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Evaluation of the Impacts of Hydrocarbon Pollution on the Health of Residents of Oil Producing Communities

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***Abstract* - Hydrocarbon pollution has become a global problem bedeviling the whole world and has so attracted significant attention in international deliberations. Man can stay for days without food but not without air. Every biological organism world over, depend on air for survival. In this study, provision of fundamental information for decision making and policy implementations on the control and adaptation strategies to hydrocarbon pollution events in the study area is highlighted. Analysis of data generated from this study shows a positive relationship between SO_2 with prevalence of cough (R^2=75.85%), skin rashes (R^2=90.24%), and stooling/vomiting (R^2=61.96%) in the study area. While a negative relationship exists between the concentration of SO_2 in the study area and nose irritation (R^2=7.62%), breathing difficulty (R^2=27.42%) and chest pains (R^2=0.54%). The study revealed the prevalence of cough and skin rashes as strongly correlated with the concentration of sulphur V1 Oxide in the area.**

Keywords: Atmosphere, hydrocarbon, pollution, gas flaring, Niger Delta, diseases, inter relationship, processes and health.

I. INTRODUCTION

Air provides the oxygen we breathe, protects us from being blasted by objects from outer space. It consists of stratosphere that protects us from ultraviolet light which could cause cancer. There is no time in human history that air is devoid of extraneous material viz atmospheric composition according to Wayne (1991) varies tremendously according to location, temperature and time.

Sources of atmospheric pollution imply various activities or factors that release pollutants into the atmosphere; they include natural and anthropogenic sources (Liu, Yan, Chang, Chen, Liang, Liu, Qiang, and Youbin Sun, 2019). Natural sources include dusts from unvegetated lands, methane from animal husbandry, radioactive elements through decaying of naturally occurring radioactive elements, wildfires and volcanic eruptions in some regions. In most oil producing communities which was agrarian, natural emission of these pollutants were very low and within the earth carrying capacity. However, anthropogenic sources are increasing the quantity and amount of the pollutants daily (Mago and Gunwal 2019). It could result from stationary or mobile sources. Examples of stationary sources are standby generators and gas flaring stacks while mobile ones are vehicles on transit. It (sources of atmospheric pollution) can be classified into point and non-point sources.

Natural activities which introduce foreign substances into the atmosphere could be deleterious or un-harmful depending on their characteristics, quantity and duration of exposure. For instance, pollen grains produced during the pollination of crops alter the atmospheric composition. Similarly, volcanic eruptions emit toxic gases into the atmosphere and threaten the life of human beings within the vicinity with other environmental consequences.

In this study, the effects of hydrocarbon pollution on the health of the people residing in oil producing communities of Rivers State is carried out with a view of providing relevant information for policy decisions.

II. LITERATURE SURVEY

Studies reveal that the recent uproar in the world of atmospheric pollution is attributed to human activities (Inter Governmental Panel on Climate Change, (IPCC), 2007). Industrialization, urbanization and population explosion are fundamental human activities and processes which generate and emit foreign and harmful substances into the atmosphere, thereby exceeding the natural carrying capacity of the atmospheric environment with its attendant consequences. For instance, studies have revealed that global warming challenges are caused by human activities. IPCC (2007) noted that the principal four gases which alter the world climate system increased significantly during the industrial era. These gases in various amounts in the atmosphere also impair human health.

In view of this, the global community has taken several steps to mitigate the impacts of climate change. Several conventions, conferences and studies have continued to understand the scientific bases of atmospheric pollution and climate change as well as policy decisions arrived at curbing it. There are several legislations, policies and institutional

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frameworks to control atmospheric pollution. The law according to Bell and McGillivray (2006) is a veritable tool that may be employed to streamline and reposition vital and crucial national activities. Thus, the global community has at various times come together to agree on ways of tackling air pollution especially those that cross political boundaries. At these International levels, agreements and programs to reduce adverse environmental effects have proliferated (Finus, 2002).

It is assumed in the study that the only source of emission is anthropogenic and that exposure to these pollutants leads to decline in health status of the residents.

The Input-Output framework is further displayed in the air pollutant cycle developed by Pénard-Morand and Annesi-Maesano (2004) shows the fate of atmospheric pollutants as soon as it leaves the source.

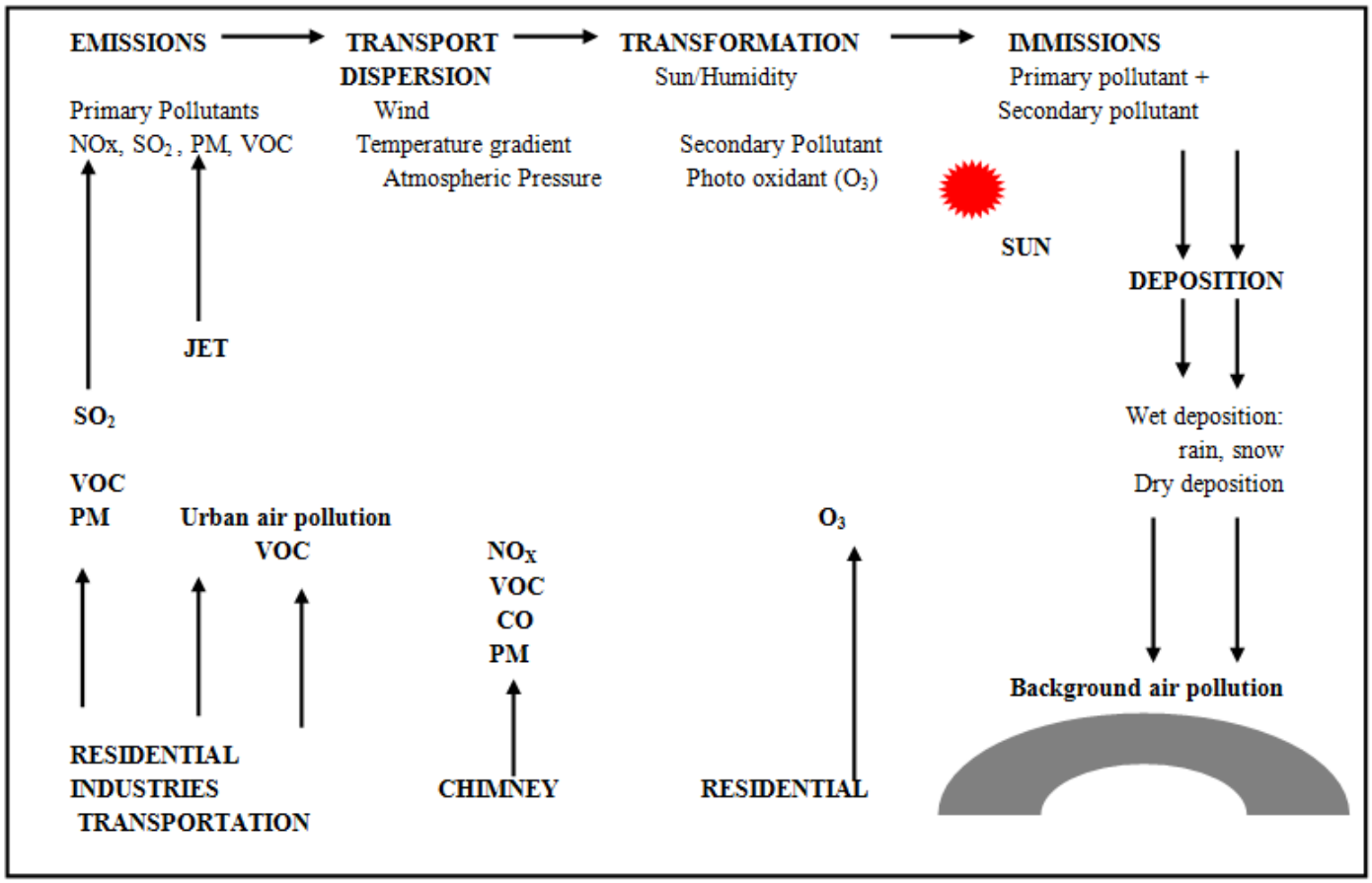

Figure 1: Air Pollutant Cycle (Pénard-Morand and Annesi-Maesano, 2004) *Modified*

According to the air pollutant cycle, atmospheric sources of emissions steering scientific debates in recent times are anthropogenic. These emissions do not definitely amount to background levels of pollution in the area. However, the atmospheric input (pollutants) undergoes processes of transportation and dispersion through wind and other atmospheric parameters such as temperature and atmospheric pressure (Qiao, Wu, Xu, Yang, and Liu, 2019). In this process, some of these pollutants are transformed into secondary pollutants such as ozone through the process of photo-oxidation. Both primary pollutants and the resultant secondary counterpart form the air pollution background levels which are deposited in the environment or perspired by living things amounting to various morphological, psychological and physiological changes.

At various conventions and protocols, agreements are aimed at solving specific global problem associated with atmospheric emission or controlling the emission of a pollutant which poses a global threat to the environment. These Conventions and Protocols such as in the United Nations Conference on Human Environment (UNCHE), (1972 Stockholm Conference) and the United Nations Conference on Sustainable Development (1992 Rio Conference). The United Nations Conference on the Human Environment, Stockholm, 1972 was the first time the international community assembled to discuss international environmental issues more generally and coherently (Bell and McGillivray, 2006). Although no treaty was signed in the Conference, an Action Plan of 109 recommendations was adopted alongside Declaration of 26 principles. It also adopted resolutions which led to the

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formation of United Nations Environmental Programme (UNEP).

In Bangkok, Thailand, Vichit-Vadakan, Vajanapoom, Ostro and HEI Health Review Committee (2017) investigated the effects of air pollution on mortality, to ascertain whether the effects of PM_{10} on mortality in the study area are similar to those in western cities. Bangkok mortality data were enhanced after the completion of few mortality studies while PM_{10} data were collected from organization currently monitoring daily PM_{10} data in the metropolitan city. After analysis, the result suggests strong associations between mortality outcomes and levels of pollutants including PM_{10}, NO_2, NO, and Ozone.

Kermani, Dowlati, Jafari, and Kalantari (2016) studied the effect of SO_2 on human health with the aim at estimating cases of excess hospitalization due to chronic obstructive pulmonary disease due to short term exposure to SO_2 during the year 2011 to 2012 in six major cities of Iran. The result shows that total cumulative numbers of hospital admission due to chronic obstructive pulmonary disease (COPD) in the six major cities, Urmia has the highest hospital admission due to Acute Myocardial Infarction.

In the Niger Delta region of Nigeria, issues of pollution at various communities where oil and gas activities take place have continued to attract international condemnation and severe reactions from host communities. For instance, in Rivers State, the UNEP Report in 2011 affirms that the Ogoni land in Southern Nigeria is environmentally devastated (UNEP, 2011). WHO, (2005) noted that ambient particulate matter across Nigerian cities is over 500% higher than the $20ug/m^3$ threshold of World Health Organization. In Onne, the Niger Delta, Ana Mynepalli, Sridhar and Bamgboye (2009) noted that respiratory, skin and eye disorders where higher among workers of NAFCON exposed to pollution. Various other scholars have carried out studies to reveal the atmospheric condition of the state particularly and Niger Delta Region at large. Adoki (2012) investigated the atmospheric concentration of some hydrocarbon pollutants in Oyibo, Rivers State and revealed that levels of particulate matter, sulphur iv oxide and oxides of nitrogen are above World Health Organization (WHO) limit, hence a significant public health issue in the State.

III. PROBLEM DEFINITION

Air pollution is a terrible situation facing oil producing communities in the Niger Delta region. In 2007, Rivers State Ministry of Environment issued a soot alert on the state to create public awareness of the emerging problem of particulate matter pollution and measures to mitigate and control it. Within this period, particulate matter (soot/carbon black) were deposited on every surface in the city, soiling nostrils, buildings, offices, cars and swimming pools. Media reports revealed incidences of respiratory diseases such as persistent cough, headaches and hypertension among the residents.

In these study areas (Ebocha, Mgbede and Okwuzi communities), gas flaring and other environmental harmful practices of the multinational oil companies have continued unabatedly for more than fifty years. Gas flaring involves incomplete combustion and a release of large amounts of black soot which is enriched with polyaromatic hydrocarbons (Nriagu, Udofia, Ekong and Ebuk, 2016). The gaseous components emitted are oxides of Nitrogen, Suphur and Carbon. Others are hydrocarbons and photochemical oxidants. Acid rain is a significant problem in the region which is caused by gas flaring leading to loss of biodiversity and economic trees. Unveiling the health effects of these noxious emissions from hydrocarbon exploitation in the study area is vital for effective policy frameworks that would strengthen the efforts of the stakeholders in addressing the lingering problem.

IV. METHODOLOGY

This study adopted the explanatory longitudinal survey design. In this vain, health information data was collected from both the health center records and through the questionnaire which was distributed among the people residing in the area for a minimum period of five years.

The medical records were accessed and examined to reveal the prevalence of air borne diseases in the area within the study period (2019). The questionnaire was worded to elicit information on the prevalence of airborne diseases and the various treatment practices adopted by the residents over the years.

In Ebocha community, a total of sixty-four questionnaires were administered to respondents, but sixty was collected. It recorded 93.75% collection and return. These data were analyzed using descriptive statistics, trend analysis as well as correlation analysis to reveal the relationship between the concentration of air pollutant and air pollution related disease across the study area.

V. RESULTS & DISCUSSION

The results from the analysis of questionnaire are shown in the following figures.

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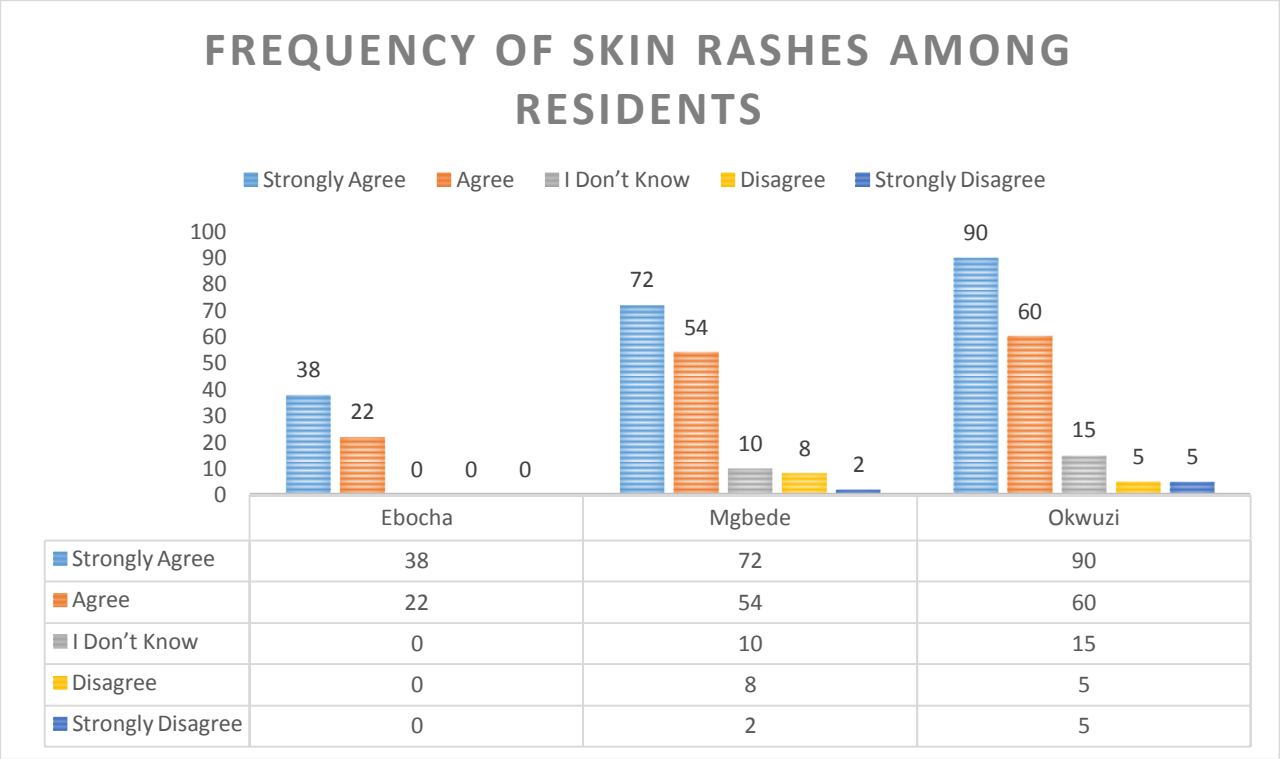
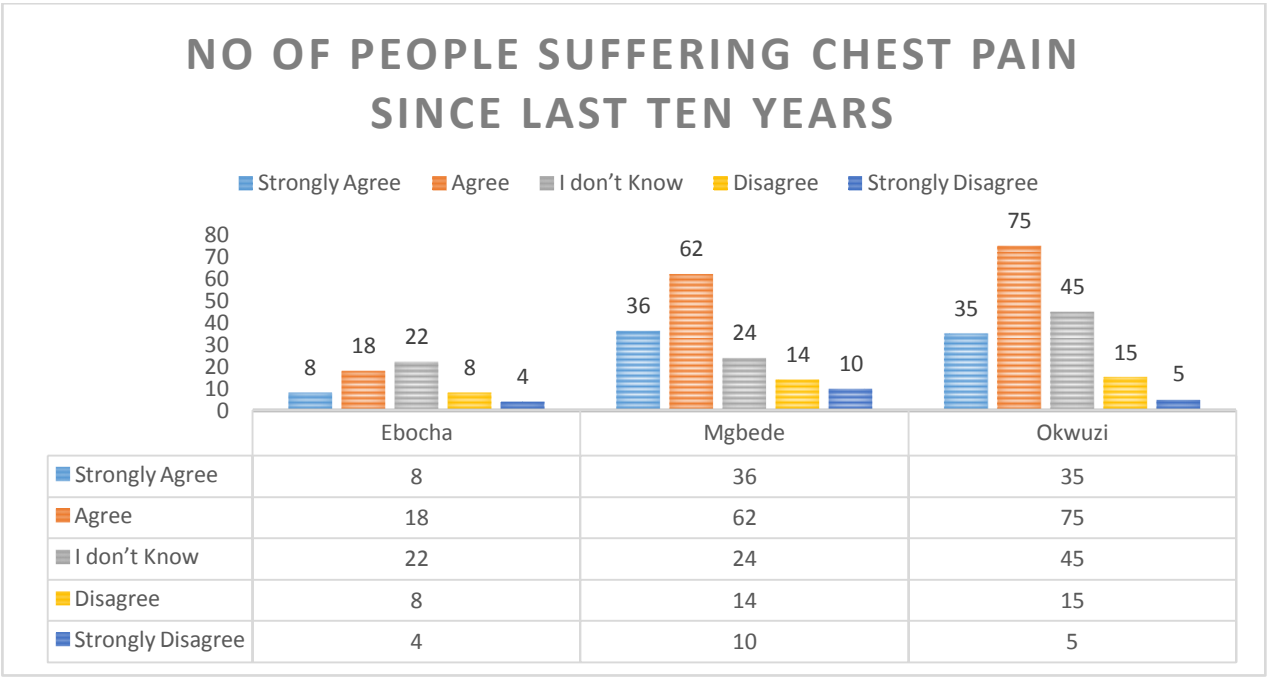


	Ebocha	Mgbede	Okwuzi
Strongly Agree	38	72	90
Agree	22	54	60
I Don't Know	0	10	15
Disagree	0	8	5
Strongly Disagree	0	2	5

Figure 2: Frequency of Skin Rashes amongst Residents in Ebocha, Mgbede and Okwuzi



	Ebocha	Mgbede	Okwuzi
Strongly Agree	8	36	35
Agree	18	62	75
I don't Know	22	24	45
Disagree	8	14	15
Strongly Disagree	4	10	5

Figure 3: Number of People suffering from chest pain since the last Ten years in Ebocha, Mgbede and Okwuzi

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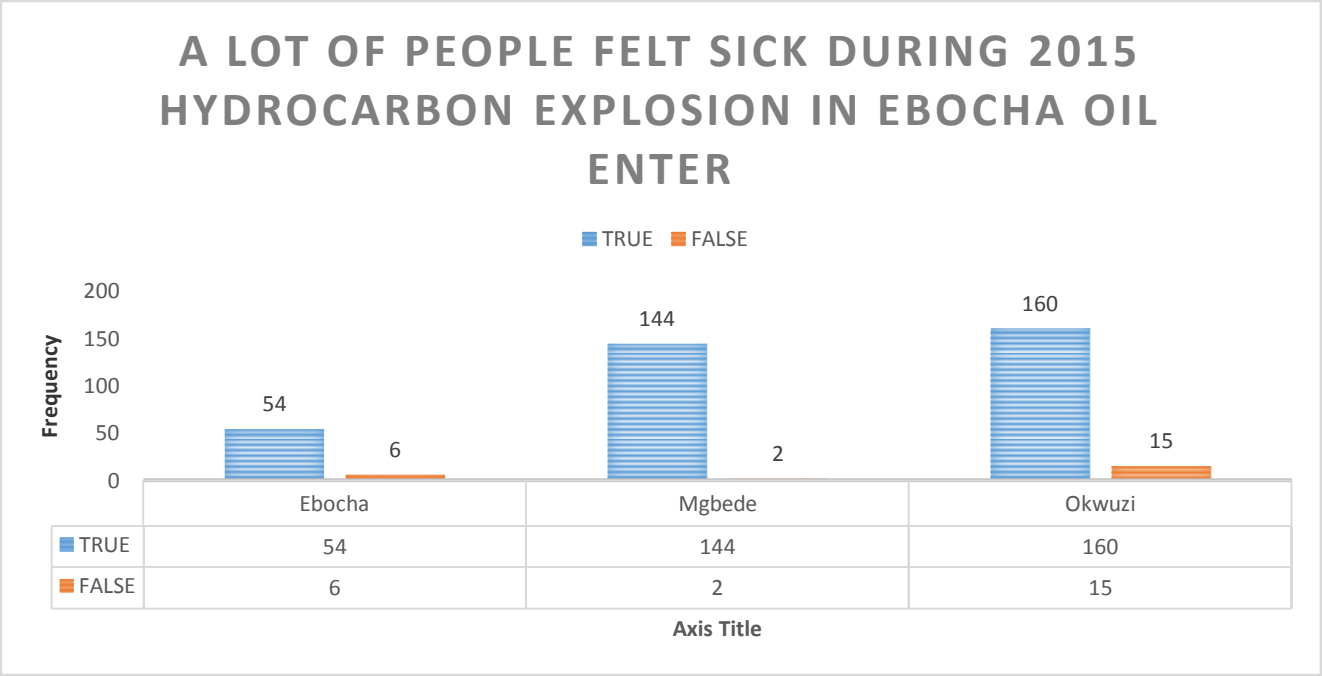

Figure 4: People that felt Sick during 2015 Hydrocarbon Explosion in Ebocha, Mgbede and Okwuzi

5.1 Discussions

Fig. 2 showed that in Ebocha, Mgbede and Okwuzi 38 respondents, 72 respondents and 90 respondents "Strongly agree" while 22 respondents, 54 respondents and 60 "Agree" respectively. 56.19% strongly agree while 36.17% agree. A total of 92.36 Either agree or Strongly agree, this indicate high awareness amongst the respondents on the prevalence of rashes in the three communities while 7.64% do not have an opinion or disagree with the frequency of Skin Rashes amongst residents.

Fig. 3 revealed that in Ebocha, 22 respondents "do not know" which represents 36.67% of respondents represents the maximum frequency, while 4 respondents which depict the minimum frequency are those that "strongly disagree" and comprises 6% of respondents. In Mgbede, the maximum frequency is 62 respondents which represent 42.47%, while the minimum frequency is 10 respondents, which stands for those that disagree. In Okwuzi, 75 respondents (44.12%) "Agree" which indicates the maximum frequency, while 15 (8.82%) respondents "Disagree" which represent the minimum frequency.

Fig. 4 showed that in Ebocha, Mgbede and Okwuzi, 54 (14.17%) respondent, 144 (37.80%) respondents and 160 (41.80%) respondents respectively are of the opinion that a lot of people felt sick during 2015 Hydrocarbon Explosion in Ebocha Oil Field.

Following an oil pipeline explosion in the area in 2015, 54 respondents (90%) affirmed that the prevalence of diseases during that period was high. As such a lot of persons were sick following exposure to hydrocarbon emissions.

Correlation analysis of the medical records in the area and the concentration of atmospheric pollutants showd a positive relationship between SO_2 with prevalence of cough (R^2=75.85%), skin rashes (R^2=90.24%), and stooling/vomiting (R^2=61.96%) . While a negative relationship existed between the concentration of SO_2 in the study area as well as nose irritation (R^2=7.62%), breathing difficulty (R^2=27.42%) and chest pains (R^2=0.54%).

In proffering solutions to the effect of pollution on the health of the people: In Ebocha, 30 respondents "Strongly Agree" and 30 respondents "Agree" that strategic installation of air pollutants monitoring instruments in the area by the government is an indication of commitment to environmental protection. This showed that 100 % of respondents both "Strongly agree" and "Agree".

In the mitigation of air pollutants in the area through fines and sanction on air pollution industries, 60 respondents (100%) in Ebocha choose "Very good" as option for mitigating pollution impact on the people.

VI. CONCLUSION

This study evaluated the effect of hydrocarbon emission on the residents of Ebocha, Mgbede and Okwuzi, oil producing Communities in Ogba/Egbema/Ndoni L.G.A of Rivers State. It revealed that the atmospheric condition in the area is injurious to health. The prevalence of cough and skin

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rashes correlated well with the concentration of sulphur V1 Oxide in the atmosphere. This agrees with the UNEP report on Ogoniland (UNEP, 2011) which stated that the air people breath in oil producing communities in Nigeria are injurious to health. Strengthening of environmental regulatory framework on polluting industries and installation of air quality monitoring instruments in the area was adjudged vital in protecting the lives of the people. Law is a veritable tool that may be employed to streamline and reposition vital and crucial national activities (Bell and McGillivray, 2006).

VII. FUTURE STUDIES

Further studies on long term epidemiological studies are advocated in the area to unravel the prolonged health status of the residents to guide health care policy makers in planning intervention measures.

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