The Role of Seat Belt in the Prevention of Fatalities and Determination of Fatality Index of Road Traffic Accidents in Rivers State, Nigeria

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ABSTRACT

BACKGROUND

Road traffic crashes still remain a prominent cause of death worldwide but proper use of safety belts can prevent death in some of these accidents. The aim of this study was therefore to examine the role of seat beltuse/violation in Rivers State, Nigeria and to determine its relationship with fatality of road traffic accidents.

METHOD

The study was a retrospective study conducted in conjunction with the FRSC on the incidence of RTA in the Rivers State located in the South Southern region of Nigeria. Relevant information was requested from the research and statistics department of the corporation. These comprised the number of vehicular accidents before and after the enforcement of seat belt law, seat belt violations and the number of injured persons and deaths.

RESULT

From1970 to 1985, there were a total of 4211 accidents, out of which fatal accidents constituted only 15%, deaths recorded were 439 and total casualties were 4075 per 100,000 of the population and between 2005 and 2012,total number of accidents was 452 out of which fatal accidents constituted 25%. There were a total of 367 deaths and 2193 injured per 100,000 of the population.

CONCLUSION

The relationships of seat belt use/violation and outcomes of RTA in Rivers State were not statistically significant in this study. With the increased motorization and populationin the country and state,some benefit was observed in this present study in Nigeria, with the serious enforcement of seatbelt laws.

Keywords: *Seat belt; Road crashes; fatality index; Port Harcourt.*

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INTRODUCTION

Road traffic accidents (RTA) remain the leading cause of mortalities and morbidities due to trauma in Nigeria [1].Amongst the mechanisms which result in injuries sustained from road traffic accidents, vehicle speed is a very significant determinant of fatality from vehicular crashes[2]. On the other hand, preventive measures and mechanisms such as use of properly fitted seat belts are extremely essential and mandatory to minimize the effects of road traffic accidents [3].There were 307,529 road traffic accidents in Nigeria, between 1976 and 1981resulting in 50,973 deaths[4]. The incidence of accidents between 1995 and 2000reduced to 84,002 out of which 37,544 deaths were recorded [5]. The total of road traffic accidents between 2002 and 2007further reduced to 69,739 with 34,447 deaths [6]. Reports have been provided on statistics of road traffic accidents in Lagos State, South Western, Nigeria, from 1970 up till year 2001[7-11], such reports on Rivers State with a population as close to that of

Lagos State is yet to be updated.

The Federal road safety corporation in Nigeria (FRSC) was established in 1988 to monitor and control the activities of motorists in order to ensure compliance to traffic rules and regulations [12]. The National road traffic regulation came into effect in 2004 and prominent amongst these regulations was the use of seat belt, but enforcement did not begin until 2005.There has been no published report available on the assessment of the regulatory activities of the FRSC on the control of RTA since 2008. In addition, some of the mortalities from road traffic crashes do not pass through the Accident and Emergency and Morbid Anatomy departments of our hospitals in Nigeria and a good number of the injured do not come to the tertiary health care, it therefore becomes difficult to compute an actual overall statistics of injuries and deaths sustained due to RTA from hospital records alone. Several measures have been put in place by both the Police force and Road safety team to prevent accidents and reduce casualties but there is need for thorough and continuous evaluation. Therefore the purpose of the study was to evaluate the role of seat belt in the reduction of fatalities from vehicular crashes in Rivers State, South-South, Nigeria, to determine the fatality index and to design a comprehensive and modifiable format for data acquisition, monitoring and evaluation of road traffic accidents.

METHOD

The study was a retrospective study conducted in conjunction with the FRSC on the comparison of outcomes of RTA between the pre-enforcement (1970-1985) and post-enforcement (2005-2012) periods in the Rivers State, Nigeria. Certain relevant information was requested from the research and statistics department of the corporation. Information on such data that existed before the establishment/pre-enforcement period of FRCS was requested from documented police reports. These include the number of vehicular accidents and the crashes which were classified into minor, serious and fatal. Information on the number of injured persons and deaths were also obtained. In addition data on gender, age groups and regions of the body affected were also requested while available records of seat belt violation were also obtained. Data was analyzed using SPSS package version 16 (SPSS Inc, Illinois, Chicago). Values were expressed as simple frequencies and proportions per 100,000 of the population. The values of the total number of death divided by the total number of injured × 100 referred to as "fatality index" of road traffic accident was determined for each year. Mean and standard deviation values were determined.

Normal distribution of each sample variable was tested by Kolmogorov Smirnov test and Z values were documented. The means of the values for variables were compared by the nonparametric Wilcoxon Signed rank test for related paired samples and significance value was obtained for each RTA outcome (Total no. of accident, injured, death, total casualty and fatality index). P values of ≤ 0.05 were considered significant. Regression analysis was used to determine the association between severity of RTA (number of injured and deaths)and seat belt use. Spearman's rho correlation test and regression analysis were also done for all outcomes of RTA (Total no. of accident, injured, death, total casualty and fatality index) and seat belt violation.

RESULT

Table 1: Demographics of road accidents in Rivers State, Nigeria from 1970 to 1985

Year	Minor	Serious	Fatal	Total	Injured	Death	Total	Fatality index
1970	52	48	45	145	131	11	142	8
1971	39	80	35	154	153	12	165	8
1972	123	22	58	203	170	15	185	9
1973	120	28	68	216	191	18	209	9
1974	116	81	54	251	196	19	215	10
1975	162	92	30	284	211	21	232	10
1976	219	97	40	356	296	26	322	9
1977	164	109	34	308	114	30	144	3
1978	175	101	38	314	303	35	338	12
1979	44	172	39	255	223	30	253	13
1980	99	143	38	280	267	33	300	12
1981	88	158	48	294	277	39	316	14
1982	126	169	28	323	300	43	343	14
1983	118	145	32	295	282	38	340	13
1984	109	132	25	266	251	34	285	14
1985	134	112	21	267	250	35	286	14
Total	1888	1689	633	4211	3615	439	4075	

In the pre-enforcement period from1970 to 1985(table 1), there were a total of 4211 accidents, out of which fatal accidents constituted only 15%, deaths recorded were 439 and total casualties were 4075 per 100,000 of the population.

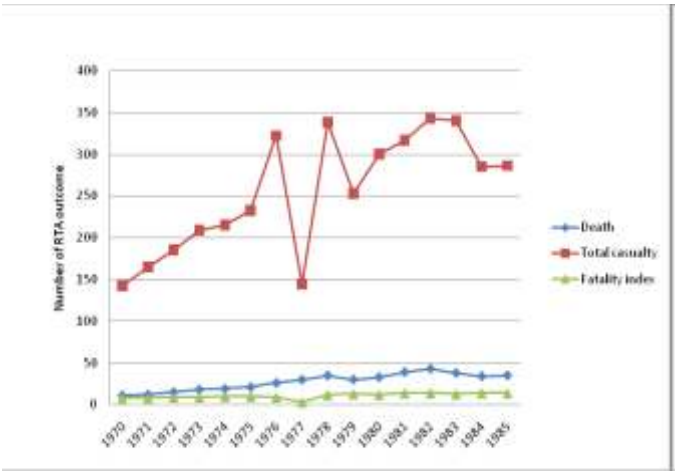

Fig. 1: Time series chart of total casualties, death and fatality index by year for Pre-enforcement period (1970-1985)

The peak years of accidents over the period were 1976 and 1982, and the years of peak fatality index were 1981, 1982, 1984 and 1985 with index of 14 and the year with lowest fatality index was 1977 with index of 3. The highest number of death was recorded in 1982 and the lowest in 1970. The highest number of injured was in 1982 and the lowest in 1977 (figure 1).

Table 2: Demographics of road accidents in rivers state, Nigeria from 2005 to 2012

Year	Minor	Serious	Fatal	Total	Injured	Death	Total	Fatality index
2005	30	30	28	88	100	38	138	38
2006	17	35	11	63	123	30	153	24
2007	109	22	58	189	218	54	272	25
2008	133	28	68	229	325	64	389	20
2009	51	81	23	155	523	34	557	7
2010	37	15	10	62	176	47	223	27
2011	18	37	40	95	198	47	245	19
2012	57	109	34	200	530	53	583	10
Total	452	357	272	1081	2193	367	2560	

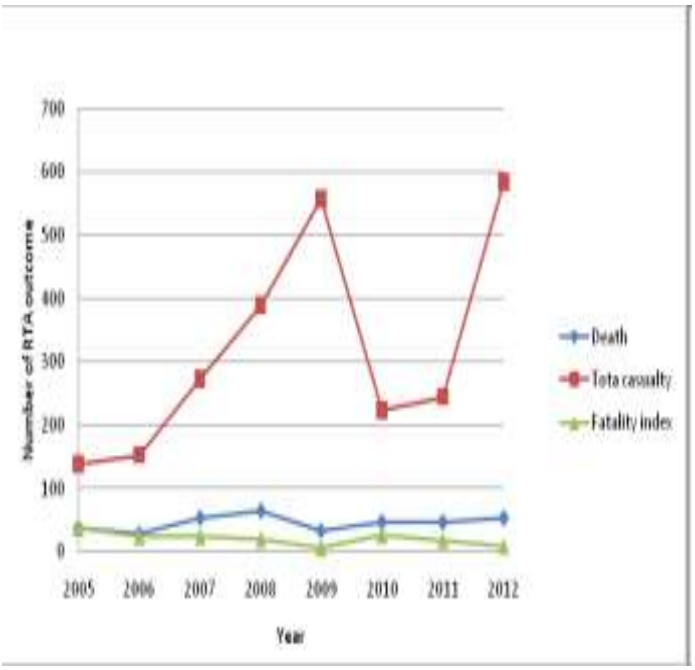

Fig. 2: Time series chart of total casualty, death and fatality index by year for Post-enforcement period (2005-2012)

After the enforcement of seat belt law (2005 and 2012), total number of accidents were 452 out of which fatal accidents constituted 25%. There were a total of 367 deaths and 2193 injured per 100,000 of the population. The highest number of injured was in 2012 and the lowest in 2005 (table 2). The peak years of total accidents over the period were 2009 and 2012 while the least incidences were recorded in 2005 and 2006.The year of peak fatality index was 2005 and the least was 2009. The highest number of death was recorded in 2008 and the lowest in 2006 (figure 2).

Table 3: Mean, Standard deviation values of RTA outcomes for Pre and Post-enforcement periods

	Pre -enforcement(1970 - 1985)			Post -enforcement(2005 - 2012)			Significance value
Outcome	Mean	SD	Z	Mean	SD	Z	0.05
Total No. of accident	263.1	58.6	0.67	135.1	66.2	0.64	0.12
Injured	225.9	61.8	0.61	274.1	169.8	0.72	0.32
Death	27.4	10.2	0.65	45.9	11.4	0.47	0.01
Total casualty	254.7	71.3	0.66	320.0	172.6	0.66	0.26
Fatality index	10.8	3.1	0.63	21.3	9.8	0.45	0.02

SD- Standard deviation, Z- kolmogorov-Smirnov value

Mean values of the total no. of accidents for the 2 periods were 263.1 and 135.1 with corresponding SD and Z values as shown in table 3. Mean values were 225.9 and 169.8 for injured and 254.7 and 320.0 for total casualty. When the mean values of the three outcomes were compared, the p values obtained were 0.12, 0.32 and 0.26 respectively(table 3).

Numbers of injured and number of death are direct parameters which determine severity of RTA. When the association of seat belt use and the severity of RTA in the 2 periods was analyzed, values of linear regression analysis for injured caseswere; ANOVA, 0.316 and R coefficient, 0.214, for cases of death; ANOVA, 0.001 and R coefficient, 0.651. Multinomial logistic regression for combined (injured and death) variables in the 2 periods; gave Chi-square value of 17.43, significance level was 0.739, Confidence interval, CI (2.28, 4.37).

TABLE 4: Relationship of Seatbelt Violation (SBV) and RTA outcomes from 2009 to 2012

YEAR	Total seat belt violation	Total accident	Injured	Death	Total casualty	Fatality index
2009	3024	155	523	34	557	7
2010	4470	62	176	47	223	27
2011	7151	95	198	47	245	19
2012	4620	200	530	53	583	10
Spearman's correlation coefficient		0.000	0.000	0.632	0.000	0.400
Significance level(rho)		0.500	0.500	0.184	0.500	0.300
ANOVA Significance level , 0.05		0.025	0.036	0.001	0.026	0.040

The 2009 and 2012 had the lowest fatality indices of 7 and 10 with the lowest seat belt violations of 3,024 and 4,620 respectively. In 2011, seat belt violation was 7,151 but the injured was 198 and death was 47 with a fatality index of 19. Spearman' (rho) one-tailed correlation coefficients are reflected in table 4 with the significance level, death and fatality index recorded 0.184 and 0.300 respectively.

Univariate analysis of variance was 0.025 for total accidents, 0.036 for injured, 0.001 for death, 0.026 for total casualty and 0.040 for fatality index. Death recorded the lowest significance level (table 4). Multinomial regression analysis for total casualty as dependent variable and other co-variables (injured, death, fatality index) with seat belt violation as the independent factor gave Chi square value of 11.09 with significance level of 0.270.

DISCUSSION

A major limitation of this study was the unavailability of information and data on the gender and age distribution of casualties of RTA, road users involved and parts of the body affected as well as the mode of RTA for the two periods in Rivers State. In addition, there was no data for 1986 to 2004 and seatbelt violations from 2005 to 2008.Differences in the number of years between the two periods under study were taken care of with appropriate statistical methods of analysis. The Wilcoxon Signed-rank non parametric test is useful to compare means of two related sample data that are dichotomous with population that is assumed not to be normally distributed.

Findings from this present study showed that the percentages of fatal accidents were generally less than that of minor and serious accidents in both periods. This is similar to reports on RTA in Lagos and Imo states which documented similar findings[1-6]. The higher percentage in the post-enforcement period was possibly due to the influx of second hand or fairly used vehicles regarded as 'tokunbo' vehicles into the country in the last two decades, and the quest by most commercial drivers to make more profit without maintaining the vehicles[1-6].

Globally, about 40,000 people die each year in car accidents, which is the leading cause of death for victims under the age of 35[1-3]. Safety belts can prevent death in about half of these accidents. In our study we recorded total death figures of439 and 367 per 100,000 of the

population respectively in the two periods under study. This was much higher than the figures from the 2004 WHO report on road traffic injury prevention in which a total of 0.95 deaths per 100 million passengers-kilometers and 28 deaths per 100 million passengers-travel hours were documented[4]. The years with the maximum and minimum values of fatality index and death did not correspond in both periods, this was due to the varying values of injured for those years and this shows that fatality does not only represent the number of deaths recorded, but both direct and indirect parameters must be considered. There are no other reports available to compare all outcomes in different periods.

There were more cases of accidents in the pre-enforcement period, but there was no significant difference in the mean values of total accidents despite the difference in the number of years in the 2 periods. Higher figures were obtained for other outcomes (injured, death, total casualty and fatality index) in the post-enforcement period. The higher figures for the four outcomes may not reflect only seat belt violations but it may be coupled with some other human, vehicle and road related factors[5-8], similarly, lower mean figures for the outcomes in the pre-enforcement period may be attributed to lower population at that period[9-13]. There were significant differences for death and fatality index outcomes between the 2 periods with p values of 0.01 and 0.02 respectively but it was not significant for injured and total casualty with p values of 0.32 and 0.26, and use of seat belt might have contributed to variations in the significance values of these four outcomes. Active interventions like use of seat belts are estimated to reduce motor vehicle fatalities by 50% and serious injury by 55%[13].In a recent study[14], more interventions and strategies to reduce injuries to motor vehicle occupants were reviewed and these mainly focused on interventions to prevent human errors.

When the relationship of seat belt use in the reduction of deaths and severely injured was evaluated, regression analysis showed no significant association between this factor and, the number of injured and deaths both individually and combined. This might be due to differences in population in different periods and the influence of other documented factors[15-35].

There was no significant statistical evidence of relationship between seatbelt violations with the fatality indices although the values of seat belt violations were lower for the years 2009 and 2012 with fatality indices of 7 and 10 reflecting low death number in relation to high number for injured. The spike in the seat belt violations in 2011 in this study was not only difficult to explain but did not associate directly with the lower total casualty figures for that year which was probably due to compliance to other factors such as control of speed and less drunk driving amongst others[36-38].Also, there was no significant relationship between number of seat belt violations and other four outcomes (no. of total accidents, injured, death, total casualties) in this study between 2009 and 2012.

Recent reviews of the relative efficacy of primary versus secondary enforcement suggested that primary enforcement of the seat belt law is more effective than secondary laws[11-14]. Enforcement of seat belt laws clearly affects compliance. In Greece, a comprehensive intervention campaign on seat belt use, even without increased law enforcement, resulted in some benefit[20]. A study in Singapore, reported that seat belt regulation did not seem to impact much on traffic fatalities[21] and a similar finding was observed in this present study in Nigeria, despite some serious enforcement.

It is still admissible that the occurrence and fatality of vehicular accidents is multifactorial with driver impatience as one of the key factors [38. Therefore all necessary orientation, legislation and checks must be implemented to prevent or minimize this menace.

Adequate documentation of accidents and its

effects is needed in Nigeria for the purpose of monitoring and evaluation especially after multiple interventions and strategies. These should include traffic calming [11], (defined as physical measures that reduce negative effects of vehicle usage, changes in driver behavior and improving the conditions of our roads for all users). The road construction policy and specific road profiling/policing should also be encouraged.

A wholistic and comprehensive approach is necessary to achieve an accident free nation, on the human aspect, defensive(anticipatory, pre-emptive, indicative) driving need be emphasized [33], and all drivers and cyclists must be properly trained, orientated and retrained to imbibe the rules and regulations guiding safety driving [34].

In conclusion, the relationships of seat belt use/ violation and outcomes of RTA in Rivers State were not statistically significant in this study. There was increased population and motorization in the country and state but the difference in the total number of road traffic accidents between the two periods was not statistically significant. Also, with reduced death figures in relation to the injured in 2009 and 2012 when seat belt violations were lower, some benefit was observed with some serious enforcement of seatbelt laws in this present study. This was attributable to the comprehensive and intensive preventive approach of the federal road safety cooperation of Nigeria.

I further recommend in addition to the various legislative measures in place, the design and use of a simple format for complete data acquisition and effective monitoring of RTA in Nigeria if not already in use.

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APPENDIX

Format for Data Acquisition, Monitoring and Evaluation of Road Accidents

Date of accident
Time of accident
Site of accident
No. of vehicles/cycles involved
Type of vehicles
Year of make of vehicles
Vehicle Registration numbers
Road users affected: Drivers, passengers, occupants, pedestrians, cyclists,
Location/seat of injured/dead in the vehicle
No. of casualties
Gender: Male / Female
Age Group: Children / Adult
No. of injured: Gender: Male Female Age group: Children Adult
No of Death: Gender: Male Female Age group: Children Adult
Cause of the accident:
Human- Drunk driven, inadequate driving skills, fatigue, failure to comply to traffic rules, speed, impatience, Health condition of the driver e.g., status of the eyes, ears, legs, heart, driving license, evidence of adequate training
Vehicle / cycle- Absence of indicator lights, brake failure, absence of wipers, non functional wind screens, absent side and center mirrors,
Environment- Bad roads, zebra crossings, cameras, presence/absence of traffic wardens, absent or non functional street lights
Combination
Use of protective devices: helmet, safety belts, air bags, children safety chairs, children door locks
Suspected parts of body Injured: Head, neck, chest, upper limb, abdomen, lower limb
Miscellaneous/Other relevant information