TRANSPORTATION AND ITS HEALTH IMPLICATIONS IN NIGERIA

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Abstract

Purpose: This study examines the effects of atmospheric pollution emanating from transport infrastructure on human health in Ibadan metropolis, Nigeria.

Design/methodology/approach: Primary and secondary data were used for this research. The primary source involved the use of structured questionnaires to elicit information on the effects of transport pollutants in the study area. On average, fifty households, each in the three residential areas in Ibadan metropolis, were interviewed. In all, a total of one hundred and fifty household heads were interviewed. Secondary data were obtained from government periodicals, unpublished theses and journals. Descriptive and inferential statistics were used to analyze the data

Findings: The findings revealed that the transport sector has contributed significantly to the emissions of toxic substances into the atmosphere. High demand for used automobiles has increased the emission of toxic substance into the atmosphere, which is inimical to human health in the study area. Approximately 45.9% of the respondents claimed that they have transport-related diseases such as asthma, eye problems and upper respiratory tract infections in the city. The study concluded that there is a need to reduce trips through integration of land uses and transportation planning, and more importantly, there is a need to shift to more energy-efficient modes.

Originality/value: Despite the strict regulations imposed on the importation of used vehicles into the country, the secondary data obtained from the Oyo State Licensing Office showed that the importation of automobile vehicles into Nigeria (which do not meet the emission standards of advanced countries) has increased tremendously over the years. Similarly, reliable data from the statistical records of Oyo State Environmental Protection Agency revealed that the rate of emission of toxic substances has increased over the past decade because of the discharge of pollutants from transport infrastructure.

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INTRODUCTION

Personal mobility is a significant aspect of any space economy. In addition to being an expression of an individual's free will, mobility takes place with the view to overcoming friction of distance and movement to different activity centres located in urban centres. For instance, trips to work, schools, markets, recreational centres and banks are undertaken in order to procure such services located in urban spaces (Adetunji, 2010). The segregation between residential areas and different land uses owing to the high rate of urbanization in towns and cities in African countries, and Nigeria in particular, has led to high travel demands, which rely mostly on automobiles with complex traffic on urban routes (Newman and Kenworthy, 1999). The resultant effects are traffic congestion, emission of toxic substances and frequent accidents on highways. Studies have shown that transport is a major contribution to the emission of greenhouse effects and perhaps carbon dioxide (CO_2) is growing faster in the transportation sector than in any other sector; and its effects on the health of people, community values and environmental ecology are very severe (BDTCC, 2009; Lloyd and Lewis, 2005).

The Bellagio Declaration on Transportation and Climate Change on 16 May, 2009 revealed that in 2006, transport accounted for 13% of global greenhouse gas emission (GHG) while 23% of global CO_2 emissions from fuel combustion are transport-related. The report further revealed that between 1970 and 2006, global GHG emission from the transport sector increased by 130% globally. Studies have shown that the developed countries are largely responsible for the largest share of GHG emission from the transport sector, and emissions from third world countries are growing rapidly (BDTCC, 2009: Lloyd and Lewis, 2005; Ogunsanya, 2004). Transport-related particles, particularly carbon monoxide (CO) emissions are expected to increase by 57% worldwide in the period 2005–2030; and transport in the less developed countries will contribute more than 50% of this increase from both passenger and freight transport (BDTCC, 2009). In a related study, BDTCC, (2009)

observed that some of the current GHG emissions in the transport sector and virtually all the expected growth in emissions come from private cars, light duty vehicles, cabs and trucks. The study affirmed that zone concentration in the atmosphere is largely caused by the transport sector.

Theoretical framework and literature review

Studies have shown that approximately half of the world's population now lives in urban areas compared with only 15% in 1900. Similarly, more than 70% of the world's megacities will be found in developing countries (Wall *et al.*, 2005; World Bank, 2002). The increase in urbanization has led to high travel demands as people keep in touch with each other and require prompt accessibility to places in the urban environment, resulting in serious traffic congestion, GHG emissions and other environmental hazards. In Nigeria, urban traffic congestion is characterized by many poorly maintained and sometimes unserviceable imported vehicles. The effect of the emission of toxic substances (CO and hydrocarbons) from the transport sector has prompted the proponent urbanism to advocate for integration of transportation planning into land use. The New Urbanism (TNU) movement proposed a reintegration of residential, recreational, employment-generating organization and commercials. This model holds that when different land uses are located very close to the residential land unit, the commuting distance to different activity centres will be shorter.

The poor economic status of many Nigerians and societal attitudes towards the importation of used vehicles in Nigeria have been largely responsible for the emission of toxic substances such as carbon monoxide, hydrocarbons, lead (Pb) and sulphur dioxide (SO_2), which are very harmful to human health. As cited in Ogunmodede (2004), transport is responsible for most of the Pb concentrations which appear in the bloodstream of urban dwellers. Undoubtedly, transport-related air pollution has been found to be more severe over congested urban streets where pollutants may produce conditions that are harmful to human health (Hoyle and Knowles, 1998).

Much research on the external effects of transportation reveals that the importation of automobiles to the country creates more havoc to human life in terms of congestion, accidents and emission of toxic substances (CO, Pb and SO_2) which are detrimental to human health

(BDTCC, 2009; Campbell-Lendrum and Corvalan, 2007; Ogunsanya, 2004). Studies have shown that approximately one third of a vehicle's lifetime emission stems from the manufacturing process of vehicles, which has an adverse effect on the environment (Houdashelt, 2006; BDTCC, 2009). In the light of this observation, it is highly imperative to examine the consequences of the high travel demands of urban residents in automobiles in Ibadan metropolis with a view to improving their mobility patterns.

The study area

Ibadan is a typical city in Nigeria which has experienced a high rate of urbanization over the past four decades. The study area comprises eleven contiguous Local Government areas. Like many urban centres in Nigeria, Ibadan grew organically without any form of master planning (Ipingbemi, 2009). The high density areas are mainly occupied by the indigenous Ibadan people. These areas include Mapo, Atipe, Labiran, Bere and Oja Oba. Many of the intra-city roads in this area are too narrow to accommodate vehicular traffic, which invariably makes mobility temporarily difficult during the rainy season. The situation in low-density areas of the city is different from that of the urban region because the former are well-planned and occupied mostly by high-income earners and top civil servants. Some of the roads in the low-density areas of the city are tarred with bitumen and motor-worthy during most parts of the year.

The land use arrangement in Ibadan metropolis is greatly affected by movement patterns of urban residents in the city. For instance, many of the employment-generating organizations generate more trips than areas of the city that are mainly for residential purposes. The daily commuting to different activity centres in mixed land use areas generates more complex traffic hazards, such as noise pollution and emissions of toxic substances to the urban environment, which is inimical to human health. It is interesting to note that the transport infrastructure in Ibadan metropolis is poorly developed. Many of the intra-city routes are poorly designed and maintained, thus compounding the mobility crises in the city. Some of the inhabitants are low-income earners who cannot afford to buy new automobiles to enhance their daily commuting. The resultant effects are that many of the urban residents in the city depend on either public or private

vehicles for their day-to-day transactions, which culminates in the emission of toxic substance into the atmosphere.

METHODOLOGY

Primary and secondary data were used for this research. The primary source involves the use of structured questionnaires to elicit information on the effects of transport pollutants in the study area. The respondents were asked to indicate the distance of their residence/work places to the transport hub, transport network connecting their residential units/work places, mode of transport embarked upon most frequently, types of pollution experienced in their area, nature of health challenges experienced as a result of transport emissions and many other questions. On average, fifty households, each in the three residential areas in Ibadan metropolis, were interviewed. These areas are of high, medium and low residential density. A stratified sampling technique was used to select two local government areas from each of the residential areas identified in the city. In each density area identified, an average of fifty buildings was randomly selected and only one head of household in each of the building was interviewed. A total of one hundred and fifty households were interviewed. Secondary data were obtained from government periodicals, unpublished theses, journals, etc. Descriptive and inferential statistics such as Pearson's product moment correlation analysis were used to analyse the strength of the relationship between the massive importation of automobiles in Ibadan and emissions of toxic substances into the atmosphere. Similarly, a regression analysis was used to examine the relationship between the geographical location of respondents' places of work to the transport hub, and household's challenges to the transport-related diseases within the last year.

RESULTS OF THE ANALYSIS

The findings revealed that 3,242 vehicles were registered in Oyo State in the year 2000 and due to high travel demand for automobiles, this figure increase tremendously to 6,277 in 2003. However, the number of registered vehicles in the state was reduced to 3,869 in the year 2004 because of the stringent policy limiting the age of used vehicles imported into the country. The acute shortage of public transport services in the country with respect to the high rate of population growth and the transport agony of the citizens in Nigeria forced the then government to lessen the limit to the age of used vehicles that could be imported into

the country in order to increase the accessibility characteristics of the people in both rural and urban areas of the country to different locations. To this effect, Table 1 reveals that the number of registered vehicles has increased from 6,753 in 2005 to 38,651 in 2010.

An evaluation of utilization of transport services available in Table 2 in the city reveals that 22.1% of people commute on foot to different activity patterns, 25.6% rely mostly on both motorcycles and tricycles for their day-to-day transactions while 52.3% of the urban population depend on automobiles, which are poorly maintained because of the high price of the spare parts of vehicles imported into the country since the introduction of the Structural Adjustment Programme (SAP) in 1986.

Year	Cars	Buses	Lorry	Pick-up	Truck	Motorcycle	Total
2000	1,613	486	21	57	81	984	3242
2001	2,663	502	94	62	89	2460	5870
2002	2,416	773	88	94	96	2420	5887
2003	2,863	669	105	68	78	2490	6277
2004	1,112	1,060	132	65	98	1402	3869
2005	1,726	180	53	08	18	4768	6753
2006	1,744	193	62	12	12	6778	8801
2007	1,763	201	76	15	31	9832	11918
2008	3,508	729	73	375	54	14586	19325
2009	5,938	1,829	98	584	92	28156	36747
2010	6,509	1,856	556	934	515	28281	38651

Source: Oyo state licensing office statistical record, 2012

Table 1. Number of registered vehicles between 2000 and 2012 in Oyo state

Modal choice	Percentage of the modal share (%)
Trekking	22.1%
Bicycle/tricycle	4.7%
Motorcycle	20.9%
Personal car	24.4%
Public transport (bus/cab)	27.9%
Total	100.0%

Source: author's computation, 2012

Table 2. Modal choice availability in Ibadan (percentage)

The type of pollution experienced in a geographical area varies over time and space and depends mostly on the transport infrastructure present. In this context, pollution refers to harmful substances released into the atmosphere, which can be in the form of dust and smoke from automobiles. Table 3 indicates that 66.3% of the atmospheric pollution experienced in Ibadan metropolis is dust. This type of pollution is mostly experienced by people who have their residential unit connected to un-tarred roads. The remaining 33.7% of the atmospheric pollution experienced by the inhabitants of the city is the emission from automobile exhaust pipes. The respondents who indicated that they experience pollution caused by exhaust vehicular movement claimed that they live or work very close to the transport hub in the city.

The high demand for used vehicles has increased the emission of toxic substance into the atmosphere in the study area. In the year 2000, the rate of emission of CO_2 and SO_2 into the atmosphere was 113 and 0.15 respectively and these figures increased enormously to 142 and 0.2 respectively by the year 2010. At the aggregate level of all types of pollutants, Table 4 reveals that total emission rates increased from 145.4 in the year 2000 to 180 in 2010. This is an increase of approximately 81%.

It is pertinent to note that the rate of importation of used automobiles is highly positively correlated with the rate of emission of toxic substances. The correlation coefficient is r = 0.89 and it is significant at 0.01%. The coefficient of determination is R2 = 0.79 and this implies that 79% of the city's emission rate was caused by the release of harmful substances into the atmosphere from vehicular exhaust, while the remaining 21% may be attributed to dust, smoke from industrial plants, cooking and generators. The result of this analysis is tangential to the finding of Adegbite (2011), who examined the effect of atmospheric pollution on the inhabitants of Oluyole Industrial Estate in Ibadan and revealed that

Table 3. Pollution types and nature of road network connecting respondent work place/residence in Ibadan (percentage)

Road surface	Dust	Exhaust from vehicular movement	Total (%)
Earth surface roads	77.8%	22.2%	100.0%
Tarred roads	44.8%	55.2%	100.0%
Total	66.3%	33.7%	100.0%

Source: author's computation, 2012

Years	$C0_2$	$S0_2$	NO_2	PM	CO	Total
1990	90	0.05	0.02	0.08	10	110.2
1991	90	0.05	0.02	0.1	17	112.2
1992	95	0.05	0.03	0.15	20	115.3
1993	100	0.09	0.03	0.15	20	120.3
1994	101	0.09	0.03	0.17	22	123.3
1995	102	0.09	0.03	0.17	23	125
1996	104	0.09	0.04	0.17	24	128.3
1997	105	0.09	0.04	0.17	25	130.3
1998	108	0.1	0.05	0.19	27	135.3
1999	110	0.1	0.05	0.19	30	140.3
2000	113	0.15	0.06	0.19	30	145.4
2001	113	0.15	0.06	0.19	30	145.4
2002	116	0.16	0.07	0.19	32	148.4
2003	116	0.16	0.07	0.19	32	148.4
2004	120	0.16	0.07	0.19	33	153.5
2005	123	0.17	0.08	0.22	33	156
2006	125	0.17	0.08	0.25	35	160
2007	132	0.17	0.09	0.27	36	168
2008	135	0.19	0.1	0.27	37	172
2009	139	0.2	0.1	0.29	87	176
2010	142	0.2	0.1	0.29	38	180

Source: Oyo State Environmental Protection Agency, Ibadan, 2010

Table 4. Annual emissions in Ibadan from 1990- 2010

many of the residents have been affected by eye irritations, blurred vision and respiratory ailments such as bronchitis, allergic disorders, asthma, lung cancer and many other related diseases (see Table 5 below).

Similarly, the emission of toxic substances into the atmosphere has led to the increase in temperature of the study area over the years. Table 6 reveals that there is a linear and positive relationship between the rate of ejection of toxic substance into the atmosphere and climatic variability (temperature changes) in the city. The correlation coefficient is r- 0.97 and significant at 0.01.The erratic temperature changes have led to the depletion of the ozone layer, with chronic health implications for the inhabitants.

The high rate of smoke emissions from automobiles in the city has adverse effects on the health of the inhabitants of Ibadan and many other similar cities in Nigeria. Table 7 reveals that 45.9% of the respondents claimed that they have transport-related diseases while the remaining 54.1% of the respondents indicated that they are less affected by transport-related diseases in the city. It is pertinent to note that 50% of the respondents who claimed that they have transport-related health challenges have eye problems; approximately 16.7% has asthma and the same percentage has skin-burn diseases. In addition, 8.3% and 5.6% of the patients claimed that they have upper respiratory tract infections and hypertension respectively. Only 2.8% of respondents indicated that they have hearing impairment resulting from unpleasant sounds emanating from indiscriminate use of horns by motorists and record players.

Table 5.
Relationship between the number of registered vehicles and emission rate in Ibadan metropolis between the years 2000 and 2010

	Emission Rate	Registered Vehicles
Emission rate Pearson correlation	1	.893(**)
Sig (2-tailed)		.000
N	11	11
Registered vehicle Pearson correlation	.893(**)	1
Sig (2-tailed)	.000	
N	11	11

Correlation is significant at the 0.01 Level (2-tailed)
Source: author's computation, 2012

Table 6.
Relationship between the rate of emission of toxic substances and climatic variability in Ibadan

	Emission rate	Registered vehicles
Temperature Pearson correlation	1	.969(**)
Sig (2-tailed)		.000
N	12	11
Emission Pearson correlation	.. .969(**)	
Sig (2-tailed)	.000	1
N	11	11

Correlation is significant at the 0.01 Level (2-tailed)
Source: author's computation, 2012

Obviously, many of these diseases occur as a result of exhaust from automobiles, combustion activities of industries, and dust particles, as well as smoke from the burning of fossil fuels. The interview with the health officers at the General Hospital in Ibadan revealed that the patients who live close to transport hubs/polluted areas have accumulated severe respiratory ailments over the years. The high rate of temperature changes in the city has aggravated the health challenges faced by these people due to the depletion of the ozone layer, which invariably affects the terrestrial radiation received on the Earth's surface. On several occasions, many of the people living or working very close to transport hubs/heavy traffic complained of severe headaches, fatigue and body irritation.

A critical examination of Table 8 shows that there is a low but positive correlation between the geographical location of work places/residential units of the inhabitants and the related transport health challenges in the city. The correlation coefficient is 0.48 and it is significance at 0.00.

Transport-related disease	Percentage (%)
Hypertension	5.6%
Asthma	16.7%
Upper respiratory tract infection	8.3%
Eye problems	50.0%
Hearing impairment	2.8%
Skin Burn Disease	16.7%
Total	100.0%

Source: author's computation, 2012

Table 7. Respondents with health challenges related to transport diseases in Ibadan

	Emission rate	Registered vehicles
Distance of Pearson residence to correlation the transport hubs		
Sig (2-tailed)	1	.078
N	88	.47985
Health Pearson challenges correlation as	.870	1
result of Sig (2-tailed) transport emission	.479	85
N	.85	

Correlation is significant at the 0.01 Level (2-tailed)
Source: author's computation, 2012

Table 8. Relationship between the geographical locations of respondents to work places to the transport hub and their health challenges

This suggests that the emission of toxic substances into the atmosphere is not restricted to a particular geographical area because of the general circulation of air.

Akin to this observation, Table 9 indicates that approximately 50% of the respondents who either work or live a distance of less than 100metres from the transport hubs claimed that they have health challenges related to transport diseases in the study area. Another 30.8% of those respondents who live or work between 101 and 200metres from the transport hubs indicated that they have had similar health problems within the last six months. A significant proportion (23.1%) of responding households who reside beyond 200metres from the transport hubs claimed that they also have health challenges related to transport diseases in the study area. This is an indication of the distance decay effect on the proportion of people with health challenges in relation to the proximity of their residence to the heavy traffic flow.

The planning implications for the study

An uneven distribution pattern of socio-economic facilities in urban centres in Nigeria generate a considerable volume of movement between residential areas to other different land uses, and this requires automobile transport to meet the travel demand of urban residents in Nigeria. Incidentally, some of the imported vehicles used for these services do not meet the emission standards of the Western world. The emissions from the exhaust pipes of automobiles wreak havoc on the health of the people in the city. There is a need to re-design the master plan of the city to improve the mobility characteristics of the urban residents. There is also a need to review the transport policy in the country and encourage people to commute via a non-automobile mode of transport, as automobiles use petrol, which produces hydrocarbons and SO_2—substances that are harmful to human health.

Table 9. Distance of residence to the transport hub and health challenges experiences in Ibadan metropolis

Distance of residence/ work place to transport hubs	Percentages of people with health challenges related to transport infrastructure (100%)
Less than 100metres	46.2%
Between 101 and 200metres	30.8%
Greater than 200metres	23%

Source: author's computation, 2012

CONCLUSION

THE high demand for automobile trips in developing cities in Nigeria has led to complex traffic congestion, frequent accidents and emissions of harmful substances such as CO, SO_2 and Pb into the atmosphere. This has resulted in widespread transport-related diseases in many urban centres in developing countries of the world such as Nigeria, who depend on the importation of automobiles that do not meet the emission standards of the western world. This type of problem had earlier been experienced in the Asian countries, particularly in China, and they encouraged the use of non-motorized modes of transport for their day-to-day transactions to minimize the congestion in their cities. The Nigerian government should encourage their citizens to adopt the use of less energy efficient modes of transportation for their travel demands as the use of these modes emits less harmful substances into the atmosphere. There should be constant public enlightenment on the risks involved for the people living or working close to the transport hubs. This study concludes that the use of light rail should be introduced for urban mobility in the major urban centres in Nigeria and other similar cities in developing countries of the world.

ENDNOTE

BDTCC (2009), Campbell-Lendrum and Corvalan (2007) affirmed that transport emission has adverse effects on human health, but such research rarely exists in urban centres in Nigeria, where the importation of used vehicles has increased tremendously over the past three decades.

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