# EFFECT OF SAFETY EDUCATION ON KNOWLEDGE OF AND COMPLIANCE WITH ROAD SAFETY SIGNS AMONG COMMERCIAL MOTORCYCLISTS IN UYO, SOUTHERN NIGERIA

## O. E.  JOHNSON[1] and A.M. ADEBAYO[2]

[1]Department of Community Health, University of Uyo Teaching Hospital, Uyo, Nigeria [2]Department of Community Health, Federal Medical Centre, Owo, Ondo State, Nigeria,

*Corresponding Author:* Dr. Ofonime E.Johnson        *E-mail:* drjohnsonoe@yahoo.com

*Conflict of Interest:* None declared

## SUMMARY

**Objective:** Compliance with road safety signs is important in the reduction of motorcycle accidents. The aim of this study was to implement health education intervention and assess its impact on the knowledge of and compliance with road safety signs among commercial motorcyclists in Uyo, Southern Nigeria.

**Method:** This was an intervention study among motorcyclists in Uyo, Southern Nigeria, with a control group from a similar town. The instrument of data collection was a semi-structured interviewer administered questionnaire. Subjects were selected through multistage sampling method. Baseline data on compliance to road safety signs was collected from both groups. Motorcyclists in the intervention group were given education on the importance of compliance to road safety signs. Data was subsequently collected from both groups 3 months post intervention and analysed using the Statistical Package for the Social Sciences version 11.

**Result:** A total of 200 respondents participated in the study, 100 from each group. Following intervention, respondents with good knowledge score increased from 21% at baseline to 82% at 3 months post intervention in the intervention group (p<0.05) and from 19% to 21% in the control group. Compliance score in the intervention group increased from 15% to 70% (p<0.05) and from 12% to 18% in the control group.

**Conclusion:** A significant increase in compliance to road safety signs was recorded among motorcyclists in the intervention group after safety education. All motorcyclists should therefore be given education on road safety signs as this will improve compliance and lead to safer road use among them.

**Keywords:** knowledge score; compliance score; road safety signs, motorcycle accidents, safety education

## INTRODUCTION

Motorcyclists constitute an important group of road users globally. In many low income and middle income countries (LMIC), motorcycles are an increasingly common means of transport. In India, for instance, 69% of the total number of motor vehicles are motorized two- wheelers.[1] In China, in 2004, it was estimated that more than 67 million motorcycles were registered in the country.[2] In Vietnam, the number of motorcycles has grown from 500,000 to 10,000, 000 in the past 10 years.[3] In Nigeria, commercial motorcycles constitute one of the chief modes of transportation and by far, the most common form of informal transport system. There has been a phenomenal increase in the use of motorcycles for commercial purposes in most cities and rural areas of Nigeria in the last few years.[4]For instance, as at 2008, there were over 120,000 motorcyclists in Akwa Ibom State alone, which is just one of the 36 states in Nigeria.[5]

Motorcyclists and passengers are among the most vulnerable road users and represent an important group to target for reducing road traffic injuries.[6] Motorcyclists have an especially poor safety record when compared to other road user groups. Their mortality rate in the UK per million vehicle kilometre is approximately twice that of pedal cyclists and over 16 times that of car drivers and passengers.[7]About 70-90% of road deaths in Thailand and 60% in Malaysia were reportedly among users of motorized two wheelers.[8,9] According to the revised highway code of the Federal Road Safety Commission of Nigeria, the chances are 8:10 that a motorcycle accident will result in death or very serious injury.[10]

Disobeying road signals was one of the risk taking actions reported among motorcyclists in an in-depth study in London which put the rider and other road users at risk.[11] In Nigeria, commercial motorcyclists have been observed to pay little attention to road safety regulations leading to road traffic accidents involving other road users. A study carried out in Ondo, an urban town in western Nigeria reported that only 28.5% of motorcyclists who scored high on road safety practice observation scale could be considered safe for their

passengers and other road users.[12] Many men are abandoning menial jobs and becoming commercial riders overnight without any prior training on motorcycle riding and road safety precautions therefore endangering themselves and other road users.[4] A study conducted among motorcyclists in Benin, Nigeria reported that 448 out of 996 (45%) of the motorcyclists received no form of training on the use of motorcycle before they commenced operations. [13] Unfortunately, the rise in use of motorcycles has led to an accompanying rise in poor road safety practices leading to increased rate of accidents on Nigerian roads.[14] It has been observed that motorcycle riders often ignore safety measures, thus increasing their risk of accidents with other road users with which they share the same traffic space.[15] Thus, it is unsurprising that the incidence of injuries among Nigerian motorcyclists in different studies reportedly range between 27.2- 60%.[6,12,16]

Road safety education is said to be a potent tool for the reduction of motorcycle accidents.[17] This study therefore was conducted to implement and evaluate the effect of a health education intervention on knowledge and compliance to road safety signs among motorcyclists in Uyo, Southern Nigeria.

## MATERIALS AND METHOD

An intervention study was carried out among registered motorcyclists in Uyo, Akwa Ibom State, Southern Nigeria in September 2008. The estimated population of Uyo metropolis as at 2006 was 304,000.[18] The control group was made up of registered motorcyclists in Ikot Ekpene, about 30 kilometers from Uyo, with an estimated population of 142,377.[18] The major means of intra city transportation in both cities is the motorcycle. Ikot Ekpene was selected as the control town because it has the second highest number of motorcyclists after Uyo and it is relatively more urban than other towns in the State and therefore more comparable to the intervention town. Data from the secretariat of the motorcyclists association in the State, showed that there were 30,000 motorcyclists in Uyo and 15,000 in Ikot Ekpene.[5]

### Sample Size
The sample size formula for comparison of 2 related group proportions was used.

where, N=

$$\{Z_\alpha \; \sqrt{P_o(1-P_o)} + Z_\beta \sqrt{P_1(1-P_1)} \;\}^2 \over (P_1-P_o)$$

$Z_\alpha$=Standard normal deviate when the probability of having a type 1 error $_\alpha$ is 5%=1.96.

$Z_\beta$=Standard normal deviate when the probability of having a type 2 error $_\beta$ is 10%=1.28.
Power (1-β) =90%
$P_o$= Baseline knowledge and road safety practice of motorcyclist before intervention.
$P_1$= Proportion of respondents whose knowledge and skills are improved after the intervention.
Knowledge score was used as an outcome measure and reference was made to a previous study where the knowledge score of motorcyclists was reported to be 32.6%[19].
$P_0$= 32.6%=0.33
At the end of the study, it was assumed that intervention should achieve at least 16% change in knowledge.
$P_1$= 48.6%=0.486 = 0.49
Estimated sample size=

$$\{1.96 \; \sqrt{0.33(1-0.33)} + 1.28\sqrt{0.49(1-0.49)} \;\}^2 \over (0.49-0.33)$$

= $(0.92+0.64/0.16)^2$= $9.75^2$
= 95 (+ 5% attrition) = 99.75
This was rounded up to 100 respondents per group.

### Sampling Technique
The study participants were selected using multi-stage sampling technique. The motorcyclists in each town operated from specific locations within the towns in clusters. There were 60 clusters in Uyo and 32 in Ikot Ekpene. Each cluster in both locations had 400-550 registered motorcyclists. A list of these clusters was obtained from the chairmen of the motorcyclists associations of the two towns involved in the study and 4 clusters were selected in each town by simple random sampling technique.

Twenty-five motorcyclists were subsequently selected from each cluster by simple random sampling technique, using table of random numbers. This gave a total of 100 motorcyclists in each group. The instrument of data collection was a semi-structured interviewer administered questionnaire. Twenty-five community health officers assisted in administering the questionnaires.

### Data Collection
Baseline information was collected from both groups on their socio-demographic characteristics, knowledge and compliance to road safety signs. The participants in Uyo were given education through lecture, visual aids and interactive sessions on identification of road safety signs and the importance of compliance to such signs, after which immediate post intervention data was collected. Data was finally collected from both groups 3 months post intervention.

*Data Analysis*

Respondents were asked to identify ten different traffic signs. One mark was awarded for each correctly identified sign and no mark for each sign that was wrongly identified. The minimum score obtainable was 0 and the maximum obtainable score was 10. Respondents' knowledge and compliance to road traffic signs were scored and then grouped into 3 – Good ($\geq 7$), Fair (5 – 6) and poor ($\leq 4$). Data obtained was analysed using the Statistical Package for the Social Sciences (SPSS) version 11. Frequencies and means were generated. Chi square test and t-test were used to test for differences in knowledge and compliance to road safety signs before and after the training. Level of significance was set at 5%.

## RESULT

A total of 200 male respondents participated in the study, 100 from each group. The mean age of respondents in the intervention and control groups were 33.4 ($\pm8.7$) and 33.5 ($\pm8.3$) years respectively. In the intervention group, 46 (46%) of the respondents had primary education, while 40 (40%) had secondary education. In the control group, 48 (48.0%) also had primary education, while 35 (35%) had secondary education. Up to 76 (76%) in the intervention and 70 (70%) control group respectively reported starting to ride motorcycle for commercial use more than 3 years prior to the study (Table 1).

**Table 1** Selected socio-demographic characteristics and work history of respondents by study group

| Socio-demographic characteristics | Intervention N = 100 n (%) | Control N = 100 n (%) | Statistics $\chi^2$ | p-value |
|---|---|---|---|---|
| Age group (years) | | | | |
| <30 | 34(34) | 38(38) | | |
| 30 – 39 | 42 (42) | 33 (33) | 1.77 | 0.4 |
| $\geq 40$ | 24 (24) | 29 (29) | | |
| Mean Age ($\pm$S.D) years | 33.4($\pm$8.70) | 33.5($\pm$8.28) | 0.04* | 0.96 |
| Highest level of education | | | | |
| Nil formal education | 8 (8) | 9 (9) | | |
| Primary | 46 (46) | 48 (48) | | |
| Secondary | 40(40) | 35(35) | 0.72 | 0.86 |
| Post secondary | 6 (6) | 8 (8) | | |
| Number of years of as commercial motorcyclist (yrs) | | | | |
| $\leq 3$ | 24 (24) | 30 (30) | | |
| 4 – 6 | 40 (40) | 44 (44) | 1.8 | 0.60 |
| 7 – 9 | 20 (20) | 16 (16) | | |
| $\geq$10 | 16 (16) | 10 (10) | | |

*t- test

In the intervention group, the motorcyclists showed increase in knowledge of all the road safety signs at the immediate post intervention phase compared to baseline. This however dropped slightly 3 months later, but was still far higher than findings at baseline. At 3 months post intervention, 78 (78%) of the respondents in the intervention group correctly identified the 'no horning' sign compared to 23 (23%) at baseline, while in the control group only 25 (25%) identified it compared to 21 (21%) at baseline.

Concerning the 'no parking sign, the number of respondents who could identify it in the intervention group increased from 21 (21%) at baseline to 85 (85%) at 3 months post intervention, while it reduced slightly from 26 (26%) to 24 (24%) in the control group. At 3 months post intervention, the 'no u turn' sign was identified by 88 (88%) of respondents in the intervention group compared to 32 (32%) at baseline, while only 23 (23%) could identify it in the control group compared to 24 (24%) at baseline.

Similarly, 85 (85%) of those in the intervention group identified the 'no right turn' and 'no left turn' signs 3 months post intervention compared to 30 (30%) at baseline, while only 33 (33%) could identify it in the control group at both baseline and 3 months post intervention. Concerning the traffic light signs, 85 (85%) of respondents in the intervention group could identify the 'get ready' sign 3 months post intervention compared to 58 (58%) at baseline while only 56 (56%) of those in the control group identified it compared to 54 (54%) at baseline. The changes in the intervention group were all statistically significant at p<0.05 while they were not in the control group (Table 2).

**Table 2** Knowledge of Road Safety signs in different study phases

| Road sign | Intervention group | | | | Control group | | Statistic $\chi^2$ | p-value |
|---|---|---|---|---|---|---|---|---|
| | **Baseline N=100 n (%)** | **3months post intervention N=100 n (%)** | **Statistic $\chi^2$** | **p-value** | **Baseline N=100 n (%)** | **3 months after N=100 n (%)** | | |
| **No horning** Yes No | 23 (23) 77 (77) | 78 (78) 22 (22) | 60.50 | 0.00 | 21 (21) 79 (79) | 25 (25) 75 (75) | 0.45 | 0.50 |
| **No parking** Yes No | 21 (21) 79 (79) | 85 (85) 15 (15) | 80.2 | 0.00 | 26 (26) 74 (74) | 24 (24) 76 (76) | 0.11 | 0.74 |
| **No stopping** Yes No | 17 (17) 83 (83) | 90 (90) 10 (10) | 107.1 | 0.00 | 15 (15) 85 (85) | 17 (17) 83 (83) | 0.15 | 0.70 |
| **No u- turn** Yes No | 32 (32) 68 (68) | 88 (88) 12 (12) | 65.33 | 0.00 | 24 (24) 76 (76) | 23 (23) 77 (77) | 0.03 | 0.86 |
| **No right turn** Yes No | 30 (30) 70 (70) | 85 (85) 15 (15) | 61.89 | 0.00 | 33 (33) 67 (67) | 33 (33) 67 (67) | 0.00 | 1.00 |
| **No left turn** Yes No | 30 (30) 70 (70) | 85 (85) 15 (15) | 61.89 | 0.00 | 33 (33) 67 (67) | 33 (33) 67 (67) | 0.00 | 1.00 |
| **T junction** Yes No | 32 (32) 68 (68) | 82 (82) 18 (18) | 51.00 | 0.00 | 28 (28) 72 (72) | 32 (32) 68 (68) | 0.38 | 0.54 |
| **Stop** Yes No | 83 (83) 17 (17) | 92 (92) 8 (8) | 3.70 | 0.05 | 81 (81) 19 (19) | 81 (81) 19 (19) | 0.00 | 1.00 |
| **Go** Yes No | 83(83) 17(17) | 92(92) 8(8) | 3.70 | 0.05 | 81 (81) 19 (19) | 81(81) 19(19) | 0.00 | 1.00 |
| **Get ready** Yes No | 58(58) 42(42) | 85(85) 15(15) | 17.89 | 0.00 | 54(54) 46(46) | 56(56) 44(44) | 0.08 | 0.78 |

In the intervention group the number of respondents whose knowledge was rated as good increased from 21 (21%) to 100 (100%) at immediate post-intervention and dropped to 82 (82%) at 3 months post intervention (p <0.05). In the control group those rated to have good knowledge only increased from 19 (19%) at baseline to 21 (21%) at 3 months post intervention (p = 0.96).

The mean scores were computed from a total score of 10 for questions on traffic signs. In the intervention group the scores increased from 4.1 at baseline to 8.6, while in the control group, the mean knowledge score was 4.1 compared to 3.9 at baseline. The difference observed in knowledge score between the intervention and control groups at 3 months post intervention was statistically significant at p< 0.05.

**Table 3** Motorcyclists' compliance with road safety signs by study phases

| Safety signs | Intervention group | | | | Control group | | | |
|---|---|---|---|---|---|---|---|---|
| | Baseline N=100 n (%) | 3months after N=100 n (%) | Statistic $\chi^2$ | p-value | Baseline N=100 n (%) | 3 months after N=100 n (%) | Statistic $\chi^2$ | p-value |
| **No horning** | | | | | | | | |
| Always | 16 (16.0) | 60 (60) | | | 14 (14) | 12 (12) | | |
| Sometimes | 7 (7.0) | 18 (18) | 60.87 | 0.00 | 7 (7) | 13 (13) | 2.06 | 0.36 |
| Never | 77 (77.0) | 22 (22) | | | 79 (79) | 75 (75) | | |
| **No parking** | | | | | | | | |
| Always | 15 (15) | 76 (76) | | | 18 (18) | 17 (17) | | |
| Sometimes | 6 (6) | 9 (9) | 85.06 | 0.00 | 8 (8) | 7 (7) | 0.12 | 0.94 |
| Never | 79 (79) | 15 (15) | | | 74 (74) | 76 (76) | | |
| **No stopping** | | | | | | | | |
| Always | 10 (10) | 75 (75) | | | 7 (7) | 12 (12) | | |
| Sometimes | 7 (7) | 15 (15) | 109.92 | 0.00 | 8 (8) | 5 (5) | 2.03 | 0.36 |
| Never | 83 (83) | 10 (10) | | | 85 (85) | 83 (83) | | |
| **No u- turn** | | | | | | | | |
| Always | 23 (23) | 65 (65) | | | 13 (13) | 13 (13) | | |
| Sometimes | 9 (9) | 23 (23) | 47.98 | 0.00 | 11 (11) | 11 (11) | 0.00 | 1.00 |
| Never | 68 (68) | 23 (23) | | | 76 (76) | 76 (76) | | |
| **No left turn** | | | | | | | | |
| Always | 22 (22) | 71 (71) | | | 20 (20) | 22 (22) | | |
| Sometimes | 8 (8) | 14 (14) | 63.04 | 0.00 | 13 (13) | 11 (11) | 0.26 | 0.88 |
| Never | 70 (70) | 15 (15) | | | 67 (67) | 67 (67) | | |
| **T junction** | | | | | | | | |
| Always | 24 (24) | 75 (75) | | | 22 (22) | 24 (24) | | |
| Sometimes | 8 (8) | 7 (7) | 55.54 | 0.00 | 6 (6) | 8 (8) | 0.49 | 0.78 |
| Never | 68 (68) | 18 (18) | | | 72 (72) | 68 (68) | | |
| **Stop** | | | | | | | | |
| Always | 75 (75) | 86 (86) | | | 74 (74) | 76 (76) | | |
| Sometimes | 8 (8) | 6 (6) | 4.28 | 0.12 | 7 (7) | 5 (5) | 0.36 | 0.84 |
| Never | 17 (17) | 8 (8) | | | 19 (19) | 19 (19) | | |
| **Go** | | | | | | | | |
| Always | 77 (77) | 84 (84) | | | 74 (74) | 76 (75) | | |
| Sometimes | 6 (6) | 8 (8) | 3.83 | 0.15 | 7 (7) | 5 (5) | 0.36 | 0.84 |
| Never | 17 (17) | 8 (8) | | | 19 (19) | 19 (19) | | |
| **Get ready** | | | | | | | | |
| Always | 50 (50) | 80 (80) | | | 48 (48) | 48 (48) | | |
| Sometimes | 8 (8) | 5 (5) | 20.40 | 0.00 | 6 (6) | 8 (8) | 2.52 | 0.28 |
| Never | 42 (42) | 15 (15) | | | 46 (46) | 44 (44) | | |

Table 3 shows compliance of motorcyclists to road safety signs by study phases. In the intervention group the motorcyclists who reported always obeying the 'no horning sign' increased from 16 (16%) at baseline to 60 (60%) at 3months post-intervention, while they reduced from 14 (14%) at baseline to 12(12%) 3 months later in the control group. The 'no parking' sign was reportedly always obeyed by 76 (76%) in the intervention group at 3 months post intervention compared to 15 (15%) at baseline, while only 17 (17%) obeyed it in the control group at 3 months compared to 18 (18%) at baseline.

The reported level of obedience to the 'no stopping' sign increased from 10 (10%) at baseline to 75 (75%) 3months later among motorcyclists in the intervention group compared to from 7 (7%) to 12 (12%) in the control group. Sixty-five (65%) of motorcyclists in the intervention group reported obeying the 'no u turn' sign post intervention compared to 23 (23%) at baseline while only 13(13%) reported obeying it both at baseline and 3months later in the control group.

Furthermore, at 3 months post intervention, 71 (71%) in the intervention group reported obeying the 'no left and no right turn' signs compared to 22 (22%) at baseline, while only 22(22%) obeyed it post intervention in the control group compared to 20 (20%) at baseline. Concerning traffic light signs, 80(80%) reported obedience to the 'get ready sign' compared to 50 (50%) at baseline, while level of obedience remained at 48 (48%) in the control group 3 months post intervention. The observed changes in the intervention group were all statistically significant at p< 0.05. In the control group, however, the noted changes were not significant. Three months post-intervention, the number of respondents whose score concerning compliance to road safety signs was good (≥7) by study phases increased from 15 (15%) to 70 (70%) (p = 0.00), while it only changed from 12 (12%) at baseline to 18 (18%) 3months later in the control group (p = 0.23).

## DISCUSSION

This study assessed the effect of health education on the knowledge and compliance of motorcyclists in Uyo to road safety signs. The motorcyclists in Ikot Ekpene were selected as control due to the similarity of the two towns and the riding patterns in both locations. Over 70% of the motorcyclists in both groups were less than 40 years of age with a mean age of about 33 years. This differs from findings reported in Igbo-Ora, South Western Nigeria, where Owoaje et al documented the mean age of the commercial motorcyclists interviewed to be 27.4 ±7.4 years.[16] Another study carried out in Yola, Adamawa State, Northern Nigeria showed that 88% of the motorcyclists in the study were aged between 18 and 30 years.[14]

Most commercial motorcyclists therefore generally belong to the most productive age group. Only about a fifth of motorcyclists in each group had good knowledge about road signs despite the fact that majority of them had been riding for commercial purpose for 4 years and above. This finding might have been due to the fact that most of the riders did not attend any formal riding institution where they would have been exposed to the traffic signs and the Highway Code. Similar findings were reported in other studies.

A study on the knowledge of and attitude towards road traffic codes among commercial motorcycle riders in Eastern Nigeria showed that about two thirds of the respondents had poor knowledge of road traffic codes and safety.[19] Similar findings were reported in another study conducted in Ondo, Western Nigeria.[12] In a study conducted among commercial motorcyclists in both rural and urban parts of Oyo State, Nigeria, Sangowawa reported that out of 365 motorcyclists, up to 292 (80%) had poor knowledge of road safety signs and as a result, most did not obey them.[20] Another study in South Western Nigeria showed that less than 20% of the motorcyclists studied obeyed the traffic codes more than half the time they saw them.[16]

The increase in knowledge of road safety signs recorded post intervention among the motorcyclist clearly shows that virtually all the motorcyclists were literate enough to benefit from a simple training session. Similar results are likely to be obtained among any group of motorcyclists offered such education. The slight decrease in their knowledge over the three month period compared to immediate post intervention shows the need for periodic training of the motorcyclists as there is a decline in knowledge over time. A high compliance to road safety signs was also reported in the intervention group three month post intervention compared to baseline. In the control group however, there was no significant change in knowledge and compliance to road signs at baseline and three months later.

These findings suggest that the reason for lack of compliance to the road signs at baseline in both groups was largely due to lack of knowledge of the road signs and when safety education was given to the intervention group there was a marked difference. Post intervention, it was however observed that not all those who had adequate knowledge obeyed the road and traffic signs. This suggests that other factors also contributed to lack of compliance to road signs among motorcyclists though the main reason seemed to have been poor knowledge.

Training programmes have been found to be effective in reducing crashes among motorcyclists. In order to reduce the percentage of deaths and injuries from motorcycle crashes, many states in US have established safety programs. Illinois, for example, has a program known as the Cycle Rider Safety Training Program. The research in Illinois reported that most motorcyclists were riding without training and that more than 90 percent were self-taught.

Through the Cycle Rider Safety Training Program, the state of Illinois was able to educate 136,800 students between 1976 and 1996 and from 1976 to 1995 motor-

cycle crashes in Illinois decreased by more than 45 percent and fatalities decreased by 57 percent.[21] Motorcycle rider education may therefore be a promising intervention for prevention of motorcycle related injuries.[22]

### Limitation
The issue of self-reporting was considered a limitation since one had to rely on the information given by the motorcyclists concerning their compliance with road safety signs.

## CONCLUSION
This study showed that safety education had a positive effect on the knowledge and compliance to road safety signs among motorcyclists in the intervention group and a similar result is likely to be obtained if such intervention is carried out on all motorcyclists. It is therefore recommended that periodic road safety education and re-training should be organized for motorcyclists by the government to ensure that they are familiar with road signs and other safety precautions.

## ACKNOWLEDGEMENTS

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