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# Built environment and cancers – Are our homes safe?

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## Summary

In Nigeria, some of the environmental factors that may predispose to cancer risk are- unsafe water supplies, untreated sewage, sullage, industrial effluents and emissions. Household hazardous wastes (e.g. batteries, paints, Cytotoxic / genotoxic drugs, etc.), use of cooking fuels (e.g. firewood, charcoal and kerosene), roasted foods, and diesel/petrol generators contribute to cancer causing chemicals particularly polycyclic aromatic hydrocarbons (PAH), benzene derived byproducts, heavy metals etc. in the immediate vicinity of the households irrespective of socioeconomic status of the population. These agents spread the cancer causing chemicals into the environment both outer and built environment. Other emerging issues are the water disinfectant chemicals, arsenic, hormones and drug residues, PAH, dioxins and furans which are proven carcinogens. In addition, leachates (liquid effluents) from the waste dumpsites find their way into terrestrial and aquatic ecosystems and return to human body through food chain. Ecosystems are degraded resulting in biodiversity loss and bioaccumulation of toxic substances. In Niger Delta region, oil spillage and gas flaring activities have been causing morbidity among women and children. Changing lifestyle also plays a role in cancer increase as evident from colorectal cancers. Cancer of the lung, skin, and prostate were more reported from Niger Delta region than other areas in south-west. More evidence is shifting towards the environment as a major cause in cancer incidence. The Nations' tertiary Institutions lack adequate facilities to detect some of the environmental chemicals which may be suspected carcinogens. There is need to strengthen Research & Development activities in Environmental Toxicology and move ahead in line with the emerging environmental threats to health particularly, cancers.

**Keywords:** *Cancer, built environment, water, polycyclic aromatic hydrocarbons, carcinogens, waste management*

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## Résumé

Au Nigeria, certains facteurs environnementaux prédisposant les risques du cancer inclus la qualité de l'eau, les eaux usées, les émissions industrielles. Les déchets domestiques (batteries, peintures, médicaments cytotoxiques / génotoxiques, etc.), usage des gaz a chauffage (bois, charbon et pétrole), Les aliments fumes et les générateurs a diesel/ essence contribuent au cancer particulièrement les hydrocarbonés polycyclique aromatisées tels que les produits dérivé du benzène et les métaux lourds dans notre environnement mis a part le statut socioéconomique de la population. Ces substances augmentent l'incidence du cancer dans notre environnement. D'autres issues émergeant incluent les désinfectants chimiques, arsénite, les résidus des hormones et des médicaments, dioxine et les furanes qui sont démontrés carcinogeniques. En plus, les liquides effluents dans les sites de dépôt d'ordures entrainé dans les écosystèmes terrestre et aquatiques et retourne dans le corps humain par la chaine alimentaire. Les écosystèmes sont dégradés résultant une perte de la biodiversité et la bioaccumulation des substances toxiques. Dans la région du Niger Delta, les activités pétrolières continues de causer la souffrance parmi les femmes et les enfants. Changer le style de vie peut aussi augmenter les causes du cancer telque les cancers colorectaux. Le cancer des poumons, de la peau, de la prostate étaient plus reports dans cette région que d'autres régions au sud-ouest. Plus d'évidences est retourné vers l'environnent comme cause majeur de l'incidence du cancer. Les institutions tertiaires nationales manquent les infrastructures adéquates pour détecter les polluants environnementaux suspectes carcinogeniques. Il est nécessaire de supporter les activités de recherche et de développement en toxicologie environnementale et cancer.

## Introduction

Human environment is an interdependent web of natural resources. These resources are soil, water, air, plants and animals. Any imbalance in their management results in negative impact which may affect human health [1]. Cancer has widely been

perceived to be related to changes in the demography, socioeconomic parameters, epidemiological risk factors and better reporting of the disease [2,3]. But the emerging facts show that cancer is worldwide and is related to environmental and other factors such as sunlight, radiation, drugs, hormones, chemicals, food additives, industrial chemicals, polluted water and social habits like smoking and alcohol misuse. Thousands of exotic chemicals have been introduced into man's physical environment in such large quantities that the natural biological pathways for their elimination and detoxification have been overloaded. Manahan [4] classified these toxic substances based on: overall effects (mutagens, carcinogens and teratogens); chemical categories (heavy metals, metal carbonyls, organochlorine compounds) and function (food additives, pesticides and solvents). These chemicals or physical agents may damage the DNA, chromosomes or genes when exposed.

Exposure to a wide variety of natural and man-made substances in the environment accounts for at least two-thirds of all the cases of cancer in the United States. These environmental factors include lifestyle choices like cigarette smoking, excessive alcohol consumption, poor diet, lack of exercise, excessive sunlight exposure, and unsafe sexual behaviour that increases exposure to certain viruses. Other factors include exposure to certain medical drugs, hormones, radiation, viruses, bacteria, and environmental chemicals that may be present in the air, water, food, and workplace [5]. Epidemiological studies have shown that compounds such as Asbestos, Benzidine, N,N-Bis (chloroethyl)-2-naphthylamine, Chlorambucil and Vinyl chloride among others cause lung and bladder cancer, leukemia and angiosarcoma (a rare form of cancer that may occur in liver) [4]. Also of utmost importance are naturally occurring carcinogens such as aflatoxins (the most potent known hepatocarcinogens causing liver cancer) produced from some fungi such as *Aspergillus flavus* subgroup. Formation of aflatoxin-producing molds on food crops such as corn, peanuts and coconut is a matter of considerable concern especially in tropical countries with humid conditions and inadequate grain storage and drying facilities. Food related cancers resulting in colorectal cancers are found to relate to the nature of foods consumed, e.g. fried red meat, pork or lamb, sugar, eggs and diets high in fat [6].

Ibadan Cancer Registry recorded relatively more deaths due to colo-rectal cancers during the period 1990 –1999 while Port Harcourt Teaching Hospital Cancer Registry recorded over 3000 cases during the same period (extracted from records of the referred Hospitals 2007). It is believed that built environment may be a major factor in cancer causation. The main sources of carcinogens in built environment arise from several features: unsafe drinking water, foods exposed to pollutants, air in the vicinity polluted from automobile and industrial exhausts, the materials used in building construction and maintenance, and lifestyle of the people. Cancers can also occur due to occupational exposures including exposure to cooking fuels particularly in traditional practices of using firewood and other fuels.

This paper describes an appraisal of available information on factors in Nigerian built environment that may predispose the populations to cancers.

## Materials and methods

The information documented here is obtained from available literature, records from selected tertiary hospitals, and experimental work carried out by the authors in the last few years. Data from Cancer Registry were obtained for the period 1992 and 2001 from two major cancer registries situated in the University College Hospital (UCH), Ibadan, and the University of Port Harcourt Teaching Hospital (UPTH), Port Harcourt.

Laboratory analysis of Arsenic and Poly Aromatic Hydrocarbons (PAH) levels was carried out in the Environmental Health Laboratories of the authors using standard methods. Arsenic was determined in the ground waters collected from selected States (Anambra, Borno, Delta, Ekiti, Enugu, Imo, Kaduna, Katsina, Kogi, Nasarawa, Osun and Rivers). The samples were acidified immediately after collection and were analyzed using Atomic Absorption Spectrophotometer at the Central Laboratory, Obafemi Awolowo University, Ile-Ife.

PAH were determined in water, air and soil samples collected from Port Harcourt area using High Performance Liquid Chromatography (HPLC) with a 5um column, SUPELCOSIL™ LC-PAH Col: 12435-007 of dimensions 15cm x 4.6mm. The analysis was carried out at NNPC laboratory, Port Harcourt. Appropriate ethical procedures were followed.

## Cancers in Nigeria

Cancer registration started in 1960 and a National Headquarters of Cancer Registries in Nigeria was established in 1990. The most common cancers in Nigeria are carcinoma of the uterine cervix and breast for women and liver and prostate cancers for men. In Nigeria, patients tend to present at a younger age than in industrialized countries. In recent years, the Federal

Government created a 'Consultative Committee on National Cancer Control' to formulate policy guidelines relating to the prevention and management of cancer. Societies such as the Nigerian Cancer Society, the Society of Oncology and Cancer Research of Nigeria, the Society for the Study of Pain, and the Palliative Care Initiative, as well as patient advocacy groups, are active in promoting cancer control and prevention [3].

## Nigerian built environment

Nigerian built environment varies from place to place. Nigeria has six well demarcated ecological zones with cultural diversity. Several factors determine the health of the residents. The location, building materials used particularly the roofing, construction materials and paints, water supply, domestic activities, neighbourhood, surrounding exposures from emissions, socio-economy, culture and a host of others. These factors may contribute to the release of various carcinogenic compounds (Fig. 1).

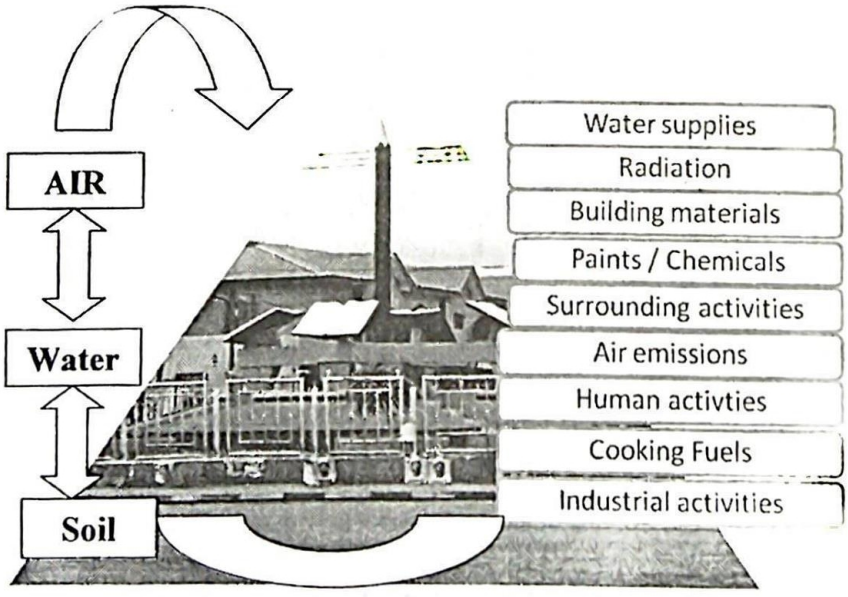


**Fig. 1:** Built environment and factors that predispose to cancers (Source: Authors)

## Carcinogens in drinking water

The occurrence of micro-pollutants, both organic and inorganic in raw water sources presents a serious threat to the quality of drinking water and therefore human health [7]. Human activities contribute to these. Under various conditions such as chemical treatments, disinfection processes or distribution, hazardous compounds such as trihalomethanes may be introduced. Agricultural activities also add various chemicals injurious to health.

## Arsenic

The types and quantities of carcinogens present in drinking water at the point of consumption will differ depending on whether they result from contamination of the source of water, arise as a consequence of treatment processes, or enter as the water is conveyed to the user. Source-water contaminants of concern include arsenic, asbestos, radon, agricultural chemicals, and hazardous wastes. Of these, the strongest evidence for a cancer risk involves arsenic, which is linked to cancers of the liver, lung, bladder, and kidney [7]. A study carried out in Nigeria by Bamigboye and Sridhar (unpublished data, 2008) indicate that arsenic is found in some pockets in 12 States studied but no serious attention has been paid hitherto as a health risk. The arsenic levels ranged between 0 to 2.42 mg/l (Table 1) in borehole and deep well waters which form drinking water sources in many households. Arsenic is also found in electronic waste (e-waste) generated in large quantities in Nigeria now and the leachates from dump sites are a threat to ground waters where the arsenic levels in soils (mg/kg) and leachates (mg/l) ranged between 2.83 to 8.0 (Renshaw, Ana, Oloruntoba and Sridhar, 2008 unpublished data).

A large number of studies carried out in the USA and other industrialized countries have shown association between toxic chemicals and cancer. Review of the results from epidemiological studies in the USA by Smith *et al.* [8] revealed that there is

**Table 1:** Arsenic levels in waters from boreholes and deep wells in 12 States* of Nigeria (Bamigboye and Sridhar 2008 Unpublished Data)

| Arsenic level | Borehole waters Number (%) | Deep Well waters Number (%) | Total(%) |
|---|---|---|---|
| 0.00—0.05mg/l (No Risk) | 80(52.3) | 73(47.7) | 153(43.1) |
| 0.06-0.09 mg/l (Moderate Risk) | 10(58.8) | 7(41.2) | 17(4.8) |
| >0.10 mg/l (High Risk) | 94(50.8) | 91(49.2) | 185(52.1) |

**From 12 States: Adamawa, Borno, Delta, Ekiti, Enugu, Imo, Kaduna, Katsina, Kogi, Nasarawa, Osun, and Rivers*

persuasive evidence that inorganic arsenic is a cause of human cancer at several sites. Although causal association between ingested arsenic and skin cancer had previously been established, the evidence presented in this paper strongly supports a causal relationship between ingested arsenic and both liver and lung cancer. There is also evidence from Taiwan that arsenic causes human kidney and bladder cancer. Wu *et al.* [9] observed a significant dose-response relation between arsenic levels in well water and cancers of the bladder, kidney, skin, and lung in both males and females, and cancers of the prostate and liver in males. However, no association was found for cancers of the nasopharynx, esophagus, stomach, colon, and uterine cervix, and for leukemia. Arsenic levels in well water were also associated with peripheral vascular diseases and cardiovascular diseases in a dose-response pattern, but not with cerebrovascular accidents.

### Chlorine

Chlorine which has been used world-wide for water treatment to reduce the risk of infectious diseases may account for a substantial portion of the cancer risk associated with drinking water. According to Morris [7], the by-products of chlorination-'Trihalomethanes' are associated with increased risk of bladder and rectal cancer, possibly accounting for 5000 cases of bladder cancer and 8000 cases of rectal cancer per year in the United States. Studies by Marabini *et al* [10] demonstrated the formation of disinfection by-products (DBPs) which involved the evaluation of the formation during the disinfection processes that could explain the genotoxic and carcinogenic effects of drinking waters at the waterworks of Castiglione del Lago (Italy). In an earlier study, Pillai *et al* [11], and Gabbita *et al* [12] demonstrated that the peculiar smell that emanated from Bangalore Water Supply in southern India was as a result of excessive chlorination of polluted source water which was tapped for the first time after ten years of stagnation. Trihalomethanes were responsible for such quality deterioration felt by the consumers.

Kasim *et al* [13] examined the association between exposure to drinking water chlorination disinfection by-products and adult leukemia risk in Canada. They found some variation between adult leukemia risk and chronic exposure to disinfection chlorination by-products. For chronic myelocytic leukemia, there were positive associations with nearly all of the studied chlorination disinfection by-product variables. Duration of exposure seems to be an important component of chronic myelocytic leukemia risk. In contrast, the odds ratios for other studied leukemia subtypes were found to decrease by increasing years of exposure to the studied chlorination disinfection by-product variables, with a significant protective effect notable for chronic lymphocytic leukemia and hairy cell leukemia. Other studies on DBPs include those of King *et al* [14] and Cantor *et al* [15].

### Lead

Lead is a major toxic compound in the built environment. Lead exposure comes from drinking water, air and smoke and exhausts. There is no conclusive proof that lead causes cancer in humans. Kidney tumours have developed in rats and mice that had been exposed large doses of lead compounds. The US Department of Health and Human Services (DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the United States Environmental Protection Agency (USEPA) has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans [16]. Studies carried out at the Division of Environmental Health,

of College of Medicine, University of Ibadan revealed that lead is a pervasive chemical and found in toxic levels in waters, food, paints, batteries, and automobile emissions. Though Nigeria has phased out lead from gasoline, lead is still entering the country through imported gasoline from other countries where lead phase out is not practiced (Sridhar and others unpublished data).

**Carcinogens in air**

Many people in the most polluted regions of the world not only live in urban areas but also spend about 90 per cent of their time indoors. Sources of indoor air pollution may include people, domestic animals, tobacco smoke, cooking (especially wood-burning stoves), heating and lighting in building and decorating materials, microorganisms, moulds and fungi [17].

In the industrialized countries, a lot of studies have been carried out to establish the relationship between indoor air pollution and health. Study by Gustafson *et al* [18] in a small Swedish town concluded that domestic wood burning seems to increase personal exposure to 1,3-butadiene (known carcinogen) as well as indoor levels of 1,3-butadiene, benzene and possibly acetaldehyde. Ramanakumar *et al* [19] studied the risk of lung cancer from residential heating and cooking fuels in Montreal, Canada. The study concluded that women were more at risk than men to both traditional heating and cooking. In the Nigerian context, cooking is done inside the premises with no proper ventilation and the type of fuels vary from cheap wood, paddy husk, saw dust, charcoal and kerosene. In the northern Nigeria, people use fire inside the house to warm the colder nights in harmattan season. These practices need to be addressed for their carcinogenic potential.

Boffetta [20] also reported an increased risk of mesothelioma among individuals experiencing residential exposure to asbestos. While many building industries are eliminating fine asbestos from roofing sheets, in Nigeria the building materials come from importation from other countries which may not have stringent standards. The asbestos roofing sheet manufacturing company in Bauchi claims that they have phased out fine fibre asbestos sheet production (Personal discussions with the Factory Manager). The asbestos fibres may also come from spun drainage pipes, false roofing, and other building materials.

A causal association was also established between passive tobacco smoking and lung cancer, which may be responsible for 1.6 per cent of lung cancers. Cigarette smoke contains more than 100 cancer-causing substances. The risk for cancers of the mouth, voice box, and esophagus is further increased among smokers who also drink more than two drinks a day [5, 21]. Radon causes lung cancer when inhaled for prolonged periods of time. Zielinsli *et al* [22] confirmed radon from residential exposure is now an established risk factor for lung cancer. In Nigeria, the source of radon may be limited to urban housing and may not be a factor in traditional or rural houses. Cancer cases attributable to radiation exposure due to soil radioactivity are low, constituting only between 1.3% and 9.2% of the total reported cases [23].

Studies by Chiang and Liao [24] and Yang *et al* [25] have shown that exposure to particulate matters (PMs) and carcinogenic polycyclic aromatic hydrocarbons (PAHs) in smoke emitted from heavy incense burning may promote lung cancer risk. The incenses are usually made from a series of plant materials such as tree bark, roots, resins, flowers or essential oils. While burning, these materials are known to produce potentially carcinogen substances such as carbonyls, benzene and hydrocarbons (PAHs). Women spending several hours at cooking are exposed to benzo- (a)-pyrene, a deadly carcinogen through suspended particulates which often exceeds 7000 $\mu g/m^3$. Barbecue is also potentially carcinogenic through formation of heterocyclic amines and polycyclic aromatic hydrocarbons formed during the grilling and frying and barbecuing of certain so called "muscle meats" such as beef, pork, poultry and fish. A typical two hour barbecue can also release dioxins equivalent of 220,000 cigarettes [26].

In Nigeria however, there is a dearth of information on environmental risk factors of cancer. A review of the abstract book for the Union Internationale Coutre Cancre (International Union Against Cancer) World Cancer Congress revealed that most studies in Nigeria concentrated on clinical presentation [27, 28, 29]. Others featured on management of cancer cases [30, 31], and on knowledge, attitudes and practices [32, 33, 34]. There is therefore a need to identify and quantify risks posed by environmental contaminants, develop cost-effective methods for monitoring and interventions in order to minimize cancer risks.

**Waste management and cancers**

Waste management is increasingly considered as a health risk depending on the choice of technology. Up to 50 million tonnes of old personal computers are thrown away each year on waste dumps where they pose a pollution threat to the environment and to people. One warehouse complex in Port Apapa in

Lagos is handling up to 40 container loads each month [35]. Legislation exists that prohibit the simple sending of old computers to be dumped - but the problem is that Nigeria's booming second-hand computer industry gives ample scope for computer waste to be brought in.

In Nigeria open burning is practised routinely to get rid of the increasing volumes of waste. Furans and Dioxins are feared as deadly carcinogens. Nigeria has adopted incineration as a method for managing the healthcare wastes. In the last few years there has been growing controversy over the incineration of health-care waste. Under some circumstances, including when wastes are incinerated at low temperatures or when plastics that contain polyvinyl chloride (PVC) are incinerated, dioxins and furans and other toxic air pollutants may be produced as emissions and/or in bottom or fly ash (ash that is carried by air and exhaust gases up the incinerator stack). Exposure to dioxins, furans and co-planar Polychlorinated Biphenyls (PCBs) may lead to adverse health effects including cancers.

Long-term, low-level exposure of humans to dioxins and furans may lead to the impairment of the immune system, the impairment of the development of the nervous system, the endocrine system and the reproductive functions. Short-term, high-level exposure may result in skin lesions and altered liver function. Exposure of animals to dioxins has resulted in several types of cancer [36]. There is insufficient evidence to prove that chronic low-level exposures to dioxins and furans cause cancer in humans. WHO has established a Provisional Tolerable Monthly Intake (PTMI) for dioxins, furans, and polychlorinated biphenyls (PCBs) of 70 picograms (10-12 g) per kilogram of body weight. The PTMI is an estimate of the amount of chemical per month that can be ingested over a lifetime without appreciable health risk.

Evidence of cancers of people living near incineration plants is mostly from industrialized countries. People living within a radius of 7.5 to 10 Km have shown significant increase in laryngeal cancer, gastric cancer mortality, lung cancer and risks of other cancers specifically of stomach, colorectal, liver, and lung cancer. A study in Britain showed that of 119/235 (51%) cases reviewed, primary liver cancer was confirmed in 66 (55%) with 21 (18%) definite secondary cancers. The proportions of true primaries ranging between 55% and 82% (i.e. excluding secondary cancers) give revised estimates of between 0.53 and 0.78 excess cases per $10^5$per year within 1 km [37].

**Radiation sources**

An assessment of the risks associated with terrestrial gamma radiation dose rate levels in some cities across the major geological formations of the country showed that in the Northern region the number of individuals at risk of incurring cancer ranged between 0.25 and 3.25 $yr^{-1}$ with an average value of 1.46±0.45, while in the southwestern region it ranged between 0.76 and 5.50 $yr^{-1}$ with a mean value of 1.66±0.63 and in the south-eastern region it was between 0.17 and 0.89 $yr^{-1}$ with a mean value of 0.35±0.14. Of the entire population of Nigeria, about 160 individuals annually are at risk of incurring cancer due to exposure to terrestrial gamma radiation [38].

**Niger Delta Region**

Nigeria possesses 159 total oil fields and 1481 wells in-operation according to the Ministry of Petroleum Resources (Shell International Petroleum Company, Developments in Nigeria, London, March 1995). The most productive region The Niger Delta is considered as an environmental disaster zone. The levels of PAH in surface waters at Eleme were 3 folds higher than that recorded at Ahoada East indicating that there were possible contaminations from the industrial sources. Levels were higher than guideline limits of 50ng/l. The highest number of 7 PAH components in surface waters were found in the stream at Aleto Community (Ana and Sridhar unpublished data), whilst the highest total PAH levels (8.89 x 104ng/l)) were recorded in the stream waters at Onne [39].

Between 1986 and 1996, 2.5 million barrels of petroleum-equivalent to 10 Exxon Valdez disasters have been spilled in this region [23]. The burning of 8 million cubic feet of natural gas every day compounds the environmental catastrophe. Pollution caused by the oil and natural gas industry has also led to ground water pollution, leading to outbreaks of diarrhea epidemics. Birth deformities are on the rise, as are certain soft tissue cancers [40]. Similarly, on the Caribbean Island of Curaao, pollution from the Shell's refinery has contaminated the small island which is surrounded by 20 km of coral reef, and damaged the health of the community with complaints of premature deaths, cancers, birth defects, bronchitis, skin diseases and asthma [41].

From December 1997 to December 2000, about 362 cancer cases were reported and treated in the University of Port Harcourt Teaching Hospital. The data were analyzed using Hewlet Packard Model No HP 67HP97. 186 of these cases came from Bayelsa State, 154 came from Rivers State and 22 cases came from Abia, Akwa-Ibom, Imo and Cross

**Table 2:** Cancers registered at Port Harcourt and Ibadan Cancer Registries [39]

| Cancer cases | PortHarcourt N (%) | Ibadan N (%) | $X^2$ | p-value | Significance |
|---|---|---|---|---|---|
| Lung | 33 (3.65) | 113 (3.21) | 0.344 | 0.58 | Not significant |
| Skin | 172 (19.0) | 365 (10.4) | 49.79 | 0.000 | Significant |
| Eye | 15 (1.66) | 258 (7.33) | 38.95 | 0.000 | Significant |
| Bladder | 8 (0.885) | 159 (4.52) | 25.12 | 0.000 | Significant |
| Prostate | 257 (28.4) | 631 (17.9) | 48.86 | 0.000 | Significant |
| Breast | 418 (46.2) | 1997 (56.7) | 31.43 | 0.000 | Significant |
| Total | 904 (100.0) | 3,521 (100.0) | - | - | - |

*Shaded cells are significantly higher cancer cases among populations in petroleum exploration areas;*

Rivers states but were resident in Port Harcourt. 69.75% of the 362 reported cases were females whereas 30.178% were males. Out of 362 reported cases, carcinomas of Reproductive system were 251, those of Liver were 53, those of gastrointestinal tract were 40 and others e.g. leukemia and Lungs etc., 18. The communities most affected were those in Bayelsa state, Etche, Ogoni, Port Harcourt and to less extent Kalabari, Okrika and Opopo in Rivers state. The incidence of cancer in these communities correlated with the polluting activities of oil companies. For Bayelsa correlation coefficient (r) = 1, for Etche, r = 0.99 for Ogoni, r = 0.84 for Port Harcourt and Ikwerre, and r = 0.75 for Ahoada and for Kalabari, and r = 0.45 for Okrika and Opopo The results point out possible petroleum exploration activities as the main constituent of cancer etiology in that sub-region while other factors are not ruled out [42]. A World Bank study of the environment of Niger Delta revealed that gas flaring in Niger Delta particularly Rivers and Bayelsa states releases about 35 million tons of $CO_2$ and 12 million tons of methane per year and hence about 815,000 metric tons/year of air pollution load exist in Rivers and Bayelsa States [43]. A study carried out by 'Climate Justice' estimates that exposure to benzene from gas flaring would result in 8 new cases of cancer yearly in Bayelsa State alone (http:// www.steppingstonesnigeria.org accessed September 2008). .

Niger Delta Region deserves a comprehensive study on the occurrence of cancers. A comparative assessment of cancers registered in two Cancer Registries one in Niger Delta and the other from the South West, far from the oil explorations and gas flaring indicate a glaring difference in the nature of cancers (Table 2). In the Niger Delta Region the percentage of cancers of skin and prostate are significantly more than the other region. However, the lung cancers are slightly more.

## Emerging views on cancers

The US EPA has listed a large number of industrial and developmental activities and a variety of chemicals that may cause cancers. This list is growing every year. This may be an eye opener for those less industrialized countries in planning their own industrial development.

There have been differing views on the role played by the environment on the occurrence of cancers. Some of the environmental chemicals react with the ecosystems and cancer is a response to toxicity. Dose responses and the animal models used in the studies will have a significant effect in deducing this effect. Some of the chemicals also mimic the hormonal activity and polychlorinated biphenyls (PCBs) are the typical examples. Poor environmental hygiene was also linked with cancers (Table 2). Attention is slowly shifting to include the environment of very early life as it may influence the likelihood of developing cancer many years later.

## Conclusion

Although cancers are often discussed in the clinical literature, more specific data is lacking in Nigeria [3]. The Nigerian cancer scenario is still confusing without any conclusive evidence on the causative factors. More and more evidence is tilting towards environment, food and life style as major factors in cancer incidence. Environment is very complex. Interest in Ecosystem Health is catching up to address the emerging health problems. Every year large quantities of new chemicals are being introduced into the environment which finds their way to human and animal bodies through soil, water and air [44]. But the toxicity data particularly low dose and long term exposure is lacking. Nigeria has several policies in line with the international norms to contain the spread of the environmental chemicals. The country is also a signatory to various international treaties. However,

what is missing is effective implementation of some of the policies.

Another grey area is lack of monitoring and surveillance facilities in the country. The laboratories should be adequately equipped to meet the challenges of ever growing technologies. Cancer prevention can substantially reduce the prevalence of malignancies in Nigeria. Effective implementation of environmental health policies needs cooperation from communities, governmental arms and transparency at all levels. Comprehensive health education programmes can to a great extent prevent exposure to environmental chemicals. There is also a need to promote consumer protection through establishment of people oriented groups. Investment in health education to promote healthy living and to reduction of pollution and environmental contaminants, and creation of comprehensive and well-funded cancer screening and prevention programmes are some of the most effective ways to reduce the burden of cancer.

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