# CORRELATION MATRIX AND REGRESSION ANALYSIS OF SELECTED DISEASES IDENTIFIED WITH GREENHOUSE GAS EMISSION IN EKET LOCAL GOVERNMENT AREA OF AKWA IBOM STATE

**BY**

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***ABSTRACT***

*The study investigated correlation matrix and regression analysis of selected diseases identified with greenhouse gas emission in Eket Local Government Area of Akwa Ibom State. The population of this study comprised of data from the Ministry of Environment Uyo and Ministry of Health in Eket. The study adopted descriptive and explanatory design. Data obtained from respondents was analysed using the descriptive techniques which included the use of means, range, standard deviations and graphs. The inferential statistical methods used include trend analysis and Pearson's Product Moment Correlation Analysis. It was concluded that greenhouse gases contributes significantly to the prevalence of respiratory tract infections, asthma, heart attack and itching in Eket and its environs. It was therefore recommended that the government should work in concert with multinational companies in the area to encourage periodic medical checks and subsidized bills on gas related sicknesses for the people of the area.*

## INTRODUCTION

Nigeria flares more gas than any other country in the world: approximately 75 percent of total gas production in Nigeria is flared, and about 95 percent of the "associated gas" which is produced as a by-product of crude oil extraction from reservoirs in which oil and gas are mixed. Flaring in Nigeria contributes a measurable percentage of the world's total emissions of greenhouse gases; due to the low efficiency of many of the flares much of the gas is released as methane (which has a high warming potential), rather than carbon dioxide. At the same time, the low-lying Niger Delta, which Eket is an integral part, is particularly vulnerable to the potential effects of sea levels rising.

Patin (1993) reports that emission of hydrocarbon gases pollute the water used by humans. He revealed that these gases are absorbed into the water and when drank, the gases rapidly penetrates the human system and disturbs the main functional system (respiration, nervous system, blood circulation and enzyme actions). Evidence of these disturbances includes a number of respiratory-related symptoms like heart attack, cancer of the lungs, and collapse of the central Nervous System.

Cairns (1992) noted that the most common greenhouse gas that is predominantly noticed in water, apart from carbon dioxide, is methane. He added that methane

intoxicates the waters and that medical toxicology distinguishes between three main types of intoxication by methane. Light intoxication which results in severe contractive effects in the central nervous and cardiovascular systems; medium-increases Leukocytes in the peripheral blood; Heavy-results in severe disturbances of the Cerebrum, heart tissues, alimentary canals.

Increasing amount of greenhouse gases in the atmosphere that results in global warming could lead to new health concerns. A statement released from the Inter-governmental Panel on Climate Change (IPCC) stated thus: "Climate Change is likely to have wide-raging and mostly adverse impacts on human health, with significant loss of life". As temperatures increase towards the poles, insects and other pests will equally migrate towards poles. These insects and pests could be allowed to migrate up to 550 km or 550 miles. Some insects carry diseases such as malaria and dengue fever. Thus, an increase in these insects and pests closer to the poles could result in an increase in these diseases. It could also lead to 50 to 80 million additional cases of Malaria annually, a 10-15% increase. "Malaria and dengue fever are already beginning to spread pole-wards" (Epstein, 2007).

According to California Environmental Protection Agency (2000) human studies have confirmed that air-borne fine particles can sicken or kill people. For example, laboratory rat with respiratory disorder died after being exposed to air pollution at concentrations as those found today in California (CEPA, 2000). Similarly many other studies in other countries of the world show that air particles increase premature deaths in infants and adults. These air particles are said to travel globally (IPCC, 2001). More so, air pollutants from fossil fuels have global impact. It is not just a local, national or regional concern because they can be transported thousands of miles away. Fine particles from say Kuwaiti oil fields have been detected in countries thousands of miles away from Kuwait (Morris, et al, 1998). In a fact sheet on Air Quality and Human Health Impacts of Greenhouse Gas Emissions for 1990 assessment, it was revealed that, respiratory diseases were the leading causes of disabilities and illness worldwide. Also, the 2005 respiratory related diseases ranked top, as causes of poor health globally (US EPA 2007).

According to the California E. P. A. (2000), the animal health impact of over-emitting greenhouse gases which result in formation of ozone and addition of particulate matters into the atmosphere include: 6,500 premature deaths, 4,000 hospital admission cases for respiratory diseases, 3,000 hospital admission cases for cardiovascular diseases, 3,500 asthma attack, and 2,000 asthma related emergency-room-visits reduced lung function growth rate in children. Analyses of the economic effects of these poor health conditions are enormous. Going by the estimated 6,000 premature death, professionals in various works of life are certainly included and the dis-economy of this is that such losses cost the nation, the state or the community a lot if translated into monetary value. Again, the dis-economies suffered in conducting the burial of the deceased or taking over the responsibility of catering for the deceased family is quite substantial and unappreciable.

According to Smith (2000), health effects, of course, is derived from exposure and thus it can be expected that global ill-health from air pollution is dominated by indoor exposures in developing countries as well. The precise extent of impact, unfortunately, is not known yet, but enough information is available to make reasoned

estimates for India, where more data are available than in most other developing countries. Evidence from 13 studies in developing countries indicate a odds ratio range of 2–3,3 i.e. young children living in solid-fuel using households have two to three times more risk of serious Acute Respiratory Infection (ARI) than unexposed children after adjustment for potential confounders including socio-economic status (Smith, 2000). Chronic obstructive pulmonary disease (COPD), such as chronic bronchitis, in women accounts for about 1.5 per cent of deaths in India and 16 per cent in China. Evaluations of eight studies in developing countries indicate an adjusted odds-ratio range of 2–4 for women cooking over biomass fires for many years (Bruce et al., 2000; Smith, 2000).

From model predictions, increased frequency of gusty thunderstorms is likely to be experienced in the South-South zone of Nigeria, and where they are already experienced, may become more intensified (IPCC, 2004). Sea level rise is also predicted to cause widespread flooding and degradation of the coastal settlements within this region, leading to loss of life and property, economic hardships, devastation of infrastructures, large-scale migration and its consequent refugee problem. It is sad to note that after 45 years of oil exploration and exploitation in the Niger Delta region of Nigeria, and having witnessed the tremendous wealth that the nation has made out of the oil sector, the Niger Delta is suffering from terrible environmental degradation. Of recent, such confrontations have been hijacked by criminal elements in the society (popularly called militants) who vent all kinds of atrocities through such dastardly acts as mob raids and rampage, hostage taking, killing of innocent people, and the willful destruction of properties. These incidents have led to closure of many companies and oil wells resulting in loss of revenue to both the oil companies and the government. Youth unemployment, especially among graduates is high due to these conflicts and loss of revenue.

There are frequent complaints in Eket/Ibeno areas about heat rash and general discomfort, asthma, malaria and dengue fever, foul air, poor agricultural yields, declining fish catch and upper respiratory tract infections in children and adults. In the area, surface streams have become polluted, there are power outages due to frequent thunderstorms and rapid deterioration of physical structures, including zinc roofs. Medical reports also suggest that increasing number of the productive human population suffer from heart attack, a very serious situation that impact on the production and gross domestic product of the place. Since these greenhouse gases can stay in the atmosphere for hundreds of years, their effects are apparent. This study seeks to ascertain correlation matrix and regression analysis of selected diseases identified with greenhouse gas emission in Eket Local Government Area of Akwa Ibom State.

**Aim and objectives of study**

The aim of this study is to determine correlation matrix and regression analysis of selected diseases identified with greenhouse gas emission in Eket Local Government Area of Akwa Ibom State. The specific objectives are to:

1. Determine the extent of correlation of the disease suffered by the people of Eket Local Government Area from greenhouse gas emission.
2. To predict the extent of diseases suffered by the people of Eket Local

Government Area from greenhouse gas emission.

**Research hypotheses**

The following hypotheses were formulated for testing:

1. There is no significant correlation of the disease suffered by the people of Eket Local Government Area from greenhouse gas emission.
2. There is no significant effect of each components of greenhouse gas emissions on various disease suffered by the people in Eket Local Government Area

**Method**

**Research design**

The research designs adopted for this study are descriptive and explanatory design. The object of descriptive research is to portray an accurate profile of persons, events or situation. This design serves as the forerunner to the explanatory approach, involving the establishment of causal relationships between variables.

**Study area**

The study area is Eket Local Government Area of Akwa Ibom State, Nigeria. Eket is located approximately between Longitudes $7^{o}$ 30′ and $7^{o}$ 55′ East of the Greenwich meridian and Latitudes $4^{o}$ 43′ and $4^{o}$ 55′N of the Equator.

**Sources of data**

Data for this work were obtained from both primary and secondary sources. The primary sources included field and laboratory experiments using such equipments as the sensitive gas chromatograph Mass spectrometer named MEDUSA. Secondary sources of data were obtained from the Ministry of Environment Uyo and Ministry of Health in Eket.

**Method of data collection**

The systematic random sampling technique was used to select three sampling stations northward at 10 km apart from QIT into the hinterland for greenhouse gas emission tests. This was to enable the researcher to determine the variation of greenhouse gases across different locations in the study area with respect to the probable source (Qua Iboe Terminal). The primary motivation for obtaining atmospheric data from top of towers was to fill existing measurement gaps in geographic location and on spatial scales. This took care of vertical distribution of gases in the air, which is affected by the weather and depends on topography of a particular area.

**Procedure for data analysis and testing of hypothesis**

The data were treated to a wide range of descriptive and inferential statistics. The descriptive techniques included the use of means, range, standard deviations and graphs. The inferential statistical methods used include trend analysis and Pearson's Product Moment Correlation Analysis.

**Data Analysis and Result**

Table 1.1
Zero-order correlation matrix

| | $y_1$ | $y_2$ | $y_3$ | $y_4$ | $x_1$ | $x_2$ | $x_3$ | $x_4$ |
|---|---|---|---|---|---|---|---|---|
| Respiratory tract infections, $y_1$ | 1 | 0.954** | 0.987** | 0.919** | 0.885* | 0.861* | 0.821* | 0.838* |
| Asthma, $y_2$ | | 1 | 0.961** | 0.944** | 0.951** | 0.931** | 0.923** | 0.935** |
| Heart attack, $y_3$ | | | 1 | 0.958** | 0.857* | 0.828* | 0.795 | 0.814* |
| Itching, $y_4$ | | | | 1 | 0.817* | 0.790 | 0.785 | 0.791 |
| Carbon dioxide, $x_1$ | | | | | 1 | 0.998** | 0.989** | 0.993** |
| Methane, $x_2$ | | | | | | 1 | 0.991** | 0.992** |
| Nitrous oxide, $x_3$ | | | | | | | 1 | 0.998** |
| Ozone, $x_4$ | | | | | | | | 1 |

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

**Result of Regression analyses and interpretations**

The least-squares (simple linear) regression analysis was used. The summary of the result of the simple (bivariate) linear regression analyses are presented in table 1.2. The table shows type of greenhouse gas, health problems and the associated regression statistics. The regression statistics include correlation coefficient R, coefficient of determination $R^2$, constant a, unstandardized regression coefficient B and standardized correlation coefficient (beta). Others are the degree of freedom (df), computed F statistic and significant value.

In examining the effect of carbon dioxide ($CO_2$) on the four (4) measured health problems of respiratory tract infections (RTI), asthma (AST), heart attack (HAT) and itching (ITC), the following least-squares regression (prediction) equations were obtained from the data in table 1.2

RTI $= -39.702 + 7.163CO_2$ - - - (eq. 1a)
AST $= 9.363 + 3.699CO_2$ - - - (eq. 1b)
HAT $= -20.287 + 4.304CO_2$ - - - (eq. 1c)
ITC $= 6.240 + 3.869CO_2$ - - - (eq.1d)

**Table 1.2**

Results of least-squares regression analyses

| Group | GHG | Health problem | Regression Results | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | R | $R^2$ | Constant, a | Coefficients | | df | F | Sig. (p-value) |
| | | | | | | B | Beta | | | |
| A | Carbon dioxide | Respiratory tract infections | 0.885 | 0.783 | -39.702 | 7.163 | 0.885 | 4 | 14.47 | 0.019* |
| | Methane | | 0.861 | 0.742 | -35.857 | 19.202 | 0.861 | 4 | 11.51 | 0.027* |
| | Nitrous oxide | | 0.821 | 0.674 | -26.507 | 49.191 | 0.821 | 4 | 8.27 | 0.045* |
| | Ozone | | 0.838 | 0.702 | -34.940 | 254.392 | 0.838 | 4 | 9.44 | 0.037* |
| B | Carbon dioxide | Asthma | 0.951 | 0.904 | 9.363 | 3.699 | 0.951 | 4 | 37.69 | 0.004* |
| | Methane | Asthma | 0.931 | 0.867 | 10.975 | 9.975 | 0.931 | 4 | 25.98 | 0.007* |
| | Nitrous oxide | Asthma | 0.923 | 0.853 | 13.488 | 26.593 | 0.923 | 4 | 23.12 | 0.009* |
| | Ozone | Asthma | 0.935 | 0.875 | 9.421 | 136.483 | 0.935 | 4 | 27.97 | 0.006* |
| C | Carbon dioxide | Heart attack | 0.857 | 0.734 | -20.287 | 4.304 | 0.857 | 4 | 11.06 | 0.029* |
| | Methane | Heart attack | 0.828 | 0.686 | -17.494 | 11.460 | 0.828 | 4 | 8.76 | 0.042* |
| | Nitrous oxide | Heart attack | 0.795 | 0.633 | -12.393 | 29.569 | 0.795 | 4 | 6.89 | 0.059 |
| | Ozone | Heart attack | 0.814 | 0.662 | -17.644 | 153.305 | 0.814 | 4 | 7.85 | 0.049* |
| D | Carbon dioxide | Itching | 0.817 | 0.667 | 6.240 | 3.869 | 0.817 | 4 | 8.025 | 0.047* |
| | Methane | Itching | 0.790 | 0.624 | 8.716 | 10.309 | 0.790 | 4 | 6.649 | 0.061 |
| | Nitrous oxide | Itching | 0.785 | 0.616 | 11.204 | 27.531 | 0.785 | 4 | 6.427 | 0.064 |
| | Ozone | Itching | 0.791 | 0.625 | 7.375 | 140.487 | 0.791 | 4 | 6.675 | 0.061 |

*Regression model significant at the 0.05 level

**Discussion of the Findings**

**Effect of greenhouse gases on people's health.**

The result of this hypothesis revealed that greenhouse gases in the atmosphere do have significant effect on the health of the people of Eket. The above findings is in line with the opinion of Arquit and Fecher (2006) who are of the view that heated waves cause hotter days which facilitate ozone formation, and ozone is an extremely reactive gas that essentially attacks lung tissue by reacting chemically with it. Therefore, being the primary ingredient of smog, air pollution is very harmful to the breathing mechanism. The findings also support the studies of Lancet, (1997) and Beerling and Berner (2005) that globally, human health is extremely affected by greenhouse emissions because it pollutes the air for breathing and also increases in peak ozone level, which also affects human health negatively. The study has confirmed the result of the research conducted by Israelis Ministry of Health in 2009 which discovered that the closer proximal distance to the emissions showed increasing respiratory diseases and asthma.

**Conclusion**

In conclusion, greenhouse gas emissions impact seriously on the health of the people of the study area. The study equally reveals that because of the significant concentration of carbon dioxide in the atmosphere, a lot of people suffered heart attack in the area. In view of the above, there is no masquerading the fact that increase in human activities have increased the magnitude of atmospheric concentration of greenhouse gases. Increased or raised levels of greenhouse gases therefore have serious effects on human health in the study area.

**Recommendations**

Based on the findings of this study, the following recommendations were made:

1. Government should harness the flared gas for use in domestic, industrial and transportation sectors, through direct involvement and encouragement of foreign participations.
2. As a way of curbing increased gas flaring, government should as a matter of policy encourage gas re-injection strategy by all oil companies.
3. The government should work in concert with multinational companies in the area to encourage periodic medical checks and subsidized bills on gas related sicknesses for the people of the area.

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