years)				
18-28			43	2.2
29-38			448	23.0
39-48			959	49.3
49-58			294	15.1
➢ 58			27	1.4
No response			175	9.0
Driver's education				
None			146	0.7
Primary			8	0.4
Secondary			175	9.0
Tertiary			1490	76.6
Non-formal			259	13.3
Driver's monthly income*				
< ₦80,000 ($104.2)			518	26.6
₦81,000- 120,000 ($105.5- 156.4)			477	24.5
₦121,000-160,000 ($157.7- 208.5			294	15.1
₦161,000-200,000 ($209.8-260.6)			210	10.8
>₦200,000 ($260.6)			105	5.4
No response			342	17.6
Child's sex				
Male	1702	53.6		
Female	1473	46.4		
Child's age				
0-6 months			118	4.6
7-11 months			238	9.3
1-4years			699	27.3
4+-6years			589	23
>6 years			630	24.6
No response			288	11.2
CRS ownership				
Yes			483	24.4
No			1463	75.2
Frequency of CRS use				
Rarely			41	2.1
Sometimes			113	5.8
Often			154	7.9
Always			175	9.0
Never			1463	75.2
Child Restraint				
Seat belt only	378	11.9		
Child restraint seat	216	6.8		
On passenger's lap	419	13.2		
Unrestrained	2162	68.1		
Type of CRS n=216				
Forward-facing child seat	64	29.6		
Rear-facing child seat	49	22.6		
High-back booster seat	92	42.6		
Low-back booster seat	11	5.1		
Position of Child seats n=216				
Front	-	-		
Left rear	98	45.3		
Middle rear	93	43.1		
Right rear	24	11.1		
3rd row left rear	1	0.5		
Child seating position				
Front	645	20.3		
1st row rear	1054	33.2		
2nd row rear	1127	35.5		
Standing	349	11.0		

Note: * US$ equivalent based on $1= ₦767.43 exchange rate of the Central Bank of Nigeria (www.cbn.gov)

Table 3. Restraint of children in relation to seat belt use by driver

Children	Driver Belted		Unbelted			
Children Restraint	No.	%	No.	%	Total	p=0.000*
Seat belt only	355	93.9	23	6.1	378	
Child seat	198	91.7	18	0.8	216	
On passenger's lap	256	61.1	163	38.9	419	
Unrestrained	1169	54.1	993	45.9	2162	

*significance at 5% level

Table 4. Result of logistic regression analysis of risk factors of child restraint use

Variable	OR	95% CI
Driver seat belt use		
Belted	1.00 (ref)	
Unbelted	1.205*	1.032-1.407
Vehicle type		
Car	1.00 (ref)	
SUV	0.803*	0.697-0.92
Van	0.982*	0.979-0.985
Driver's sex		
Male	1.00 (ref)	
Female	1.026	1.006-1.046
Child's age		
<2 year	1.00 (ref)	
3 years	1.205*	1.032-1.407
4 years	1.292*	1.157-1.442
5 years	1.843*	1.411-2.407
6 years	0.989*	0.981-0.998
7 years	0.862	0.68-1.36

* Significance at 5% level

Of the 3,175 children observed in vehicles, 378 (11.9%) used seat belt only, 216 (6.8%) used child restraint seats, 419 (13.2%) sat on a passenger's lap while 2,162 (68.1%) were not restrained. The result suggests that although 62% of the drivers were restrained, only 6.8% of the child passengers were restrained.

Seating position of a child in a vehicle influence injury severity. Generally, of the 3,175 children observed, 645 (20.3%), 1054(33.2%), and 1,127(35.5%) children were seated in front, first row rear and second row rear seats respectively while 349 (11.0%) were seen standing. Observed position of child restraint seat were left rear (45.3%), middle rear (43.1%), right rear (11.1%) and third row left rear (0.5%). With regard to type of child restraint seat used, high-back booster seat was the most common (42.6%). Other types of child seat are forward-facing child seat (29.6%), rear-facing child seat (22.6%) and low–back booster seat (5.1%).

Table 3 presents information on use of restraint by child passenger and drivers. Most of the children were restrained using child seats (92%) when the driver was restrained compared with 0.8% if the driver was not restrained. It shows that the attitude of drivers towards seat belt use influence the use of restraints by child passengers. There was a significant association between driver's seat belt use and use of child restraint by children at 5% significance level (p value= 0.000). Furthermore, when the driver was restrained, 54% of the children in the vehicle were not restrained and 61% sat on a passenger's lap. This suggests that some drivers use seat belts but have a wrong attitude towards restraint of children in child seats. Restraint misuse was indicated by premature adult seat belt (93%) use by children less than eight years old.

Results of the logistic regression analysis presented in table 4 indicate the association between the explanatory variables and use of child restraint seat by children riding in vehicles. Children riding with drivers that are not restrained had a 20% higher likelihood of not being restrained in a child restraint seat compared to children riding with restrained drivers. Hence, driver's seat belt use is associated with increased child restraint use.

In terms of vehicle type, children riding in an SUV and van had a lower likelihood of not using a child restraint seat than children riding in a car. Gender of the driver was not significantly associated with the use of a child restraint by children in vehicles. As the age of the children increased, the likelihood of a child using a child restraint seat increased up to age five, after which it declined. Relative to a child who is less than two years old, children aged three, four and five years had 20%, 29% and 84% higher likelihood of using a child restraint seat respectively. However, children aged six and seven years old had a lower possibility of using a child restraint seat compared with children that are less than two years old.

Drivers who used child restraint seats were asked to state reasons for using child restraints. Most common reason stated was 'to keep the child safe'. This was the response of 126 (9.7%) drivers. Other reasons stated include 'to protect the child from injury during a crash' (6.5%), 'to keep the child firm in seat' (2.9%), for child's comfort' (1.8%) and 'avoid driver's distraction' (1.4%). On the other hand, drivers of children who were not restrained stated reasons for non-use of child restraint seat. Most (29.7%) believed that 'sitting in rear seat is safe without a child restraint'. Other reasons stated for non-use of CRS include 'It is safe to hold a child on passengers lap' (15.5%) and 'child restraint seat is not necessary for short distance trip' (6.6%). Barriers to use of child restraints seats include 'children do not like to be strapped on seats (18.9%), and 'child restraint seat is expensive' (14.5%).

Discussion

This paper examined prevalence of child restraint use and its predictors in Ibadan metropolis, Nigeria. Data was obtained through observational and questionnaire surveys conducted in five primary schools. Results of the observational survey revealed that 62.3% of the drivers used a seatbelt. The high rate of compliance to seat belt use is probably due to the concerted efforts of the Federal Road Safety Corps at increasing awareness of the importance of seat belt use by drivers. In addition, improved monitoring and enforcement of the safety regulation may have increased compliance to seat belt use by drivers (Sangowawa et al., 2006). However, the rate of child restraint use is very low (6.8%) similar to findings from another city in Nigeria (Olufunlayo et al., 2012), Aidoo et al. (2019) in Ghana, Chen et al. (2014) in China and Hallbauer et al. (2011) in South Africa. The low level of CRS use could be attributed to low level of knowledge about the importance of CRS to child's safety. The number of restrained children is very low compared with findings in high-income countries such as Queensland with 95.1% (Lenon, 2012) and Canada with 99.6% (Bruce et al., 2015).

The rate of non-use of child restraint is high (68.1%) and probably account for the high rate of reported fatality and injury in children during road crashes since non-use of child restraint is associated with higher injury risk. Although most of the child restraints were placed in the rear seat similar to findings by Dulf et al. (2019), the middle rear is the safest position for children. This suggests that 123 (56.9%) child seats were wrongly placed on the rear left and rear right positions. Furthermore, high back booster seat was the most common type of restraint used by child passengers. Children in high back booster seat have 70% reduction in injury risk during side impact crashes (Arbogast et al., 2005).

Another important finding is the position of unrestrained children in vehicles. Children were observed sitting on passengers' lap, in front seat and standing. Similar child positions in vehicles was reported by Yan et al. (2020). This practice is due to a wrong belief by parents that children are better protected

on an adult's lap and low level of awareness of the effectiveness of child restraint in reducing the risk of injury and fatality during a crash (Arbogast et al., 2009). Driver's use of seat belt is associated with the use of restraint by child passengers. Most of the children that were restrained were in vehicles whose drivers used a seat belt similar to findings by Hallbauer et al. (2011). This finding corroborates the result obtained by Roehler et al. (2019) which indicated that unrestrained drivers had a higher probability of having an unrestrained child passenger for all age groups. Furthermore, in some of the vehicles observed, while the driver was restrained, the child was not restrained. This is probably due to lack of CRS as 75% of drivers do not have a CRS. In addition, about 12 % of observed children used a seat belt which was not appropriate for their age similar to findings by Olufunlayo et al. (2018).

Analysis of the factors influencing use of CRS by child passengers revealed that driver's restraint, vehicle type, and child's age are important factors associated with use of CRS. Similar to findings by Hallbauer et al. (2011), children in vehicles with restrained drivers are more likely to be restrained compared to those in vehicles whose drivers are not restrained. Children riding in SUV and van and those aged less than five years were more likely to use child restraints. This is possibly because of less space in cars and older children may be perceived as too big to use a child restraint. This finding is similar to results obtained by Dulf et al. (2019) which showed that children five years old or younger were more likely to be properly restrained compared to older children.

Reasons for non-use of child restraint is low level of awareness about the benefit of child restraint. Respondents stated that child restraint was not necessary since child sitting in the rear seat or on an adult's lap was safe for the child. Some drivers also noted that child restraint was not necessary for short distance trips. These results are consistent with findings of Bendak and Alkhaledi (2017). The major barrier to use of child restraint is the cost of procuring the restraints and child unwillingness to use it. Drivers noted that child restraint is expensive.

Conclusion

Road crash is still the leading cause of death and injuries for children aged between 5 and 14 years in spite of advanced technology in child restraint seats. Although some low-income countries including Nigeria have laws on the use of child restraint, these laws are not properly enforced. Consequently, most of the motor vehicle crashes and deaths involving child passengers occur in developing countries.

In this paper, we examined the use of child restraint seats by children aged less than 10 years old riding in vehicles to and from nursery and primary schools, determined the factors that influence its use and parental reasons for use and non-use of child restraints seat in Ibadan metropolis, Nigeria. To this end, a cross-sectional observational survey was conducted to obtain information on vehicles, driver's seat belt use, and use of child restraint seat by child passengers. A questionnaire was designed to elicit information on socio-demographic characteristics of the driver and child, use of child restraint seat, and driver's reasons for use and non-use of child restraint seat. Results indicate that although 62% of the drivers used seat belt, only 6.8% of child passengers were restrained in appropriate child restraint seats. Possibly, low rate of use of child restraint compared with driver's seat belt use is due to the weak enforcement of existing national child restraint regulation. Due to the enforcement and penalty imposed on non-use of seat belts, compliance rate is high (rated nine) while enforcement of child restraint use is low (rated 3) in Nigeria (WHO, 2018). About 12% of child passengers were improperly restrained with adult seat belt. The children do not fit well into the adult lap and shoulder belt. Moreover, front vehicle seat is not safe for children because front passengers' airbags may cause death or harm to the child.

Most child restraint seats were placed in rear positions in vehicles. Booster and forward-facing child restraint seat were the main types of restraint seats used by children. Empirical results from logistic regression suggest that children riding with unrestrained drivers have higher odds of not using child restraint seats. Age of the child was also associated with child restraint use. The number of children restrained increased with child's age up to age five. According to the drivers (mostly parents) reasons for use of child restraint was mainly for safety, protection from injury, child's comfort and to avoid driver's distraction. On the other hand, non-use of child restraint seats is due to the belief that rear seat is safe for children without the use of child restraint seat and restraints are not necessary for short distance trips. Barriers to use of child restraint include high cost of child restraint seat and children do not like to be strapped in seats.

Findings in this study have important implications for policy makers, government, road safety agencies and parents. The current legislation on child restraint use covers children aged less than four years, but those between four and ten years are insufficiently covered. For instance, children aged seven and above can ride in a vehicle facing the front but restrained with safety belts. Therefore, the legislation needs to be amended in line with best practice. The Federal Road Safety Corps need to increase public awareness on the importance of child restraint use by child passengers through educational campaigns. Also, improved enforcement of regulations relating to the use of appropriate child restraint seat by children and driver's seat belt use will increase compliance rate.

This study has some limitations. The observational and questionnaire surveys were conducted in a limited number of schools. Hence, the results should be considered with caution. In addition, some characteristics were not measured such as weight and height of the child. These parameters are considered in the choice of child restraint systems that could be used by a child.

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