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Investigating the Availability of Modern Automotive Safety Equipment in Private and Commercial Vehicles in Adamawa State, Nigeria

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Abstract

Vehicle safety is an important control measure to improve safety on the roads. Past researches on road safety have shown that vehicle construction must conform to the requirements of both active and passive safety to prevent accidents. This study investigated the availability of modern automotive safety equipment in private and commercial vehicles in Adamawa State, Nigeria. A survey research design was used and the population of the study comprised of 316 private and commercial motorists. The sample was made up of 114 private motorists and 63 commercial motorists obtained through stratified random sampling technique. A structured questionnaire was used as instrument for data collection. Cronbach Alpha was also used to determine the reliability coefficient of the instrument. The calculated reliability coefficient was 0.87. Mean and standard deviation were used to answer the research questions, while the null hypotheses were analyzed using z-test at 0.05. The findings of the study revealed that percentage of motorists with active and passive safety equipment were found to be thirty-three and thirty-five percent respectively. This suggests that majority of the private and commercial vehicles in Adamawa State lack sufficient active and passive safety equipment. It was therefore recommended that the Nigerian Road safety agencies should enforce use of automotive safety equipment.

1. Introduction

Globally, road traffic injuries are among the leading causes of death and all manners of life-long disabilities. WHO [1] revealed that about 1.24 million people die annually on the roads, with 20–50 million sustaining non-fatal injuries. Highway safety is a worldwide problem with over 500 million cars and trucks in use, more than 500,000 people die each year in motor vehicle crashes where about 15 million are injured [2]. Road vehicles provide much better protection for their drivers and passengers than was the case a decade or even several years ago. This became possible because of the need to raise the level of road safety is higher. In Nigeria, there are three divisions of government agencies that are responsible for vehicles, approving, licensing and regulating them [3]. Many features have become more widely available as a result of research showing a range of positive benefits related to increase in driver safety. For instance, Electronic Stability Control (ESC) has proven to be so beneficial since its introduction in 1995 [4]. As safety features become standard or optional on a wider range of vehicles, more data will become available on just how effective these technologies are at mitigating and preventing crashes. Nevertheless, estimates about the potential

reduction in the number of crashes that are relevant to modern safety features are already very promising. Hamid [5] divided automotive safety systems into passive and active safety systems. *Passive safety systems* are vehicle components that respond to a crash or blast events to protect occupants from injury, whereas, *Active safety systems* are features that constantly act to reduce such events. The terms active and passive are simple but important in the world of automobile safety. Active safety is used to refer to technology assisting in the prevention of a crash, while "passive safety" is referred to the component of the vehicle (primarily airbags, seat belts and the physical structures of the vehicle) that helps to protect occupants during a crash [6]. Vehicle construction must conform to the requirements of both active and passive safety in order to prevent accidents and also to save the occupants and other road users coming in contact with the vehicle in the event of an accident [7]. Most of the safety gains made in the last several years have been due to the many safety improvements that have come about particularly in occupant protection countermeasures due to design improvements in highways and vehicle restraints and energy absorbing structures, increased seat belt use, improved emergency medical services, airbags for frontal and side crash protection, upper interior impact protection and many other such features, the focus being mostly on passive safety [8,9]. Thus far, the various studies and survey had clearly pointed out that the major factor causing vehicle crashes is mainly the human factor which account to about 93%, with driver about 57% and vehicle factor only about 2% [10,11]. Considering the aforementioned, there is a need to investigate the availability of modern automotive safety equipment in private and commercial vehicles in Nigeria.

2. Methodology

Private and commercial motorists were considered for this study and survey research design was also used. The population of the study comprised of 316 private and commercial motorists in Girei, Yola North and Yola South Local Government Area of Adamawa State. The sample of the study consisted of 114 private motorists and 63 commercial motorists which were obtained through stratified random sampling technique. The instruments used for data collection was a structured Questionnaire. The instrument was validated by two lecturers in the department of automotive engineering and experts in the field of road safety technology from Modibbo Adama University of Technology, Yola and one Road safety officer from Jimeta command. The instrument was trial tested among private and commercial motorists in Gombe State. The questionnaires were distributed to both motorists that can read and those that cannot read. Interpreters were engaged to assist those motorists that cannot read the questionnaire. Cronbach Alpha was used to determine the reliability coefficient of the instrument. The reliability coefficient was calculated to be 0.87. The acceptable values for reliability coefficients range from 0 to 1.0. A coefficient of 0 means no reliability and 1.0 means perfect reliability. Since all tests have some error, reliability coefficients never reach 1.0. Mean and standard deviation were used to answer the research questions, while the null hypotheses were analyzed using z-test. Decision rule was based on whether the computed value of the statistics (z-test) exceeds the significant level at 0.05 which is the cut-off point. The researcher took decision using two hypotheses, H_O and H_A that denote null hypothesis and alternate hypothesis respectively thus: Reject H_O in favour of H_A if the computed value of the statistics is less than the cut-off point. Otherwise, uphold H_O. The following research questions are used for this study:

1. What is the availability of active safety systems in private and commercial vehicles in Adamawa State?
2. What is the availability of passive safety systems in private and commercial vehicles in Adamawa State?
3. How willing are private and commercial motorists to pay for new automobile safety equipment to be installed in their vehicles?

3. Results and Discussion

The method used to evaluate the availability of the safety systems in private and commercial vehicles in Adamawa State is similar to that used by [6]. A safety system's availability can be determined by examining the proportion of the total automobile fleet which currently offers the particular safety system. If a safety system is not offered at all, it is unavailable. If it is offered only in few vehicles, it has limited availability. If, however, a safety system is offered by the majority of the total automobile fleet, it is readily available. Table 1 provides the answer to the research question one above. It indicates that out of 21 safety equipment under investigation, only 5 items, (that is, 28.81%) are available in majority of private and commercial vehicles in Adamawa State. This suggests that majority of the private and commercial vehicles in Adamawa State lack sufficient active and passive safety equipment.

Table 1: Percentage of the Availability of Active Safety Equipment in Private and Commercial Vehicles in Adamawa State

/N	*Items*	***Private Vehicles Np=114***			***Commercial Vehicles Nc=63***		
		Percentages (%)					
		A	***NA***	***NS***	***A***	***NA***	***NS***
1	*My car has: Anti-lock Braking System (ABS)*	***50.0***	*29.8*	*20.2*	*39.7*	*34.9*	*25.4*
2	*My car has: Traction Control (TC)*	*28.1*	*36.8*	*35.1*	*22.2*	*41.3*	*36.5*
3	*My car has: Adaptive Cruise Control (ACC)*	*29.8*	*50.9*	*19.3*	*25.4*	*36.5*	*38.1*
4	*My car has: Electronic Stability Control (ESC)*	*23.7*	*34.2*	*42.1*	*25.4*	*44.4*	*30.2*
5	*My car has: Electronic Brake-force Distribution*	*28.1*	*42.1*	*29.8*	*34.9*	*41.3*	*23.8*
6	*My car has: Adaptive Headlights (AH)*	*45.6*	*30.7*	*23.7*	*36.5*	*38.1*	*25.4*
7	*My car has: Collision Warning Systems (CWS)*	*14.9*	*53.5*	*31.6*	*20.6*	*52.4*	*27.0*
8	*My car has: Lane Departure Warning Systems*	*14.9*	*52.6*	*31.6*	*20.6*	*46.0*	*33.3*
9	*My car has: Daytime Running Light (DRL)*	*40.4*	*43.0*	*16.7*	*33.3*	*44.4*	*22.2*
10	*My car has: Blind-spot detection Systems (BDS)*	*18.4*	*50.9*	*30.7*	*22.2*	*46.0*	*31.7*
11	*My car has: Emergency Brake Assist (EBA)*	*30.7*	*39.5*	*29.8*	*22.2*	*49.2*	*28.6*
12	*My car has: Speedometer (SM)*	***67.5***	*20.2*	*12.3*	***55.6***	*25.4*	*19.0*
13	*My car has: Rear View Camera (RVC)*	*25.4*	*69.5*	*14.0*	*20.6*	*54.0*	*25.4*
14	*My car has: Speed Limiter (SL)*	*39.5*	*49.1*	*11.4*	*27.0*	*42.9*	*30.2*
15	*My car has: Fire extinguisher (FE)*	***60.5***	*29.8*	*9.6*	***52.4***	*31.7*	*15.9*
16	*My car has: Tyre Pressure Monitoring Systems*	*27.2*	*41.2*	*31.6*	*30.2*	*42.9*	*27.0*
	TM%	***33.3***	***30.0***	***30.05***	***33.3***	***30.15***	***25.4***

Key: % = percentages of available safety equipment, A= available, NA=not available, NS=not sure, Np=Number of private motorists, Nc=Number of commercial motorists. TM%= total mean percentage

Table 2 presents the percentage of the availability of passive safety equipment in private and commercial vehicles in Adamawa State. 67.5% of the private motorists said airbag is available in their vehicles, 21.9% said is not available while 10.5% said they are not sure. 79.8% of the private motorists said seatbelt is available in their vehicles, 12.3% said is not available while 7.9% said they are not sure. 59.6% of the private motorists said head restrain is available in their vehicles, 26.3% said is not available while 14.0% said they are not sure. 41.2% of the private motorists said Crumple Zone is available in their vehicles, 32.5% said is not available while 26.3% said they are not sure. 33.3% of the private motorists said laminated windshield is available in their vehicles, 29.8% said is not available while 26.3% said they are not sure. 47.6% of the commercial motorists said airbag is available in their vehicles, 27.0% said is not available while 25.4% said they are not sure. 52.4% of the commercial motorists said seatbelt is available in their vehicles, 28.6% said is not available while 19.0% said they are not sure. 49.2% of the commercial motorists said head restrain is available in their vehicles, 33.3% said is not available while 17.5% said they are not sure. 47.6% of the commercial motorists said Crumple Zone is available in their vehicles, 33.3% said is not available

while 19.0% said they are not sure. 47.6% of the commercial motorists said laminated windshield is available in their vehicles, 28.6% said is not available while 23.8% said they are not sure.

Table 2: Percentage of the availability of Passive Safety Equipment in Private and Commercial Vehicles in Adamawa State

S/N	***Items***	***Private Vehicles Np=114***			***Commercial Vehicles Nc=63***		
		Percentages (%)					
		A	***NA***	***NS***	***A***	***NA***	***NS***
17	*My car has: Airbag*	***67.5***	*21.9*	*10.5*	*47.6*	*27.0*	*25.4*
18	*My car has: Seatbelt*	***79.8***	*12.3*	*7.9*	***52.4***	*28.6*	*19.0*
19	*My car has: Head Restrain*	***59.6***	*26.3*	*14.0*	*49.2*	*33.3*	*17.5*
20	*My car has: Crumple Zone*	*41.2*	*32.5*	*26.3*	*47.6*	*33.3*	*19.0*
21	*My car has: Laminated Windshield*	*33.3*	*29.8*	*26.3*	*47.6*	*28.6*	*23.8*
	TM%	***33.37***	***26.48***	***32.1***	***25.96***	***30.48***	***33.02***

Key: % = percentages of available safety equipment, A= available, NA=not available, NS=not sure, Np=Number of private motorists, Nc=Number of commercial motorists. TM%= total mean percentage

Table 3 shows that both private and commercial motorists agree with all the items listed above with $\overline{xg}$ between 3.77 and 4.31. The private motorists agreed with all the suggested items with mean scores between 3.99 and 4.57. Item 1 has the highest mean score of 4.57 which suggest that the private are willing to install new safety features in their cars. The commercial motorists also agreed with all the suggested items with mean scores between 3.54 and 4.04 respectively. Items 1 and 2 have the highest mean score of 4.04. This also suggests that they are willing to install new safety features in their cars, research more on new safety features available in the market.

Table 3: Mean and Standard Deviation on the willingness of private and commercial Motorists to pay for new Automobile Safety Equipment to be installed in their vehicles?

	Np=114, Nc=63	***Mean of responses***				***REMARK***
S/N	***Items***	$\overline{x_p}$	$\overline{xc}$	$\overline{xg}$	***SD***	
22	*I am willing to install new safety features in my car*	*4.57*	*4.05*	*4.31*	*0.37*	*Agreed*
23	*I am willing to research more on new safety features available in the market*	*4.48*	*4.05*	*4.27*	*0.31*	*Agreed*
24	*I don't mind if Speed limiting device is made compulsory by law*	*3.99*	*3.54*	*3.77*	*0.32*	*Agreed*
25	*Safety features that help maintain safe distances between vehicles, and features that enhance braking or steering such as ACC, Collision Mitigation Braking, Collision Warning System and Rollover Mitigation and Prevention to be offered as standard equipment in Nigerian vehicles.*	*4.06*	*4.00*	*4.03*	*0.04*	*Agreed*
26	*Vehicles dealers should make safety a priority while importing cars*	*3.99*	*3.75*	*3.87*	*0.17*	*Agreed*
TGM		***4.22***	***3.87***	***4.05***		***Agreed***

Key: $\bar{x}$p= mean ratings for private motorists, $\bar{x}$c = mean ratings for commercial motorists SD= standard deviation, Np= number of private motorists, Nc= number of commercial motorists, $\bar{x}g$= Grand mean of items, TGM= total grand mean.

4.0. Conclusion

It can be concluded based on findings that very few private and commercial vehicles have adequate safety systems in their vehicles in Adamawa State, Nigeria. Percentage of motorists with passive safety equipment was found to be thirty-five percent. It was also found that the percentage of motorists with active safety equipment to be thirty-three percent. The ratio of commercial vehicles with active safety equipment to private vehicles was found to be 1:1 and ratio of commercial vehicles with passive safety equipment to private vehicles was also found to be 0.78:1.

Recommendation

Based on the findings of this study the following recommendations were made:

1. In order to increase the percentage of vehicles that are well equipped with safety fittings, government must make safety a priority for vehicle importers. This means that vehicles that do not meet the country's safety standard should not be allowed into the country.
2. Road safety agencies should make a list of auto-safety equipment, their functions and how to be used and share it with motorists or give it out in an affordable price.
3. Government should ensure that vehicle safety systems are available and affordable and educate motorists to make safety a priority when purchasing vehicles.
4. Motorists should be encouraged as much as possible to install speed limiting device in their vehicles.

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