

Trends and Distributions of Road Traffic Crashes and Injuries, Nigeria, 2013 – 2016

Obafemi Babalola (✉ drfemibabs@yahoo.com)

Research article

Keywords: Traffic, Injury, Surveillance System, Road Crash, SDG 3.6, Nigeria

Posted Date: June 24th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-37652/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background

Africa accounts for one-fifth of low- and middle-income countries' contributions to the global road traffic mortality, and Nigeria reported > 25% of this. Over the years, the trends in road traffic crashes (RTCs) in Nigeria have a slow decline. This study describes the magnitude and distribution of RTCs and injuries in Nigeria and determines if the sustainable development goal (SDG 3.6) target set in 2011 was achieved in 2016.

Methods

RTCs surveillance data from the Federal Road Safety Corps (FRSC) 2013 - 2016 was analyzed. Variables like date of the crash, route of the crash, location of the crash, the probable cause of the crash, age and sex of people involved, injured, or killed, road users type and make of vehicles were anonymized and abstracted on Microsoft Excel worksheet. RTCs outcome were classified as minor, moderate, and fatal. The road traffic injury (RTI) fatality rate is the proportion of persons killed in RTC per 100,000 population. Data analyzed for frequency, proportions, and ratio but presented in tables, trend, and charts.

Results

There were 42,813 RTCs involving 56,331 vehicles and 283,949 persons. Fatal RTCs were 12,031 (28.1%) and 23,412 (8.2%) persons died. Male to female ratio was 3:1. North-Central zone (NCZ) reported 16,097 (37.6%) of the RTCs while South-West zone (SWZ) had the highest proportion of RTCs that were fatal 2,474/6,902 (35.8%). RTI fatality rate was highest in NCZ followed by SWZ with 23.8 and 12.7 deaths per 100,000 population, respectively. The States with the highest fatal RTCs were Oyo 631/1209 (52.0%), Yobe 114/269 (42.4%), Ondo 446/1073 (41.6%) and Kogi 566/1368 (41.4%). The commonest causes of RTCs were speed violation and loss of vehicle control. From 2011 to 2016, reduction in RTC and Fatal RTC were 27.4% and 7.8%, respectively and SDG 3.6 target not met.

Conclusions

RTCs remains a major public health in Nigeria where fatal RTCs, injuries, and RTI fatality rate are differentially distributed in states and geo-political zones. RTI fatality rate was highest in NCZ and SWZ, and SDG 3.6 target was not met. Therefore, a context-specific RTCs preventive strategies should be designed and implemented in Nigeria.

Background

Road traffic injury (RTI) is a common cause of unintentional injury [1]. Globally, it is the eighth leading cause of death for all age groups and resulted in 1.35 million deaths and 50 million people injured in 2018 [2]. Low and middle-income countries account for 90% of global RTI mortality but had a fewer number of vehicles compared to developed nations [2, 3]. The African region of the World Health

Organization had one-fifth of global road traffic deaths in 2018 [4]. But Nigeria accounts for more than 25% of RTI deaths in this region [5, 6] with 20.5 road traffic deaths per 100,000 population [4, 7].

Although, the trend and magnitude of road traffic crashes or injuries have a slow decline over the years in Nigeria [8]. But the level of fatality remained high and has been worrisome considering the socio-economic burden to the individual and the nation [6]. Historically, road safety measures in Nigeria dated back to 1913 [9]. But on February 18, 1988, the Federal Road Safety Commission (FRSC) was established when Nigeria was second globally to Ethiopia as the most affected country with road traffic crashes and injuries [10]. For effective delivery of their services as a lead agency on road safety matters, FRSC was strengthened with the FRSC Act (CAP 141) and FRSC (Establishment) Act 2007 [11, 12].

The FRSC is responsible for road safety and RTI surveillance in Nigeria. It has 12 zonal commands that oversee 37 sectoral commands in 36 Nigerian States and the Federal Capital Territory (FCT). These are further divided into 205 commands with 257 formations serving as a source of RTI surveillance data in Nigeria. These formations cover 87 routes, which were divided into 24 corridors. They collate RTI data and send same to National Headquarters through the 12 Zonal Commands. In 2014, FRSC created National Crash Report Information System (NACRIS) to unified road traffic crash data by collaborating with other stakeholders on RTI, yet to be fully in operation [13]. To align with a Sustainable Development Goal (SDG) 3.6 target [14], FRSC in the year 2012–2016 strategic plan aimed to halve the road traffic crash fatalities in 2016 using the year 2011 as the baseline [8] using a quality RTI surveillance.

In 2009 first global ministerial conference on road safety i.e., Moscow Declaration, it was resolved that national RTI surveillance systems should be improved to a quality standard and comparable internationally [15]. This will encourage countries to monitor their progress to achieve the SDG 3.6 target. The frequent monitoring and evaluation of interventions to reduce RTI is one of the key elements of a Safe System approach to identifying gaps and target resource allocation more effectively [15]. Since the establishment of FRSC, studies have shown an overall decline in the magnitude of RTI [6, 8, 12] but is lagging meeting the SDG 3.6 target. There is a need for sub-national information to effectively plan a context-based intervention to drive actions to meet the SDG 3.6 target in Nigeria.

This study aimed to describe the magnitude, characteristics, trends, and distribution of road traffic crashes, injuries, and fatality rate per 100,000 population in Nigeria. It also assessed if the 50% reduction in road traffic crash fatalities (SDG 3.6 target) set in 2011 was achieved in 2016. We anticipate that this will generate information, influence policy formulations that will be used for local interventions in areas with poor RTI outcomes.

Methods

The study setting

Nigeria with a total area of 923,768 km² was ranked the seventh most populous country in the world [16]. It has 36 states with Federal Capital Territory, Abuja as the seat of government. The national road network

is approximately 200,000 km and classified as Trunk A, B, and C. Trunk A roads account for 16.5% of the road network. It is a Federal Government supported road [13]. Due to poor or total lack of rail and marine transportation, 54% of Trunk A roads are responsible for 80% of national vehicular movement [17]. Trunk B roads constitute of 27.5% of the national road network and supported by the State Government. The 774 local district governments supported 56% of the national road networks classified as Trunk C roads and usually not made of concrete or asphalt [17].

Study Design

This study was a record review of RTI data from 2013 to 2016.

Data Collection

RTI data from 2013 to 2016 at the FRSC headquarters were abstracted electronically on Microsoft Excel spreadsheets by trained data abstractors. RTI surveillance variables like unit or sector reporting, date of the crash, time of the crash, reporting time, route of the crash, location of the crash, probable cause of the crash, number of people involved, the severity of RTI, age, sex or gender, type, and make of the vehicles involved in road traffic crash and injury. Each of the FRSC Sector and Zonal commands collect and verify road traffic crashes and injuries data every month and send it to the National Headquarters for further verification, validation and they are archived for future use. This was the data released for this study.

Data Variables And Data Tool

The outcome or dependent variables are road traffic crash and road traffic injury. Variables such as date of the crash, time of the crash, route of the crash, location of the crash, the probable cause of the crash, number of people involved, age group, sex, and type/make of vehicles involved are independent variables. All vehicles involved in the crash were assigned to one crash. One or more probable causes of the crash is assigned to the crash and vehicles involved. RTI fatality rate was defined as persons killed in RTC per 100,000 population for each locality and was used to rank the risk of RTI fatality among the 36 states in Nigeria. The severity of RTI was defined as minor injury when persons involved in road traffic crash has bruises, minor laceration, and no extended hospital admission beyond 48 hours. Serious or moderate injury is when persons involved in a road traffic crash and sustained moderate to severe injury without death but some disabilities with extended hospitalization beyond 48 hours. Fatal injury is injuries that led to the death of persons involved in RTC. However, fatal RTC is road traffic crash that involved a death of at least one person among people involved in RTC for example, vehicle occupants and pedestrians. A road traffic crash is "a collision or incident involving at least one road vehicle in motion, on a public road or private road to which the public has right of access [15]". The age was classified into adults as anyone aged 18 years or more, otherwise, the individual is a child.

Data Validation For Analysis

At each data collection point, the officer in charge of RTI data, the unit head and the head of the command verified and certified the data before forwarding it to the next level. Therefore, there are 3 levels of data verification and validation inherent with FRSC RTI surveillance data, i.e., at the collection point (FRSC formations), the state command, and at the FRSC Headquarters. Data abstracted were anonymized and cleaned for analysis with Microsoft Excel and Epi Info 7 statistical software. Descriptive or univariate analysis, like frequency, proportions, and the ratio was calculated, and information presented in tables, trend and charts or graphs.

Results

Characteristics of RTC, age and sex distributions of the injured

The characteristics of road traffic crashes (RTCs), severity, and number of vehicles involved from 2013–2016 were shown in Table 1. There are 42,813 RTCs involving 56,331 vehicles and 283,949 persons involved from 2013–2016. Of the total RTC, crashes involving one vehicle accounted for 31,374 (73.3%), 12,031 (28.1%) were fatal, and 26,373 (61.6%) were serious or moderate. There was a progressive decrease in number of RTC from 13,656 in 2013 to 9,580 in 2016. Usually, the monthly national average of RTCs reporting was 892, this peaked to 1,697 in February, and lowest was 589 reported in November. In overall, 7 persons were involved per RTC.

Table 1
Characteristics of RTC and vehicles involved, Nigeria, 2013–2016

RTC variables	Year 2013	Year 2014	Year 2015	Year 2016	Total
RTCs reported	13,656	9,873	9,704	9,580	42,813
One vehicle, n (%)	8,118 (59.4)	8,340 (84.5)	7,302 (75.2)	7,614 (79.5)	31,374 (73.3)
Two vehicles, n (%)	4,761 (34.9)	1,275 (12.9)	2,170 (22.4)	1,714 (17.9)	9,920 (23.2)
More than 2 vehicles, n (%)	777 (5.7)	258 (2.6)	232 (2.4)	252 (2.6)	1,519 (3.5)
Total number of vehicles	20,227	11,747	12,507	11,850	56,331
Total persons involved	83,914	69,710	65,008	65,317	283,949
Persons involved per RTC	6.1	7.1	6.7	6.8	6.6
Persons involved per vehicle	4.1	5.9	5.2	5.5	5.0

Between 2013 to 2016, people involved in RTC were 283,949, adults (aged > 18 years) were 255,149 (89.9%) and male to female ratio was 3:1. Among people involved in RTCs, 23,412 (8.2%) were killed (fatally injured), and 133,273 (46.9%) not injured. The overall case fatality rate (CFR) i.e., proportion of persons involved in RTCs that died was 8.2%. However, CFR was 10.1% in children compare to 8.0% in adults as shown in Table 2.

Table 2
Age and sex distribution of persons involved, injured, and killed in RTC, Nigeria, 2013–2016

Characteristics	2013	2014	2015	2016	Total
Total persons involved n (%)	83914 (29.5)	69710 (24.5)	65008 (22.9)	65317 (23.0)	283949
Age and sex, involved in RTC, %					
Male	76.3	62.9	73.5	75.5	72.2
Female	23.7	37.1	26.5	24.5	27.8
Adult	94.5	77.0	93.6	93.8	89.9
Child	5.5	23.0	6.4	6.2	10.1
Total person injured n (%)	39803 (31.3)	27245 (21.4)	30275 (23.8)	29941 (23.5)	127264
Age and sex, injured in RTC, %					
Male	75.6	69.8	73.1	75.0	73.6
Female	24.4	30.2	26.9	25.0	26.4
Adult	94.7	87.8	93.9	93.8	92.8
Child	5.3	12.2	6.1	6.2	7.2
Total person killed n (%)	6442 (27.5)	6147 (26.3)	5821 (24.9)	5002 (21.4)	23412
Age and sex, killed in RTC, %					
Male	77.3	60.9	78.9	78.7	73.7
Female	22.7	39.1	21.1	21.3	26.3
Adult	92.1	73.3	93.3	92.9	87.6
Child	7.9	26.7	6.7	7.1	12.4
Total case fatality rate*, %	7.7	8.8	9.0	7.7	8.2
CFR Male	7.8	8.5	9.6	8.0	8.4
CFR Female	7.4	9.3	7.1	6.7	7.8
CFR Adult	7.5	8.4	8.9	7.6	8.0
CFR Child	10.9	10.3	9.5	8.9	10.1
*CFR = (number of persons killed in RTC/total persons involved in RTC) * 100					

Distribution Of Fatal Road Traffic Crashes And Injuries

The three geo-political zones in northern Nigeria accounted for 27,732 (64.7%) of the RTCs. Specifically, North-Central Zone with 15% of Nigeria's population reported highest number of RTCs 16,097 (37.6%), followed by 7,900 (18.5%) from North-West Zone. North Central and North West Zones were among the first three zones with highest proportion of deaths among persons involved in RTCs. In descending order, South West geo-political zones with approximately 20% of Nigeria population reported the highest proportion of 35.8% (2,474/6,902) of RTCs reported that were fatal, South-South reported 33.8% (1,303/3,854), North West 32.5% (2,565/7,900), South East 27.5% (1,188/4,325), North East 25.0% (935/3,735), and North Central 22.3% (3,566/16,097).

Table 3
Distributions of RTC and injured by states, Nigeria, 2013–2016

Zone	States	Total RTC	Fatal RTC n (%)	Persons Involved	Persons kill n (%)	Persons injured n (%)
N/Central	BENUE	1431	374 (26.1)	7273	683 (9.4)	3842 (52.8)
	FCT	5919	1023 (17.3)	32338	1645 (5.1)	11624 (35.9)
	KOGI	1368	566 (41.4)	11991	1161 (9.7)	4944 (41.2)
	KWARA	855	245 (28.7)	6100	494 (8.1)	2614 (42.9)
	NASARAWA	3314	591 (17.8)	17007	1002 (5.9)	8737 (51.4)
	NIGER	2172	553 (25.5)	12167	1237 (10.2)	5563 (45.7)
	PLATEAU	1038	214 (20.6)	6222	392 (6.3)	3186 (51.2)
N/East	ADAMAWA	1049	162 (15.4)	5509	272 (4.9)	2502 (45.4)
	BAUCHI	1159	349 (30.1)	7810	745 (9.5)	4112 (52.7)
	BORNO	103	25 (24.3)	756	75 (9.9)	490 (64.8)
	GOMBE	752	222 (29.5)	5205	483 (9.3)	3106 (59.7)
	TARABA	403	63 (15.6)	2094	121 (5.8)	1279 (61.1)
	YOBE	269	114 (42.4)	2929	467 (15.9)	1678 (57.3)
N/West	JIGAWA	572	192 (33.6)	3364	430 (12.8)	2133 (63.4)
	KADUNA	2639	1040 (39.4)	19215	2073 (10.8)	9724 (50.6)
	KANO	1528	436 (28.5)	11191	971 (8.7)	5484 (49.0)
	KATSINA	1042	373 (35.8)	6687	831 (12.4)	3929 (58.8)

In terms of RTI fatality rate as shown in Fig. 1, North Central geopolitical zone reported 23.8 deaths per 100,000 population, South-West zone 12.7, North West 11.7, South East 9.5, South-South 9.1, and North East 8.6.

Among the 36 Nigeria States as shown in Table 3, the three leading states with the highest proportion of RTCs that were fatal are Oyo State, 52.2% (n = 631/1209), Yobe 42.4% (114/269), and Ondo 41.6 (446/1,073). The ten leading states with high proportion of persons involved and killed in RTC were Yobe 15.9% (467/2,929), Cross River 13.3% (403/3,025), Jigawa 12.8% (430/3,364), Katsina 12.4% (831/6,687), Oyo 12.1% (1,207/10,008), Kebbi 11.2% (370/3,315), Sokoto 11.2% (324/2,889), Kaduna 10.8 (2,073/19,215), A/Ibom 10.6% (154/1,455) and Niger 10.2% (1,237/12,167). In Fig. 1, Federal Capital Territory (FCT) and Nasarawa state, both in North Central Zone of Nigeria reported the largest number of average annual RTCs of 1,479 and 828, respectively with RTI fatality rate of 13.2 and 10.4 deaths per 100,000 population, respectively.

Zone	States	Total RTC	Fatal RTC n (%)	Persons Involved	Persons kill n (%)	Persons injured n (%)
	KEBBI	628	157 (25.0)	3315	370 (11.2)	2047 (61.7)
	SOKOTO	558	137 (24.6)	2889	324 (11.2)	1551 (53.7)
	ZAMFARA	933	230 (24.7)	5864	504 (8.6)	2948 (50.3)
S/East	ABIA	394	100 (25.4)	3458	173 (5.0)	1417 (41.0)
	ANAMBRA	1064	297 (27.9)	8231	510 (6.2)	2651 (32.2)
	EBONYI	970	300 (30.9)	5673	446 (7.9)	1843 (32.5)
	ENUGU	1111	286 (25.7)	8958	541 (6.0)	3389 (37.8)
	IMO	786	205 (26.1)	5812	329 (5.7)	2262 (38.9)
S/South	A/IBOM	240	95 (39.6)	1455	154 (10.6)	616 (42.3)
	BAYELSA	341	43 (12.6)	2221	88 (4.0)	589 (26.5)
	C/RIVER	566	192 (33.9)	3025	403 (13.3)	1342 (44.4)
	DELTA	1070	414 (38.7)	8331	751 (9.0)	3322 (39.9)
	EDO	1055	421 (39.9)	9032	841 (9.3)	3274 (36.2)
	RIVER	582	138 (23.7)	3602	271 (7.5)	1350 (37.5)
S/West	EKITI	317	80 (25.2)	1662	145 (9.7)	809 (48.7)
	LAGOS	1529	298 (19.5)	11072	482 (4.4)	3643 (32.9)
	OGUN	1694	587 (34.7)	14166	1143 (8.1)	5935 (41.9)
	ONDO	1073	446 (41.6)	8572	829 (9.7)	3622 (42.3)
	OSUN	1080	432 (40.0)	8745	819 (9.4)	4463 (51.0)

In terms of RTI fatality rate as shown in Fig. 1, North Central geopolitical zone reported 23.8 deaths per 100,000 population, South-West zone 12.7, North West 11.7, South East 9.5, South-South 9.1, and North East 8.6.

Among the 36 Nigeria States as shown in Table 3, the three leading states with the highest proportion of RTCs that were fatal are Oyo State, 52.2% (n = 631/1209), Yobe 42.4% (114/269), and Ondo 41.6 (446/1,073). The ten leading states with high proportion of persons involved and killed in RTC were Yobe 15.9% (467/2,929), Cross River 13.3% (403/3,025), Jigawa 12.8% (430/3,364), Katsina 12.4% (831/6,687), Oyo 12.1% (1,207/10,008), Kebbi 11.2% (370/3,315), Sokoto 11.2% (324/2,889), Kaduna 10.8 (2,073/19,215), A/Ibom 10.6% (154/1,455) and Niger 10.2% (1,237/12,167). In Fig. 1, Federal Capital Territory (FCT) and Nasarawa state, both in North Central Zone of Nigeria reported the largest number of average annual RTCs of 1,479 and 828, respectively with RTI fatality rate of 13.2 and 10.4 deaths per 100,000 population, respectively.

Zone	States	Total RTC	Fatal RTC n (%)	Persons Involved	Persons kill n (%)	Persons injured n (%)
	OYO	1209	631 (52.2)	10008	1207 (12.1)	5244 (52.4)
<p>In terms of RTI fatality rate as shown in Fig. 1, North Central geopolitical zone reported 23.8 deaths per 100,000 population, South-West zone 12.7, North West 11.7, South East 9.5, South-South 9.1, and North East 8.6.</p>						
<p>Among the 36 Nigeria States as shown in Table 3, the three leading states with the highest proportion of RTCs that were fatal are Oyo State, 52.2% (n = 631/1209), Yobe 42.4% (114/269), and Ondo 41.6 (446/1,073). The ten leading states with high proportion of persons involved and killed in RTC were Yobe 15.9% (467/2,929), Cross River 13.3% (403/3,025), Jigawa 12.8% (430/3,364), Katsina 12.4% (831/6,687), Oyo 12.1% (1,207/10,008), Kebbi 11.2% (370/3,315), Sokoto 11.2% (324/2,889), Kaduna 10.8 (2,073/19,215), A/Ibom 10.6% (154/1,455) and Niger 10.2% (1,237/12,167). In Fig. 1, Federal Capital Territory (FCT) and Nasarawa state, both in North Central Zone of Nigeria reported the largest number of average annual RTCs of 1,479 and 828, respectively with RTI fatality rate of 13.2 and 10.4 deaths per 100,000 population, respectively.</p>						

Road user's type, RTC fatality and Probable causes of RTC

The road users i.e., motor vehicle occupants involved in collision between motor vehicles and bicycles accounted for 13 RTCs but with highest proportion, 12.9% (8/62) of those involved in RTCs killed and the collision accounted for more deaths among children 18.2% (2/11) than adults compared to other categories of road users type as shown in Table 4. There were 1,950 RTCs involving the collision between the motor vehicle and motorcycle with 8.8% (877/10,007) persons involved killed.

Table 4

Road user's type at collision, age distributions of persons involved, and RTC fatality, Nigeria, 2013–2016

	Persons died in Fata RTC				RTC	
	Involved		Killed		Total, n	Fatal, n (%)
Road users' type	Adult, n	Child, n	Adult, n (%)	Child, n (%)		
MVO* only	165094	18380	12828 (7.8)	1857 (10.1)	23833	7104 (29.8)
Motorcycles only	18110	1958	1179 (15.8)	158 (8.1)	6174	992 (16.1)
MVO & Motorcycles	9140	877	791 (8.7)	86 (9.8)	1950	591 (30.3)
Tricycles only	977	77	24 (2.5)	6 (7.8)	255	24 (9.4)
MVO & Tricycles	778	94	40 (5.1)	4 (4.3)	130	21 (16.2)
MVO & Bicycles	51	11	6 (11.8)	2 (18.2)	13	4 (30.8)
Motorcycle & Bicycles	28	6	0 (0.0)	0 (0.0)	11	0 (0.0)
Motorcycle & Tricycles	24	2	1 (4.2)	0 (0.0)	10	1 (10.0)
Bicycle only	16	1	0 (0.0)	0 (0.0)	7	0 (0.0)
Pedestrian	4	0	0 (0.0)	0 (0.0)	3	0 (0.0)
Not reported	60927	7394	5645 (9.3)	785 (10.6)	10427	3294 (31.6)
Grand Total	255149	28800	20514 (8.0)	2898 (10.1)	42813	12031 (28.1)

*Motor vehicle occupants

Of the 42, 813 RTCs, no probable cause of RTCs was reported for 2,826 (6.6%). Speed violation 24.8%, was the commonest probable cause of RTCs, loss of vehicular control 23.5%, dangerous driving 11.1%, violation of sign light 10.0%, wrongful and dangerous overtaking 7.8%, tire burst 6.9%, brake and mechanical failure 6.2%, route violation 4.4%, road obstruction 1.6%, and overloading 0.8%. Others were, driving under the influence of alcohol 0.7%, and fatigue or sleeping on steering while driving 0.5, pedestrian crossing 0.4%, and using phone while driving 0.2%. Among 8,561 jointly reported probable causes of RTCs, speed violation and loss of vehicular control were the two most commonly reported, accounted for 2,068 (24%), followed by sign light violation and loss control 765 (8.9%), speed violation and dangerous driving 483 (5.6%), and 335 (3.9%) for speed violation and tire busted.

Trends Of Rtc And Sustainable Development Goal Target 3.6

The number of reported road traffic crashes reduced from 13,656 in 2011 to 9,580 in 2016, resulting in a 27.4% reduction, fatal crash reduced by 7.8% from 2,840 in 2011 to 2,618 in 2016, and the number of persons involved in RTCs and killed reduced by 22.4%, from 6,442 in 2011 to 5,002 in 2016. The targeted

proportion of RTC that were fatal for 2016 was 10.8%, but there was a progressive increase in the proportion of RTC that were fatal from 21.5% in 2011, peaked at 31.1% in 2015 and declined to 27.3% in 2016. The RTI fatality rate had 29.7% decrease instead of 50% target. It was 3.7 persons per 100,000 population in 2013 but declined to 2.6 persons per 100,000 population in 2016, as shown in Fig. 2.

Sub-nationally as shown in Fig. 3, ten out of the 36 States and FCT achieved the 50% target e.g., Bayelsa, Edo, Ekiti, Rivers, Imo, Kebbi, Adamawa, FCT, Delta and Benue. In descending order, these states have a retrogressive drive toward the SDG 3.6 target; Ebonyi (82.3%), Bauchi (62.0%), Gombe (27.2%), Yobe (19.7%), Taraba (15.2%), Ondo (14.5%), Borno (12.9%), Lagos (10.6%), and Abia (5.1%).

Discussion

Nigeria is one of the countries that report high rates of road traffic crashes and fatalities in the world [18]. RTC and injuries are one of the major public health concerns [2, 4, 19] as shown in this study with a monthly average of 892 RTCs reported in Nigeria. Three out ten RTCs were fatal and 8% of persons involved died. These high fatality rates could be a reason why Nigeria is leading other countries in RTC's fatality reported from WHO Afro region [5, 6]. This study revealed that male gender and adults are mostly affected with RTCs [19–21] and could cause severe economic effects on household productivity because male genders are the usual breadwinners for households in Nigeria [22]. The proportion of fatal crashes in this study was similar to 28.6% reported in a study that analyzed RTCs between 1990 and 2012 [6]. This reflected no change in the proportion of fatal crashes from 2013 to 2016 compared to pre-2013.

There is a wide variation among the 36 states and FCT in the six geopolitical zones with the occurrence of RTCs [6, 22, 23], proportion of persons killed in RTCs, fatal RTCs, and RTCs fatality rate per 100,000 population. The North Central geopolitical zone with 15% of Nigeria population accounted for every fourth out of ten RTCs in Nigeria, but only one-fifth were fatal RTC, North-West geo-political zones with 25% of Nigeria's population had one-tenth of persons involved in RTCs killed, and South-West geo-political zones with approximately 20% of Nigeria population had 16% of RTCs in Nigeria but reported the highest proportion of fatal RTCs. Also, the South-South geopolitical zone was second to South West as zones with the highest proportion of fatal RTCs. This clearly shows that RTCs has differential effects on each geo-political zone as well as the states.

Five states in the North-West geopolitical zone namely, Jigawa, Katsina, Kebbi, Sokoto, and the Kaduna States were among the ten leading states with high proportions of persons involved in RTCs killed. Yobe and Cross River states were leading the rank. Other states in these ranks were Oyo, Akwa Ibom and Niger. Although this study reported lower road traffic deaths per 100,000 population of 3.2 compared to 20.5 reported by WHO in 2018 [4]. But North Central and South-West geopolitical zones were mostly affected with each zone having four of its states among the ten leading states with high RTI deaths per 100,000 population. The states were FCT, Nasarawa, Kogi and Niger states in the North Central zone, and Ogun, Ondo, Osun, and the Oyo States in South-West geopolitical zone. Other states among this league were Kaduna and Edo. These high-risk states were similar to what had been reported in previous studies [6, 23].

The impact of RTCs on vulnerable road users was high in this study as 13% of those involved in crashes that occurred in a collision between motor vehicles and bicycles died. It also revealed that 9% of those involved in a collision between motor vehicles and motorcycles, and 7% of those involved in a collision between motorcycles died. The use of motorcycles in Nigeria has increased recently as it is easier to purchase, maintain, popularly used for transportation, and has been associated with vulnerability [21]. Common causes of RTCs in Nigeria were similar to previous studies[12, 21],. Speed violation and loss of vehicle control, as well as sign light violation and loss of vehicle control, were the most common joint causes of RTC. Other common probable causes of RTCs are dangerous driving, violation of sign lights, wrongful and dangerous overtaking, burst tires, brake and mechanical failure, route violation, road obstruction, and overloading. The use of fairly-used imported tires has been seen to cause RTCs in Nigeria [21].

There has been a declining trend in the number of RTCs in Nigeria [23, 24], but the number of persons per RTC increases. This might be attributable to vehicular overloading and a more improved road condition [6]. The number of people who are killed or seriously injured in RTCs is a key performance indicator to measure the safety of a nation's transport system [24]. To measure the progress to achieve SDG 3.6 target, the proportional reductions in the persons involved and killed in RTCs, and fatal RTCs in 2016 compare to 2011 was < 30% and 8%, respectively. This was far lower to the national target set from 2011 to be achieved in 2016. Therefore, the SDG 3.6 target was not met nationally in 2016, as this might be linked to the weakness in the enforcement of safety elements like seat belts and helmets, despite high awareness that did not translate to practice [21, 25],. Some of the 36 states and FCT were able to halve the road crash fatality rate (SDG 3.6) in 2011 by 2016. Bayelsa, Edo, Ekiti, Rivers, Imo, Kebbi, Adamawa, FCT, Delta and Benue met the SDG 3.6 target set in 2011 by 2016, but Ebonyi, Bauchi, Gombe, Yobe, Taraba, Ondo, Borno, Lagos, Abia, Sokoto and Katsina show a negative trend and failed to meet the target in 2016.

Limitations

This is a secondary data analysis collected by the FRSC; it is therefore not insulated from limitations. The data analyzed omitted variables for seatbelts and safety helmets use and data on response time, use of alcohol, the exact location of RTCs with geo-coordinates, post-crash management and 30 days post-crash outcome were deficient and not analyzed. The data may not account for all RTCs in Nigeria. No evidence showing that data analyzed was merged with other sources or RTI like police motor traffic division, insurance, and public and private health facilities. Though the data covered all the states and FCT in Nigeria but must be interpreted with cautions. However, it is reliable in providing programmatic decisions to inform effective interventions to reduce RTI in Nigeria.

Conclusions

RTC with associated injuries and deaths is still a public health concern in Nigeria affecting the young age group. Though there is a decline in some indicators between 2011 to 2016, Nigeria did not meet the SDG

3.6 target. There are differential distributions among the geo-political zones and states in Nigeria, concerning the number of RTCs, fatal RTCs, number of persons killed in RTCs, fatality rate, deaths per 100,000 population, and meeting the SDG 3.6 target. The peculiarity with each location will be useful in the planning and implementation of context-based interventions among the states and FCT rather than a one-size-fits-all approach.

Abbreviations

WHO - World Health Organizations; RTCs Road Traffic Crashes; RTI - Road Traffic Injury; FRSC - Federal Road Safety Corps; SDG–Sustainable Development Goal; FCT–Federal Capital Territory; CFR–Case Fatality Rate; LMIC–Low- and Middle–Income Countries; NACRIS–National Crash Report Information System.

Declarations

Ethical Considerations

Ethical approval was granted by Kaduna State Ministry of Health and Human Services Institution Review Board with reference number MOH/ADM/744/Vol.1/480. It is a secondary data analysis of road traffic crash (RTC) and injuries in Nigeria, with less contact and risk to human subject. The data extracted was anonymized, analyzed, adequately protected, and stored.

Consent for publication: Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declared that they have no competing interests.

Funding

This study was supported by Independent Contractor Services Agreement funded by the United States Centers for Disease Control and Prevention through Task Force for Global Health, TEPHINET non-communicable disease mini-grant 2017. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the United States Centers for Disease Control and Prevention or the Department of Health and Human Services.

Authors' contributions: Not applicable

Acknowledgements

The authors thank everyone that supported the implementation of this study. We also thank all the stakeholders of road traffic injury surveillance, FRSC National Headquarters, Abuja Nigeria. We used Mendeley reference manager and Epi info software in this manuscript.

References

1. 10.1093/epirev/mxq009
Chandran A, Hyder AA, Peek-Asa C. The Global Burden of Unintentional Injuries and an Agenda for Progress. *Epidemiol Rev* [Internet]. 2010;32(1):110–20. Available from: <http://epirev.oxfordjournals.org/cgi/doi/10.1093/epirev/mxq009>.
2. World Health Organization. Global Status Report on Road Safety 2018. [Internet]. Geneva; 2018. Available from: https://www.who.int/violence_injury_prevention/road_safety_status/2018/en/.
3. Razzak J, Shamim M, Mehmood A, Hussain S, Ali M, Jooma R. A successful model of road traffic injury surveillance in a developing country: process and lessons learnt. *BMC Public Health* [Internet]. 2012;12(1):357. Available from: <http://www.biomedcentral.com/1471-2458/12/357>.
4. World Health Organization Regional Office for Africa. Status of road safety in the African region. Congo Brazzaville; 2018.
5. World Health Organization. Global Status Report on Road Safety 2013: Supporting a decade of action. Geneva 27, Switzerland.; 2013.
6. Kolawole G. Spatial Trend and Management of Road Traffic Accident Fatalities in Nigeria. *Acad J Interdiscip Stud*. 2015;4(1):25–34.
7. World Health Organization. Road Safety in the African Region the Facts 2013 [Internet]. 2013. Available from: http://www.who.int/violence_injury_prevention/road_safety_status/2013/report/factsheet_afro.pdf.
8. Sumaila AF. Road crashes trends and safety management in Nigeria. *J Geogr Reg Plan*. 2013;6(3):53–62.
9. Oyeyemi B, Olayemi, Balogun S. Development in Road Safety in Nigeria [Internet]. Academia. Unpublished; 2009 [cited 2019 May 22]. Available from: https://www.academia.edu/3583843/Development_in_Road_Safety_in_Nigeria.
10. Godwin Akpan. History of Federal Road Safety Corps in Nigeria – (FRSC) [Internet]. Best School News. 2018 [cited 2019 May 22]. Available from: <https://bestschoolnews.com/history-federal-road-safety-corps-nigeria/>.
11. Ohakwe J, Iwueze ISCD. Analysis of Road Accidents in Nigeria. *Asian J Appl Sci*. 2011;4(2):166–75.
12. Gana AJ, Emmanuel JA. Road Transportation and Traffic Law Enforcement in Nigeria: A case study of the Federal Road Safety Corps (FRSC). *West African J Ind Acad Res Vol11*. 2014;11(1):134–51.
13. Federal Road Safety Corps N. The Pathfinder. *FRSC Transp Dig*. 2014;IV(January).
14. World Health Organization. Health - United Nations Sustainable Development Goals [Internet]. WHO. 2016. p. 1–92. Available from: <https://www.un.org/sustainabledevelopment/health/>.

15. World Health Organization. Data systems: A Road Safety Manual for Decision-Makers and Practitioners [Internet]. Geneva 27, Switzerland.; 2010. Available from: http://apps.who.int/iris/bitstream/10665/44256/1/9789241598965_eng.pdf.
16. United Nations/DESA. World Population Prospects 2017 – Data Booklet (ST/ESA/SER.A/401) [Internet]. United Nations, Department of Economics and Social Affairs, Population Division. 2017 [cited 2019 May 22]. Available from: https://population.un.org/wpp/Publications/Files/WPP2017_DataBooklet.pdf.
17. Federal Ministry of Works. Compendium report on road infrastructural and related development in Nigeria- An inventors manual [Internet]. Federal Ministry of Works, Nigeria. 2013. Available from: .
18. Ozoilo1 AAA and KN. The epidemiology and type of injuries seen at the accident and emergency unit of a Nigerian referral center. *J Emerg Trauma Shock*. 2014;7(2):77–82.
19. Onyemaechi NOC, Nwankwo OEER. Epidemiology of Injuries Seen in a Nigerian Tertiary Hospital. *Niger J Clin Pract*. 2018;21(6).
20. Ajike SO, Adebayo ET, Amanyiewe EU, Ononiwu CN. Original Article An epidemiologic survey of maxillofacial fractures and concomitant injuries in Kaduna, Nigeria. *Niger J Surg Res*. 2005;7(3–4):251–5.
21. Adekanye AO, Solagberu BA. nigerian city: identifiable issues for road traffic injury control. 2014;8688:1–5.
22. Adekunle J. Aderamo. Road Traffic Accident Injuries and Productivity in Nigeria Adekunle. *Asian Econ Soc Soc*. 2012;2(7):334–44.
23. Ukoji VN. Trends and patterns of fatal road accidents in Nigeria (2006–2014). IFRA- Niger Work Pap Ser [Internet]. 2014;(35). Available from: <http://www.ifra-nigeria.org/IMG/pdf/fatal-road-accidents-nigeria.pdf>.
24. Aderamo AJ. Assessing the Trends in Road Traffic Accident Casualties on Nigerian Roads. 2012;31(3):19–25.
25. Idris SH, Sambo MN, Gambo H, Hassan A. Factors affecting self-reported use of seat belt among commercial vehicle drivers in Gusau metropolis Zamfara State North-western Nigeria. *Int J Inj Contr Saf Promot*. 2013;20(4):380–4.

Figures

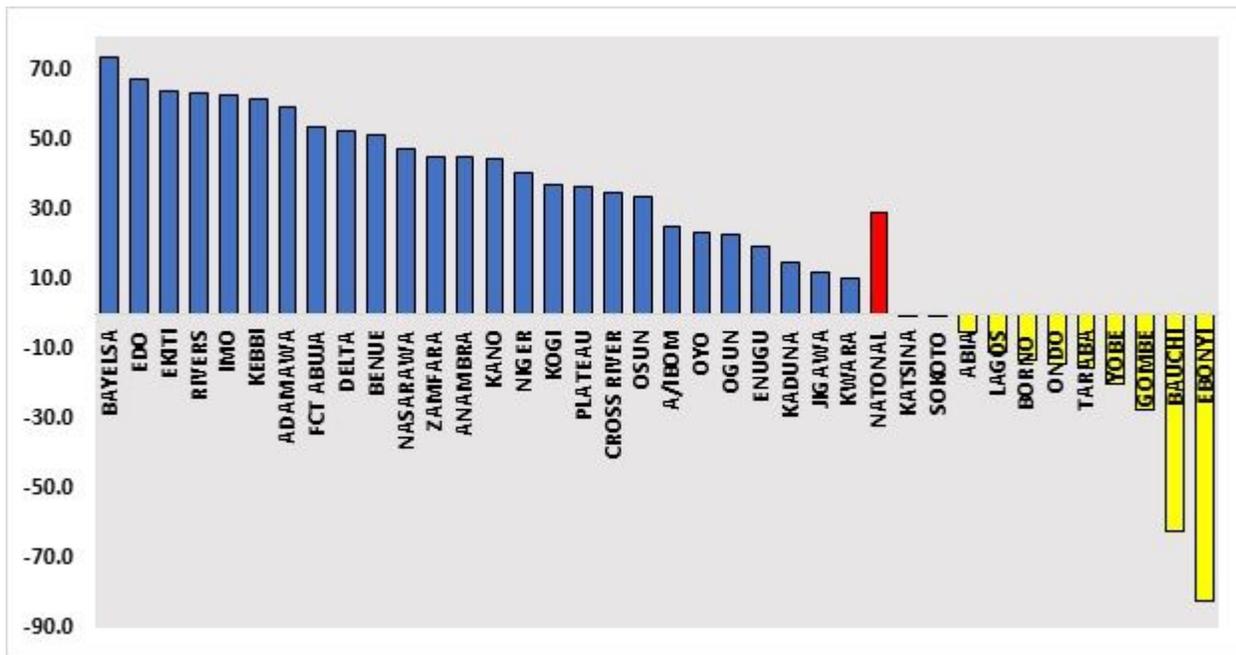


Figure 1

Reduction in RTC fatality rate in Nigeria states and FCT to meet SDG 3.6 goal, 2013 to 2016.

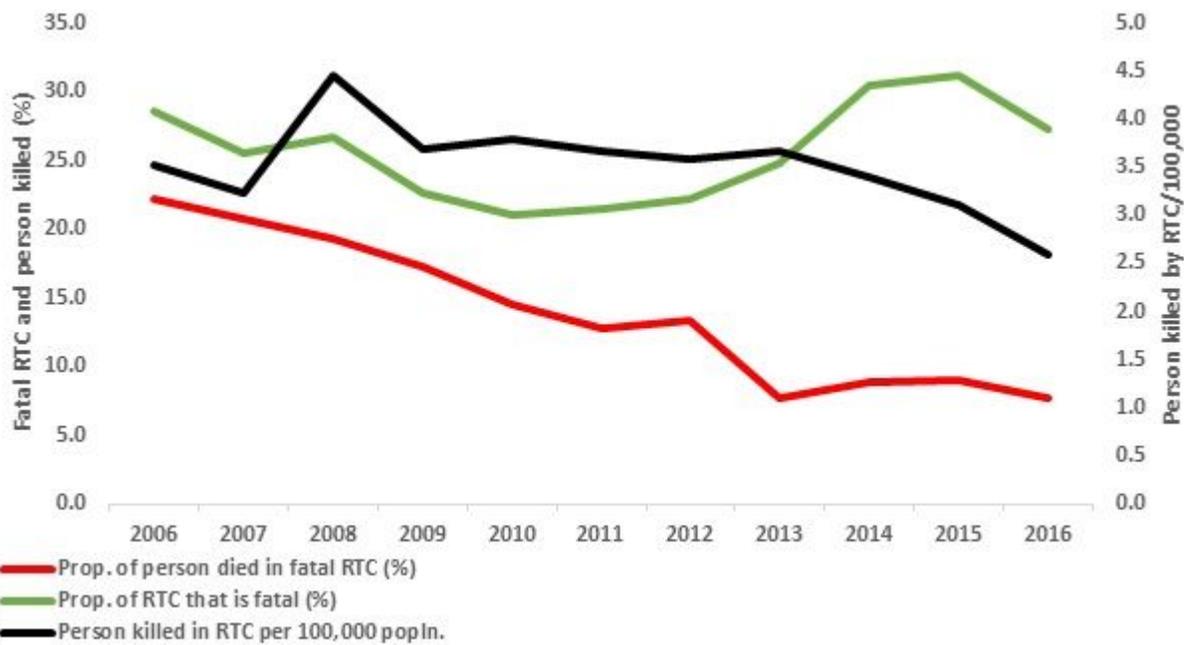


Figure 2

Trend of the proportion of fatal RTC, person killed and fatality rate (person killed in RTC per 100,000 population)

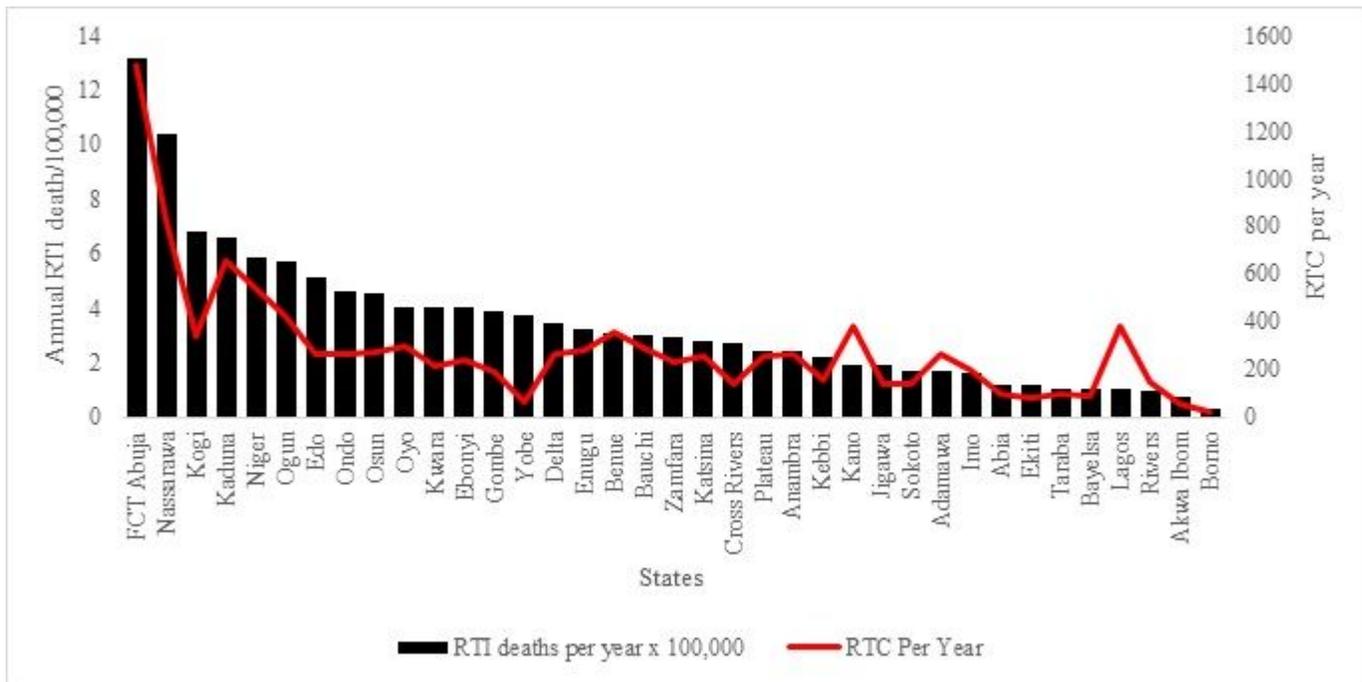


Figure 3

Annual RTI fatality rate and RTCs reported by Nigeria states and Federal Capital Territory, 2013 to 2016.