Health Impact Assessment of Air Pollution in Some Selected States in Nigeria

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ABSTRACT---- ***This work contains the health impact assessment of air pollution in some selected states in Nigeria; it gives estimates of mortality morbidity and established the major sources of air pollution in Nigeria. Data were collected from General Hospital in some part of the country. The period covered is three years (2012-2014) for each hospital. Analysis of the data collected shows that Lagos and Abuja recorded the highest number of patient that died and survived the attack by air born diseases within the period of 2012-2014 investigation i.e up to 1,338 cases followed by Abuja with 1,218 cases while Port-Harcourt has a least number of 78 patient out of 3,744 cases recorded. The analysis has shown that the number of people that die for pneumonia is higher in Kano which is about 30% of the result. But the numbers that survive the Asthma in the period of study is higher in Port-Harcourt which is 9%. The study reviewed that people mostly affected by these diseases are those located in Lagos, Abuja e.t.c and this is as a result of numerous gases emitted from populated vehicles and poor movement of waste.***

1. INTRODUCTION

The word pollution originated from the Latin word "pollutes" past participle of "polluere" meaning to soil or to defile. (Schwartz, 1994).Pollution is the process of making air, water, soil etc dirty. Environmental pollution is any discharge of material or energy into the natural environment (water, air, land) that causes or may cause acute (short term) or chronic (long term) detriment to the earth's ecological balance or that which lowers the quality of life.

The industrialization of society, the introduction of motorized vehicles and the explosion of human population however have caused an exponential growth in the production of goods and services. Coupled with this growth, it has been a tremendous increase in waste/ by products. The indiscriminate discharge of untreated industrial and domestic wastes into water, the spewing of thousands of tons of particulate and airborne gases into the atmosphere, the "throwaway" attitude towards solid waste and the use of newly developed chemicals without considering potential consequences have resulted in major environmental disaster.

Besides, pollution being in form of the material pollutant such as particulate matter, gasses, chemicals in water, solid waste etc. It can also exist in a non-material form. Example of non-material forms of pollution are noise, excess light and heat. (Schwartz, 1994)

Air pollution occurs at the earth's atmosphere and the branch of physics that studies the atmosphere is atmospheric physics. The atmospheric physicist attempts to model the earth's atmosphere using fluid flow equation, chemical models and air models.

Atmospheric physics has close links to meteorology and climatology and also covers the design and construction of instruments for studying the atmosphere and interpretation of the data they provide; which include remote sensing electrostatic precipitor that is used as an air pollution control device.

Atmospheric dispersion models are physics principles which are computer programmes that use mathematical algorithms to stimulate how pollution in the ambient air disperse and in other principles of physics like density diffusion, and molecular weight are supplied to access air pollution by providing explanations on the movement of air pollutants from one point to the other. Most air pollutants travel long distance because they are at higher temperatures and lower density than the ambient air which surrounds them and some others having lower molecular weight.

Sources of air pollution refer to the different locations, activities or factors which are responsible for the releasing of the pollutants into the atmosphere. These sources can be classified into two ways which are: natural and man-made sources.

2. METHODOLOGY

The World Health Organization (WHO) states that 2.4 million people die each year from causes directly attributed to air pollution, with 1.6 million of the deaths attributed to indoor air pollution (Bruce, 2000).

The health effect of air pollution has been subjected to intense study in recent years. The most significant health effects of air pollution have been associated with Particulate Matter (PM) and to a lesser extent with ground level ozone. Particulate Matter (PM) is a mixture of many subclasses of pollution which vary in size and chemical composition. Most studies have examined the health effects based on particle size. The largest health impacts have been associated with particles small enough to penetrate deep into the respiratory track: fine particle ($PM_{2.5}$ smaller that 2.5 microns or 2.5 x 10^{-6} meters in diameters) and PM_{10} (Smaller than 10 microns).

Combustion metallurgical processes, automKadunale exhaust and secondary sulphate and nitrate particles formed by the atmospheric transformation of sulphurdioxoide (SO_2) and oxides of nitrogen (NO_2) are the main sources of these smaller particles. Elevated levels of NO_2 and SO_2 also result in higher hospital admissions and emergency room, but these effects are small compared to those of particular matter (PM). Similarly, the health effects of particles larger than 10 microns, arising primarily from suspended dust like those from cement industries and agricultural produce are also small. The health impacts of air pollution depend on the sensitivity and the exposure level of the susceptible population to the pollutant. The largest health impacts result from exposure to fine particulate pollution (Romieu*et et al. 2002*).

Effects of Air Pollution on humans and environment

Human Health

Air pollution has been consistently linked with substantial tour dens of ill-health in developed and developing countries. The effects of air pollution on humans are fatal and life threatening (Michael *et al., 1998*).

World Health Organization (WHO) statistics show that over 2 million people succumb to the seems to be attributed to air pollution (WHO, 1999). Doctors and other scientists and researchers have uncovered several diseases that seems to be caused by or at least aggravated by air pollution including Asthma, chronic obstructive Pulmonary Diseases, Empty Soma, Cardiopulmonary Diseases, Pneumonia, Premature Mortality, Heart Attack, difficulty in breathing, Wheezing and Laughing, Acute vascular dysfunction, Lung Cancer, Thrombus and so on. The commonest among these diseases found in our hospital statistic include:

Air pollution is one of the causes of asthma, for people who already suffer from asthma attacks, i.e. it can aggravate their condition. Research has reviewed that healthy people can develop asthma after years of living or working in an area with heavy air pollution. This type of asthma is known as “occupational asthma” as it is a result of working in a particularly contaminated area.

Heart Disease

Air pollution has been shown to be a factor in the development of all heart diseases; among the pollutants that cause heart disease are carbon monoxide and nitrogen dioxide (Kumar, 2007).

Air Pollution Control

Pollution control is a term used in environmental management. It means the control of emission and effluent into air, water or soil. Without pollution control, the waste products from consumption, heating, agriculture, mining, manufacturing, transportation and human activities, whether they accumulate or disperse, will degrade the environment (Charles, 2011).

Natural Cleansing of the atmosphere

Human activities produce particles which enter the air but these particles are removed either through the “wet” process involving clouds and rain and the dry process. The settling of particles is as a result of gravitational force in the dry process. These small particles in the atmosphere form a coagulated mass and fall out under gravity.

Similarly, a rain drop may collide with and collect particles as it falls. This wet process is known as wash out. Particles with sizes of over 100 microns may impact and stick to surfaces such as buildings, automKadunales, vegetables and statues etc which may later be washed off by rain. Hygroscopic materials absorb moisture from the air and become liquid droplets. Also, gases may be removed from the atmosphere by precipitation. Some gases react chemically with other gases or particles in the atmosphere to produce new compounds which may be a solid, liquid or a gas. A good example is the reaction of hydrogen, sulphide, (H_2S) with oxygen (O_2) to produce sulphur dioxide (SO_2) and water vapour (H_2O).

$2H_2S(g) + 3O_2\ (g) = 2SO_2(g) + 2H_2O\ (l)$

$SO_2(g) + H_2O\ (l) = H_2SO_3\ (g)$

H_2SO_3 is a sulphurous acid vapour, or a liquid droplet. The above reaction ends up removing a particulate matter-hydrogen sulphide from the atmosphere. The liquid droplet may fall as rain, snow or dew. In major cities like Makurdi, Abuja, Lagos and Calabar, etc where the concentration of lead acid is high as a result of exhaust fumes from vehicles, if the sulphurous acid formed does not condense, it may react with lead to produce lead sulphate and hydrogen.

$$H_2SO_3 + PbO = PbSO_4 + H_2$$

Even in relatively clean areas, the rural areas for instance, with little or no vehicular smokes, the acid combines with oxygen to form weak sulphuric acid.

$$2H_2SO_3 + O_2 = 2H_2SO_4$$

The acid formed (H_2SO_4) maybe absorbed during rainfall and falls as acid rain or solid particles which will melt at relatively low humidity to form liquid droplet.

3. RESULTS

The tables 1-3, the graph and the charts below show the distribution of air-borne diseases in the sampled areas in Nigeria States. The areas where data were collected include; General hospitals; Port-Harcourt, Oyo, Kano, Abuja, Lagos, Anambra, Kaduna and Enugu. The period covered is three years (2013- 2015) for each hospital.

The tables 1,2 and 3 show the total number of people attacked by air pollution diseases in the sampled areas, the total number that survived and the total number that died respectively. This shows only those that had severe attacks and were admitted. Those whose cases were not severe and were treated at the output department (OPD) were not included.

The air pollution diseases common in Nigeria States include Pneumonia, Bronchitis, Asthma, Pulmonary Tuberculosis (PTB), Upper respiratory tract infection (URTI), Tuberculosis.

Table I: Sum total of people admitted in the sampled areas between 2012-2014.

Name of disease	Port-Harcourt	Oyo	Kano	Abuja	Lagos	Anambra	Kaduna	Enugu	Total
PNEUMONIA	46	107	8	89	78	27	0	0	355
BRONCHITIS	13	3	0	2	60	9	5	1	93
ASTHMA	6	16	7	101	79	31	16	3	259
PTB	6	93	51	57	353	63	93	0	716
URTI	7	70	23	599	768	63	282	13	1825
TUBERCULOSIS	0	1	18	370	0	0	45	62	496
Total	78	290	107	1218	1338	193	441	79	3741

Table II: Total number of patients that were admitted and survived (2012-2014)

Name of disease	Port-Harcourt	Oyo	Kano	Abuja	Lagos	Anambra	Kaduna	Enugu	Total
PNEUMONIA	44	107	5	88	78	27	0	0	349
BRONCHITIS	13	3	0	2	60	8	5	1	92
ASTHMA	6	16	7	98	76	29	16	3	251
PTB	6	93	39	57	342	55	93	0	685
URTI	7	70	23	598	766	63	282	13	1822
TUBERCULOSIS	0	1	17	364	0	0	44	62	488
Total	76	290	91	1207	1322	182	440	79	3687

Table III: Total number of patients that were admitted and died (2012- 2014)

Name of disease	Port-Harcourt	Oyo	Kano	Abuja	Lagos	Anambra	Kaduna	Enugu	Total
PNEUMONIA	2	0	3	1	0	0	0	0	6
BRONCHITIS	0	0	0	0	0	1	0	0	1
ASTHMA	0	0	0	3	3	2	0	0	8
PTB	0	0	12	0	11	8	0	0	31
URTI	0	0	0	1	2	0	0	0	3
TUBERCULOSIS	0	0	1	6	0	0	1	0	8
Total	2	0	16	11	16	11	1	0	57

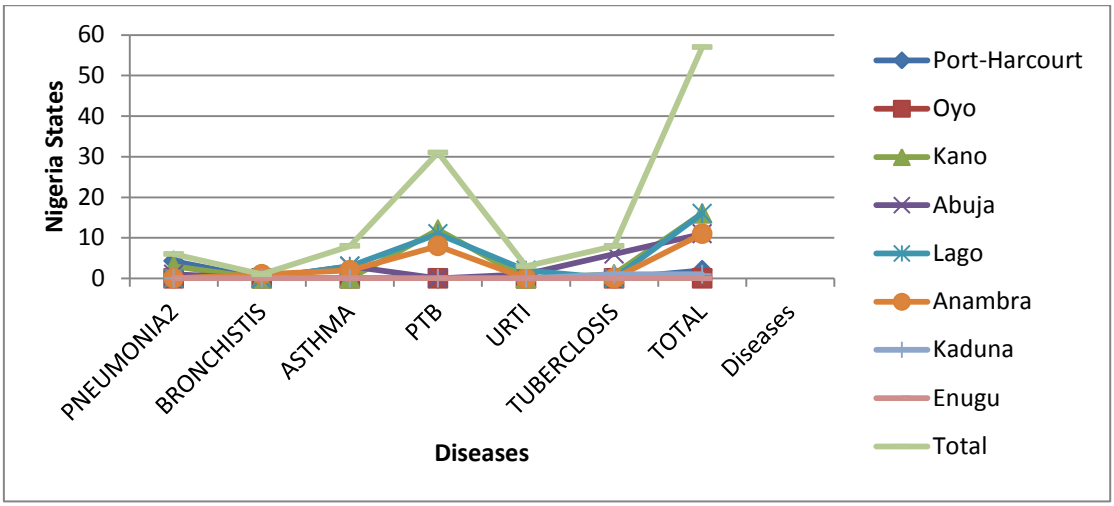


Fig I: The distribution of air-borne disease in the sampled areas

For Pneumonia

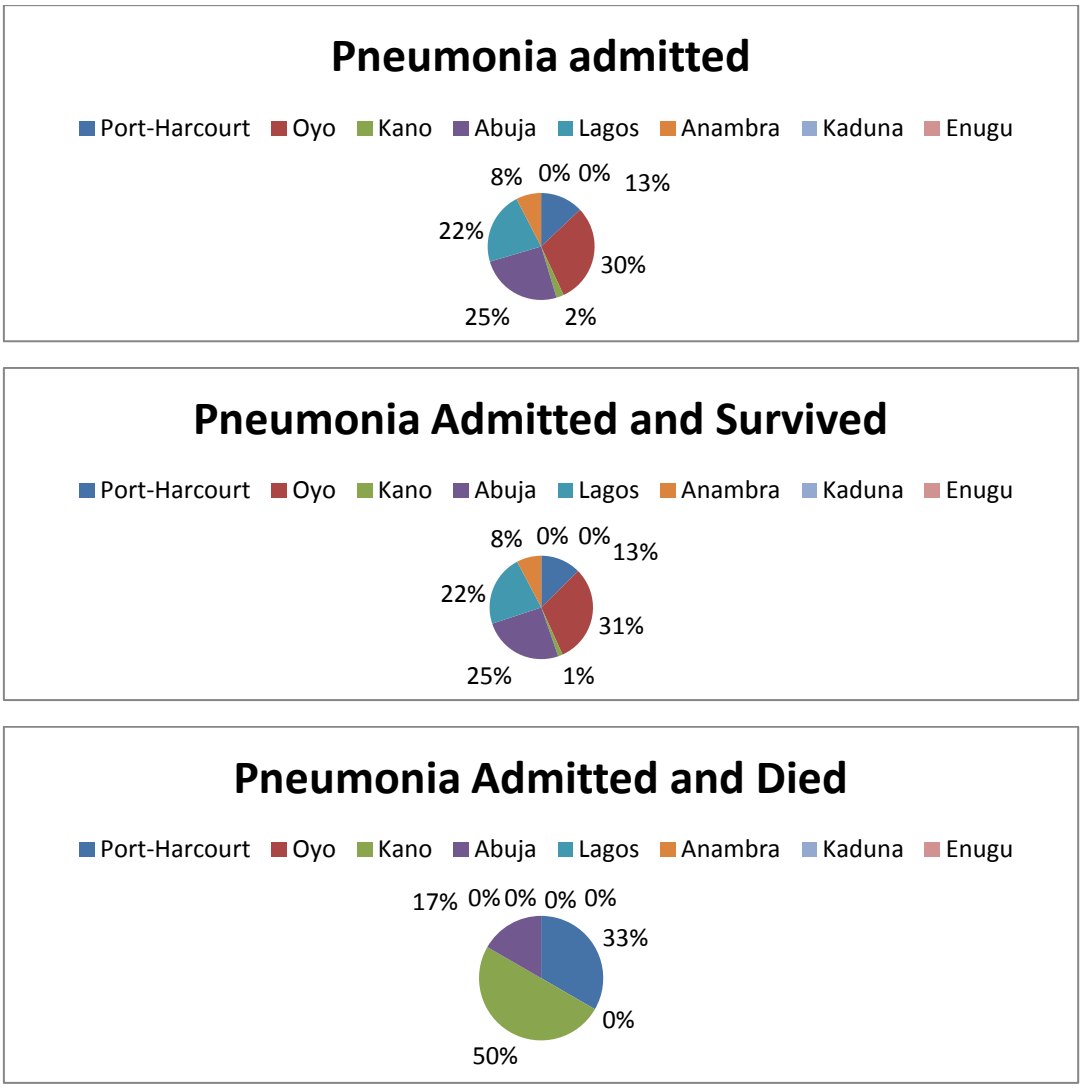


Fig. II: Chart showing the number of patients admitted, admitted and survived, and admitted and died (2010-2012).

For Bronchitis

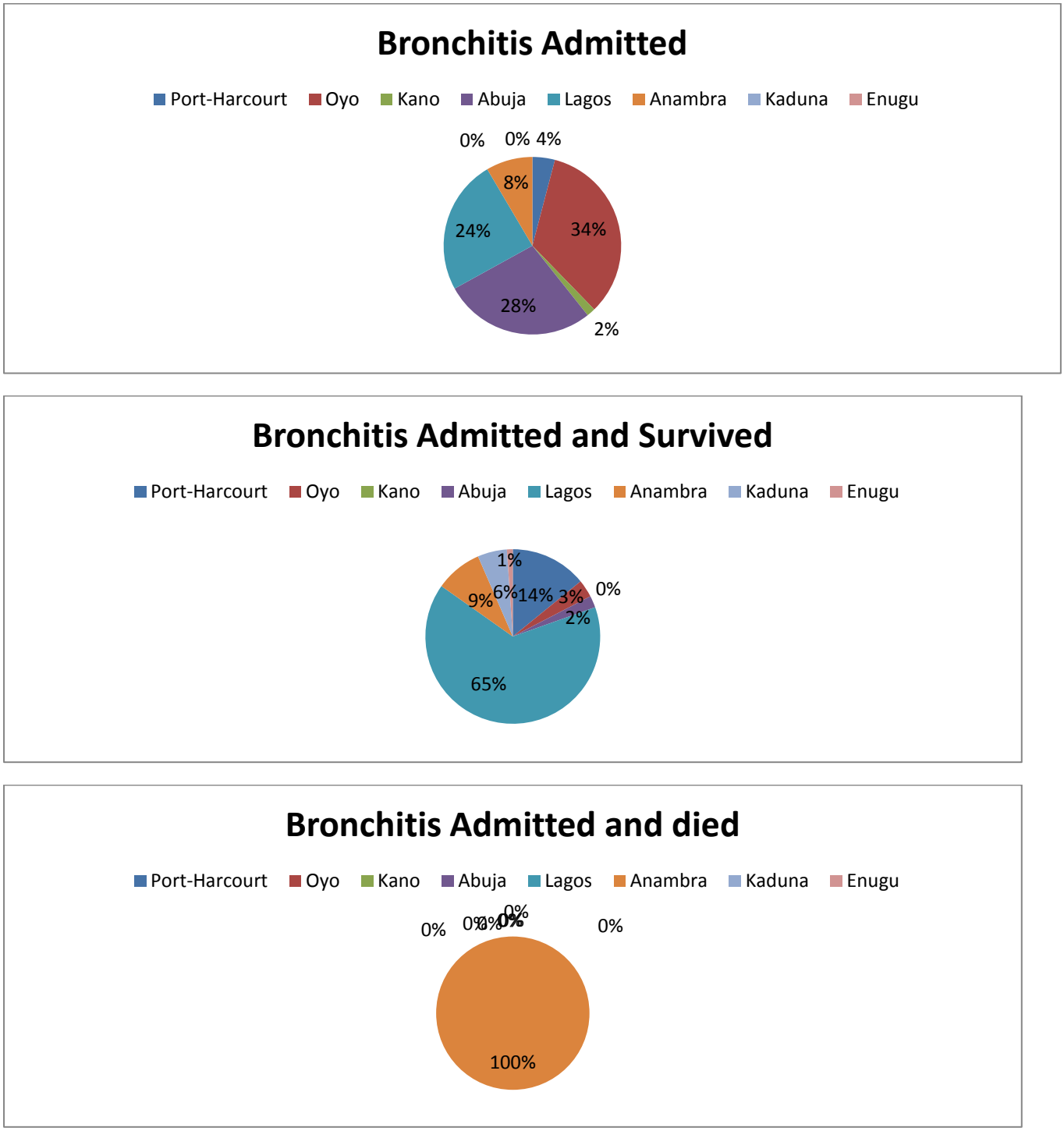
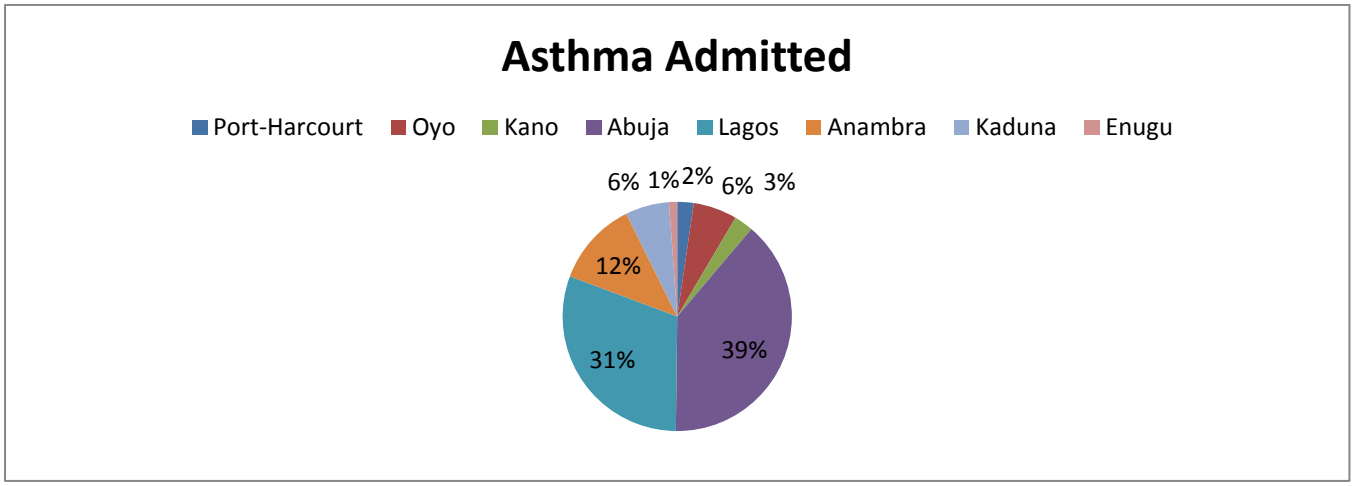
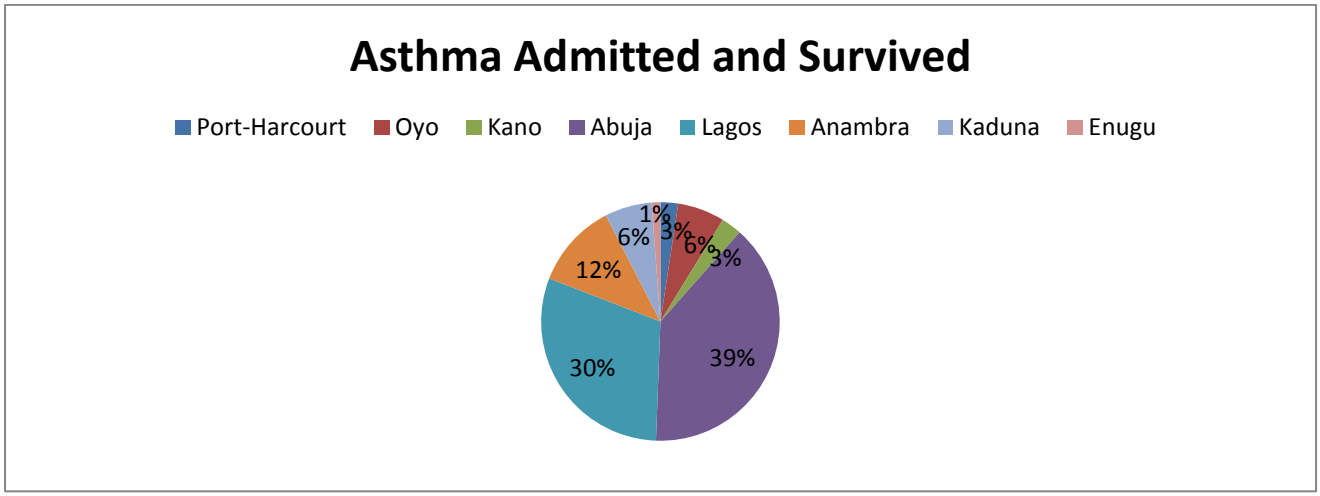


Fig. III: Chart showing the number of patients admitted for Bronchitis, admitted, admitted and survived and admitted and died.

Asthma





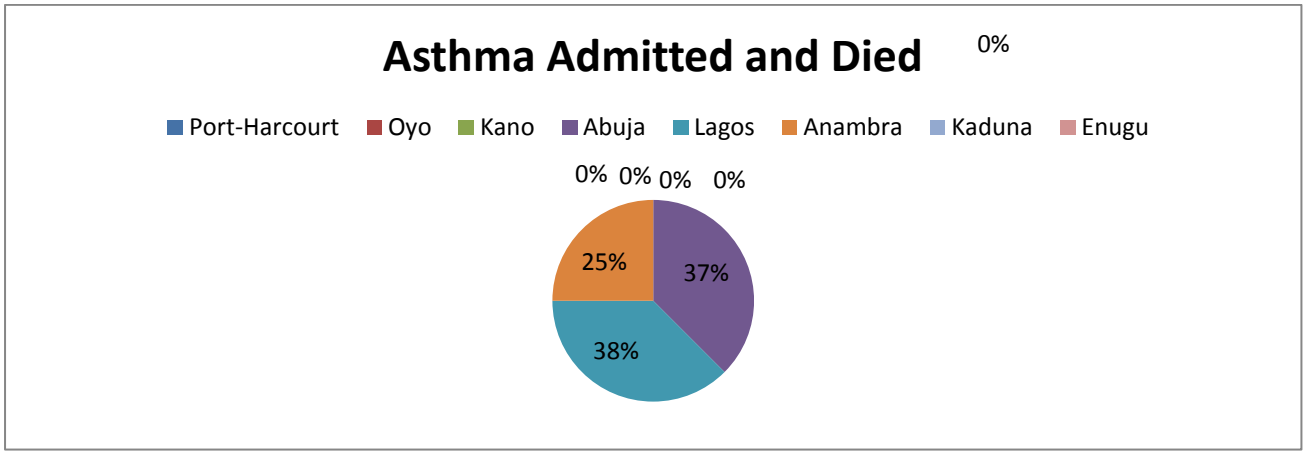
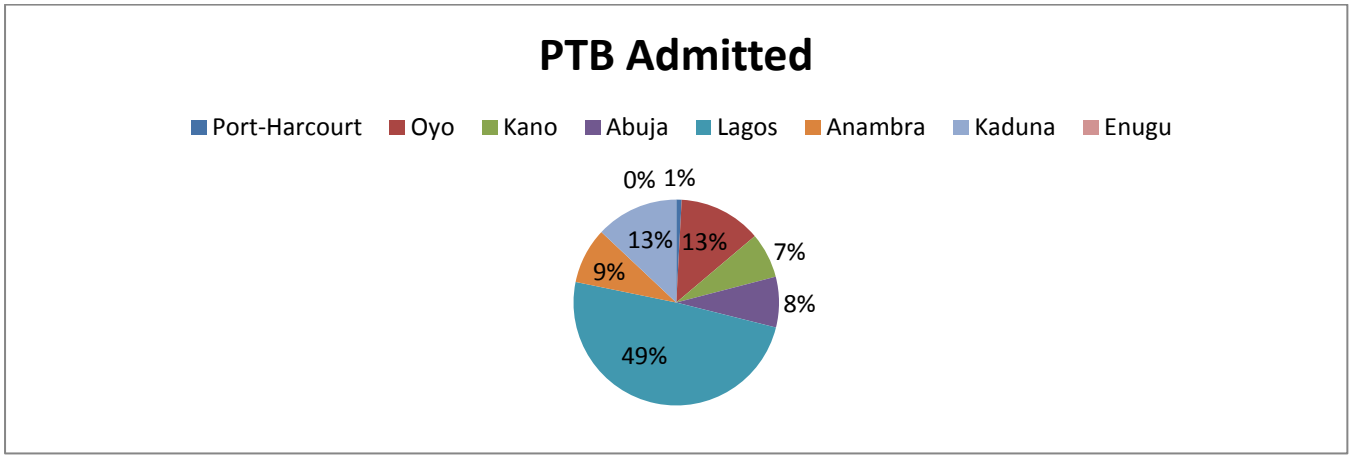
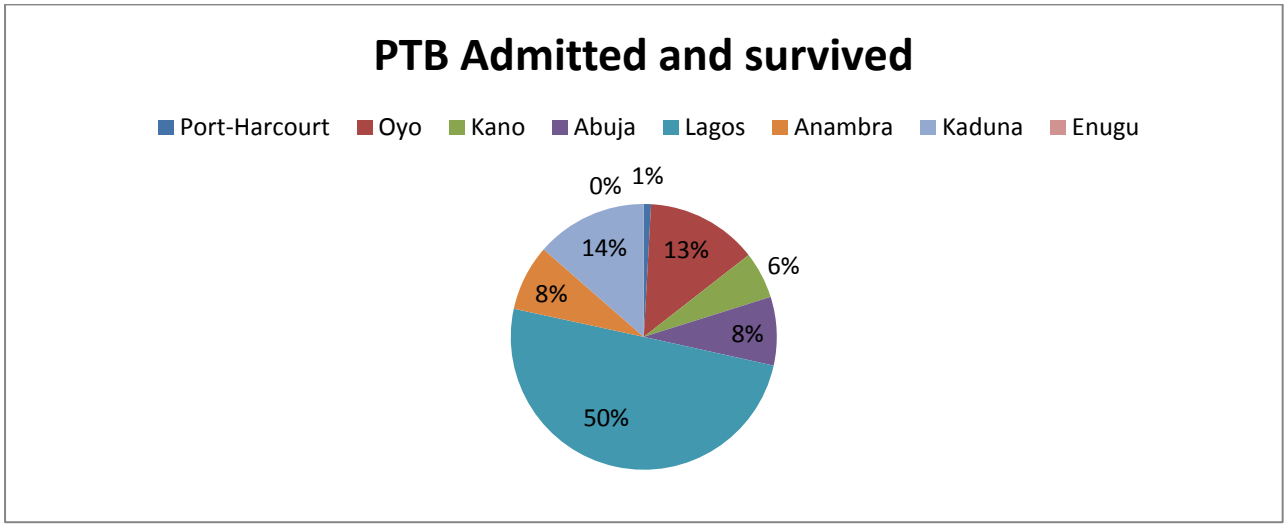


Fig. IV: Chart showing the number of patients admitted for Asthma, admitted, admitted and survived and admitted and died.

PTB





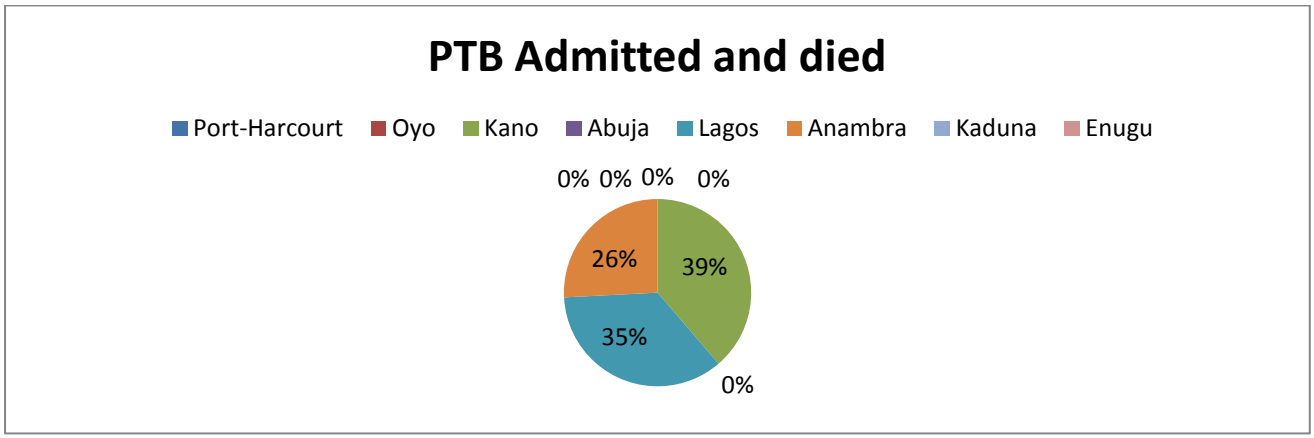
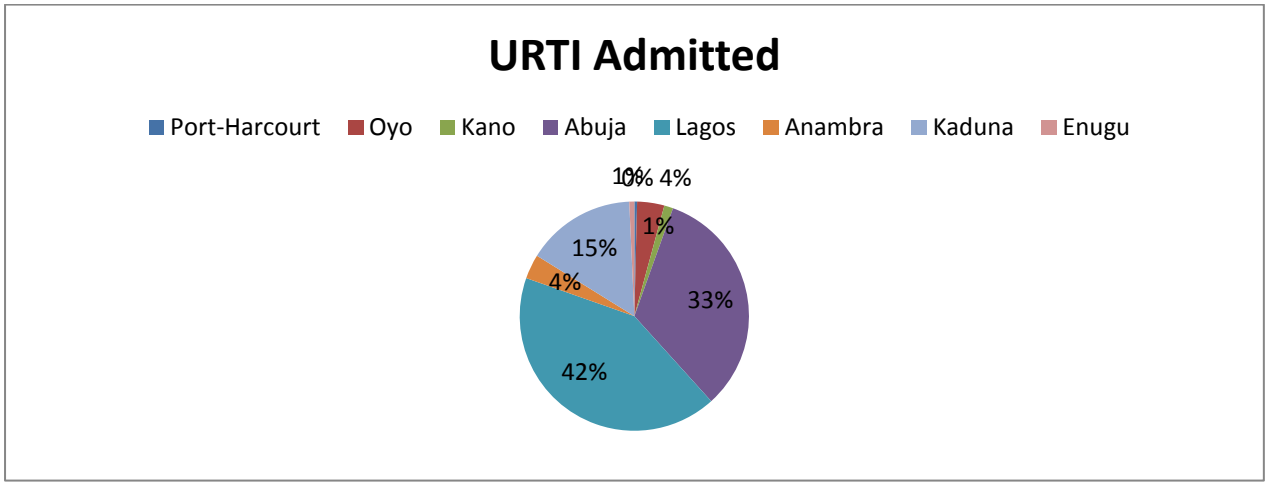
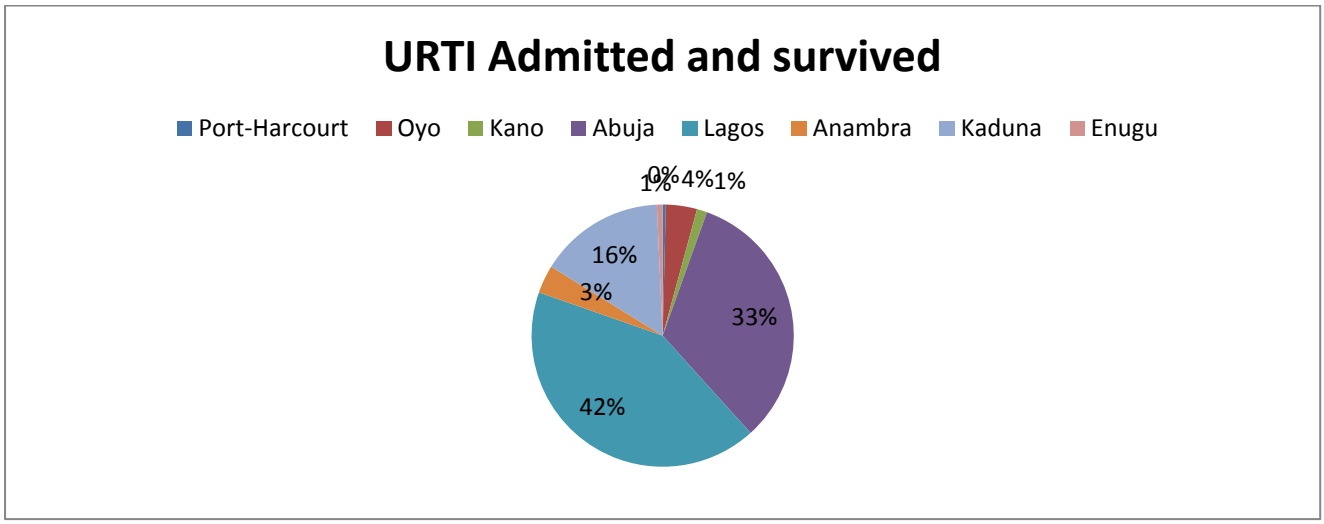


Fig. V: Chart showing the number of patients admitted for PTB, admitted, admitted and survived and admitted and died.

URTI





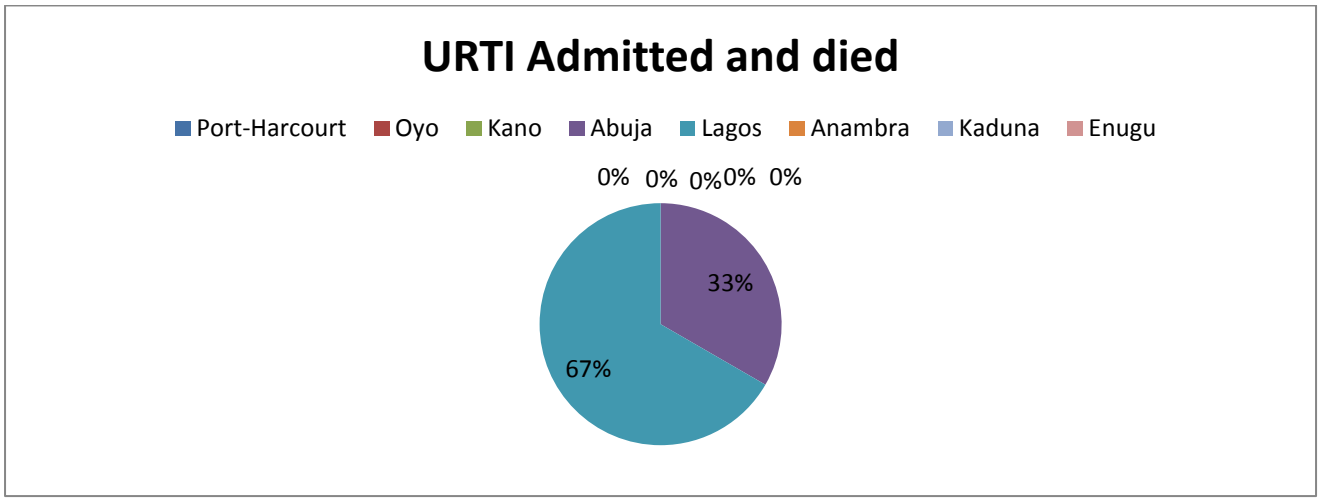
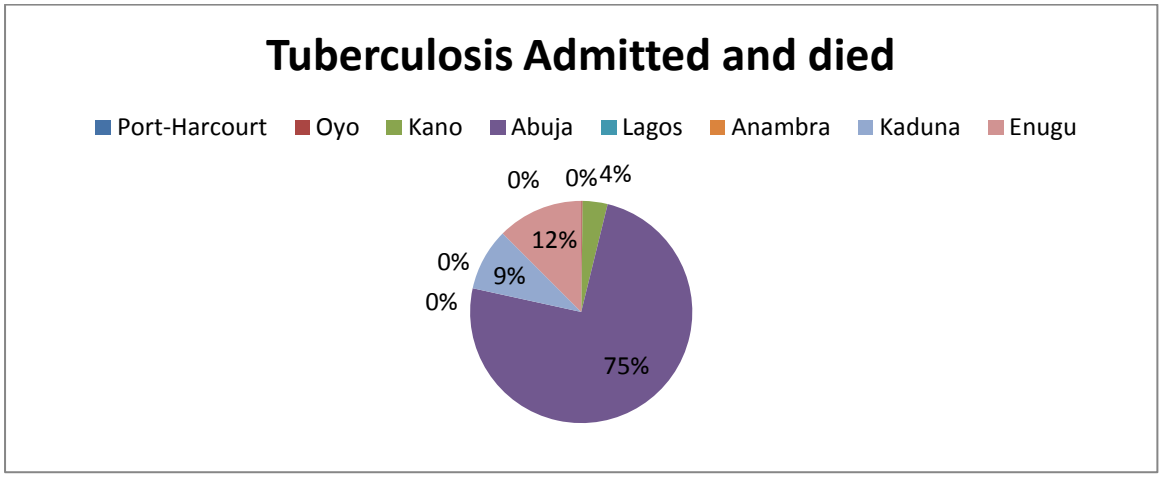
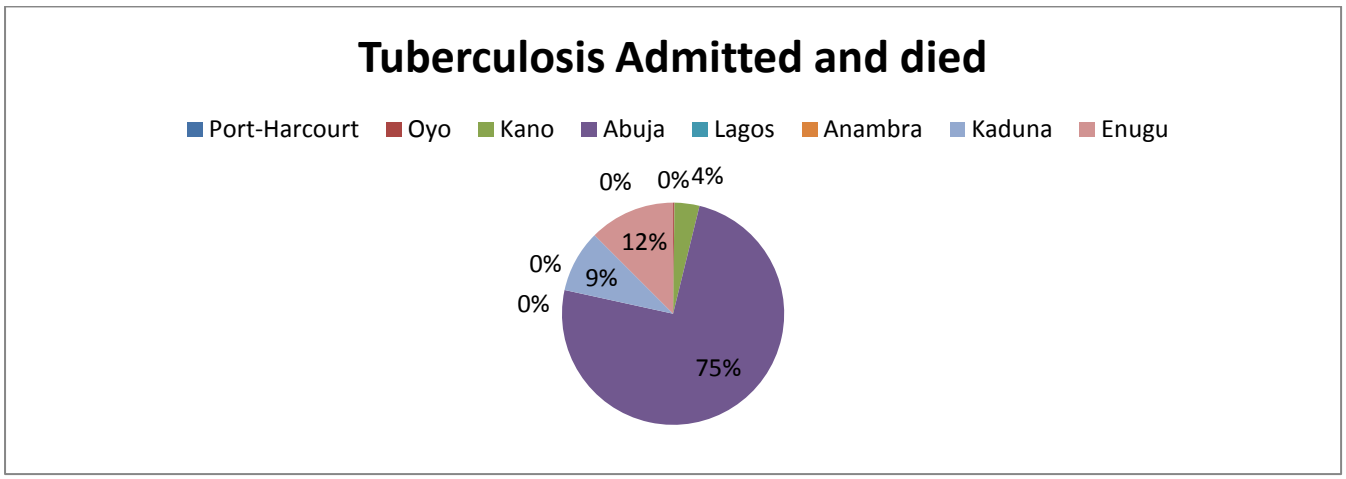


Fig. VI: Chart showing the number of patients admitted for URTI, admitted, admitted and survived and admitted and died.

Tuberculosis





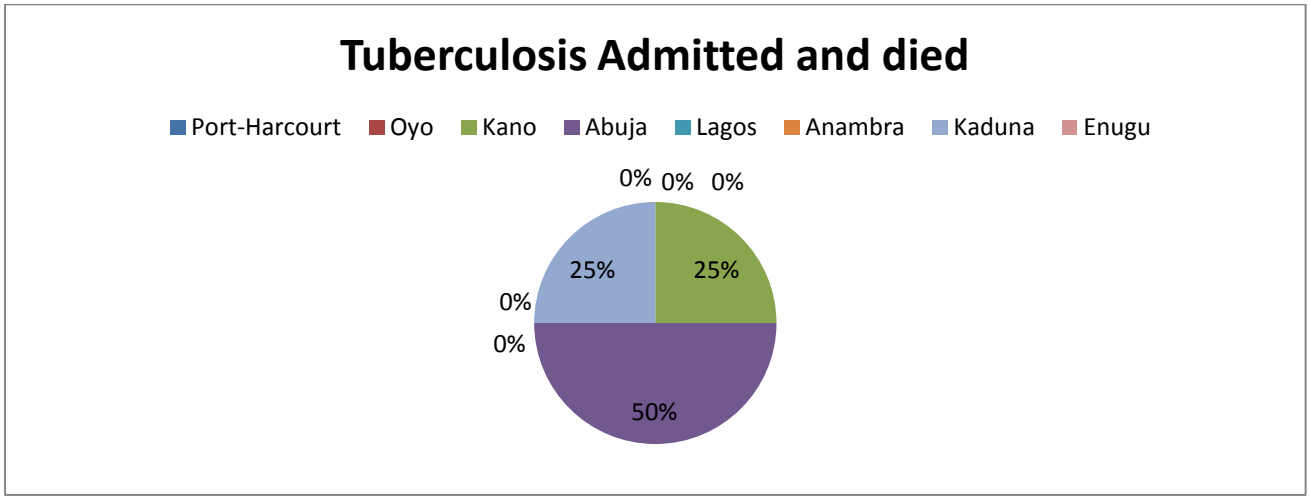


Fig. VII: Chart showing the number of patients admitted for Tuberclosis, admitted, admitted and survived and admitted and died.

4. DISCUSSIONS

From the tables, Lagos and Abuja recorded very high numbers of patients suffering from upper respiratory tract infection (URTI), pulmonary tuberculosis (PTB), allergic asthma, tuberculosis, pneumonia and bronchitis.

Lagos is the most populated city in Nigeria State (2006 census) and source of air pollution which includes smoke stacks of factories, motor vehicles fumes, and the effect of sound, dust and burnt particles in agriculture, fumes from paints, hair

spray, varnish and other solvents and so on. Thus, this number of patients suffering from these respiratory diseases maybe as a result of the above.

Other places like Oyo, Kaduna and Lagos have the least number of people suffering from the disease of air pollution. This may be probably because these areas are less densely populated (2006 census) when compared to other cities named above. There are lesser vehicles though the people are mostly farmers and agricultural activities are quite significant in these areas. The distribution of the diseases overlaps between the dry season and the rainy season.

5. CONCLUSION

From the analysis of the information and / or data collected, Lagos and its neighbouring towns have the highest number of people attacked by the diseases of air pollution and is closely followed by Port-Harcourt.

Also, the number in Kaduna, Oyo, Anambra and Kano is high. These may be as a result of inhalation of cement dust, vehicular smokes, fumes from factories and fire woods, dust particles from agricultural activities, burning of incineration and so on. Other areas like Abuja and Enugu whose population are less than Kano, Port-Harcourt and Lagos (2006 census), the least effect of air pollution diseases were noticed. These areas have lesser population, lesser vehicle numbers and all kinds of domestic burnings are also very small. The least number of patients recorded in some of these less populated areas could be attributed to ignorance since very few cases were reported to the hospitals.

6. RECOMMENDATION

We are polluting the environment most especially the air faster than it needs to be, through air daily activities. In cases where possible, we should avoid situations or actions that introduce pollutants into the air.

In Lagos, Port-Harcourt and Kano; factories should be located away from residential areas. For those living in rural areas and still use fire woods to cook, the kitchens should be designed in such a way that smoke will be discharged high up in the atmosphere. There should be enough spaces for smoke to escape as soon as it is released to avoid accumulation of smoke in the kitchen. Similarly, towns and cities should be planned in such a way that factories, cement factories, mechanic villages, industries, sewage disposals, highways etc. are located away from residential areas. Processing of agricultural products should also be outside residential areas.

Nigeria farmers should be properly educated on the dangers associated with long time exposure to the dust particles from agricultural products and silo gases (NO) during harvesting and processing of grains, small particles from pesticides, insecticides and during fertilizer application and also from slaughter houses (abattoirs) and feedlot operations. These particles, most of them are smaller than 4.5μm in aerodynamic diameter and are responsible for the diseases of air pollution identified in this work.

In all, the government should urgently address the power problem in the country as this will go a long way to help minimize the volume of fumes released into the air and hence reduce the negative impact of air pollution on the people and other living organisms.

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