

## Short Communication

# Study proposal of the impact of gas flaring on health of communities in Delta state Nigeria

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### ABSTRACT

Gas flaring is the continuous discharge of gaseous fuel into the atmosphere during oil and gas operations. Over the past years, there has been an increased concern of the impact of gas flaring on the environment and recently on human health. The impact of gas flaring in Niger Delta, Nigeria is of local and global environmental concern. The uncontrolled and wasteful flaring of gas has caused negative impacts on the flora, fauna and human health and livelihood in the region. Reports indicate that gas flaring in Nigeria contributed more greenhouse gases (GHGs) such as carbon dioxide, methane, nitrous oxide, chlorofluorocarbons to the atmosphere than the combined contribution of gas flaring on GHGs in the Sub-Saharan African countries. The GHGs emitted during gas flaring contribute significantly to global warming which may result in sea level rise and hasten the effects of climate change. Gas flaring, commonly carried out by oil exploration companies in Nigeria poses a hazard to the health of populations and environment by pollution, warming and release of GHGs. This study sought to identify the risks associated with gas flaring in relation to human health in Delta region of Nigeria.

**Keywords:** Gas flare, Greenhouse gases, Human health problems, Negative impact, Niger Delta

### INTRODUCTION

Natural gas is a naturally occurring hydrocarbon gas mixture consisting of methane, carbon dioxide, ethane, propane, nitrogen and butane. During the extraction of oil, a considerable amount of gas is found alongside oil as a by-product. In most cases, it is disposed by burning through a process known as flaring. Gas flaring is the burning of natural gas that is associated with crude oil during extraction in places where there is no capacity or infrastructure to trap and make use of the gas. It takes place as a result of technical, regulatory or economic constraints.<sup>1,2</sup> It is a process by which unusable or excess natural gas is released by a pressure valve and burned, releasing tons of carbon dioxide into the atmosphere. Gas flaring can also be described as the steady discharge of

gaseous fuel into the atmosphere during the exploration of oil.<sup>3</sup> In Nigeria, gas flaring commenced during the discovery and exploitation of petroleum products in 1958. It was reported that gas flared into the oil communities in Nigeria emit toxic chemical substances such as nitrogen dioxides, sulphur dioxide and highly volatile compounds such as benzene, toluene, xylene and hydrogen sulfide and these substances can negatively affect human health and livelihood.<sup>4</sup> Gas flaring releases GHGs and toxic compounds into the atmosphere and this triggers climate change resulting in gradual rise in atmospheric temperature thereby exposing the earth to high intensity of solar radiation. Among others, this results in eroding of the coastal shorelines and flooding in lowlands and destruction of agricultural crops and these lead to outbreak of diseases, food insecurity and acid rain.<sup>5,6</sup> A recent study examined if living in a gas flaring host

community was associated with being hypertensive using the Niger Delta region as a case study.<sup>7</sup> Their analysis revealed that there was a significant relationship between gas flaring and hypertension.

Studies have shown that several pollutants of flare cause respiratory problems, insomnia, headache, cancer, bronchitis and depression, blood disorders, damage to the skin, asthma and anaemia.<sup>7-10</sup> More detailed review of literatures on these phenomena of interest were as

previously published.<sup>11,12</sup> The objective of this paper was to espouse the problem and outline the proposal of research work to be done.

**Research objectives and hypothesis**

The aim of this study was to identify the risks associated with gas flaring in relation to human health and the health literacy in the community in Delta region of Nigeria. The study objectives, hypothesis and research question/design are tabulated in Table 1.

**Table 1: Reformatted table for proposal methods.**

Objectives	Hypothesis	Methods	Proposed statistics	Research designs
<b>Evaluate public health impact of environmental pollution due to gas flares</b>	Pollution due to gas flares has had a negative impact on environment and community health	Quantitative and qualitative analysis	Multivariate analysis; thematic	Survey* the host community residents including community health workers
<b>Assess disease prevention and treatment for diseases that are expected to increase because of gas flaring</b>	Diseases that are more prevalent as a result of gas flaring were not easily prevented and treated	Quantitative and qualitative analysis	Chi square; multivariate; thematic	Survey* the companies' community relations programs and healthcare providers experience
<b>Compare the impact on health in gas flaring host communities and non-gas flaring host communities</b>	Impacts on health or wellbeing in gas flaring host communities were more severe as compared to non-gas flaring host communities	Quantitative and qualitative analysis	MANOVA; thematic	Comparative descriptive study of host versus neighbouring communities
<b>Assess the association between gas flaring and prevalence of diseases, host communities versus neighbouring communities</b>	There was an association between gas flaring and prevalence of diseases of interest to this study in gas flaring host communities	Quantitative analysis	Correlation; regression analysis	Survey the communities and healthcare providers
<b>Evaluate the government's efforts in mitigating the adverse effects of gas flaring already being experienced by gas flaring host communities</b>	Government's efforts in mitigating the adverse effects of gas flaring already brings experienced by gas flaring host communities were not sufficient.	Quantitative and qualitative analysis	Chi square; multivariate; thematic	Survey* relevant government offices; oil companies, and healthcare providers

\*Survey encompasses qualitative and quantitative methods; qualitative data will be analyzed thematically to supplement quantitative analysis; BCW: behavioural change wheel.

**METHODS**

**Ethical considerations**

Ethics approvals were obtained from human research ethics committee of Charles Sturt university Australia and from Novena university Nigeria. African/Nigerian culture was very hierarchal hence discussion to seek permission from paramount rulers of the communities and village elders constituted part of other necessary

approvals. The hospitals, oil companies and regulatory office also gave their consent to carry out the study where necessary.

An overview of what the research entailed and how the results will be utilized were given to the respondents. The entire study was carried out in a way that guaranteed the confidentiality and integrity of the participants. Participation were voluntary and although participants were encouraged to respond to all questions, they had

informed that if there were questions that they feel they do not want to answer they could skip.

All information and data were anonymous, confidential and private and kept securely. Participants were asked to provide freely information of their health and their family and this was anonymous and non-identifiable. Consent was in the form of acceptance, completion of the questionnaire and returning it to researcher. All data were treated with confidentiality and names and addresses were not required. Equally, for oil companies, names and addresses were not required. Alphanumeric identifiers were used throughout data collection and in the presentation of the results. Overall results after statistical analysis were presented and not individual data.

Furthermore, reports had shown that inhabitants of the Niger Delta region, had expressed worry about the effects of gas flaring on their quality of life and health but they had little or no information on the impacts of pollution. It was not anticipated that the study caused any further distress to the respondents and the interviewer than e.g. the anxiety that was already there. On the contrary, the awareness about this study in the community had provided comfort to the communities, while the expressed anxieties were also evaluated. For easy access in the communities, the researcher was accompanied by local security and residents.

### **Operational plan**

The study took place in the Delta region of Nigeria. The following steps were applied: a critical literature review to give a global perspective and allow comparison with similar communities followed by qualitative and quantitative research. Qualitative approach made provision to gain understanding of BCW including capacities and motivations of the stakeholders. In addition, it enabled exploration and understanding of the perception, attitudes the respondents. This complemented the quantitative research method. Quantitative approach was enable statistical and mathematical modelling to allow more robust comparisons between groups. Structured questionnaires with specific questions capturing the objectives was designed and administered to communities, health workers, oil companies and government agencies.

Table 1 is a tabulated summary of proposed methods for the research objectives and associated hypothesis. Also, a more detailed methods shall follow as a protocol paper.

## **RESULTS**

### **Expected outcomes**

The anticipated findings for the respective 5 research objectives were summarized as follows. Knowledge of the public health impact of environmental pollution due to gas flares was established, knowledge of the public

health impact of environmental pollution due to gas flares was established; deep insights of the disease prevention and treatment: BCW on adaptation and mitigation programs; an understanding of the impact on health in gas flaring host communities and non-gas flaring host communities: environmental and occupational health, BCW of stakeholders; establish the association between gas flaring and prevalence of diseases: family health epidemiology and the extent of government's efforts in mitigating the adverse effects of gas flaring: BCW.

### **Significance of study**

Flaring was a concern to the public and it was a government priority because of the potential health risks and environmental concerns associated with this activity and also because it wasted a valuable non-renewable resource. Previous research on gas flaring in the Niger Delta focused majorly on environmental impacts, consequences and damage rather than human health issues.<sup>13,14</sup> However, many communities in the Niger Delta believed that their health, crops, homes and livelihoods were affected by gas flaring. While other factors may be at play, the lack of attention paid to this crucial issue, meant that villagers' questions and fears were unanswered.<sup>14</sup> It was therefore imperative to critically evaluate and understand the impact of gas flaring on public health. The justification and significance of the study were to: give insights on the effect of gas flares as environmental pollutants on public health; compare the impacts of gas flaring on the health of host versus neighbouring communities with and without gas flares; provide information of the epidemiology of the diseases due to gas flaring and provide insight into stakeholders' BCW on policies mitigation and adaptation.

## **DISCUSSION**

Nigeria is the highest producer of oil in Africa and ranked sixth amongst the organization of petroleum exporting countries (OPEC). There had been a remarkable transformation in Nigeria's economy as a result of the exploitation of oil resource.<sup>15</sup> However, the environment of the oil producing regions have suffered degradation and loss in economic and social values. The oil producing communities in the Niger Delta region were located in the southern part of Nigeria. Gas flaring practice had been the preferred means of disposing associated or waste gas by various petroleum exploration and production companies operating in the Niger Delta for over six decades.<sup>16</sup>

Whenever gas was flared, energy was wasted, GHGs and other pollutants were released and human beings as well as environment were at risk of pollution. The flaring of gas generated an unending, excessive and blazing fire burning day and night thereby exposing the people to toxins that threaten their health and livelihoods.<sup>14</sup> Majority of gas flares were situated close to local communities and often lack sufficient safety and security

measures for inhabitants who may risk working near the heat of the flare.<sup>17</sup> There have been over 250 identified toxins released from flaring including carcinogens such as benzopyrene, benzene, carbon disulphide (CS<sub>2</sub>), carbonyl sulphide (COs) and toluene; metals such as mercury, arsenic and chromium; sour gas with H<sub>2</sub>S and SO<sub>2</sub>; nitrogen oxides (NO<sub>x</sub>); carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>) which contributed to the GHGs.<sup>14</sup> Associated gas flared into the atmosphere contained GHGs as well as other poisonous substances such as dioxins, benzene, toluene, nitrogen and SO<sub>2</sub>.<sup>18</sup>

These poisonous gases caused serious health problems to the people living near the gas flaring sites. These health problems included cancer, asthma, acute leukemia and a variety of other blood disorders, immune dysfunction, respiratory illness, spontaneous abortion, reproductive disorders, endocrine dysfunction, skin disorder, heat irritation, sunstroke, heat exhaustion, autoimmune rheumatic diseases, thyroid cancers, reduced life expectancy and deformities in children. Pregnant and lactating women were also at risk.<sup>19,20</sup> The inhabitants of Niger Delta strongly believed that the region was bedeviled with discomfort, suffering and obliteration regardless of the region being the financial backbone of Nigeria.<sup>15</sup> It was reported that a resident of Ebedei community in Niger Delta who lived besides the constant flame of a gas flare expressed concern about the possible effects of gas flaring on his health and that of his children.<sup>21</sup>

The federal government of Nigeria had been concerned with the growing trend of gas flaring and put in place several measures to curb this menace, however the extent of behavioural change wheel (BCW) and effectiveness, especially in the reduction of the volume of gas produced has yet to be investigated. For instance, in 2017, 7.6 billion cubic meters of gas was flared in the country and this may have led to negative health impact to those living around the flare sites.<sup>22</sup> Further, preliminary study had indicated that the community's concern around health impact may be associated with distance to gas flare site; but no significant difference in prevalence of disease linked to gas flaring.<sup>23</sup> Given the foregoing background, it was pertinent to conduct a research to understand the epidemiology of diseases in communities with and without gas flaring and to investigate the health impact of gas flaring by comparing the human health outlook/outcomes between communities with and without gas flaring.

## CONCLUSION

This study proposal has set out the agenda of a doctoral research work. The strength is in available human and material resources to carry out the project. The weakness lies in the limitation of scope of work being majorly a survey. The opportunity lies in the reality of the community vis-à-vis environmental health problems. However, it must be acknowledged that movement

restrictions including social distancing occasioned by COVID-19 posed a threat to the work.

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