



## Ergonomic Assessment And Driving Experience of Taxicab Operators In Nigeria

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**ABSTRACT :-** :- This study investigates the work related hazard experienced by occupational drivers of public transport in Nigeria using participatory ergonomic intervention approach with the sample size of 838 respondents. Ergonomic risk factors responsible for pain, stress, strain and other disorder experienced by the subjects were likewise identified. The technological systems as well as operator of the system were considered for necessary assessment and the results show some mismatch between the two complex elements of the man-machine system. Factors that significantly influence drivers' performance include the road conditions, human capabilities and limitations, design variability of vehicles and instability in government policy on transportation activities. Development of effective databank, establishment of functional legal framework and enforcement of the same were identified as key solution to precarious situation of business drivers in the public transport sector of Nigerian economy.

**Keywords:** - Business driving, WRMD, Discomfort, Ergonomics.

### I. INTRODUCTION

Transportation has been identified as the largest Industry worldwide. It is a task which involves the use of any of the available technological system (automobile). The operator of such transportation facility is often exposed to attendant stress, strain, pain and discomfort which are evidently felt at varying body parts. Efforts have been made by manufacturer of vehicles used for transport business to minimize work-related hazards predominant in transport industry through various design improvements, and redesign resulting from further considerations of ergonomic factors particularly as it relates to drivers, truckers or other operators' workplace design and environment [1] and [2]. However due to the dearth of relevant anthropometric data of user population (particularly in the underdeveloped nations), little or no positive impact is felt in spite of all the commitments to research and development in the field of the ergonomics of vehicles.

Nigeria is a major importer of different makes and brands of vehicle but whose anthropometric data needed for the design the facility is yet to be developed. Situation in transportation industry grow worse and worse by day with large fleets of cars, sport utility vehicles (SUV), sedan and truck that enter the country regularly. There is virtually no household without a transportation facility in form of bicycle, motorcycle, car etc. Record of vehicular accidents increases on yearly basis and the state of the roads in the country also worsen based on reported accident rate as presented by Federal Road Safety Commission of Nigeria (FRSC).

Work-related musculoskeletal disorders (WRMDs) and other postural damage may result in physiological illness that may develop over a period of weeks, months, or even years due to prolonged mechanical stresses and deformity imposed on the musculoskeletal system [3] and [4]. WRMDs are prevalent in occupational driving especially among Taxi drivers operating in Nigeria [5] and [6] This is evident by the observed number of hawkers of herbal medications as well as western medicine patronized by the drivers at their various motor parks [7]. In developed countries like US where needed anthropometric databank exists there are still reported cases of WRMD among drivers [8] hence the continuous efforts and commitments toward improvement on the design of vehicles produced for local and international market. The difference in the characteristics of the markets could be responsible for significant change noticed in patronage as well as sales of

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common household products. The case become worse in many developing countries where there is no effective legislative control on importation of vehicles couple with porous border through which goods are smuggled into the country. In many of these cases the end users are especially vulnerable to the risk imposed by the poorly designed products and worse still no compensation from causal agent(s) is provided. Noticeably a number of manufacturers placed much premium on esthetics rather than the functional and design capability of the in-vehicle elements. The characteristics relating to the limitations and capabilities of drivers in developing countries are yet to be fully studied and documented. This explains why there are frequent complaints of misfit or mismatch between operators' anthropometric characteristics and workplace reported by driver of cabs and busses used in many of such countries. The design of driver work-envelope is also strongly connected with the anthropometric characteristics of the user population body variables [9]. This study investigates work related musculoskeletal disorders (WRMD) and other degrees of discomforts experience by operators of taxicab in Nigeria. It is also designed to suggest effective and peculiar intervention activities to minimize or eliminate pain and other disorders experienced while driving.

## **II. MATERIALS AND METHOD**

Subjects were selected randomly among the adult populations who have been licensed to drive vehicle in the Country. A Sample size of eight hundred and fifty-three ( $n = 838$ ) was predetermined using the ISO 15535 with precision level of  $p = 0.05$  [10]. The study was carried out at the southwestern geopolitical zone of Nigeria where both sex were found to engage in occupation and non-occupational driving. A stratification of the subjects was also considered to understand the distribution of vehicle operators and the impact of driving activities among the studied population. To further establish the ergonomic risk factors responsible for pain, stress, strain and other disorder experienced by the subjects, the individual respondent is given brief information about the survey and the importance of participating in it was adequately emphasized with the assistance of four trained enumerators. The investigation conducted involves the use of structured questionnaire, oral interview and participatory ergonomic intervention approach [8]. Subjects were accosted at different location such as public taxicab garages, shopping malls, petrol stations and car parks. The study was limited to drivers of Cars, Sedans and SUVs and no prejudice were placed on the make of the selected categories of vehicles.

### **Personal Data**

Respondent's demographic profile such as age, gender, marital statures and work hour were collected through the designed structured questionnaire. The status of the operators' certification which is the official driving license was investigated. Other information requested for are previous skill acquired, years of experience, and working capacity.

### **Social and Educational Statures**

The perceived rate of unemployment among youths in Nigeria has force many graduates of both middle and tertiary institutions to opt for business driving which in real term do not require special education and training to get started and licensed. The basic requirement for obtaining driver's license to operate cabs as specified by the Nigeria Road Safety Commission (FRSC) include medical clearance particularly on the eye and evidence of no disabilities as well as other mental and physical fitness. The enumerators were trained to assist the illiterate and other semi-literate respondents in the filling of the questionnaire and to interview subjects on issues relating to social responsibility of the operators.

### **Vehicle Characteristics**

Impact of vibration from multiple points of misalignments in vehicles impacts significantly on the stress, pain and discomforts such as low back pain, fatigue, spinal disc damage etc. experienced by drivers of was investigated. The makes, models and brands of vehicle plying the roads in the study area were surveyed. Five relevant measurable features of the vehicle were considered for characterization study. Information as automobile size, year of manufacture, mileage, type of steering and steering wheel shape were also investigated. The makes, models and brands of vehicle plying the roads in the study area were surveyed. Five relevant measurable features of the vehicle were considered for characterization study. Information as automobile size, year of manufacture, mileage, type of steering and steering wheel shape were investigated.

### **Road Condition and Musculoskeletal Problems**

Road negligence leading to deterioration has resulted in road roughness and dilapidation which impose severe stress on motorists Road roughness and general assessment of Nigerian road was carried out. Number of hours on the wheel, and the effects of driving with time on selected human body parts were also investigated [11]. The participatory ergonomic intervention approach (PEIA) used includes structured questionnaire,

interview, operators and ergonomic expert opinion poll and physical assessment of relevant elements of driver-taxicab system [7].

**III. RESULTS AND DISCUSSION**

The ages of the operators were observed to be normally distributed around 30-39 age group with 95 % who are qualified by law of the Federal Republic of Nigeria to drive as shown in table 1. It is important to note that operation of Taxicab and public transportation in particular is largely the job for the adults. Only one percent of the respondents were 60years and above [12]. This suggests that old age and the associated musculoskeletal troubles impede safe and comfortable operation of Taxicabs. Business driving is highly dominated by male with less than 1 % being female found in the cause of the survey. Single digit percentage was recorded for respondents who were single (8 %). This suggests that driving is a job embraced by married men who were believed to be responsible people in the society and should be conscious, understand and imbibe safety rules while driving. The responses obtained and the observations made by the enumerators during the survey informed that the level of education of the operators was generally low as shown in table 2. This suggests the possible reason for violations of road safety rules and instructions placed on bill boards along major roads. The opinion of the study population is that driving belongs to one of the last choice job which dropout (from formal education) youth and adult fall back to for livelihood. Not less than forty-three percent of the respondents reported that they always or often spent more than 8 hours per day as the regulated working hour limit (table 3). With such long hours of seated operation, it could be argued that the most important component of the Taxicab operator’s working environment is the cab seat [7], [13] and [14]. This also indicates that the driver is exposed to high level of risk which could result in musculoskeletal problems, poor performance, injury and/or accident. The risk exposure of the respondents to work related injury is also influenced by other tasks like assisting in carrying passenger’s load into the vehicle. Other major problems that characterized this type of occupation include exposure to whole body vibration; unfit seat system and long-time confinement to a fixed position. This is more pronounced in the field of study where more than half (56%) of the sampled taxicab drivers operated above the established International Labour Organization (ILO) standard 8 hour working day. Less than one quarter (24.4 %) of the respondents operated less than 8hr in a day while less than 2 % worked less than four hours a day. The attrition rate become increasingly pronounced from age 46years as a result of attendant work related musculoskeletal disorder such as low back pain that is prevalent among business drivers.

**Table 1:** Age Distribution of Taxi Drivers in the Study Area

Age(year)	Respondents	
	N	%
13-19	0.0	0.0
20-25	41.0	4.9
26-29	128.0	15.3
30-35	229.0	27.4
36-39	205.0	24.5
40-45	149.0	17.8
46-49	46.0	5.5
50-59	32.0	3.8
60 and Above	8.0	1.0
Total	838.0	100.0

% = Percent Responded, N = Number of Responses

**Table 2:** Drivers’ Level of Education

Level of Education	Respondents	
	N	%
Primary School	441	52.6
Junior Secondary School (JSS)	137	16.2
WAEC, NECO/SSCE	242	29.8
Ordinary National Diploma (OND)	13	1.6
Higher National Diploma (HND)	5	0.6
First Degree	1	0.1
Masters Degree	0	0.0
Total	838	100.0

% = Percent Responded, N = Number of Responses

**Table 3:** Number of Hours Driver Spend in Driving Task

Working Hours	Respondent	
	N	%
2	2	0.24
3	7	0.84
4	19	2.27
5	50	5.97
6	67	8.0
7	81	9.67
8	248	29.59
Above 8	364	43.44
Total	838	100.00

% = Percent Responded, N = Number of Responses

Respondents ranked WRMD experienced on both upper and lower back the same and the adverse effect of the disorder on performance of the operator of the technological system is traumatizing particularly while in sitting position [15], [16], [17], [18] and [19]. The backrest provided and the support for the foot were found to be slightly adequate and can be improved upon through a redesign of the seat and the workplace including related in-vehicle elements [7] and [20]. Thirty-three percent of the Taxicab operators had no driver's license. This suggests that driving is considered as a means of livelihood which requires less qualification and such that any adult who wish to join in the profession are faced with minimal restraint or enforced requisite(s). The activities of Federal Road Safety Commission (FRSC) and Nigerian Police Force (NPF) must have contributed significantly to the 67 % of driver with driver's license.

Cases of expired license which account for 10-17 % of the drivers however shows the failure of established organization responsible for inspection of vehicle for roadworthiness, licensing of public transport operators and enforcement of road safety rules, these include State licensing office, Vehicle Inspection office (VIO), FRSC and NPF. The nonchalant attitude of business driver explains the failure of operators of the complex technology to renew their driving license and general poor maintenance culture of the drivers. Table 4 suggests that the rate at which people join driving as a profession is equivalent to the rate at which people retire from it. About one-quarter of the drivers had up to 15yr driving experience while about 15 % had less than 6 years' experience in occupational driving. The drivers having 6-10 years of driving experience had the largest percentage (33.65 %). Often people who engage in commercial motor driving had other trade or craft they have learnt and do practice while driving is added as part-time business. This is reflective in less than 13 % of the respondents who were found to have over twenty years driving experience. The average years of driving experience of the drivers is twelve years which falls in 11-15 year. This suggests that more people quit driving as occupation after 10 years in the job than those joining it.

**Table 4:** Years of Experience of Taxi Drivers in Occupational Driving

Experience (year)	Respondents	
	N	%
1 -5	127.0	15.1
6 - 10	286.0	34.1
11 – 15	224.0	26.7
16-20	108.0	12.9
Above 20	93.0	11.1
Total	838.0	100.0

% = Percent Responded, N = Number of Responses

Vibration from multiple point of misalignments in vehicles and bad road conditions impact significantly on the stress, pain and discomforts such as low back pain, fatigue, spinal disc damage etc. experienced by drivers of lorries, trucks, and other SUVs. In-vehicle design differences was reported by Lucas and Onawumi [13] and found to be responsible for a number of reported cases of WRMD in the transport industry. Table 5 shows the different makes of vehicles used as cabs for commercial transport found on the roads during the survey when 830 Taxi cab were sampled.

**Table 5:** Taxicab Make/Model used in the Study Area

Make	Model	Respondents		Total	
		N	%	N	%
Volkswagen	Golf	43	58.11	74	8.92
	Passat	26	35.14		
	Jetta	5	6.76		
Toyota	Carina	65	27.90	233	28.07
	Corolla	105	45.06		
	Celina	4	1.72		
	Starlet	45	19.31		
	Isuzu	1	0.43		
	Celica	1	0.43		
	Camry	12	5.15		
Nissan	Sunny	55	50.93	108	13.01
	Micra	2	1.85		
	Bluebird	16	14.81		
	Datsu	30	27.78		
	Lx	5	4.63		
Mitsubishi	Gallant	12	12.37	97	11.69
	Lancer	65	67.01		
	Cam	1	1.03		
	Space Wagon	19	19.59		
Mercedes Benz	190	1	50.00	2	0.24
	200	1	50.00		
Peugeot	504 (Wagon)	32	46.38	69	8.31
	505 (Salon)	24	34.78		
	505 (Wagon)	13	18.84		
Audi		14	1.69	14	1.69
Mazda	323	28	35.90	78	9.40
	626	32	41.03		
	2000	18	23.08		
.Opel	<i>Kadet</i>	50	38.17	131	15.78
	Omega	9	6.87		
	Ascona	72	54.96		
Tercel	4WD	17	2.05	17	2.05
Honda	Accord	7	0.84	7	0.84
				838	100.0

% = Percent Responded, N = Number of Responses

It is evident from the result obtained that Nigeria has not about eleven make/brands 4-6 passenger vehicles as Taxi and the distribution is in the order of Toyota>Opel>Nissan>Mitsubishi>Mazda> Volkswagen >Peugeot>Tercel>Audi>Honda> Mercedes Benz. It was found that 56 percent of the vehicles are fairly used commonly referred to as *Tokunbo* while about 44 percent are second hand cars. The year of manufacture of the cabs ranges between 1976 and 2000. Significant number of the cabs is not road worthy by FRSC outlined standards. The survey also revealed that not less three quarter of the cabs are in the state of disuse with many reworks of car body, damage passenger seat with sharp objects found around the seat space, failed doors and non-functional driver seat and dashboard. Some of drivers of the cab have developed/learned the ways of escaping the hand of law by bribing the law enforcement agent whose responsibility is to ensure the road worthiness of the cabs. Likewise, the vehicles were manufactured in different countries of the world having varying human characteristics which have some significant differences from that of Nigerian adult population [21]. There is no functional automobile manufacturing company presently in Nigeria which could cater for the needs and other human requirements in the country.

#### IV. CONCLUSION

The state of the cabs imported and used in public transport in Nigeria has contributed to the traumatized conditions of its operators and responsible for this is the marked mismatch between operators' characteristics and the vehicles variability. Poor road network and state is a marked circumstance leading to incessant breakdown of public vehicles and health challenges of their operators. With the current population of

Nigerians and the state of her economy, there is the need for National databank for citizens' anthropometric variables and appropriate legislation to assist the operations of the transport sector of the economy. Also the enforcement mechanism of such legislation needs to be established. The current drive of the government to attract foreign investors should be supported with indigenization of technology coupled with appropriate increase in local contents. All stakeholder in transport industry such as the manufacturers, marketers, drivers, transporters and mechanics are needed to partner together in funding solution to devastating effect of unfit in vehicle design of vehicles imported into the country.

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