ASSESSMENT OF THE HEALTH EFFECTS OF AUTOMOBILE EMISSION ON DRIVERS AND COMMUTERS IN NIGER STATE, NIGERIA

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Abstract

This paper assessed the health effects of automobile emission on drivers and commuters in Niger state, Nigeria. The research questions assessed the contributions, health effects of automobile emissions and government measures necessary to reduce the emissions. Structured questionnaire was used to collect data on the health effects, contributions and government measures necessary to reduce the effects of emissions from the respondents. Mean was the statistical tool used to answer the research questions, while t- test statistic was used to test the hypothesis at .05 level of significance. The findings revealed among others, health effects of Automobile Emission such as running nose, sneezing, headache, dizziness, fatigue, skin cancer, chest problems and eye irritation are manifested among the respondents. Based on the findings of the study, recommendations are made for the development of effective control of automobile emissions quality management programmes and putting in place effective policies and programme to reduce the health effects of automobile emissions.

Introduction

Automobile emission arises mainly from inefficient combustion of hydrocarbon fuels. Hydrocarbon gases easily unite with oxides of nitrogen (NOx) through photochemical reactions in sunlight to produce smog. NOx can combine with other organic substances in the atmosphere to create ozone, with devastating health effects on human being, vegetation and climatic stability. Hydrocarbon fuels also contain varying amounts of sulphur. The combustion of hydrocarbon (HC) fuels therefore has the potential of producing oxides of sulphur, which can combine with water in the atmosphere to form acids of sulphur. Automobile emissions significantly pollute air and require control (Karlsson 2004). With increasing concern for air toxics and climate modification caused by automobile emissions, the need for effective control is therefore important. In recent years, there has been considerable research on vehicle emissions and fumes (Marshall, Riley, Mc Kone and Nazarott 2003). Carbon monoxide (CO) causes blood clotting when it reacts with haemoglobin, and cuts the supply of oxygen in the respiration system after long exposure. This is a common occurrence in urban centres with a high level of commercial activity (Ackerman, Davies, Jefferson, Longhust and Marquez 2002; Johnson, Melengret, and Pillay 2001). The worst levels of pollution are seen in such urban cities densely populated with low standard of living (Washington, Leonard, Roberts, Young, Sperling, and Bottha 1998). Automobile emissions present an important environmental hazard that needs to be investigated since it may shorten the lifespan of exposed people.

Automobile emission contribute to greenhouse effect which is a natural phenomenon in which gases in the earth's atmosphere, including water vapour and carbon dioxide, trap radiation from the sun near the planet's surface. The greenhouse effect is necessary for the survival of life; without it, temperatures on earth would be too cold for humans and other life forms to survive. But human activities, particularly over the last century, have altered the composition of the atmosphere in ways that intensify the greenhouse effect. The World Meteorological Organisation (WMO, 2006), observed that the concentration of carbon dioxide (the leading global warming pollutant) in the atmosphere has increased by thirty five percent as a result of human activity. The Inter Governmental Panel on Climate Change (IPCC) (2001) also stated that the current rate of increase in carbon dioxide concentration is unprecedented in the last 20,000 years; concentrations of other environmental pollutants have increased as well. According to the 2007 Assessment Report by the IPCC, the absence of emissions reductions has contributed to global temperatures and is estimated to increase by about 4°C, with the potential to go as high as 7°C or higher. This level of warming will have devastating effects on human life. By mid-twenty first century, the report also indicated that more than a billion people will face water shortages and hunger, including 600 million in Africa alone.

Weather extremes, food and water scarcity, and climate-related dangerous public health conditions are projected to drive the displacement of between 150 million and 1 billion people as global warming unfolds (IPCC, 2007).

Emission from automobile is growing at an alarming rate due to per capital vehicle ownership, thus resulting to high congestion and increase in the concentration of automobile emissions, thereby increasing health risk on human population. Petrol and diesel fuel possess a lot of health hazard. However, petrol and diesel fuel persist as the major source of energy for transportation systems with higher pollutant and GHG emissions particularly CO, NO_2 and SO_2. The environmental problems in terms of health effects of automobile emissions are high. Though, these automobiles also offer significant benefits related to personal freedom, mobility, and consumer affordability. The health effects of automobile emissions can be reduced and one approach to achieving this goal is to substitute alternative fuels for petrol and diesel. Heather, Lester, Rebecca and Satish (2000) however observed that continuing low fuel prices and the recent rapid improvement in performance of petrol and diesel fuelled automobiles make it ever more difficult for the alternative fuels to compete and safe the health of the citizens.

Automobile emission also contributes to the environmental problems of acid rain and global warming". Automobile emission affects climate directly and indirectly through mechanisms that cause both warming and cooling of climate, and the effects operate on very different timescales. Potentially dangerous vehicle emissions include Carbon monoxide, Nitrogen dioxide, Sulphur dioxide, Benzene, Formaldehyde, Polycyclic hydrocarbons, Lead and Tiny suspended particles ('particulate matter'). The most obvious health impact of automobile emissions is on the respiratory system. It is estimated that air pollution - of which vehicle emissions are the major contributor - is responsible for 24,000 premature deaths in the UK every year. Many of these deaths are due to asthma, bronchitis and other respiratory diseases - all of which are known to be aggravated by exposure to car fumes. http://www.bbc.co.uk/health/physical_health/conditions/exhaust_emissions.shtml. It also damaged red blood cell membranes' and interferes with cell metabolism in a way that shortens the survival of each individual cell. This can lead to anaemia - a shortage of blood cells - which can reduce the body's ability to circulate oxygen and vital nutrients. Benzene has a suppressive effect on bone marrow and impairs the development of red blood cells. Exposure to the chemical may result in a diminished number of blood cells - cytopenia - or total bone marrow loss. Carbon monoxide (CO) poisoning is similar to suffocation. CO binds to the haemoglobin contained in red blood cells 200 times more effectively than oxygen, and so can dramatically reduce the ability of the cells to transport and release oxygen to the tissues of the body. Table 1. indicates the health effects of automobile emission

Table 1: Potential harmful effects of the main automobile exhaust emission

Emission	Health effects	Environmental Effects
Carbon monoxide (CO)	Lethal at high doses. At low doses can impair concentration and neurobehavioral function. Increases the likelihood of exercise-related heart pain in people with coronary heart disease	Greenhouse gas contributing to global warming
Nitrogen oxides (NOx)	May exacerbate asthma and possibly increase susceptibility to infections	Acid rain Ground level ozone
Hydrocarbons (HC)	Low molecular weight compounds cause eye irritation, coughing and drowsiness High molecular weight compounds can be mutagenic or carcinogenic	Ground level ozone precursor
Benzene (C6H6)	Classified as a human carcinogen (Group 1) by the International Agency for Research on Cancer	
Ground-level ozone (O3)	Irritates the eyes and air passages. Increases the sensitivity of the airways to allergic triggers in people with asthma. May increase susceptibility to	Oxidants to plants, impairs growth and maturation

	infection	
Lead (Pb)	Impairs the normal intellectual development and learning ability of children	Ground water pollution and particulates in air

Source: http://www.efoa.org/air-quality.htm

Purpose of the Study

The purpose of this study is to examine the health effects of automobile emissions on drivers and commuters in Niger State, Nigeria. Specifically the study assessed:

1. The contribution of automobile emission to environmental problems,
2. Health effects of automobile emissions and
3. Government measures necessary to reduce the effects of automobile emissions in Niger State, Nigeria.

Research Questions

This study answered the following research questions

1. What are the contributions of automobile emissions to the environmental problems in Niger state?
2. What are the health effects of automobile emissions noticeable among Drivers and Commuters in Niger state?
3. What are the necessary government measures needed to reduce the health effects of automobile emission in Niger State?

Hypothesis

The following null hypothesis was tested at 0.05 level of significance:

Ho_1 There is no significant difference between the health effects of automobile emission noticeable among drivers and commuters in Niger State, Nigeria.

Methodology

The study is a descriptive survey research. The sample was made up of one thousand and sixty two motor vehicle drivers and motor cycle riders (Drivers), traffic police officers and commuters (commuters) randomly selected from each of the study areas. Eight hundred and seventy six copies of questionnaire were returned representing 82.5%. Table 2 shows the distribution and return rate of the questionnaire.

Table 2: Sample distribution of respondents

Study Area	Total	Drivers	Commuters	Number Returned
Bida	175	72 (56)	103 (88)	144
Kontagora	132	46 (30)	86 (76)	106
Minna	247	101 (89)	146 (134)	223
Mokwa	196	78 (50)	98 (71)	121
New-Bussa	125	50 (42)	95 (66)	108
Suleja	187	77 (69)	110 (105)	174
TOTAL	1062	424 (336)	638 (540)	876 (82.5%)

NOTE: Values in brackets represent the number and percentage of return.

The research instrument was a structured questionnaire. The questionnaire was divided into three sections (A-C) with fifty three items in all. Section A was used to elicit information on the contributions of automobile emissions to the environment with eighteen items, section B focused on the health effects of automobile emissions with fifteen items while section C focused on the

necessary government measures to reduce the health effects of automobile emissions with twenty items. The coefficient of correlation "r" = 0.78 was obtained to establish the internal consistency of the questionnaire items. The data collected was analysed using mean and t-test at .05 level of significance.

Results

Research Question 1

What are the contributions of automobile emissions to the environmental problems in Niger state?

Table 3: Mean responses of drivers and commuters on contributions of automobile emissions to the environment problems in Niger State

$N_1 = 336$ $N_2 = 540$

S/N	Items	$\bar{x}_1$	$\bar{x}_2$	X_t	Decision
1	Automobile emission is the major contributor to environmental problems in Niger state	2.91	3.17	3.04	Agree
2	Automobile emission is affecting the environment negatively	2.7	3.23	2.97	Agree
3	Automobile emission have effects on the health of the citizenry	2.98	2.73	2.86	Agree
4	Emission from automobile is higher in Niger State than the Federal Environmental Protection Agency standard	3.24	2.71	2.98	Agree
5	The old vehicle/motor cycle contribute more emission than the new ones	2.53	2.7	2.62	Agree
6	The quality of fuel constitute to the rate of emission problems in Niger state	2.91	2.95	2.93	Agree
7	The size of the vehicle engine affects the rate of emission problems in Niger state	2.69	2.38	2.54	Agree
8	Second hand vehicles contribute more emission than new vehicle	2.43	2.29	2.36	Disagree
9	Bad road makes you to consume more fuel on the road and contribute to the rate of emission problems in Niger state	2.65	2.58	2.62	Agree
10	The rate of speed of motor vehicle/motor cycle contributes to the rate of emission problems	2.79	2.72	2.76	Agree
11	The condition of fuel injection affect the rate of emission from motor vehicles and there by constitute to the environmental problems in Niger state	2.77	2.68	2.73	Agree
12	Automobile emissions do not have any effects on environment	2.51	1.89	2.20	Disagree
13	Greenhouse gases including CO, NO_2 and SO_2 from the burning of fossil fuels like automobile emission have great effects on the environment	3.15	3.06	3.11	Agree
14	The Earth's temperature has warmed significantly over the last 100 years and is affecting the health of the citizens	2.55	2.95	2.75	Agree
15	The Ozone depletion is directly caused by the increase in CO, NO_2 and SO_2 from automobile emission	3.02	2.55	2.79	Agree
16	An increase in the emission from automobile will continue to create serious environmental problems	2.92	2.72	2.82	Agree
17	The heat from automobile exhaust also contributes to environmental problems	2.91	3.13	3.02	Agree
18	Automobile emission is one of the most pressing environmental issues in Niger State	2.94	2.71	2.83	Agree

Key: $\bar{x}_1$ = Mean of drivers $\bar{x}_2$ = Mean of commuters
X_T = Mean of total respondents, N_1 = Numbers of drivers,
N_2 = Numbers of commuters

Table 3 indicates that the respondents only disagree with items 8 and 12 but agree with the other 16 items because their mean responses is 2.5 or above. The grand mean shows the overall responses of the groups to each of the items. The result revealed that automobile emission is a major contributor to environmental problems in Niger State.

Research Question 2
What are the health effects of automobile emissions noticeable among drivers and commuters in Niger state?

Table 4: Mean responses of drivers and commuters on the health effects of automobile emission in Niger State

N_1 = 336 N_2 = 540

S/N	Items	$\bar{x}_1$	$\bar{x}_2$	X_t	Decision
1	Eye irritation occurs when you are exposed to automobile emission	2.85	3.09	2.97	Agree
2	Chest pain occurs when you are exposed to automobile emission	2.95	2.83	2.89	Agree
3	You feel nasal problem with exposure to automobile emission	2.95	2.84	2.90	Agree
4	You feel throat problem with exposure to automobile emission	2.73	3.13	2.93	Agree
5	You feel headache with exposure to automobile emission	3.32	2.59	2.96	Agree
6	You feel running nose/sneezing with exposure to automobile emission	2.56	2.51	2.54	Agree
7	You feel asthma attack problem with exposure to automobile emission	1.99	2.27	2.13	Disagree
8	You feel body itching problem with exposure to automobile emission	2.74	1.9	2.32	Agree
9	Exposure to automobile emission increase your health problems	3.16	3.07	3.12	Agree
10	Whooping cough occurs with exposure to automobile emission	2.95	2.62	2.79	Agree
11	The high rate of skin cancer in the Niger State is primarily due to the effects of automobile emission	2.51	2.73	2.62	Agree
12	Automobile emission will cause high rate of drowsiness	2.46	2.6	2.53	Agree
13	An increase in the automobile emissions will cause more skin cancer	2.6	3.05	2.83	Agree
14	Exposure to automobile emissions causes a lot of health problem to people	2.57	2.88	2.73	Agree
15	Automobile emissions affects lost of memory, fatigue and slow reflexes	2.56	3.06	2.81	Agree

Key: $\bar{x}_1$ = Mean of drivers, $\bar{x}_2$ = Mean of commuters, X_T = Mean of total respondents, N_1 = Numbers of drivers, N_2 = Numbers of commuters.

Table 4 indicates that the respondents rejected items 7 but agree with items 1 – 6 and items 8 – 15 because their mean responses is 2.5 or above while items 7 was less than 2.5. The grand mean shows the overall responses of the groups to each of the items. The result indicated that the health effects of automobile emission are manifested among the respondents in Niger State.

Research Question 3

What are the necessary government measures needed to reduce the health effects of automobile emissions in Niger State?

Table 5: Mean Responses of Drivers and Commuters on the Necessary Government Measures Needed to Reduce the Health Effects of Automobile Emission in Niger State

$N_1 = 336$ $N_2 = 540$

S/N	Items	$\bar{x}_1$	$\bar{x}_2$	X_t	Decision
1	Government should repair the bad road	3.11	2.76	2.94	Agree
2	Government should increase the number of public vehicles with less emission problems	2.77	2.26	2.52	Agree
3	Government should educate people on the effects of automobile emission	2.79	3.14	2.97	Agree
4	Government should enact laws that will check the effects of automobile emission	2.80	2.70	2.75	Agree
5	Government should establish strict emission control laws and regulations	2.81	2.51	2.66	Agree
6	Government should establish an energy management unit to address the effects of automobile emission	2.69	2.71	2.70	Agree
7	Government needs to establish energy consumption and effects of automobile emission baseline inventory	2.74	2.56	2.65	Agree
8	Government should include automobile emission adaptation and mitigation in programs and planning	2.79	2.53	2.66	Agree
9	Government should develop and distribute critical information on automobile emission	2.97	2.54	2.76	Agree
10	Government policies and actions should help populations most at risk	2.61	2.77	2.69	Agree
11	Government should empower public health officials to prepare for effects of automobile emission	3.21	2.99	3.10	Agree
12	Government should strengthen protection of Niger state natural systems	2.55	2.63	2.59	Agree
13	Non Governmental Organisations should be empowered for proper sensitisation on the effects of automobile emission	2.49	2.79	2.64	Agree
14	Every automobile vehicles must pass maintenance and engine efficiency test before moving on the road	2.77	2.68	2.73	Agree
15	Automobile emission and its effects should be included in our school curricula	2.60	2.48	2.54	Agree
16	Government should establish a comprehensive energy efficiency and renewable energy education program	2.24	2.80	2.52	Agree
17	Only hybrid vehicles should be allowed on our road	2.37	2.21	2.29	Disagree
18	There should be ban on old vehicles on our road	2.53	2.00	2.27	Disagree
19	There should be a proper control on the quality of petrol/diesel we use in our vehicles	2.93	2.69	2.81	Agree
20	Government enforces the fixing of catalytic converter in all motor vehicles	2.25	2.57	2.41	Disagree

Key: $\bar{x}_1$ = Mean of drivers, $\bar{x}_2$ = Mean of commuters, X_T = mean of total respondents, N_1 = Numbers of drivers, N_2 = Numbers of commuters

Table 5 indicates that the respondents disagree with items 17, 18 and 20 but agree with the other 17 items because their mean responses is 2.5 or above. The grand mean shows the overall responses of the groups to each of the items. The result presented in Table 5 shows that government need to take a proactive decision to check the menace of automobile emission in Niger State.

Hypothesis

There is no significant difference between the health effects of automobile emission noticeable among drivers and commuters in Niger State, Nigeria.

Table 6: t-test Analysis of the Noticeable Health Effects of Automobile Emissions among Drivers and Commuters in Niger State, Nigeria

SN	Items	$\bar{x}_1$	STD_1	$\bar{x}_2$	STD_2	t-cal	t-table	Remark
1	Eye irritation occurs when you are exposed to automobile emission	2.85	0.695	3.09	0.581	-5.33	1.97	NS
2	Chest pain occurs when you are exposed to automobile emission	2.95	0.642	2.83	1.155	1.97		NS
3	You feel nasal problem with exposure to automobile emission	2.95	0.731	2.84	0.736	2.16		S
4	You feel throat problem with exposure to automobile emission	2.73	0.962	3.13	0.672	-6.67		NS
5	You feel headache with exposure to automobile emission	3.32	0.58	2.59	0.804	15.53		S
6	You feel running nose/sneezing with exposure to automobile emission	2.56	0.916	2.51	0.902	0.79		NS
7	You feel asthma attack problem with exposure to automobile emission	1.99	0.913	2.27	0.676	-4.91		NS
8	You feel body itching problem with exposure to automobile emission	2.74	0.863	1.9	0.441	16.47		S
9	Exposure to automobile emission increase your health problems	3.16	0.62	3.07	0.609	2.14		S
10	Whooping coughing occurs with exposure to automobile emission	2.95	0.932	2.62	0.772	5.41		S
11	The high rate of skin cancer in the Niger State is primarily due to the effects of automobile emission	2.51	0.795	2.73	0.729	-4.07		NS
12	Automobile emission will cause high rate of drowsiness	2.46	0.958	2.6	0.75	-2.26		NS
13	An increase in the automobile emission will cause more skin cancer	2.6	0.754	3.05	0.832	-8.18		NS
14	Exposure to automobile emission causes a lot of health problem to people	2.57	0.981	2.88	0.82	-4.84		NS
15	Automobile emission affects lost of memory, fatigue and slow reflexes	2.56	0.834	3.06	0.577	-9.62		NS

KEY $\bar{x}_1$ = mean for drivers, $\bar{x}_2$ = mean for commuters, S = Not Significant, N = Significant STD_1 = standard deviation for drivers. STD_2 = standard deviation for commuters.

This study revealed that there is no significance difference between the noticeable health effects of automobile emissions among the drivers and commuters in Niger State, since the t calculated value of items 1,2,4,6,7 and 11-15 is less than the t table value of 1.97.

Discussion

From the findings of this study, it could be concluded that automobile emission stand as the major contributor to environmental problems in Niger State and the general health effects of automobile emission on drivers and commuters are. The significance of health effects of automobile emissions

have been addressed in extensive studies with both humans and various animal species. Under varied experimental protocols, considerable information has been obtained on the toxicity of automobile emissions, its direct effects on the blood and other tissues, and the manifestations of these effects in the form of changes in organ function. WHO (1986) reported that many of the animal studies, however, have been conducted at extremely high levels of automobile emission (i.e., levels not found in ambient air).

Pollution resulting from CO, NO_2 and SO_2 from automobile emission may place an undue burden on the respiratory system and contribute to increased morbidity and mortality, especially among susceptible individual in the general population. In Benin, there is data that exposure to traffic pollutants, specifically polycyclic aromatic hydrocarbons, has led to comparatively higher levels of DNA damage in urban residents (Autrup 2006). The high concentrations of both SO_2 and CO have obvious health implications, Schwela (2000) reported that SO_2 exposure is associated with reduced lung function, difficulty breathing, eye irritation, and other adverse effects, while CO has neurobehavioral and cardiovascular effects, such as headache, dizziness, and heart palpitations. This is an indication that there is a serious need for the reduction of automobile emissions in order to guarantee the good health of the citizens. Efforts by government in this direction will greatly help in reducing typical automobile emissions. Reducing emissions was agreed to reducing the demands for oil, improvement on ambient air quality and a comprehensive state/national framework for automobile emissions control, fuel quality, and fuel economy based on harmonised standards.

Conclusion

From this study, it could be concluded that that high concentration of Automobile Emission leads to a wide range of health problems. NO_2 consist of nitric oxide and nitrogen dioxide formed by the reaction of oxygen and nitrogen within an engine's combustion chamber. While at a low level it affects the ozone which is directly harmful to human health by causing respiratory problems and reducing lung function. It does appear that residence of Niger state have a high risk of health problems related to automobile emissions.

Recommendations

From the above findings, the following recommendations are made:

1. There should be proper education and mass awareness programs on the health effects of automobile emissions in Niger State.
2. The Niger State government should be determined to protect the environment and human health and should be able to put in place effective policies and programmes to reduce the health effects of automobile emissions.
3. The government should create an effective control of automobile emissions quality management programmes.

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