



Relationship between Petrochemical Pollution and Oculo-Visual Health in Onelga Region of the Niger Delta

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Common sense and simple economics suggest that countries endowed with an abundance of natural resources should prosper. Yet over many years, it has been observed that developing nations rich in oil, gas or mineral resources have been disadvantaged in the drive for economic growth. It is rather unfortunate that, after over fifty years of oil exploration and exploitation in Nigeria, the basic infrastructures seem to be in decay (as roads for instance, are now death traps, power supply is epileptic, poverty is an endemic problem as most of the erstwhile fertile lands in Niger Delta region is infertile and devastated by pollution, which invariably affects the health in general and the oculo-visual health in particular, of inhabitants of that region. The research design of this study was anchored on document analysis, which was based on an examination of records from three private eye clinics in Ogba, Egbema, Ndoni Local Government Area (ONELGA) of Rivers State, Nigeria. The population of this study comprised children, young adults, and workers living in and around ONELGA. The age range of the subjects is 6 months to 70 years. The study revealed that no significant relationship was found between oculo-visual health and general well-being of the citizens. The study concludes that in spite of the fact that there is no significant relationship between petrochemical pollution and oculo-visual health, there is the need to protect the vulnerable in the society from the harmful effects of petrochemicals on oculo-visual well-being.

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1. INTRODUCTION

Oil is a major source of energy in Nigeria and the world in general. Oil being the mainstay of the Nigerian economy plays a vital role in shaping the economic, social, political, educational, technological, environmental, and general well-being of any country [1].

A long-standing economic development program is the United Nations (UN) sponsored National Millennium Goals for Nigeria. Under the program, which covers the years from 2000 to 2015, Nigeria is committed to achieving a wide range of ambitious objectives involving poverty reduction, education, gender equality, the environment and health [2]. Unfortunately, Nigerian policy formulation and implementation focus is being restricted to human capital investment in the form of crude oil, ignoring investment in health, especially eye care, among others.

Petroleum has been recognized as a potential environmental contaminant since shortly after the beginning of the Twentieth Century. Reports of the biological consequences of ship wrecks involving cargos of crude and fuel oil began to appear in the popular and scientific press. Scientific literature on the subject was sparse until after World War II when reports of the effects of oil pollution began to appear with greater frequency [3].

Petroleum production and export play a dominant role in Nigeria's economy and account for about 90% of her gross earnings. This dominant role has pushed agriculture, the traditional mainstay of the economy, from the early fifties and sixties, to the background [4]. However, it has its own side effects on the populace of Nigeria, with attendant environmental pollution and health hazards.

So much evidence is pointing to the fact that humans were not designed to breathe, absorb, ingest oil and petrochemicals [5]. Petrochemicals are chemical products derived from petroleum. Some chemical compounds made from petroleum are also obtained from other fossil fuels, such as coal or natural gas, or renewable sources, such as corn or sugar cane [6].

Petrochemicals and their by-products, such as dioxin, are known to cause an array of serious

health problems, including cancers, oculo-visual problems and endocrine disruption, especially in areas where petrochemical industries are located. This is the problem of the people of Niger Delta region of Nigeria, where most of the oil exploring/exploiting activities take place. They are mainly affected due to residential exposure to petrochemical pollutants.

Petrochemicals are manufactured from crude oil and natural gas liquids, and are used to produce thousands of products that make life possible. Everything not made from rocks, plants, other living things or metal is made from petrochemicals. This includes everything made of plastic [7].

We are still petro saturated because chemicals are not tested for health effects before being put into use, and by the time it is figured out that something is making people sick, so many people have been affected, especially when the environmental warning signs are not acted upon. It is also difficult getting independent researchers fund health research.

We come into contact with chemicals every day. This is called chemical exposure. Although some chemical exposures are safe, others are not. A certain amount of a harmful chemical must enter our bodies to make us sick. Harmful chemicals can get into our body if we breathe, eat or drink them, or if they are absorbed through our skin.

People respond to chemical exposures in different ways. Some people may come into contact with a chemical and never be harmed. Others may be more sensitive and get sick. Sometimes illness happens only if we are exposed to a harmful substance for a long time but in most cases, short time exposure causes illness or discomfort. Some diseases get worse when we come into contact with a harmful substance, and some diseases are caused by exposure to chemicals. A few examples of diseases caused by an exposure include smog and asthma caused by exposure to smog, mesothelioma caused by exposure to asbestos, and learning disabilities caused by exposure to lead. Exposure to chemicals can also cause cataract, allergic conjunctivitis, dry eye/irritation, etc. [5].

Not everyone is aware of how petrochemicals are messing with our health, since the use of toxic laundry and personal care products is almost universal, almost everyone does know someone with cancer, asthma/bronchitis, autism and other “environmentally” influenced conditions who would immediately benefit from a serious reduction in personal care and laundry product pollution, especially fragranced products [5].

The effects of petrochemical pollution has not only impacted on the general health of the citizens, it has in addition negatively affected the visual health of the people of the Niger Delta region. Petrochemical pollution over the last couple of decades has resulted in people losing their sight and consequently, their means of livelihood. This has increased the number of patients visiting eye clinics in the region. Unfortunately, these eye clinics are owned by private eye care practitioners. The inability of the oil companies to provide basic facilities for handling eye defects arising from petrochemical exploration is worrisome. The oil industries and Nigerian forget the very fact that eye is the key to human existence and no economy can be driven by blind populace, therefore, the functional application of the visual apparatus is germane to national development [8].

Common sense and simple economics suggest that countries endowed with an abundance of natural resources should prosper. Yet over many years, it has been observed that developing nations rich in oil, gas or mineral resources have been disadvantaged in the drive for economic growth. It is rather unfortunate that, after over fifty years of oil exploration and exploitation in Nigeria, the basic infrastructures seem to be in decay (as roads for instance, are now death traps, power supply is epileptic, poverty is an endemic problem as most of the erstwhile fertile lands in Niger Delta region is infertile and devastated by pollution. Also, noxious fumes from gas flaring and other radiations are competing for space in the air and in the lives of citizens.

A health system is effective to the extent it makes use of the available resources to meet its stated health care aims and objectives. The major objective of every nation irrespective of the level of development is to provide high quality health care to its populace. The resources needed to provide this high quality health include financial, as well as human and material resources. Researchers [e.g., 8, 9, 10, 11, 12]

acknowledge the diverse health aims of acquiring knowledge, skills, values and attitude necessary for the health sector. Apart from the government, the petrochemical companies are major players in the health needs of their host communities. There has been a general conception in oil host communities in Nigeria that the oil exploration companies are not doing enough to cater for the health needs of the citizens of these communities.

It can further be argued that the oil companies are moderately doing better in other sectors of health related issues, but losing focus on the major aspect of human existence, which is the eye. In an evaluation of medical records from eye clinics, it is evident that most of the eye conditions suffered by citizens of the host communities are associated with petrochemical pollution.

In this paradigm, the citizens of the host communities see oil companies as insensitive to their to their health needs, particularly the eye defects, which is a major negative effect of gas flaring and radiations emanating from their operations. Therefore, they concluded that the activities of the oil companies are unworthy, since it affects their health, for the most part, their eyes. The Ministry of Health, regardless of their efforts at nation building, have failed in properly addressing the most essential needs (eye care) of the populace, especially in the communities hosting the oil companies.

This informed the need to investigate the effects of petrochemical pollution on Oculo-visual health, and to assess their impact on the general well-being of the citizens of the Niger Delta. This study also attempted to ascertain whether petrochemical pollution has negative effect on Oculo-visual health of the Niger Deltans. To this end, the study also examined the role of petrochemical companies in the prevention and control of petrochemical pollution in the Niger Delta region. See table 1 for major events in the history of the Nigerian Oil and Gas.

1.1 Purpose of the Study

Research on the relationship between petrochemical pollution and Oculo-visual health scarcely exists in Nigeria. However, the theme of this study has become a major industry in more advanced countries of the world. A search of the internet has not proved otherwise. However, it took decades to happen in, for example, Canada,

United States of America, Australia, Britain, Germany, Saudi Arabia, China and more. This body of research has now had a major impact on policy at national, state, local and school levels. As a result, this study sought explicitly, to learn from the research on the relationship between petrochemical pollution and Oculo-visual health and to apply its lessons to policy on, for example, environment, town planning, and health in Nigeria.

Conversely, there are limited research publications in Nigeria as regards this area of discourse. Those that exist are very narrow, and do not focus on the possible health consequences of petrochemical pollution especially, Oculo-visual health. The overall objective of this study was to improve the eye care of Nigerians. This study's expectation was to explore the practical health policies of oil exploration companies and their implications on host communities in Nigeria.

It was also an attempt to analyze theoretically (documents) and empirically (clinical records) of petrochemical pollution and eye health of persons within the Niger Delta region. Specifically, this study was designed to theoretically and empirically investigate the following research objectives:

- To make a theoretical analysis of the relationship between petrochemical pollution and Oculo-visual health in the Niger Delta region.
- To ascertain whether petrochemical pollution has negative effect on Oculo-visual health of the Niger Deltans.
- To make recommendations concerning the impact of petrochemical pollution in the Niger Delta region.

1.2 Research Questions

The following research questions were tailored towards the problems stated above. The research questions of this study provide focus and direct attention to the major issues of concern in this research project and what the researcher specifically wants to understand by doing this study. Therefore, they help determine what data to collect and how and where to collect it. In order to provide possible answers to the problems of this study, the following research questions were addressed:

- What is the effect of petrochemical pollution on oculo-visual health in Niger Delta?
- What is the impact of oculo-visual health on the general well-being of the citizens of the Niger Delta?

1.3 Research Hypothesis

The research hypothesis that guided this study is:

- Petrochemical pollution has a relationship with Oculo-visual health in Niger Delta

2. BACKGROUND

According to Nigerian National Petroleum Company (NNPC) [6], Oil was discovered in Nigeria in 1956 at Oloibiri in the Niger Delta after half a century of exploration. The discovery was made by Shell-BP, at the time the sole concessionaire. Nigeria joined the ranks of oil producers in 1958 when its first oil field came on stream producing 5,100 bpd. After 1960, exploration rights in onshore and offshore areas adjoining the Niger Delta were extended to other foreign companies. In 1965 the EA field was discovered by Shell in shallow water Southeast of Warri.

Following the discovery of crude oil by Shell D'Arcy Petroleum, pioneer production began in 1958 from the company's oil field in Oloibiri in the then Eastern Niger Delta. By the late sixties and early seventies, Nigeria had attained a production level of over 2 million barrels of crude oil a day.

3. LITERATURE REVIEW

3.1 Air Pollution

Air pollution encompasses a diverse array of anthropogenic chemical emissions including gaseous combustion products, volatile chemicals, aerosols (particulate), and their atmospheric reaction products.

Air pollution effects are many, and they may be really harmful. It distinguishes between short-term acute effects and long-term chronic effects of air pollution. Acute effects may be brought on, for instance, by *pollution episodes*, while chronic effects may generally affect a greater proportion of the population [13].

Table 1. Major Events in the history of the Nigerian oil and gas

S/N	Year	Event
1	1908	Nigerian Bitumen Co. & British Colonial Petroleum commenced operations around Okitipupa
2	1938	Shell D'Arcy granted Exploration license to prospect for oil throughout Nigeria
3	1955	Mobil Oil Corporation started operations in Nigeria
5	1956	First successful well drilled at Oloibiri by Shell D'Arcy
6	1956	Changed name to Shell-BP Petroleum Development Company of Nigeria Limited
7	1958	First shipment of oil from Nigeria
8	1961	Shell's Bonny Terminal was commissioned. Texaco Overseas started operations in Nigeria
9	1962	Elf started operations in Nigeria. (As Safrap). Nigeria Agip Oil Company started operations in Nigeria
10	1963	Elf discovered Obagi field and Ubata gas field Gulf's first production
11	1965	Agip found its first oil at Ebocha Phillips Oil Company started operations in Bendel State
12	1966	Elf started production in Rivers State with 12,000 b/d
13	1967	Phillips drilled its first well (Dry) at Osari –I. Phillips first oil discovery at Gilli-Gilli –I
14	1968	Mobil Producing Nigeria Limited) was formed. Gulf's Terminal at Escravos was commissioned
15	1970	Mobil started production from 4 wells at Idoho Field. Agip started production. Department of Petroleum Resources Inspectorate started.
16	1971	Shell's Forcados Terminal Commissioned. Mobil's terminal at Qua Iboe commissioned
17	1973	First Participation Agreement; Federal Government acquires 35% shares in the Oil Companies. Ashland started PSC with then NNOC (NNPC). Pan Ocean Corporation drilled its first discovery well at Ogharefe –I.
18	1974	Second Participation Agreement, Federal Government increases equity to 55%. Elf formally changed its name from "Safrap". Ashland's first oil discovery at Ossu –I
19	1975	First Oil lifting from Brass Terminal by Agip DPR upgraded to Ministry of Petroleum Resources
20	1976	MPE renamed Ministry of Petroleum Resources (MPR) Pan Ocean commenced production via Shell-BP's pipeline at a rate of 10,800 b/d
21	1977	Government established Nigerian National Petroleum Corporation (NNPC) by Decree 33, (NNOC & MPR extinguished)
22	1979	Third Participation Agreement (throughout NNPC) increases equity to 60% Fourth Participation Agreement; BP's shareholding nationalised, leaving NNPC with 80% equity and Shell 20% in the joint Venture. Changed name to Shell Petroleum Development Company of Nigeria (SPDC)
23	1984	Agreement consolidating NNPC/Shell joint Venture
24	1986	Signing of Memorandum of Understanding (MOU)
25	1989	Fifth Participation Agreement; (NNPC=60%, Shell = 30%, Elf=5%, Agip=5%)
26	1991	Signing of Memorandum of Understanding & joint Venture Operating Agreement (JOA)
27	1993	Production Sharing Contracts signed –SNEPCO. Sixth Participation Agreement; (NNPC=55%, Shell=30%, Elf= 10%, Agip=5%). The coming on-stream of Elf's Odudu blend, offshore OML 100.
28	1995	SNEPCO starts drilling first Exploration well. NLNG's Final Investment Decision taken
29	1999	NLNG's First shipment of Gas out of Bonny Terminal
30	2000	NPDC/NAOC Service Contract signed
31	2001	Production of Okono offshore field.
32	2002	New PSCs agreement signed. Liberalisation of the downstream oil sector. NNPC commences retail outlet scheme

Source: Nigerian National Petroleum Company (NNPC) (2010)

Air pollution comes from both natural and human-made (anthropogenic) sources. However, globally, human-made pollutants from combustion, construction, mining, agriculture and warfare are increasingly significant in the air pollution equation [14].

Motor vehicle emissions are one of the leading causes of air pollution. China, United States, Russia, India, Mexico and Japan are the world leaders in air pollution emissions. Principal stationary pollution sources include chemical plants, coal-fired power plants, oil refineries, petrochemical plants, nuclear waste disposal activity, incinerators, large livestock farms (dairy cows, pigs, poultry, etc.), PVC factories, metals production factories, plastics factories, and other heavy industries. Agricultural air pollution comes from contemporary practices which include clearing felling and burning of natural vegetation, as well as spraying of pesticides and herbicides [15].

Millions of metric tons of hazardous waste are generated globally each year. In 2010, the United States alone produced about 250 million metric tons. Americans constitute less than 5% of the world's population, but produce roughly 25% of the world's CO₂, and generate approximately 30% of world's waste. However, from the beginning of 2007, China tends to have overtaken the United States as the world's biggest producer of CO₂ while still far behind based on per capita pollution - ranked 78th among the world's nations [16,17].

Over the last years, concern for the possible influence of exposure to air pollutants in human has grown; exposure levels which may be reached nowadays in our dwellings and in our streets. Studies on infant mortality and exposure to particles show an outstanding consistency in the magnitude of the effects, despite the different designs used. As a whole, data show that an increase in 10 lg/m³ of particle concentration (measured as PM10) is associated with about 5% increase in post-neonatal mortality for all causes and around 22% for post-neonatal mortality for respiratory diseases. Regarding damage in foetal health, although results are not always consistent, most studies show associations with exposure to air pollution during pregnancy. However, the precise mechanisms of action of air pollutants on adverse reproductive results are still unknown, so is the period of exposure most relevant during pregnancy and the specific pollutant which may represent a

higher risk. Follow-up studies evaluating personal exposure to different air pollutants are required, allowing for the adequate evaluation of the impact of each pollutant in different periods of human development [18].

Results from epidemiological and experimental studies show that infants and aged are especially susceptible to the toxic effects of pollutants such as suspended particles, polycyclic aromatic hydrocarbons (PAH). In the case of exposure to air pollutants where exposure occurs through inhalation, children inhale a relatively higher volume of air than adults [19].

In recent years there is a growing concern about the possible influence on health of the exposure to air pollutants during infancy through adulthood exposure to concentrations which may be reached nowadays in our homes or streets. Recent studies have added proofs of the impact of exposure to air pollution on the risk of intrauterine or post-neonatal death or congenital defects prematurity and foetal development [20,21].

3.2 Petrochemicals

Petrochemicals are chemical products derived from petroleum. Some chemical compound made from petroleum are also obtained from other fossil fuels, such as coal or natural gas, or renewable sources such as corn or sugar cane. Petrochemicals are manufactured from crude oil and natural gas liquids, and are used to produce thousands of products.

The two most common petrochemical classes are olefins (including ethylene and propylene) and aromatics (including benzene, toluene and xylene isomers). Oil refineries produce olefins and aromatics by fluid catalytic cracking of petroleum fractions. Chemical plants produce olefins by stream cracking of natural gas liquids like ethane and propane. Aromatics are produced by catalytic reforming of naphtha. Olefins and aromatics are the building-blocks for a wide range of materials such as solvents, detergents, and adhesives. Olefins are the basis for polymers and oligomers used in plastics, resins, fibers, elastomers, lubricants, and gels [4,22,23].

Petrochemicals make possible many innovations and benefits for society. They are used to make medications and medical devices for treatment of illness. They are the building blocks for body

armor and other high-tech materials, which are used to protect police officers, fire fighters and the men and women in armed forces. They are key raw materials that keep us safe while driving in our cars, and make modern communications possible. In fact, even our hi-tech communication gadgets, such as desktop computer, laptop or smart phones are made from petrochemicals. Petrochemicals and their derivatives, as well as all chemicals and the facilities that handle them, are highly regulated throughout the world to ensure the health of consumers and the environment.

3.3 Petrochemical Pollution

Petrochemicals are manufactured from crude oil and natural gas liquids, and are used to produce thousands of products that make life possible. Everything not made from rocks, plants, other living things or metal is made from petrochemicals. This includes everything made of plastic.

Chemicals are not tested for health effects before being put into use, and by the time it is figured out that something is making people sick, there are a lot of people affected. Especially when the environmental warning signs are not acted upon. It is also not easy getting the health research funded by independent researchers. You come into contact with chemicals every day. This is called chemical exposure. Although some chemical exposures are safe, others are not. A certain amount of a harmful chemical must enter your body to make you sick. Harmful chemicals can get into your body if you breathe, eat or drink them, or if they are absorbed through your skin.

3.4 Health Conditions Associated With Petrochemical Pollution

The discarded petrochemicals in the Niger Delta region of Nigeria have had direct impacts on the lives of many people in the area. For over five decades these people have struggled to survive as a result of the effects that the contamination has had on their living conditions. Everyday life of the indigenous people has been strongly influenced by the petrochemical waste left behind by petroleum operations. One of the largest problems caused by the oil waste is pollution seeping into the water supply of the communities in the area. More than 30 billion gallons of oil waste, known as formation water, was released into the environment. Formation water contains unusable petroleum by-products (petro-

chemicals) mixed with water from beneath the bedrock. These contaminants leached into the Amazon Basin's headwaters, which serve as the water supply for many communities [24].

Streams and rivers in the contaminated areas of Niger Delta region have collected much of the crude oil, especially in times of rain, when petroleum products are carried from the waste pits by the running water. The contamination is also brought to the surfaces of streams and rivers as the turbulence of the water stirs the settled heavy oil waste. People have reported a decrease in aquatic life and an increase in death of livestock that drink this water. Unfortunately, these are the very water sources used by the locals for drinking, cooking and bathing. According to Gay et al. [25], peasants have reported skin rashes after bathing in these waters. Many people, the majority being children, have gotten horrible rashes and sores on their skin from bathing in water that is severely contaminated by oil [26]. Many adults, usually between the ages of 40 and 60, who live near oil pits, have been struck with cancer of the stomach and/or skin [27]. Hurtig & Sebastián [24] conducted a study to contrast the cancer rates of people living near oil pits to people who live far from them. Their research shows that people who lived in close proximity to the contamination had elevated rates of cancer of the stomach, rectum, skin, soft tissue, kidney, cervix, and lymph nodes. They also found a great increase in hematopoietic cancers among children who were less than 10 years of age.

In the Northeast region of Ecuador, for example, Hurtig & Sebastián [28] noted a correlation between childhood leukemia and living in close proximity to oil fields. In the provinces of Sucumbios, Orellana, Napo, and Pastaza, which are all located in Northeast Ecuador, there were 91 cancer incidences and 42 leukemia incidences in children aged 0-14 between the years 1985-2000. Of these, 28 cases of leukemia and 27 other forms of cancer were reported in counties that were exposed to petrochemical waste. The relative risk calculated in this study for both genders to experience leukemia in all age groups was determined to be significantly higher in areas affected by the oil contamination. Another study by Sebastián [29] was conducted in Ecuador on the pregnancy outcomes of women aged 17 to 45. Women living in contaminated areas for at least 3 years were studied and interviewed along with a control group that lived in areas of the Amazon Basin in

Ecuador that were untouched by oil. Local streams and rivers used for drinking, bathing and fishing were tested from both contaminated and non-contaminated areas and the former revealed concentrations of polynuclear aromatic hydrocarbons (PAHs) that were 10 to 10,000 times greater than levels considered acceptable by U.S. Environmental Protection Agency guidelines. Miscarriage rates were found to be much more prominent in oil-contaminated areas as the study revealed a risk for spontaneous abortion 2.34 times higher among communities situated near oil contamination.

The health effects believed to be associated with petrochemicals in Kuwait varied greatly due to the wide range in possible exposure [30]. The oil contamination, occurring in the water, on land, and in air, affected different aspects of people's health. As the crude oil wells burned, they released a host of toxic chemicals into the atmosphere. High levels of particulate matter were found in air samples. Husain [31] reveals that chronic and probably irreversible respiratory disorders result from long-term exposure to these contaminants. Kuwait's oil is characterized as sour crude, containing high levels of sulfur. As a result, when ignited, the oil is much more toxic than its low sulfur containing counterpart known as sweet crude. Human health and the vegetation of the area were potentially affected as reported by Husain [32], who says that the burning wells produced large amounts of toxic gases including sulfur dioxide (SO₂), carbon monoxide (CO), hydrogen sulfide (H₂S), carbon dioxide (CO₂), along with the oxides of nitrogen (NO(x)) as well as particulates containing partially burned hydrocarbons and metals. The many oil wells burned for months, producing dramatic visual effects in the air [31]. The effects were seen around the world as a global concern erupted over significant potential changes in meteorological patterns and ecosystems, along with adverse health effects among those exposed to the smoke and pollution. As many of those affected by the smoke plume were veterans, there was a strong concern over the potential long-term effects, which have yet to be characterized. According to Gastañaga et al. [33], the vast range of health problems of American and Australian veterans related to their exposure to crude oil in the Gulf War, include infections and parasitic diseases, neoplasms, endocrine, nutritional, and metabolic diseases, mental disorders, diseases of the blood, nervous system, circulatory system, respiratory system, digestive system and genitourinary system,

complications of pregnancy, skin diseases, musculoskeletal system diseases, poisoning, asthma, acute bronchitis, chronic bronchitis, malignant neoplasms of the respiratory and intrathoracic organs, malignant neoplasms of the oropharynx, nasopharynx, and hypopharynx, emphysema, ischemic heart disease, respiratory conditions due to chemical fumes and vapors along with other diseases of the respiratory system.

The impacts of the oil released into the Persian Gulf on human health and the environment have been more significant due to the shallow depths, limited circulation, and high salinity and temperature that distinguish the north-eastern part of the Gulf [34]. Apprehension was evident in both the scientific community and the public. A significant area of concern was the extent of contamination of seafood with petroleum hydrocarbons.

In reaction to the anxiety, studies assessing the impact of oil pollution on the marine ecosystem of the Persian Gulf were performed. Despite this array of research, focus was not directed toward the effects on the consumer. The study by Al-Bahloul et al. [34] aimed to identify whether seafood being sold in Kuwaiti markets was safe to eat. A wide variety of toxins at high concentrations were found in fish and shrimp samples taken from Kuwaiti fishing waters. Elevated levels of one chemical, naphthalene, omnipresent in seafood samples, were indicative of the pollution of Kuwait's territorial waters with crude oils.

3.5 Eye Conditions Associated With Petrochemical Pollution

3.5.1 Allergic conjunctivitis

Conjunctivitis is a common eye condition worldwide. It causes inflammation (swelling) of the conjunctiva—the thin layer that lines the inside of the eyelid and covers the white part of the eye. Conjunctivitis is often called "pink eye" or "red eye" because it can cause the white of the eye to take on a pink or red colour [35].

The most common causes of conjunctivitis are viruses, bacteria, and allergens. But there are other causes, including chemicals, fungi, certain diseases, and contact lens wear (especially wearing lenses overnight). The conjunctiva can also become irritated by foreign bodies in the eye and by indoor and outdoor air pollution caused,

for example, by petrochemical vapours, fumes, smoke, or dust. These result in a condition simply called allergic conjunctivitis.

3.5.2 Cataract

Cataracts are cloudy areas in the lens inside the eye, which is normally clear. Cataracts can develop in one or both eyes. If they develop in both eyes, one will be more severely affected than the other. A normally clear lens allows light to pass through to the back of the eye, so that the patient can see well-defined images. If a part of the lens becomes opaque, light does not pass through easily and the patient's vision becomes blurry, like looking through cloudy water or a fogged-up window. The more opaque (cloudier) the lens becomes, the worse the person's vision will be.

Lipid peroxides are believed to play a role in cataract formation. Niwa and Iizawa [36] examined serum lipid and lipid peroxide levels in patients with atopic dermatitis (AD) complicated by cataract formation in comparison with AD patients without cataracts and patients with other forms of dermatitis, taking into account any treatment with corticosteroids. Serum levels of chylomicrons, very-low-density lipoprotein, and lipid peroxide levels were increased, and superoxide dismutase activity was markedly less inducible in patients with cataract. These abnormalities demonstrated were irrespective of previous topical corticoid treatments. Atopic dermatitis (AD) patients without cataracts also showed significant abnormalities in all of the parameters measured, but these were less marked than in the AD patients with cataracts. Unfortunately, it was observed that most of the patients originated from areas of high environmental pollution (made up of mainly, petrochemical pollutants) whose products are known to produce great amounts of reactive oxygen species, excessive lipid peroxide formation, perhaps in part environmentally induced, seems to correlate to severe, adult-type AD with cataract formation.

Cataracts can also be precipitated by the excessive heat produced by gas flaring and other combustion activities associated with petrochemical production, which could result in coagulation of the protein materials in the crystalline lens. Lifetime lead exposure may increase the risk of developing cataracts, even in unborn babies, resulting to congenital cataracts [37].

3.5.3 Corneal foreign body

Corneal foreign body is foreign material on or in the cornea, usually metal, glass, or organic material, including petrochemical pollutants. Corneal foreign bodies generally fall under the category of minor ocular trauma. Small particles may become lodged in the corneal epithelium or stroma, particularly when projected toward the eye with considerable force [38,39].

The foreign object may set off an inflammatory cascade, resulting in dilation of the surrounding vessels and subsequent edema of the lids, conjunctiva, and cornea. White blood cells also may be liberated, resulting in an anterior chamber reaction and/or corneal infiltration. If not removed, a foreign body can cause infection and/or tissue necrosis. Foreign bodies are one of the most frequent causes of visits for ocular emergencies. Sometimes, the foreign body may not be present at the time of examination, having left the residual corneal abrasion with resultant pain. Superficial corneal foreign bodies are much more common than deeply embedded corneal foreign bodies, and mostly associated with petrochemical pollution [40].

3.5.4 Pterygium

A pterygium is a growth that develops on the conjunctiva or mucous membrane that covers the white part of your eye. It is a benign or noncancerous growth that is often shaped like a wedge. In some cases, a pterygium can extend to the cornea, the clear part of the eye that covers the iris and pupil. Pterygia usually do not cause blind, but can interfere with vision if further growth is not checked or prevented as it encroaches on the corneal surface. In some patients, pterygium can be inconveniencing with occasional complaints of itching and sandy (or foreign body) sensation.

Pterygium is a raised, wedge-shaped, non-cancerous growth of the conjunctiva onto the cornea, characterized by elastotic degeneration of and fibrovascular proliferation.

Pterygia are caused by too much exposure to ultraviolet (UV) light, hot air, and excessive heat. They occur more often in people who live in warm climates (especially, those living in and around oil prospecting/producing areas where gas flaring and combustion activities are constant) and spend a lot of time outdoors in sunny or windy environments. People whose

eyes are exposed to elements like pollen, sand, smoke, dust, or wind on a regular basis have a higher risk of developing this condition. Other risk factors include having light skin and light eyes. This is associated with extreme sun or wind exposure, wearing protective (photo chromic lenses, or sunglasses with side shields and/or wide brimmed hats and using artificial tears throughout the day may help prevent their formation or stop further growth [41] see figure 1.



Fig. 1. Photo description of pterygium of the eye

Source: *Doctors Gate* (2011, p. 3)

3.5.4 Dry eyes

Dry eyes are caused by a lack of adequate tears. Our tears are a complex mixture of water, fatty oils, and mucus. This mixture helps make the surface of our eyes smooth and clear, and it helps protect our eyes from infection. The symptoms may include dryness, grittiness, irritation, burning and even excessive tearing or watering [42].

For some people, the cause of dry eyes is an imbalance in the composition of their tears. Other people don't produce enough tears to keep their eyes comfortably lubricated. Eyelid problems, medications and other causes, such as environmental factors, also can lead to dry eyes.

According to Swartwout [43], aging process, which involves free radical damage to body tissues increases the prevalence of dry eye symptoms. As we get older, on average, our eyes produce 40% less lubrication. Pregnancy can also trigger dry eyes. Environmental allergens, toxins, and other irritants, like exposure to air conditioning, wind, excessive sunlight, dust, contact lenses, dry

airplane air, smog and smoke contribute as well. For example, in one study 40% of dry eye patients were smokers. Also, second hand cigarette smoke reduces the breakup time of the tears by 40%. Even a single cigarette can produce a level of carbon monoxide of 400 ppm (parts per million). Carbon monoxide, along with smog and chemical fumes inactivates lysozyme, the natural antibiotic secreted in the tears [43].

4. METHODOLOGY

4.1 Area of Study

This study was carried out in Ogba/Egbema/Ndoni Local Government Area (ONELGA) of Rivers State. ONELGA is inhabited by Ogba, Egbema and Ndoni ethnic groups. They are great farmers and fishermen/women and with a rich cultural history. The local government is home to multinational oil exploration and servicing companies such as, SDPC, TOTAL, NAOC. ONELGA has an Area: 969 km² – Density: 292.4 in h./km² [2006] – Change: +2.8%/year [1991 → 2006. According to the 2006 census, ONELGA has a population of 283,294 [44]. Fig. 2 shows the map of Rivers State, indicating Ogba/Egbema/Ndoni Local Government Area at the apex of the map.

4.2 Research Design

The research design of this study was anchored on document analysis, which was based on an examination of records from three private eye clinics in Ogba, Egbema, Ndoni Local Government Area (ONELGA) of Rivers State, Nigeria. It evaluated the effect of Petrochemical Pollution on Oculo-visual health. The use of document materials is an integral part of the instruments for data gathering. They are valuable sources of data gathering in public health studies. The categories of documents used in this study include both primary and secondary sources. Primary sources are in the form of patients' clinical/medical records that have first-hand information on the theme of this study. Secondary sources include textbooks, journals, quoted materials, reports of researches carried out by other investigators, relevant to the theme of this study [45]. The choice for this method is because its major advantage is that documents are generated contemporaneously with the events they refer to. Therefore, they are least expected to be subjected to memory decay or memory distortion compared with data obtained

using interview method [46] (Bowen, 2009). The materials used for this study were validated using Scott [47] overlapping validity criteria *vis-à-vis*, authenticity, credibility, representativeness and meaning, which is guided By document selection [48,46,49,50].

The choice of the use of private clinics was because there were no records of eye patients in the government owned hospitals in the area of study.

4.3 Study Population

The population of this study comprised children, young adults, and workers living in and around ONELGA. The age range of the subjects is 6 months to 70 years. The Tables 1-6 in chapter four show the clinical records of patients who presented to the clinics between 2007 and 2012 with various eye conditions.

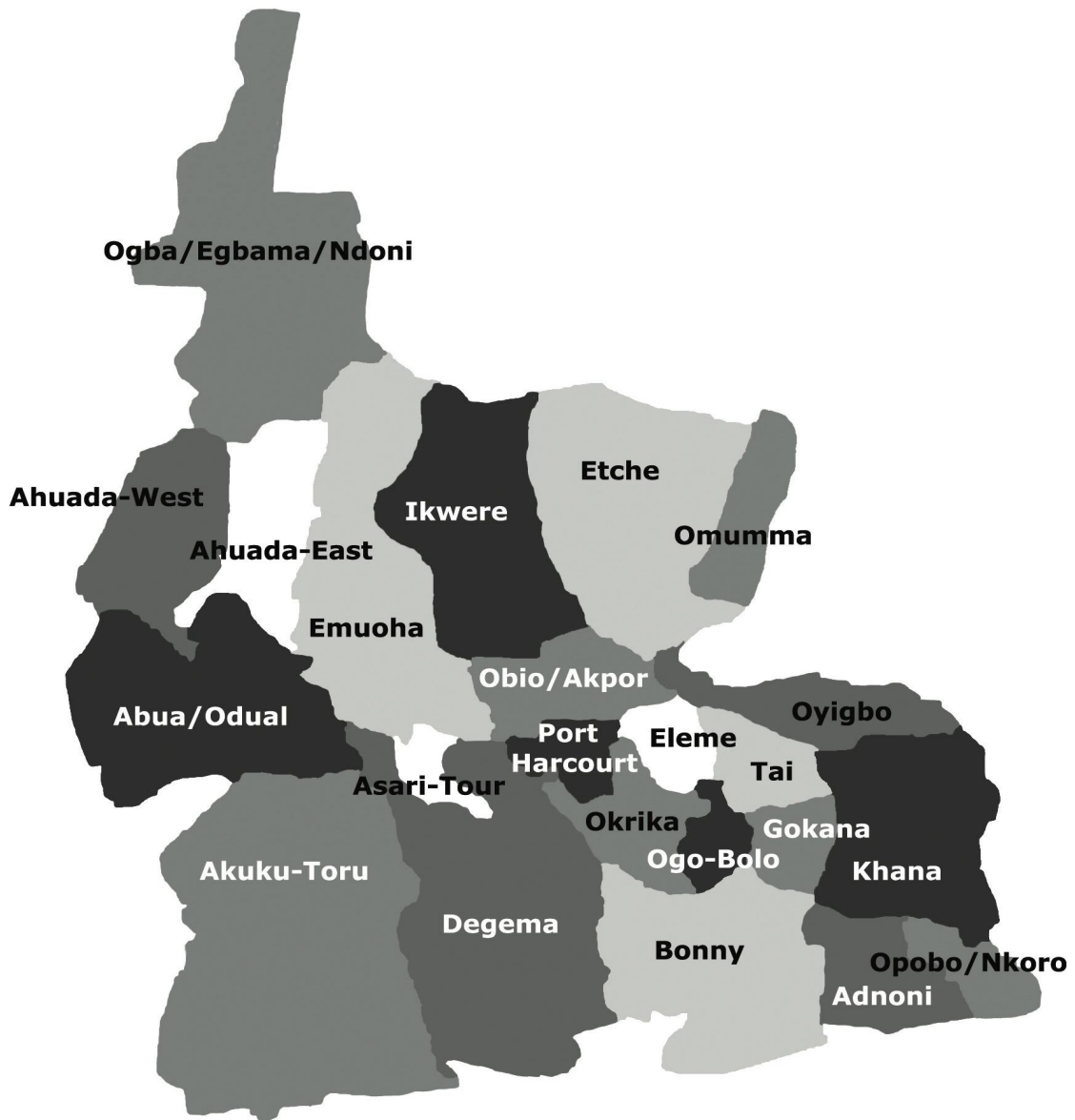


Fig. 2. Map of rivers state, showing ONELGA

4.4 Sampling and Sampling Technique

The sampling technique used in this study is what is known and called the stratified sampling technique. This is a situation where the subjects were stratified into groups of 100 patients per year whose eye problems were treated and/or managed in the selected clinics between 2007 and 2012.

4.5 Data Collection

The data for this study were gathered from the records of the patients, who presented with eye conditions to the three eye clinics within the study area.

4.6 Data Analysis

The data were analyzed to compare the relationship between petrochemical pollution and oculo-visual health. Cross tabulation was used because it is one of the simplest and most common ways of demonstrating the presence or absence of a relationship [51].

5. RESULTS

5.1 Research Question One

The Tables 2-7 show the clinical records of patients who presented to the clinics between 2007 and 2012 with petrochemical pollution-induced eye conditions. The patients comprised oil workers and people living in and around the oil prospecting and producing areas. It is important to note that the conditions listed below are not trauma-induced, age-related or systemic disease complications. In other words, such conditions as senile or diabetic cataract, infective conjunctivitis, corneal ulcers/infections, etc are excluded.

In the year 2007 (Table 2), out of the randomly selected 100 patients (including oil workers and people living in and around the oil prospecting and producing areas) who visited the clinics with various eye problems, 27(27%) of them had conditions that are related to petrochemical pollution. Cataract patients were 3(3%), corneal foreign body (cfb) 7(7%), dry eye/irritation 3(3%), pterygium 7(7%), and allergic conjunctivitis 7(7%).

Table 3 shows that in 2008, of the randomly selected 100 patients, 29(29%) had eye conditions, which were caused by petrochemical

pollution. It shows that 2(2%) of the patients had cataract, 5(5%) had cfb, 4(4%) had dry eye/irritation, 5(%) had pterygium, and 13(13%) had allergic conjunctivitis.

In 2009, of the 100 patients, which were randomly selected, 22(22%) presented with petrochemical pollution-induced eye problems, such that 1(1%) reported with cataract, cfb 3(3%), dry eye/irritation 2, pterygium 2(2%), and allergic conjunctivitis 14 patients (See Table 4).

One hundred randomly selected patients were also treated for different kinds of eye problems in 2010, 21(21%) of them had petrochemical pollution related problems, which include 2(2%) cataract, 7(7%) cfb, 2(2%) pterygium, and 10(10%) vernal conjunctivitis allergic conjunctivitis cases. None of the patients had dry eye/irritation (see Table 5).

In 2011, out of randomly selected 100 patients who came to the clinics with various eye problems, 16(16%) of them had conditions that are related to petrochemical pollution. Cataract patients were 2(2%), corneal foreign body (cfb) 1(1%), pterygium 2(2%), and allergic conjunctivitis 11(11%). There was no case of dry eye/irritation (see Table 6).

Also in 2012, 16 of the 100 randomly selected patients (Table 7) reported with petrochemical pollution-induced eye conditions, made up of 1(1%) cataract, 3(3%) cfb, 2(2%) pterygium, and 10(10%) allergic conjunctivitis cases. Similar to 2010 and 2011, no patient had dry eyes/irritation in 2012.

5.2 Research Question Two

5.2.1 Oculo-visual health and general well-being of citizens

Generally, no significant relationship has been found between oculo-visual health and general well-being of the citizens (see Tables 2-7), but for those whose vision is affected by petrochemical pollution, their living is hampered in one way or another. The discomfort associated with petrochemical pollution-induced eye conditions could constitute an inconvenience and nuisance to the victims. Ordinarily, those with low grade to moderate refractive errors appear to lead a normal life, but not so with high to very high refractive patients. Incidentally, some specific oculo-visual conditions, such as end stage chronic open angle glaucoma, retinitis

pigmentosa, cataract and the retinopathies (diabetic and hypertensive), have had serious negative impact on the general wellbeing of citizens affected. Most of them are financially and socially handicapped by these conditions, having lost their jobs because of their inability to meet the oculo-visual challenges of their work.

However, those whose cases were identified early, with proper treatment/management, have maintained a healthy and normal living.

Age and gender were not particularly considered in this study because petrochemical pollution-induced eye problems have no age or gender preference. However, it was observed that these conditions affected more males of working age (retired and unretired) than females of all ages (see appendix).

5.3 Research Hypothesis

The analysis of the data collected shows that out of the 600 randomly selected patients who reported to the clinics, between 2007 and 2012, with various eye conditions, only 131(21.8%) had petrochemical pollution-induced eye problems. These are cataract 11(1.8%); corneal foreign body 26(4.3%); dry eye/irritation 9(1.5%); pterygium 20(3.0%); and allergic conjunctivitis, 65(10.8%). Considering the figures obtained from this simple (percentage) calculation, 131(21.8%) is so small and insignificant when compared to a total of 600 patients whose clinical records were used (examined) in this study. In this respect therefore, it can be established that there is no significant relationship between petrochemical pollution and oculo-visual health. Thus, the hypothesis was rejected. See table 8.

Table 2. Clinical records of patients who presented with petrochemical pollution-induced eye conditions in 2007

S/N	Petrochemical pollution-induced eye conditions	No. of patients	%
1	Cataract	3	3
2	Corneal foreign body	7	7
3	Dry eyes/Irritation	3	3
4	Pterygium	7	7
5	Allergic Conjunctivitis	7	7
	Total	27	27

Table 3. Clinical records of patients who presented with petrochemical pollution-induced eye conditions in 2008

S/N	Petrochemical pollution-induced eye conditions	No. of patients	%
1	Cataract	2	2
2	Corneal Foreign body	5	5
3	Dry eyes/Irritation	4	4
4	Pterygium	5	5
5	Allergic Conjunctivitis	13	13
	Total	29	29

Table 4. Clinical records of patients who presented with petrochemical pollution-induced eye conditions in 2009

S/N	Petrochemical pollution-induced eye conditions	No. of patients	%
1	Cataract	1	1
2	Corneal foreign body	3	3
3	Dry eyes/Irritation	2	2
4	Pterygium	2	2
5	Allergic Conjunctivitis	14	14
	Total	22	22

Table 5. Clinical records of patients who presented with petrochemical pollution-induced eye conditions in 2010

S/N	Petrochemical pollution-induced eye conditions	No. of patients	%
1	Cataract	2	2
2	Corneal foreign body	7	7
3	Dry eyes/Irritation	-	-
4	Pterygium	2	2
5	Allergic Conjunctivitis	10	10
	Total	21	21

Table 6. Clinical records of patients who presented with petrochemical pollution-induced eye conditions in 2011

S/N	Petrochemical pollution-induced eye conditions	No. of patients	%
1	Cataract	2	2
2	Corneal foreign body	1	1
3	Dry eyes/Irritation	-	-
4	Pterygium	2	2
5	Allergic Conjunctivitis	11	11
	Total	16	16

Table 7. Clinical records of patients who presented with petrochemical pollution-induced eye conditions in 2012

S/N	Petrochemical pollution-induced eye conditions	No. of patients	%
1	Cataract	1	1
2	Corneal foreign body	3	3
3	Dry eyes/Irritation	-	-
4	Pterygium	2	2
5	Allergic Conjunctivitis	10	10
	Total	16	16

Table 8. Cumulative analysis of petrochemical pollution-induced eye conditions between 2007 and 2012

S/N	Petrochemical pollution-induced eye conditions	No. of patients	%
1	Cataract	11	1.8
2	Corneal foreign body	26	4.3
3	Dry eyes/Irritation	9	1.5
4	Pterygium	20	3.0
5	Allergic conjunctivitis	65	10.8
	Total	131	21.8

6. CONCLUSION

Petrochemicals are undoubtedly important commodities in the world. Without which most vehicles cannot move, many homes cannot be heated, and national economies especially in some developing countries would crumble. Regrettably, with petrochemical exploration and extraction practices comes an inherent risk of spills and flaring with associated health hazard or complications. Spills and flaring can range in magnitude from a few quantities that spill and

flare during production and refining as a result of deteriorating infrastructure, shipping mistakes, and inadequate handling practices. Hazardous petrochemical waste, which must be stored or transported to prevent it from affecting the human environment where drilling occurs, is also produced in vast quantities by oil processes and can possibly spill into the environment causing damage and discomfort to residents in communities where these activities are prevalent.

Research these days tends to focus on finding a problem and then adding another petrochemical pharmaceutical as a “treatment” instead of then looking for the cause(s) of the problem to eliminate the cause(s), thereby creating even more complex problems that we’ll never be able to solve.

In spite of the fact that this study revealed no significant relationship between petrochemical pollution and oculo-visual health, there is the need to protect the vulnerable in the society from the harmful effects of petrochemicals on oculo-visual well-being.

Let us take better care of our environment, ourselves and each other. Let us practice the precautionary principle. Let us leave this planet inhabitable for future generations, and look forward to the Nigeria’s Vision 20: 2020, and the seventh Millennium Development Goal (MDG) that ensures environmental sustainability.

In the course of this study, some of the petrochemical pollution induced oculo-visual problems were complicated by other conditions, like hypertension, diabetes, glaucoma, bacterial and viral infections. Therefore, it was quite difficult to specifically identify them as effects of petrochemical pollution. Secondly, an attempt to carry out on-the-spot (active) visual screening of oil workers at their job sites was restricted by the company management because they feared that such a study would work against their interest.

As a result, the researcher relied only on the clinical records of patients who were treated for petrochemical pollution induced conditions, some of which were free from other disease complications.

It is recommended that we should take better care of our environment, ourselves and one another. Let us check gas flaring, oil spillage and practice the precautionary principle.. We should stop buying all the junk and toxic products and use safe, non-toxic products and materials that don’t pollute the environment and ourselves. Let us leave this planet inhabitable for future generations.

This study recommends further research on the impact of petrochemical pollution on oculo-visual health considering other derivations such as age, gender, occupation, etc. Government and the oil companies should partner in areas of protective and treatment programmes toward ensuring that

the vulnerable citizens are adequately protected, and existing conditions are treated and managed.

CONSENT

Not applicable.

ETHICAL APPROVAL

Consent forms were not required because this study is not against the public interest or violates any Nigerian legislation.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Odularu GO. Crude oil and the Nigerian economic performance; 2008. Retrieved November 21, 2012 from http://www.ogbus.ru/eng/authors/Odularo/Odularo_1.pdf.
2. UNDP. What UNDP does in Nigeria; 2012. Retrieved November 20, 2012 from <http://www.ng.undp.org/#>.
3. Albers PH. An Annotated bibliography on petroleum pollution. Version 2007. USGS Patuxent Wildlife Research Center, Laurel, MD; 1998.
4. Wikipedia (n.d). Petrochemical. Retrieved November 3, 2014 from <http://en.wikipedia.org/wiki/Petrochemical>.
5. Environmental Health. Seriously “Sensitive” to Pollution; 2012. Retrieved February 20, 2014 from <http://lindasepp.wordpress.com/2012/12/30/petrochemicals-and-human-health/>.
6. NNPC. History of the Nigerian Petroleum Industry; 2010. Retrieved November 22, 2012 from <http://www.nnpcgroup.com/NNPCBusiness/BusinessInformation/OilGasinNigeria/IndustryHistory.aspx>.
7. AFPM. Petrochemicals; 2013. Retrieved February 20, 2014 from <http://www.afpm.org/policy-positions-petrochemicals/>.
8. Ihekaire DE. The comparative efficacy of cyclopegic drugs–tropicamide and cyclopentolate. International Journal of Scientific Research in Education. 2012; 5(3):223-246.

9. Ihekaire DE, Anyanwu C. Learning-related vision problems in school age children in Imo State University Primary and Secondary Schools. *International Journal of Scientific Research in Education*. 2012;5(2):109-116.
10. Beach MC, Saha S, Cooper LA. The role and relationship of cultural competence and patient-centeredness in health care quality; 2006. Retrieved October 31, 2012 from: http://www.commonwealthfund.org/us_r_doc/beach_rolerelationshipcultcomppatint-cent_960.pdf
11. Stewart S. Cultural competence in health care. Sydney, Australia: Diversity Health Institute; 2006.
12. Cohen JJ, Gabriel BA, Terrell C. The case for diversity in the health care workforce. *Health Affairs*. 2002;21(5):90-102.
13. Gray I. Air pollution effects; 2008. Retrieved December 22, 2013 from <http://www.tropical-rainforest-animals.com/air-pollution-effects.html>.
14. United Nations. Declaration of the United Nations Conference on the Human Environment; 1972.
15. Beychok MR. A data base for dioxin and furan emissions from refuse incinerators. *Atmospheric Environment*. 1987;21(1):29-36.
16. Wikipedia (n.d). Pollution. Retrieved November 3, 2014 from <http://en.wikipedia.org/wiki/Pollution>.
17. e-Waste Facts. Is e-Waste a growing concern? 2013. Retrieved December 22, 2013 from <http://www.causesinternational.com/ewaste/e-waste-facts>.
18. Lacasana M, Esplugues A, Ballester F. Exposure to ambient air pollution and prenatal and early childhood health effects. *European Journal of Epidemiology* 2005;20:183-199.
19. Perera FP, Illman SM, Kinney PL, et al. The challenge of preventing environmentally related disease in young children: community-based research in New York City. *Environ Health Perspect*. 2002;110:197-204.
20. Woodruff T, Grillo J, Schoendorf KC. The relationship between selected causes of post-neonatal infant mortality and particulate air pollution in the United States. *Environ Health Perspect*. 1997;105:608-612.
21. Pereira L, Loomis DP, Conceicao GMS, et al. Association between air pollution and intrauterine mortality in Sao Paulo, Brazil. *Environ Health Perspect*. 1998;106:325-329.
22. Matar S, Hatch LF. Chemistry of petrochemical processes. Gulf Professional Publishing; 2001.
23. Staff. Petrochemical Processes. *Hydrocarbon Processing*. 2001;71-246.
24. Hurtig AK, Sebastián MS. Geographical differences in cancer incidence in the Amazon Basin of Ecuador in Relation to Residence near Oil Fields. *International Journal of Epidemiology*. 2002;31:1021-1027.
25. Gay J, Shepherd O, Thyden M, Whitman M. The health effects of oil contamination: a compilation of research; 2010. Retrieved February 14, 2014 from <http://www.netes.org/abstract-medicine/50540-1-10-december-15th-the-health-effects-oil-contamination-compilation-rese.php>.
26. McGovern J. Letter to the honorable Barack Obama President-Elect of the United States; 2008. Retrieved September 5, 2010 from <http://mcgovern.house.gov/uploads/scan001.PDF>
27. Hurtig AK, Sebastián MS. Oil in the Amazon Basin of Ecuador: The Popular Epidemiology Process. *Pan American Journal of Health*. 2004b;15(3):205-211.
28. Hurtig AK, Sebastián MS. Incidence of Childhood Leukemia and Oil Exploitation in the Amazon Basin of Ecuador. *International Journal of Occupational and Environmental Health*. 2004a;10:245-250.
29. Sarangi S. Discourse Practitioners as a Community of Interprofessional Practice: Some Insights from Health Communication Research. In: C. Candlin (Ed) *Research and Practice in Professional Discourse*. Hong Kong: City University of Hong Kong Press; 2002.
30. Abramson MJ, Forbes AB, Glass DC, Ikin JF, Ittak P, Kelsall HL, McKenzie DP, Sim MR. Respiratory Health Status of Australian Veterans of the 1991 Gulf War and the Effects of Exposure to Oil Fire Smoke and Dust Storms. In *Thorax*. 2004;59:897- 903.
31. Husain T. Kuwaiti Oil Fires: Source Estimates and the Plume Characterization. In *Pergamon-Elsevier Science, Atmospheric Environment*. 1994;28:2149-2158.

32. Husain T. Terrestrial and atmospheric environment during and after the gulf war. In *Environment International*. 1998; 24(1):189-198.
33. Gastañaga VM, Gray GC, Kaiser KS, Reed RJ, Smith TC. Self-reported Symptoms and Medical Conditions among 11,868 Gulf War-era Veterans: The Seabee Health Study. In *American Journal of Epidemiology*. 2002;155(11):1033-1044.
34. Al-Bahloul M, Al-Hashash H, Al-Yakoob S, Saeed T. Preliminary exposure assessment for kuwaiti consumers to polycyclic aromatic hydrocarbons in seafood. In *Environment International*. 1995;21(3):255-263.
35. Centers for Disease Control and Prevention. Conjunctivitis (Pink Eye). 2014. Retrieved April 4, 2014 from <http://www.cdc.gov/conjunctivitis/about/causes.html>.
36. Niwa Y, Iizawa O. Abnormalities in serum lipids and leukocyte superoxide dismutase and associated cataract formation in patients with atopic dermatitis. *Arch Dermatol*. 1994;130(11):1387-1392. doi:10.1001/archderm.1994.01690110053006.
37. Medical News Today. What are cataracts? What Causes Cataracts? 2013. Retrieved April 2, 2014 from <http://www.medicalnewstoday.com/articles/157510.php>.
38. Skrtic L. Hydrogen sulfide, oil and gas, and peoples' health, energy and resources group. Berkeley, USA: University of California. 2006.
39. El-Naggar AY. Monitoring of hydrogen sulfide, methyl mercaptan and total sulfide at gas processing facilities. *Advances in Materials and Corrosion*. 2012;1(1):78-84.
40. Sowka JW, Gurwood AS, Kabat AG. *Handbook on Ocular Disease Management*. New York, USA: Jobson Publishing; 2001.
41. Doctors Gate. Photo description of Pterygium of the eye; 2011. Retrieved April 4, 2014 from <http://networkedblogs.com/ijnfn>.
42. Mayo B. Causes; 2012. Retrieved April 2, 2014 from <http://www.mayoclinic.org/diseases-conditions/dry-eyes/basics/causes/con-20024129>.
43. Swartwout G. (n.d). Dry Eye: Prevention & Reversal. Retrieved November 3, 2014 from <http://www.selfgrowth.com/articles/dry-eye-prevention-reversal>.
44. Nigeria Population Commission. Data for National Development; 2006. Retrieved November 23, 2012 from <http://www.population.gov.ng/index.php/state-population>.
45. Olorube NP, Kpolovie PJ. Approaches to conducting scientific research in education, arts and the social sciences. *Online Journal of Education Research*. 2012;1(3):44-56.
46. Bowen G. Document analysis as a qualitative research method. *Qualitative Research Journal*. 2009;9(2):27-40. doi: 10.3316/QRJ0902027.
47. Scott J. A matter of record: documentary sources in social research. Cambridge: Polity Press; 1990.
48. Bowen G. Preparing a qualitative research-based dissertation: Lessons learned. *Qualitative Report*. 2005;10(2):208-222.
49. Curry LA, Nembhard IM, Bradley EH. Qualitative and mixed methods provide unique contributions to outcomes research. *Circulat*. 2009;119:1442-1452. doi: 10.1161/CIRCULATIONAHA.107.742775.
50. Abanobi OC. Guidelines for project report, thesis, and dissertations. Owerri, Nigeria: Opinion Research and Communication; 2009.
51. Olorube NP. Teacher education, school effectiveness and improvement: a study of academic and professional qualification on teachers' job effectiveness in Nigerian secondary schools. Doctoral Dissertation, December 2006. University of Helsinki, Faculty of Behavioral Sciences, Department of Applied Sciences of Education, University of Helsinki Press; 2006.

APPENDICES

The tables below represent the raw data of clinical records of patients who reported to the clinics used in this research between 2007-2012.

Table 1. Clinical records of patients who reported to the clinics in 2007

No.	Date	Sex	Age	Occupation	Diagnosis
1	1/01/07	M	25	Trading	Traumatic Uveitis, OS
2	1/01/07	M	80	-	Senile cataract, OU
3	02/01/07	M	45	Civil Servant	Presbyopia
4	02/01/07	F	10	Student	Myopia
5	03/01/07	M	50	Trading	Inflamed pterigium, OD
6	03/01/07	F	48	Teacher	Presbyopia
7	04/01/07	F	68	Teacher	Ocular Hypertension
8	04/01/07	M	35	Oil Worker	Irritation
9	05/01/07	F	1	Infant	Allergic Conjunctivitis, OU
10	05/01/07	M	40	Farmer	Bacteria Corneal Ulcer, OS
11	06/01/07	M	28	Student	Traumatic cataract, OD
12	06/01/07	F	20	Student	Allergic Conjunctivitis, OU
13	8/01/07	F	40	Civil Servant	Presbyopia
14	8/01/07	M	52	trader	Infective Ureitis, OU
15	9/01/07	M	32	Carpenter	Irritation
16	9/01/07	F	70	-	Inflamed pterigium, OD
17	10/01/07	F	20	Student	Hyperopic astigmatism
18	10/01/07	F	15	Student	Myopia
19	11/01/07	M	55	Trading	Cataract (diabetic)
20	11/01/07	M	38	Trading	Traumatic glaucoma, OS
21	12/01/07	M	23	Applicant	Scleritis, OS
22	12/01/07	F	37	Teaching	Presbyopia
23	13/01/07	M	75	-	Senile cataract, OU
24	13/01/07	F	66	Trading	Ocular hypertension
25	15/01/07	M	50	Farmer	Bacteria Corneal Ulcer, OD
26	15/01/07	M	36	Motorcyclist	Inflamed pterigium, OU
27	16/01/07	F	23	Applicant	Allergic Conjunctivitis, OU
28	16/01/07	M	4	-	Allergic Conjunctivitis, OU
29	17/01/07	M	36	Clergy	Allergic Conjunctivitis, OU
30	17/01/07	F	2 ^{1/2}	Student	Keratitis, OU
31	18/01/07	M	70	Farming	Dry eyes
32	18/01/07	M	50	Trading	Vitreous floater, OD
33	19/01/07	M	23	Student	Myopia
34	19/01/07	F	25	Student	Esophona /hyperopia, OU
35	20/01/07	F	18	Student	Diplopia (double pupil) OD
36	20/01/07	M	65	Oil Worker	Central nuclear cataract, OU
37	22/01/07	F	6 months	-	Congenital cataract, OU
38	22/01/07	F	39	Oil Worker	Presbyopia
39	23/01/07	F	65	Farmer	Dry eyes
40	23/01/07	M	45	Business	Vascular cornea, OS
41	24/01/07	M	12	Student	Myopic astigmatism
42	24/01/07	M	15	Student	Kerato-conjunctivitis, OD
43	25/01/07	M	8	Pupil	Allergic Conjunctivitis, OU
44	25/01/07	F	52	Oil Worker	Lens sclerosis, OU
45	26/01/07	M	35	Business	Glaucoma, OS
46	26/01/07	M	23	Welder	Irritation
47	27/01/07	F	8	Student	Hyperopic astigmatism
48	27/01/07	M	55	Farmer	Cataract
49	29/01/07	M	30	Business	inflamed pterigium, OS

50	29/01/07	F	44	Oil Worker	Allergic Conjunctivitis, OU
51	30/01/07	F	22	Student	Astigmatism
52	30/01/07	F	38	Applicant	Presbyopia
53	31/01/07	M	25	Oil Worker	Astigmatism
54	1/02/07	M	60	Business	Presbyopia
55	1/02/07	F	35	Nursing	Iritis (traumatic), OU
56	2/02/07	F	68	Trader	Ocular hypertension
57	2/02/07	M	48	Farmer	Corneal Ulcer, OD
58	3/02/07	M	51	Oil Worker	Punctate Keratitis, OD
59	3/02/07	F	41	Teaching	Presbyopia
60	5/02/07	M	Adult	Civil Servant	Presbyopia
61	5/02/07	F	75	-	Cataract (senile)
62	6/02/07	F	48	Civil Servant	Lens sclerosis, OU
63	6/02/07	F	41	Business	Presbyopia
64	7/02/07	M	12	Student	Astigmatism
65	7/02/07	M	30	Student	Inflamed pterigium, OD
66	8/02/07	F	67	Trading	Ocular hypertension
67	8/02/07	F	41	Trading	Traumatic Uveitis, OS
68	9/02/07	M	36	Farming	Congestive Glaucoma
69	9/02/07	M	27	Carpenter	Irritation
70	10/02/07	M	21	Trading	Irritation
71	10/02/07	F	14	Student	Hyperopic astigmatism
72	12/02/07	F	70	Farmer	Inflamed pterigium, OD
73	12/02/07	M	18	Student	Myopic astigmatism
74	13/02/07	M	42	Pastor	Anterior Uveitis (traumatic), OS
75	14/02/07	M	45	Teacher	Presbyopia
76	15/02/07	F	55	Oil Worker	Hyperopic presbyopia
77	16/02/07	F	75	-	Cataract (senile)
78	17/02/07	M	80	-	Aphakia, OD
79	19/02/07	F	45	Trader	Presbyopia
80	20/02/07	F	30	Applicant	Inflamed pterigium, OS
81	21/02/07	M	3	Infant	Allergic Conjunctivitis, OU
82	23/02/07	M	9	Student	Astigmatism
83	24/02/07	M	43	Oil Worker	Primary Angle closure Glaucoma
84	25/02/07	F	65	Farmer	Cataract (senile)
85	26/02/07	F	39	Teacher	Presbyopia
86	27/02/07	M	48	Worker	Presbyopia
87	1/03/07	M	29	Welder	Irritation
88	2/03/07	M	70	Farming	Dry eyes
89	3/03/07	M	78	-	Congestive Glaucoma
90	5/03/07	M	30	Surveyor	Allergic Conjunctivitis, OU
91	6/03/07	F	52	Civil Servant	Presbyopia
92	7/03/07	F	50	Farming	Vitreous Floater, OD
93	8/03/07	F	25	Student	Punctate Keratitis, OS
94	9/03/07	M	23	Student	Bacteria Corneal Ulcer, OS
95	10/03/07	F	43	Oil Worker	Presbyopia
96	12/03/07	M	10	Student	Astigmatism
97	13/03/07	M	12	Student	Myopic astigmatism
98	14/03/07	F	15	Student	Hyperopic astigmatism
99	15/03/07	F	75	-	Cataract (senile)
100	16/03/07	F	42	Oil Worker	Cataract (diabetic)

Table 2. Clinical records of patients who reported to the clinics in 2008

No.	Date	Sex	Age	Occupation	Diagnosis
1	1/01/08	M	69	Oil Worker	Vitreous floaters, OD
2	2/01/08	M	45	Business	Presbyopia
3	3/01/08	M	41	Oil Worker	Presbyopia
4	4/01/08	F	39	Teacher	Presbyopia
5	5/01/08	M	10	Student	Myopia
6	7/01/08	F	35	Trader	Uveitis (traumatic), OS
7	8/01/08	F	42	Business	Inflamed pterigium, OU
8	9/01/08	F	9	Student	Vernal Conjunctivitis
9	10/01/08	M	15	Student	Esophoria
10	11/01/08	F	38	Teaching	Presbyopia
11	12/01/08	F	45	Civil Servant	Presbyopia
12	14/01/08	M	74	-	Cataract (senile)
13	14/01/08	F	47	Civil Servant	Cataract (Diabetic)
14	16/01/08	F	41	Business	Presbyopia
15	17/01/08	M	28	Oil Worker	Irritation
16	18/01/08	M	25	Student	Scleritis, OS
17	19/01/08	F	10	Student	Kerato-conjunctivitis, OU
18	21/01/08	F	36	Farming	Primary Angle closure Glaucoma
19	22/01/08	M	22	Applicant	Allergic Conjunctivitis, OU
20	23/01/08	F	19	Student	Allergic Conjunctivitis, OU
21	24/01/08	M	70	-	Dry eyes/Irritation
22	25/01/08	M	48	Oil Worker	Punctate keratitis, OS
23	26/01/08	M	9	Student	Allergic Conjunctivitis, OU
24	28/01/08	F	52	Oil Worker	Presbyopia
25	29/01/08	F	13	Student	Myopic astigmatism
26	30/01/08	F	14	Student	Hyperopic astigmatism
27	31/01/08	M	36	Clergy	Allergic Conjunctivitis, OU
28	1/01/08	M	45	Oil Worker	Presbyopia
29	2/01/08	M	75	-	Cataract (senile)
30	4/02/08	M	30	Business	Inflamed pterigium, OS
31	5/02/08	F	43	Oil Worker	Presbyopia
32	6/02/08	F	45	Teacher	Presbyopia
33	7/02/08	F	58	Oil Worker	Cataract (traumatic), OD
34	8/02/08	M	48	Oil Worker	Presbyopia
35	9/02/08	F	12	Student	Astigmatism
36	11/02/08	M	25	Welder	Foreign body
37	12/02/08	M	75	-	Cataract (senile)
38	13/02/08	M	6months	-	Myopic astigmatism
39	14/02/08	M	16	Student	Vernal conjunctivitis
40	15/02/08	F	12	Student	Myopia
41	16/02/08	F	42	Oil Worker	Presbyopia
42	18/02/08	M	32	Oil Worker	Cataract (trauma), OS
43	19/02/08	M	35	Farmer	Corneal Ulcer (Bacteria), OD
44	20/02/08	M	45	Civil Servant	Presbyopia
45	21/02/08	F	18	Student	Hyperopic astigmatism
46	22/02/08	F	15	Student	Myopia
47	23/02/08	M	52	Business	Glaucoma (PACG), OS
48	25/02/08	M	50	Oil Worker	Presbyopia
49	26/02/08	F	45	Teacher	Presbyopia
50	27/02/08	F	42	Civil Servant	Presbyopia
51	28/02/08	M	35	Oil Worker	Allergic Conjunctivitis, OU
52	29/02/08	M	15	Student	Myopic astigmatism
53	1/03/08	F	42	Oil Worker	Presbyopia

54	3/03/08	M	28	Carpenter	Foreign body
55	4/03/08	M	52	Farmer	Inflamed pterigia, OU
56	05/03/08	M	53	Oil Worker	Presbyopia
57	06/03/08	F	65	Farmer	Ocular hypertension
58	07/03/08	M	46	Civil Servant	presbyopia
59	8/03/08	F	24	Business	Uveitis (Aterior/traumatic), OS
60	10/03/08	M	60	Business	Lens sclerosis, OU
61	11/03/08	M	42	Oil Worker	Presbyopia
62	12/03/08	M	32	Welder	Foreign body
63	13/03/08	F	10	Student	Allergic Conjunctivitis, OU
64	14/03/08	F	15	Student	Allergic Conjunctivitis, OU
65	15/03/08	F	39	Civil Servant	Presbyopia
66	17/03/08	M	55	Oil Worker	Allergic Conjunctivitis, OU
67	18/03/08	F	10	Student	Myopia
68	19/03/08	M	39	Clergy	Aphakia (traumatic)
69	20/03/08	M	70	Farmer	Cataract
70	21/03/08	M	45	Oil Worker	Presbyopia
71	22/03/08	M	38	Business	Inflamed pterigia, OU
72	24/03/08	F	44	Oil Worker	Presbyopia
73	25/03/08	F	48	Teacher	Presbyopia
74	26/03/08	M	58	Oil Worker	Cataract (trauma), OS
75	27/03/08	F	12	Student	Astigmatism
76	28/03/08	M	25	Carpenter	Foreign body (corneal OS
77	29/03/08	M	1yr	-	Xerophthalmia
78	31/03/08	M	16	Student	Myopia
79	1/04/08	F	65	Trader	Ocular hypertension
80	2/04/08	F	6	Student	Allergic Conjunctivitis, OU
81	3/04/08	M	18	Student	Hyperopic astigmatism
82	4/04/08	M	70	Farming	Dry eyes/Irritation
83	5/04/08	M	78	-	Glaucoma
84	7/04/08	M	35	Surveyor	Allergic Conjunctivitis, OU
85	8/04/08	F	52	Civil Servant	Presbyopia
86	9/04/08	F	50	Farming	Vitreous Floater, OD
87	10/04/08	F	25	Student	Punctate Keratitis, OD
88	11/04/08	F	65	Farmer	Inflamed pterigia, OU
90	12/04/08	F	43	Oil Worker	Presbyopia
91	14/04/08	M	40	Business	Presbyopia
92	15/04/08	M	41	Teacher	Presbyopia
93	16/04/08	M	12	Student	Myopic astigmatism
94	17/04/08	F	18	Student	Keratitis, OD
95	18/04/08	F	41	Oil Worker	Presbyopia
96	19/04/08	F	13	Student	Myopia
97	21/04/08	M	50	Oil Worker	Aphakia (traumatic)
98	22/04/08	M	65	-	Cataract
99	23/04/08	M	70	-	Dry eyes/Irritation
100	24/04/08	F	39	Business	Allergic Conjunctivitis

Table 3. Clinical records of patients who reported to the clinics in 2009

No.	Date	Sex	Age	Occupation	Diagnosis
1	6/01/09	F	9	Student	Allergic Conjunctivitis
2	7/01/09	F	6	Student	Allergic Conjunctivitis
3	8/01/09	M	10	Student	Allergic Conjunctivitis
4	9/01/09	F	42	Oil Worker	Presbyopia
5	10/01/09	M	45	Business	Allergic Conjunctivitis
6	11/01/09	M	15	Student	Bacteria conjunctivitis, OD
7	13/01/09	F	40	Teacher	Presbyopia

8	14/01/09	F	75	-	Cataract (senile)
9	15/01/09	M	60	Business	Lens sclerosis (senile)
10	16/01/09	F	50	Oil Worker	Cataract (diabetic)
11	17/01/09	M	12	Student	Myopia
12	18/01/09	M	35	Farmer	Corneal Ulcer (bacteria), OU
13	20/01/09	F	39	Civil Servant	Presbyopia
14	21/01/09	M	46	Oil Worker	Presbyopia
15	22/01/09	F	15	Student	Myopia/Astigmatism (ATR)
16	23/01/09	M	9	Student	Xerophthalmia (due to vitamin A deficiency)
17	24/01/09	F	65	Farmer	Matured cataract, OU
18	25/01/09	F	60	Farmer	Inflamed pterygium
19	27/01/09	F	43	Oil Worker	Presbyopia
20	28/01/09	M	41	Paster	Presbyopia
21	29/01/09	M	18	Student	Keratitis
22	30/01/09	M	40	Business	Presbyopia
23	31/01/09	F	35	Oil Worker	Astigmatism
24	3/02/09	F	65	-	Aphakia
25	4/02/09	8		Student	Allergic Conjunctivitis
26	5/02/09	F	70	-	Dry eyes
27	6/02/09	F	6months	-	Bacteria conjunctivitis
28	7/02/09	M	52	Oil Worker	Presbyopia
29	9/02/09	M	50	Farmer	Glaucoma
30	9/02/09	M	50	Farmer	Glaucoma
31	10/02/09	F	40	Teaching	Presbyopia
32	11/02/09	M	50	Civil Servant	Ocular hypertension
33	12/02/09	M	13	Student	Allergic Conjunctivitis
34	13/02/09	M	8	Student	Allergic Conjunctivitis
35	14/02/09	F	25	Student	Allergic Conjunctivitis
36	16/02/09	M	70	-	Aphakia
37	17/02/09	M	69	-	Cataract (ou)
38	18/02/09	F	41	Oil Worker	Presbyopia
39	19/02/09	M	46	Civil Servant	Presbyopia
40	20/02/09	F	41	Trading	Traumatic Uveitis, OD
41	21/02/09	F	65	Business	Post-Cataract Operative Uveitis,
42	23/02/09	F	14	Student	Myopia
43	24/02/09	M	27	Applicant	Myopia/Astigmatism (WTR), OU
44	25/02/09	M	80	-	Mature Cataracts, OU
45	26/02/09	M	36	Motorcyclist	Inflamed Pterygium, OS
46	27/02/09	F	12	Student	Keratitis
47	28/02/09	M	54	Oil Worker	Presbyopia
48	2/03/09	M	46	Teacher	Presbyopia
49	3/03/09	M	47	Oil Worker	Presbyopia
50	4/03/09	F	70	Farming	Dry eyes
51	5/03/09	F	52	Farming	Vitreous Floater, OU
52	6/03/09	M	6	Student	Bacteria Conjunctivitis, OU
53	9/03/09	M	32	Oil Worker	Puntate Keratitis, OD
54	10/03/09	M	21	Trainee	Corneal Foreign body, OS
55	11/03/09	F	37	Rev. Sister	Anterior Uveitis (trauma)OS
56	12/03/09	F	40	Teacher	Presbyopia
57	13/03/09	F	47	Oil Worker	Presbyopia
58	16/03/09	M	40	Oil Worker	Presbyopia
59	17/03/09	M	11	Student	Myopia/Astigmatis (ATR), OU
60	18/03/09	F	65	-	Senile Cataract, OU
61	19/03/09	F	70	-	Senile Cataract, OU
62	20/03/09	M	8	Student	Myopia

63	21/03/09	M	23	Student	Myopia/Astigmatism
64	23/03/09	M	24	Student	Allergic Conjunctivitis
65	24/03/09	F	20	Student	Hordeolum Internum, OS
66	25/03/09	F	65	-	Trichiasis (Senile),OU
67	27/03/09	M	41	Oil Worker	Presbyopia
68	28/03/09	M	46	Civil Servant	Stye (upper eye lid), OD
69	3/03/09	F	55	Farmer	Trichiasis, OD
70	1/04/09	F	41	Worker	Presbyopia
71	2/04/09	M	M	Oil Worker	Corneal foreign body, OS
72	3/04/09	F	76	-	Mature Cataract, OU
73	4/04/09	F	16	Student	Hyperopic astigmatism
74	7/04/09	F	5	Student	Allergic Conjunctivitis
75	8/04/09	M	2	-	Xerophthalmia (due to vitamin A deficiency)
76	9/04/09	M	1	-	Xerophthalmia (due to vitamin A deficiency)
77	10/04/09	M	8	Student	Vernal Conjunctivitis
78	11/04/09	F	52	Industrial worker	Presbyopia
79	14/04/09	F	35	Applicant	Allergic Conjunctivitis
80	15/04/09	M	41	Oil Worker	Paralysis of Medial rectus, OS
81	16/04/09	M	10	Student	Myopia
82	17/04/09	M	42	Civil Servant	Presbyopia
83	18/04/09	M	66	-	Mature Cataracts, OU
84	21/04/09	M	22	Student	Chalazia, OU
85	22/04/09	F	23	Student Applicant	Hyperopic astigmatism
86	23/04/09	M	41	Oil Worker	Presbyopia
87	24/04/09	M	25	Oil Worker	Foreign body, OS
88	25/04/09	M	55	Oil Worker	Presbyopia
89	28/04/09	M	12	Student	Convergence Excess at near, OU
90	29/04/09	M	8	Student	Allergic Conjunctivitis
91	30/04/09	F	2	-	Xerophthalmia
92	1/05/09	F	47	Civil Servant	Presbyopia
93	2/05/09	M	75	-	Aphakia
94	5/05/09	F	70	-	Glaucoma
95	6/05/09	M	40	Farmer	Corneal Ulcer, OU
96	7/05/09	F	41	Industrial worker	Presbyopia
97	8/05/09	F	42	Teacher	Allergic Conjunctivitis
98	9/05/09	F	66	Business	Glaucoma Suspect
99	12/05/09	M	10	Student	Oblique Astigmatism
100	13/05/09	F	15	Student	Myopia/Astigmatism

Table 4. Clinical records of patients who reported to the clinics in 2010

No.	Date	Sex	Age	Occupation	Diagnosis
1	4/01/10	M	22	Student	Esophoria, OU
2	5/01/10	M	18	Student	Myopic astigmatism
3	6/01/10	M	49	Oil Worker	Presbyopia
4	7/01/10	F	52	Oil Worker	Angular Conjunctivitis, OS
5	8/01/10	F	42	Business	Presbyopia
6	11/01/10	F	10	Student	Astigmatism
7	12/01/10	F	75	-	Mature Cataract, OU
8	13/01/10	M	59	Oil Worker	Inflamed pterygia, OU
9	14/01/10	M	32	Oil Worker	Foreign Body, OD
10	15/01/10	F	39	Teacher	Presbyopia
11	18/01/10	M	49	Civil Servant	Presbyopia
12	19/01/10	F	75	-	Senile Cataracts

13	20/01/10	F	47	Civil Servant	Traumatic cataract, OS
14	21/01/10	F	28	Student	Allergic Conjunctivitis
15	22/01/10	M	66	Trading	Ocular hypertension
16	25/01/10	M	42	Business	Traumatic Uveitis, OD
17	26/01/10	F	47	Farming	Glaucoma (PACG), OS
18	27/01/10	F	40	Oil Worker	Presbyopia
19	28/01/10	M	22	Student	Corneal opacity, OS
20	29/01/10	M	21	Trainee	Corneal Foreign body, OD
21	1/2/10	M	48	Pastor	Anterior Uveitis (traumatic), OS
22	2/2/10	F	27	Oil Worker	Myopic astigmatism
23	3/2/10	M	50	Oil Worker	Traumatic trichiasis, OU
24	4/2/10	M	47	Oil Worker	Presbyopia
25	5/2/10	F	3	Student	Allergic Conjunctivitis
26	6/2/10	F	13	Student	Myopia
27	9/2/10	M	2	-	Avitaminosis A
28	10/2/10	M	44	Business	Presbyopia
29	11/2/10	F	52	Farmer	Inflamed pterygia, OU
30	12/2/10	F	28	Banker	Hyperopia
31	15/2/10	M	38	Pastor	Amblyopia
32	16/2/10	M	15	Student	Migraine headache
33	17/02/10	M	43	Driving	Hyperopic presbyopia
34	18/02/10	M	30	Student	Antimetropia (R(+)/L(-)
35	19/02/10	F	16	Student	Hyperopia
36	22/02/10	F	46	Nurse	Hyperopic presbyopia
37	23/02/10	M	33	Student	Foreign body, OD
38	24/02/10	M	1 ^{1/2}	-	Conjunctival haemorrhage, OS
39	25/02/10	F	45	Oil Worker	Presbyopia
40	26/02/10	F	39	Teacher	Presbyopia
41	01/03/10	M	13	Student	Myopic astigmatism (WTR)
42	02/03/10	F	43	Teaching	Presbyopia
43	3/03/10	F	20	Student	Allergic Conjunctivitis
44	4/03/10	F	3	Student	Bacterial Conjunctivitis, OU
45	5/03/10	F	60	Trader	Senile Cataracts
46	8/03/10	M	42	Farmer	Presbyopia
47	9/03/10	F	65	Trader	Aphakia
48	10/03/10	M	42	Trader	Presbyopia
49	11/03/10	M	17	Student	Foreign body, OS
50	12/03/10	F	18	Student	Keratitis
51	15/03/10	M	65	Welder	Cataract, OU
52	16/03/10	F	34	Student	Myopic astigmatism (WTR)
53	17/03/10	F	28	Teacher	Vitreous detachment, OD
54	18/03/10	M	$\frac{1}{2}$	-	Allergic Conjunctivitis
55	19/03/10	M	25	Electrician	Vitreous detachment, OD
56	22/03/10	M	69	Retired	Glaucoma
57	23/03/10	F	63	Contractor	Senile Cataracts
58	24/03/10	M	2	-	Subconjunctival haemorrhage, OD
59	25/3/10	M	26	Welder	Ocular hypertension
60	26/3/10	F	69	Farmer	Mature Cataract (senile)
61	1/4/10	M	17	Student	Amblyopia/low vision
62	2/4/10	M	35	Architect	Presbyopia
63	5/4/10	M	24	Student	Allergic Conjunctivitis
64	6/4/10	M	70	Gardener	Senile cataracts
65	7/4/10	F	55	Trader	Glaucoma
66	8/4/10	F	19	Applicant	Traumatic Uveitis, OD
67	9/4/10	F	30	Student	Hyperopia
68	12/4/10	F	24	Student	Keratitis

69	13/4/10	F	21	Student	Allergic Conjunctivitis
70	14/4/10	M	65	Trader	Bacterial conjunctivitis, OU
71	15/4/10	M	60	Driver	Traumatic Uveitis, OS
72	16/4/10	F	35	Trader	Traumatic Uveitis, OS
73	19/4/10	F	48	Trader	Glaucoma
74	20/4/10	F	32	Tailor	Allergic Conjunctivitis
75	21/4/10	M	30	Business	Anterior Uveitis
76	22/4/10	M	41	Electrician	Presbyopia
77	23/4/10	F	40	Trader	Foreign body, OD
78	26/4/10	M	30	Soldier	Myopic astigmatism
79	27/4/10	F	12	Student	Allergic Conjunctivitis
80	28/4/10	F	48	Caterer	Presbyopia
81	29/4/10	M	56	Carpenter	Traumatic cataract, OS
82	30/4/10	M	40	Mobile Police	Kerato conjunctivitis, OD
83	3/5/10	M	30	Motorcyclist	Corneal scar, OS
84	4/5/10	M	60	Oil Worker	Diabetic Retinopathy
85	5/5/10	F	5	Student	Allergic Conjunctivitis
86	6/5/10	M	55	Farmer	Cataract, OU
87	7/5/10	M	50	Technician	Hyperopic presbyopia
88	10/5/10	M	50	Oil Worker	Cataract (cortical), OU
89	11/5/10	F	11	Student	Allergic Conjunctivitis
90	12/5/10	M	73	Farmer	Glaucoma
91	13/5/10	F	22	Student	Punctate keratitis, OU
92	14/5/10	F	40	Trader	Astigmatism/presbyopia
93	17/5/10	F	38	Caterer	Presbyopia
94	18/5/10	M	68	Farmer	Corneal Ulcer, OS
95	19/5/10	M	50	Oil Worker	Ocular hypertension
96	20/5/10	M	21	Student	Astigmatism (WTR)
97	21/5/10	M	35	Contractor	Corneal scar, OS
98	24/5/10	M	25	Farmer	Foreign body, OD
99	25/5/10	F	30	Student	Foreign body, OD
100	26/5/10	F	70	Retiree	Aphakia

Table 5. Clinical records of patients who reported to the clinics in 2011

No.	Date	Sex	Age	Occupation	Diagnosis
1	3/1/011	M	39	Business	Nystagmus and presbyopia
2	4/1/11	M	39	Pastor	Ocular hypertension
3	5/1/11	M	38	Motor cyclist	Inflamed pterigium, OD
4	6/1/11	F	54	Oil Worker	Presbyopia
5	7/1/11	F	15	Student	Myopic astigmatism
6	10/1/11	F	45	Oil Worker	Inflamed medial canthus, OD
7	11/1/11	M	50	Civil Servant	Hyperopic astigmatic presbyopia
8	12/1/11	M	40	Business	Presbyopia
9	13/1/11	M	38	Oil Worker	Tranmatic Uveitis, OD
10	14/1/11	M	11	Student	Anterior Uveitis, OS
11	17/1/11	F	34	Trader	Inflamed pterigium, OD
12	18/1/11	M	49	Business	Oblique astigmatism
13	19/1/11	F	42	Business	Presbyopia
14	20/1/11	F	37	Applicant	Presbyopia
15	21/1/11	M	72	Trader	Diabetic cataract, OU
16	24/1/11	F	38	Business	Bilateral sub-capular cataracts
17	25/1/11	F	63	Farming	Lens Sclerosis
18	26/1/11	M	53	Oil worker	Diabetic caract, OU
19	27/1/11	F	19	Nurse	Hyperopic presbyopia
20	28/1/11	M	28	Welder	Tranmatic Uveitis, OD
21	31/1/11	M	18	Student	Kerato-conjunctivitis

22	1/2/11	M	40	Soldier	Nuclear cataract, OU
23	2/2/11	F	60	Nurse	Myopic astigmatic presbyopia
24	3/2/11	M	45	Student	Presbyopia
25	4/2/11	M	58	Farmer	Glaucoma (COAG), OU
26	7/2/11	M	48	Worker	Allergic Conjunctivitis
27	8/2/11	M	11	Oil Worker	Hyperopic presbyopia
28	9/2/11	M	20	Business	Stye, OD
29	10/2/11	M	35	Police	Corneal Ulcer, OD
30	11/2/11	F	37	Business	Allergic Conjunctivitis
31	14/2/11	F	22	Student	Accommodative insufficiency at near
32	15/2/11	M	46	Oil Worker	Presbyopia
33	16/2/11	M	39	Teacher	Mucopurulent Conjunctivitis
34	17/2/11	F	39	Comp-operator	Presbyopia
35	18/2/11	F	28	Business	Tranmatic Uveitis, OS
36	21/2/11	M	54	Clergy	Hyperopic presbyopia
37	22/2/11	M	50	Business	Tranmatic Uveitis, OD
38	23/2/11	F	70	Farmer	Senile Cataract
39	24/2/11	M	65	Farmer	Tranmatic Cataract, OS
40	25/2/11	M	30	Business	Lens Sclerosis
41	28/2/11	F	39	Business	Presbyopia
42	1/3/11	M	43	Business	Myopic presbyopia
43	2/3/11	M	53	Civil servant	Hyperopic presbyopia
44	3/3/11	M	67	Tailor	Senile Cataract
45	4/3/11	M	72	Farmer	Senile Cataract
46	7/3/11	M	92	Retired	Senile Cataract
47	8/3/11	F	27	Student	Allergic Conjunctivitis
48	9/3/11	F	38	Business	Allergic Conjunctivitis
49	10/3/11	M	22	Student	Corneal Ulcer, OS
50	11/3/11	M	28	Oil Worker	Hyperopic astigmatism
51	14/3/11	M	35	Business	Corneal Ulcer, OD
52	15/3/11	M	40	Driver	Presbyopia
53	16/3/11	M	42	Business	Allergic Conjunctivitis
54	17/3/11	F	47	Teacher	Myopic astigmatic presbyopia
55	18/3/11	M	58	Business	Cataract, OU
56	21/3/11	F	46	Civil Servant	Hyperopic presbyopia
57	22/3/11	F	65	Farmer	Lens Sclerosis (Senile)
58	23/3/11	M	72	-	Cataract Senile)
59	24/3/11	F	18	Student	Hyperopic presbyopia
60	25/3/11	M	70	Trader	Senile Cataract
61	28/3/11	M	43	Driver	Foreign Body, OD
62	29/3/11	M	48	Oil Worker	Diabetic Retinopathy
63	30/3/11	M	75	Pensioner	Hyperopic astigmatic presbyopia
64	31/3/11	M	47	Business	Hyperopic presbyopia
65	1/7/11	F	40	Business	Hyperopic presbyopia
66	4/7/11	M	46	Pastor	Hyperopic astigmatic presbyopia
67	5/7/11	F	10	Student	Astigmatism (Oblique), OS
68	6/7/11	M	11	Business	Cataract (Senile)
69	7/7/11	M	56	Driver	Hazy Vitreous due to Hyperglycemia
70	8/7/11	F	47	Business	Presbyopia
71	11/7/11	M	24	Student	Allergic Conjunctivitis
72	12/7/11	M	31	Electrician	Conjunctival Echymosis, OS
73	13/7/11	F	3	Student	Subconjunctival Haemorrhage, OS
74	14/7/11	F	25	Banking	Astigmatism (ATR), OU
75	15/7/11	M	41	Nurse	Tranmatic Uveitis, OD

76	16/7/11	F	39	Public Servant	Hyperopic presbyopia
77	18/7/11	M	50	Public Servant	Hyperopic astigmatic presbyopia
78	19/7/11	F	39	Business	Hyperopic presbyopia
79	20/7/11	F	47	Oil Worker	Hyperopic presbyopia
80	21/7/11	M	16	Student	Tranmatic Uveitis, OD
81	22/7/11	F	60	Farmer	Tranmatic Uveitis, OD
82	25/7/11	F	30	Copper	Allergic Conjunctivitis
83	26/7/11	M	2	-	Tranmatic Uveitis, OD
84	27/7/11	M	68	-	Cataract (tranmatic), OD
85	28/7/11	F	31	House wife	Allergic Conjunctivitis
86	29/7/11	M	32	Student	Allergic Conjunctivitis
87	1/11/11	M	60	Mechanic	Myopic astigmatic presbyopia
88	2/11/11	F	5	-	Cataract, OU
89	3/11/11	M	20	Student	Hyperopic presbyopia
90	4/11/11	F	19	Student	Keratitis
91	7/11/11	F	27	Teacher	Allergic Conjunctivitis
92	8/11/11	F	63	Business	Cataract (Senile)
93	9/11/11	M	38	Engineer	Iritis (tranmatic), OD
94	10/11/11	M	39	Public Servant	Hyperopic presbyopia
95	11/11/11	M	47	Oil Worker	Early Presbyopia
96	14/11/11	M	17	Student	Hyperopic presbyopia
97	15/11/11	M	52	Oil Worker	Hyperopic presbyopia
98	16/11/11	F	7	Student	Allergic Conjunctivitis
99	17/11/11	M	48	-	Cataract (tranmatic), OD
100	18/11/11	M	84	Farmer	Cataract (Senile)

Table 6. Clinical records of patients who reported to the clinics in 2012

No.	Date	Sex	Age	Occupation	Diagnosis
1	4/1/12	F	39	Oil Worker	Hyperopic presbyopia
2	5/1/12	M	40	Business	Presbyopia
3	6/1/12	M	75	Fisherman	Cataract (traumatic), OS
4	9/1/12	F	28	Business	Keratitis, OS
5	10/1/12	M	21	Student	Allergic Conjunctivitis
6	11/1/12	M	41	Business	Maculopathy, OS
7	12/1/12	M	12	Student	Uveitis(traumatic), OS
8	13/1/12	F	23	Student	Uveitis (traumatic), OD
9	16/1/12	M	70	Farmer	Cataract (senile)
10	17/1/12	F	19	Hairdressing	Corneal haze and injection, OS
11	18/1/12	M	3	Student	Vernal conjunctivitis
12	19/1/12	F	25	Student	Pinguecular, OS
13	20/1/12	M	28	Welder	Foreign body, OS
14	23/1/12	M	59	Brick layer	Corneal Ulcer,(traumatic), OS
15	24/1/12	M	88	Farmer	Uveitis (post-operation)
16	25/1/12	F	29	Business	Uveitis (traumatic), OD
17	26/1/12	M	9	Student	Cataract (traumatic), OD
18	27/1/12	F	12	Student	Myopic astigmatism (WRT)
19	30/1/12	F	60	Farmer	Presbyopia
20	31/1/12	F	5	Pupil	Allergic Conjunctivitis
21	1/2/12	F	27	Oil Worker	Allergic Conjunctivitis
22	2/2/12	M	25	Student	Astigmatism (ATR) OU
23	3/2/12	F	52	Farmer	Lens sclerosis
24	6/2/12	F	19	Student	Photophobia
25	7/2/12	F	34	Worker	Hyperopic presbyopia
26	8/2/12	M	53	Business	Myopic astigmatism and Presbyopia
27	9/2/12	F	46	Oil Worker	Presbyopia

28	10/2/12	M	49	Business	Presbyopia
29	13/2/12	F	80	Farmer	Cataract (senile)
30	14/2/12	M	60	Farmer	Lens sclerosis and vitreous floaters, OU
31	15/2/12	M	18	Student	Myopia
32	16/2/12	M	87	Pensioner	Cataract (Senile)
33	17/2/12	F	48	Business	Presbyopia
34	20/2/12	M	14	Student	Glaucoma
35	21/2/12	F	45	Trader	Hyperopic presbyopia
36	22/2/12	M	51	Business	Presbyopia
37	23/2/12	M	39	Civil Servant	Myopic presbyopia
38	24/2/12	F	26	Business	Uveitis (post-operation), OS
39	27/2/12	M	45	Civil Servant	Presbyopia
40	28/2/12	M	18	Student	Glaucoma
41	29/2/12	F	43	Trader	Presbyopia
42	5/3/12	F	18	Student	Myopia
43	6/3/12	M	28	Student	Allergic Conjunctivitis
44	7/3/12	F	3	Student	Allergic Conjunctivitis
45	8/3/12	M	38	Civil Servant	Uveitis (post-operation), OS
47	12/3/12	F	11	Student	Allergic Conjunctivitis
48	13/3/12	M	50	Business	Accommodative Insufficiency (far)
49	14/3/12	M	39	Business	Presbyopia
50	15/3/12	M	42	Business	Myopia
51	16/3/12	F	64	Oil Worker	Diabetic Retinopathy
52	19/3/12	F	30	Hairdresser	Inflamed ptergia
53	20/3/12	F	22	Student	Inflamed/ptergia+prognela
54	21/3/12	F	38	Civil Servant	Hyperopic presbyopia
55	22/3/12	F	33	Business	Photophobia
56	23/3/12	F	42	Business	Presbyopic
57	26/3/12	M	58	Public Servant	Hyperopic presbyopia
58	27/3/12	M	56	Business	Conjunctival Injection (traumatic)
59	28/3/12	M	50	Teacher	Hyperopic presbyopia
60	29/3/12	F	60	Trader	Iritis (traumatic), OD
61	30/3/12	F	72	Business	Cataract and glaucoma
62	1/10/12	M	50	Civil Servant	Hyperopic presbyopia
63	2/10/12	M	17	Student	Allergic Conjunctivitis
64	3/10/12	M	61	Operator	Iritis (traumatic), OD
65	4/10/12	F	32	Student	Glaucoma (traumatic), OS
66	5/10/12	F	34	Business	Uveitis (traumatic), OD
67	8/10/12	M	40	Business	Keratitis (punctate), OD
68	9/10/12	M	49	Filter	Presbyopia
69	10/10/12	M	73	Trader	Cataract (senile)
70	11/10/12	F	39	Farmer	Early presbyopia
71	12/10/12	M	26	Business	Allergic Conjunctivitis
72	15/10/12	M	62	Pastor	Myopic presbyopia
73	16/10/12	M	52	Student	Allergic Conjunctivitis
74	17/10/12	M	1 ^{1/2}	-	Allergic Conjunctivitis
75	18/10/12	M	66	Farmer	Congestive Glaucoma, OU
76	19/10/12	M	30	Student	Allergic Conjunctivitis
77	22/10/12	M	0.5	-	Infectious conjunctivitis
78	23/10/12	M	31	Mechanic	Foreign body, OD
79	24/10/12	F	70	Farmer	Conjunctivitis and glaucoma
80	25/10/12	F	41	Teacher	Cataract (diabetic)
81	26/10/12	M	68	Farmer	Vitreous floaters, OS
82	29/10/12	F	41	Business	Diabetic Retinopathy
83	30/10/12	M	64	Business	Corneal Ulcer (Bacteria), OD
84	31/10/12	M	69	Business	Cataract (Senile)

85	5/11/12	F	48	Farmer	Myopic astigmatism (ATR)
86	6/11/12	F	50	Business	Presbyopia
87	7/11/12	M	28	Security	Cataract, OU
88	8/11/12	F	56	Farmer	Vitreous detachment, OS
89	9/11/12	M	35	Business	Foreign body, OD
90	12/11/12	M	82	Pentronier	Cataract (Senile)
91	13/11/12	M	50	Business	Presbyopia
92	14/11/12	M	55	Civil Servant	Cataract and Glaucoma
93	15/11/12	M	60	Civil Servant	Presbyopia
94	16/11/12	F	30	Teacher	Corneal Ulcer (viral)
95	19/11/12	F	14	Student	Astigmatism (WTR)
96	20/11/12	M	64	Driver	Cataract (traumatic), OS
97	21/11/12	F	28	Student	Vitreous detachment, OS
98	22/11/12	M	14	Student	Uveitis (traumatic), OS
99	23/11/12	F	38	Tailor	Allergic Conjunctivitis
100	26/11/12	F	46	Teacher	Myopic astigmatic (WTR) Presbyopia

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