

## Review Article

# Community health perspective of gas flaring on communities in Delta region of Nigeria: narrative review

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### ABSTRACT

The Nigerian gas flares emit as many imaginable pollutants that cause several health concerns. However, there is no comprehensive study done on the health impact of gas flaring on humans in Delta state. Hence, this paper seeks to identify the risks associated with gas flaring in relation to human health and the knowledge of gas flaring in the communities of Delta region of Nigeria. Following a non-systematic approach to develop this narrative, studies that link various diseases such as hypertension, cancers, birth defects, diabetes, respiratory problems, cardiovascular and kidney disease to gas flaring in the region, the risk perception and the policies and regulations were examined. Findings from most of the papers reviewed show an association between gas flaring and the diseases identified and prevalence of most of the diseases in oil and gas communities compared to areas where gas flaring is not practiced. In conclusion, insufficient data on the prevalence and association of diseases such as hypertension, cancers, birth defects, diabetes, respiratory problems, cardiovascular and kidney disease with gas flaring were some of the gaps identified. These results necessitate the need for epidemiological studies on the health effects of gas flaring on humans.

**Keywords:** Community risks, Health problems, Regulatory policies

### INTRODUCTION

Exploration and production of oil and gas in the Niger Delta has been steadily increasing for more than four decades. These have contributed to the continuous production or release of wastes in the form of liquid, solid and gas into the environment. Flaring of gas associated with exploration and production processes contributes to the waste generated. Satellite data projections from the world bank show that global gas flaring have risen to 150 billion cubic metres compared to the levels seen in 2009. This figure is equal to the yearly total consumption of gas in Sub-Saharan Africa.<sup>1</sup> Gas flaring is the process of venting unwanted natural gas and burning it.<sup>2</sup> These activities are often characterized with the release of gases, particulates, noise and heat which

have adversely affected both human and environment. This leads to substantial contamination and deterioration of the air quality, water and land and the flora inhabiting these biomes.<sup>3</sup> Flared gas is a major source of air pollution and contributes to global warming and climate change. It has been reported that the heat from gas flares kills vegetation, prevents plant growth and reduces agricultural production around the flare stack. Furthermore, the noise scares the animals and is uncomfortable for people who work and live near the flares.<sup>4</sup>

Gas flares are potentially detrimental to the health and wellbeing of local communities as they emit a range of toxic chemicals such as oxides of nitrogen, carbon, sulphur, volatile organic compounds like benzene, toluene, xylene and hydrogen sulfide, particulate matter,

black carbon in addition to carcinogens like benzopyrene and dioxin.<sup>5</sup> These chemicals are thought to be toxic and may lead to serious health issues including asthma, coughing, chronic bronchitis, breathing difficulty and likely premature death. Hence, people living in communities where gas flaring occurs are exposed to higher risk of premature death, respiratory disorders like asthma, and cancer.<sup>6</sup> The heat and the rumbling noise emitted by flare sites near human settlements may cause severe noise pollution and heat stress, often leading to health problems such as insomnia, high blood pressure, meningitis and heat rashes.<sup>3</sup> To date, several studies have investigated the phenomenon of gas flaring. Although, there has been very little thorough research on the health impacts of gas flaring in humans residing in the Niger Delta region of Nigeria, recent interest has focused on the correlation between distance to gas flaring sites and the occurrence of certain illnesses identified in individuals in the communities studied. The findings provided more evidence to the argument that the community has more environmental and health issues due to the proximity to gas flare sites.<sup>7</sup>

Current paper builds on previous findings and goes a step further to review research works linking different diseases such as hypertension, cancers, birth defects, diabetes, respiratory problems, cardiovascular and kidney disease to gas flaring in Delta region. Furthermore, the community risk perception and policies and regulations in regard to gas flaring were discussed. To achieve this purpose, both scoping and non-systematic review methods were adopted. Scoping review and critical appraisal were used to evaluate community health studies on gas flaring. Non-systematic literature review was employed to develop narrative on community risks, regulatory policies regarding gas flaring and justification for further work.

## **COMMUNITY HEALTH PERSPECTIVES ON GAS FLARING**

Much of the literature pays attention on environmental effects of gas flaring but there is little research on the association between diseases and gas flaring in the Niger Delta of Nigeria. There are reports that exposure of communities to pollutants discharged during gas flaring in the Niger Delta perhaps causes myriad health problems of which the aetiologies of some cannot be ascertained.<sup>8</sup> Below is a review of studies that link various diseases to gas flaring.

### **Cancers**

The burden of cancer has been on the increase over the past few decades and is one of the leading causes of morbidity and mortality worldwide, with approximately 14 million new cases in 2012.<sup>9</sup> In a comparative study of two cancer reference centres in Ibadan in South west and Port Harcourt in the Niger Delta, it was highlighted that there was an association between environmental risk

factors and cancers.<sup>10</sup> In the same vein, the higher levels of skin cancers recorded in Port Harcourt may be as a result of the increased environmental risk factors in the more industrialized Port Harcourt area.<sup>11</sup>

### **Birth defects**

Congenital disorders are defects of structure or function, including metabolism. Congenital anomalies can be due to various factors including environmental teratogens and micronutrient deficiencies.<sup>12</sup> It was reported that the prevalence of birth defects in a tertiary health facility in the Niger Delta was higher than in other regions of Nigeria, possibly due to years of exposure of the inhabitants to environmental pollution such as gas flaring. The results also show an increase in congenital abnormalities between 2011 to 2014 compared to previous studies carried out years (1990 to 2003) and the authors attributed this to the number of environmental teratogens increasing over time or better diagnosis of birth defects.<sup>13</sup> These findings are similar to those reported by some researchers in Texas, who found that residing near gas flaring sites is detrimental to pregnant women and babies. The study examined 23,487 live births to women between 2012 to 2015 in Eagle Ford region, Texas and observed that exposure to a high levels of flaring was associated with 50% greater likelihoods of preterm births compared with no exposure.<sup>14</sup>

### **Diabetes**

Diabetes can be described as a persistent metabolic disease characterized by elevated levels of blood glucose, which leads over time to serious damage to the heart, blood vessels, eyes, kidneys, and nerves. About 422 million people worldwide have diabetes, particularly in low and middle income countries.<sup>15</sup> In 2015, Nwafor et al reported that residents in oil producing communities were at high risk of developing diabetes, hypertension and obesity. This study was carried out in the rural communities of Erema and Obagi which have been exposed to emissions from gas flaring for the past 50 years.<sup>16</sup> However, it must be pointed out that the research did not take into account communities not exposed to gas flaring.

### **Hypertension**

Hypertension can be defined as a condition in which the blood vessels have persistently elevated pressure placing them under more stress. It is a public health problem and WHO reported that about 1.13 billion people worldwide have hypertension.<sup>17</sup> Studies in the Niger Delta have linked pollution as a result of gas flaring to increased prevalence of hypertension. For instance, in the Niger Delta, some researchers compared inhabitants chronically exposed to gas flaring and those not exposed to gas flaring in another community and reported a high prevalence of hypertension in people chronically exposed to gas flaring than those not exposed to gas flaring<sup>18</sup>. The

study also showed that blood pressures were higher in males than females, perhaps a reflection more direct involvement in the oil and gas industry in males. Increase in hypertension with age was also observed, however not many confounders were included in the study, but the length of exposure in the elderly cannot be ruled out. Similarly, a comparative cross-sectional study was conducted on the burden of hypertension in oil and gas polluted Ebubu community and non-oil and gas polluted Usokun community in the Niger Delta and the findings revealed that hypertension prevalence was higher amongst participants in polluted environment compared to those in unpolluted area, implying a possible association between oil pollution and negative impact on health.<sup>19</sup> A cross-sectional household survey was also conducted among residents in three gas-flaring and three non-gas-flaring host communities the Niger Delta region and found that persons living in gas flaring communities were 1.75 times likely to be hypertensive than those in communities without oil exploration activities.<sup>20</sup> The evidence presented in this section suggests that living in a gas flaring host community increases the chances of being hypertensive compared to living in communities farther away from gas flare sites.

### ***Respiratory problems***

Some scientists examined the effects of gas flaring on lung function by analysing changes in peak expiratory flow rate (PEFR) of inhabitants in Ugerikoko, a gas flaring population and concluded that gas flaring adversely affects on lung function of children and adults of both sexes in gas flaring community by reducing mean peak expiratory flow rates. The severity of impact on peak expiratory flow rate worsened with longer exposure to gas flaring and thus a marked decrease in peak expiratory flow rate.<sup>21</sup> Similarly, another study of effects of gas flaring in the Ibeno community in the Niger Delta, shows that prolonged exposure to air pollution from gas flaring impacts negatively on lung function.<sup>22</sup>

### ***Kidney diseases***

Little was found in the literature on the impact of prolonged exposure to oil and gas flares on renal function. However, a case controlled research comparing some inhabitants of Niger Delta, chronically exposed to low dose emissions of oil/gas flaring with non-exposed persons from another community in the same region,<sup>23</sup> that individuals in the oil/gas flared environments are more prone to developing kidney diseases than those not exposed. In another corroborative report,<sup>24</sup> there is a high prevalence of the risk factors for developing chronic kidney diseases in a community in the Niger Delta.

### ***Cardiopulmonary parameters***

A study evaluating the impact of gas flare on cardiopulmonary parameters in some states of the Niger

Delta was carried out and the results showed increased blood pressure, pulse rate (resting heart rate) and respiratory rate of children and adults in gas flaring communities by comparison with non-flaring communities.<sup>25</sup> This implies an association between exposure to gas flares and incidences of increased blood pressure, pulse rate, respiratory rate of people domiciled in gas flaring communities in the Niger Delta.

### ***Cardiovascular diseases***

Cardiovascular diseases (CVDs) are disorders of the heart and blood vessels and include coronary heart disease, cerebrovascular disease, rheumatic heart disease and other conditions.<sup>26</sup> There are few studies linking cardiovascular disease to gas flaring especially in Nigeria. However, a cross sectional study of adults in Northeastern Colorado, USA evaluated the association between intensity of oil and gas activity and cardiovascular disease indicators in 2015 and 2016.<sup>27</sup> The findings show a positive association between the intensity of oil and gas activity within 16 kilometers of a participant's home and some indicators of cardiovascular diseases. In the same vein, some researchers evaluated the effects of prolonged exposure to gas flares on some haematological parameters and the findings show that prolonged exposure to gas flares in humans can adversely affect haemopoiesis resulting in reduction in red blood cell, haemoglobin concentration, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration and platelet count. Furthermore, this research observed that the effects of prolonged exposure to gas flares were more in females than males. This was attributed to the fact that the females were more domiciled at home or in their farms than the mobile men thus females were exposed more to polluted environment than males.<sup>3</sup> Overall, in the recent report, there is evidence of variations on community health perspectives (Table 1). This variation gives cause for further health promotion and research.

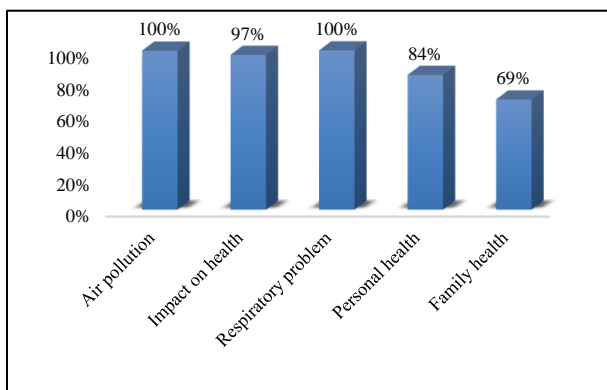
## **COMMUNITY RISK PERCEPTION**

In the Niger Delta, inhabitants reported adverse impacts of oil exploration on socio-economic livelihood and health and believe that oil drilling was associated with decreased farmland productivity, decreased fish populations due to oil spills, adverse impacts on drinking water quality, and decreased animals for hunting due to noise.<sup>28</sup> A case study examined the perception and attitudes towards gas flaring in the Niger Delta and selected Ubeji town, a community where gas flaring takes place and the results showed that people perceive gas flaring as hazardous to health, environment, and general well-being of the community. The findings further show that many residents seem to have accepted the continued gas flaring activities in the community.<sup>29</sup>

**Table 1: Evidence of variations in community health perspective.<sup>7</sup>**

Questions	Yes (%)	No (%)	Unsure (%)
There are many of these cases in your clinic that are associated with gas flaring	83	9	8
These cases frequently present to my clinic in weekly basis	28	16	56
Complain of eye irritation by residents is common and associated with gas flaring history	92	4	3
Cases of deformities in children is common and associated with gas flaring	9	21	71
Low birth weight is common & associated with gas flaring	17	10	73
Gas flaring impact negatively on the red blood cell	87	2	11
Lung cancer linked to exposure of gas flaring is common	94	4	2
Chronic obstructive pulmonary disease linked to exposure of gas flaring is common	91	4	6
Cardiovascular disease linked to high level of exposure of gas flaring is common	90	2	8
Complain of skin irritation by residents is common and associated with gas flaring	87	5	8
Majority of patients with diabetes are living nearer to gas flaring towns	31	47	21
Majority of patients with symptoms of stress are living in/near gas flaring towns	86	11	3

In another study evaluating the health risks associated with oil pollution in the Niger Delta, the community registered worry, annoyance and intolerance about the activities of oil companies such as oil production, which includes gas flaring and refinery.<sup>30</sup> This resonates with recent report indicating almost 100% awareness about air pollution, though a little lower knowledge on impact of health (Figure 1). This therefore justifies various types of research on gas flaring so that the community is well informed to make decisions and to allow negative aspects of gas flaring to be minimized and positive aspects encouraged.

**Figure 1: Level of knowledge of impact of gas flaring in communities.<sup>7</sup>**

## POLICIES AND REGULATIONS REGARDING GAS FLARING

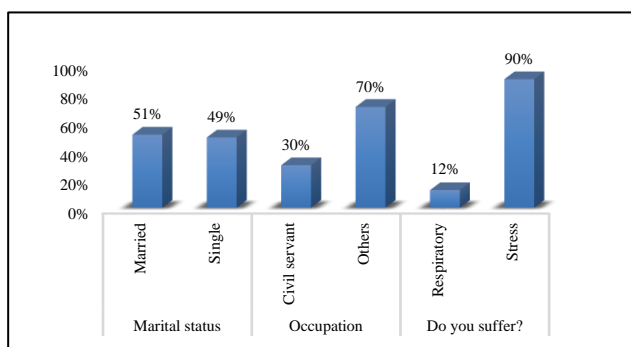
Gas flaring is an urgent environmental pollution problem especially in the Niger-Delta region where associated gas has been flared for 60 years. A number of measures have been taken to reduce and eliminate gas flaring and curtail the impacts of gas flaring on humans and the environment. Environmental concerns began to gain interest in 1972 during the United Nations conference on environment at Stockholm, Sweden, which came with 26

principles, calling on states and international organisations to “play a coordinated, efficient and dynamic role in protecting and improving the environment”. Other conferences have since taken place, but the 1992 United Nations framework convention on climate change (UNFCCC) was the first international attempt to address the problem of climate change due to emission of greenhouse gases through human activities. The aim of UNFCCC is to maintain concentrations of greenhouse gas at a degree that prevents dangerous intervention with the climate.<sup>31</sup> In 2002, the world bank initiated a global gas flaring reduction partnership (GGFR) aimed at bringing national and international oil companies, national and regional governments and international institutions to promote efforts to increase and enhance the use of natural gas associated with gas flaring and ultimately reducing flaring.<sup>32</sup> In addition, the world bank introduced the “zero routine flaring by 2030” initiative to encourage government, oil companies and development institutions to cooperate to eliminate routine flaring no later than 2030. It is pertinent to note that this initiative pertains to routine flaring and not to flaring for safety reasons or non-routine flaring, which should be minimized. Many countries have joined this partnership including Nigeria, which has proposed to end routine gas flaring by 2020. As back as 1969, the federal Government of Nigeria directed all oil companies to end gas flaring within five years, by taking steps to utilize the gas. This directive was ignored and continued gas flaring led the Nigerian government to establish the associated gas reinjection act (AGRA) of 1979 and this was a major step at regulating gas flaring. The AGRA is a legal framework for gas utilization that applies to land and the exclusive economic zone (EEZ). The international oil companies (IOCs) found it more convenient to pay a penalty for gas flaring. The 1979 gas rejection act was updated with flare gas (prevention of waste and pollution) regulations, 2018 and the thrust is to facilitate the conversion of flare gas to a marketable gas product, and the development of a competitive bidding process for entities wishing to access and utilize gas that is currently flared.<sup>33</sup> Despite the fact that there are many

environmental laws related to gas flaring in Nigerian and the institutions and instruments to effectively enforce their implementation and compliance are also put in place, gas flaring still persists. Many researchers adduce this to weak legal implementation mechanisms, obsolete infrastructure by oil and gas companies, lack of political will and corruption.<sup>34, 35</sup>

### JUSTIFICATION FOR FURTHER STUDY

Flaring is a concern to the public and it is a Government priority because of the potential health risks and environmental concerns associated with this activity and it also wastes a valuable non-renewable resource. Previous research on gas flaring in the Niger Delta focused majorly on environmental impacts, consequences and damage and not on human health issues.<sup>36,37</sup> However, many communities in the Niger Delta believe that their health, crops, homes and livelihoods are affected by gas flaring. While other factors may be at play, the lack of attention paid to this crucial issue, means that villagers' questions and fears are unanswered. Very few studies attempt to discuss the impact of gas flaring on human health. One of such studies examined the environmental impacts of gas flaring on the built environment of Ubeji metropolis and compared it with communities farther away from gas flaring sites in terms of prevalence of diabetes, heart diseases, haematological abnormalities, lung cancer, and stress. The findings revealed that the impact of gas flaring on buildings is chronic and affects not only human health and provided more evidence to the argument that the community has more environmental and health issues due to the proximity to gas flare sites.<sup>7</sup> However, the study does not take into account all stakeholders in the communities with regards to health. For instance, descriptive statistics indicate only respiratory diseases and stress among participants were categorically assessed (Figure 2).



**Figure 2: Reported description of participants' characteristics.<sup>7</sup>**

In addition, most previously published studies have not adequately assessed the association between gas flaring and prevalence of diseases in host versus neighbouring communities. It is therefore imperative to critically evaluate and understand the impact of gas flaring on public health.

### CONCLUSION

This review provides insights into the concepts of gas flaring, how it occurs and the effects of gas flaring on the environment and the health of humans. Considering this, it seems that there is little data quantifying the impact of gas flaring on the health of people whose property, crops and animals, drinking water, and air are polluted by oil, waste products from exploration and extraction, and extensive waste gas flaring. The evidence presented in this chapter suggests for critical need of studies on the impact of gas flaring on the health of communities in the Niger Delta region of Nigeria.

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