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Gas Flaring in Niger Delta Nigeria and Sustainability Development Goal Framework: Qualitative Survey of the Health Impacts, Mitigation and Adaptation

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Research Article

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ABSTRACT

Background: Petroleum exploitation and production have resulted in various environmental, socio-economic, political and health problems. This study is part of ongoing research to evaluate sustainability development goal in host communities of gas flaring operations.
Objective: The research purposes to generate thematic opinions of the community regarding the risks associated with gas flaring and evaluate the mitigation and adaptation programs of government and oil and gas companies in the Delta region, Nigeria.
Methods: This was qualitative with a quantitative component utilizing a survey of 8 open-ended and 2 semi-quantitative questions. Sample size was N = 488 and participants were over 18 years old. Thematic analysis adopted word cloud, followed by thematic aggregation and quantification.
Results: The response rates were 99.2%, 76.2%, 75.4% and 70.1% for Sections B, C, D, and F, respectively. Over 66% reported negative impacts of gas flaring including specifications of some health problems and stress and respiratory problems were most common. Lack of opinion e.g. on how oil and gas companies liaise with the community (47%) and on how government liaises with companies (63%) were observed.

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Conclusion: While the majority of respondents had opinions, they however lacked knowledge regarding what the government and/or oil and gas companies could do on mitigation and adaptation on negative impacts of gas flaring. This therefore calls for awareness campaign and health promotion in the affected communities.

Keywords: Awareness in community; impact of gas flaring; mitigation & adaptation programs; Niger Delta Nigeria; public health promotion.

1. INTRODUCTION

Petroleum exploitation and production in the Niger Delta, Nigeria over the years have resulted in various environmental, socio-economic and political problems. Gas flaring results in environmental damage that impacts negatively on plants and animals inclusive of human, and there is also loss of revenue to the oil companies and the government [1]. Reports show that gas flaring in Nigeria has contributed greenhouse gases to the atmosphere more than the combined contribution from the sub-Saharan Africa [2], and as mentioned this impacts negatively on terrestrial ecosystems and degrades the environment [3].

Gas flaring in the Niger Delta has resulted in acid rain, which corrodes roofing especially that made of zinc. This has therefore encouraged the use of asbestos for roofing [4], since asbestos has a better repelling power to acid rain than zinc. However, the usage of asbestos increases the risk of diseases such as cancer of the lung, pleural and peritoneal mesothelioma, as well as asbestosis [5], these therefore contribute to ill health of the people and animals and destroys their environment.

What is known: There are negative impacts of gas flaring and government has programs to address the problems [1,3,6].

What is unknown: The level of knowledge and opinions of the community regarding impact of gas flaring and necessary mitigation and adaptation programs are also not clear.

Research objective: The broad aim of this study was to identify the risk awareness associated with gas flaring on human health in terms of the knowledge and opinion in the community of the Delta region, Nigeria. The specific objectives are as previously published [7].

Presumptions: Knowledge is always true, but opinion is apprehension and subject to bias [8]. "I don't know" is presumed unsure, while "no idea" emphatically means non-existence of fact.

2. METHODS

Design: This was a qualitative protocol was as described [7], and involved open-ended questions that enabled suggestions from respondents. Further, details of methodology are as described in separate parts of this series that focused on quantitative aspects [9-13].

Questionnaire: This comprised 10 questions to evaluate 4 objectives (Table 1), which are alphabetically indicated as per the original objectives and questions. These questions are qualitative components of the respective questionnaires used in the referenced works indicated on the Table 1.

Inclusion Criteria: All participants in this study were the same as in previous reports on this series [9-13]. The respondents (N = 488) who returned their survey questionnaire were included and questions without responses were noted analysed, accordingly.

Statistical Analysis: The mixed method analysis involved predominantly thematic and also quantification. Except for section C, the thematic analysis first adopted 'word cloud' method using *WordItOut*, to identify themes occurring most. This was then itemization for the most common 3 – 5 themes. In quantification, responses were coded in a scaled format to enable frequency distribution of aggregated responses (Table 2). Thus, the mixed methods evaluation of knowledge and opinions is summarily:

i. Themes: word clouds to visualize common terms, followed by thematic phrases derived from ordered responses.
ii. Quantification: synonymous responses are aggregated and coded common themes, followed by descriptive frequency distributions (Table 2).

Table 1. Research objectives and questions

Section*	Research objective	Questions for qualitative evaluation
B	Evaluate public health impact of environmental pollution due to gas flares [9]	B9: What do you know as health impacts of gas flaring? B10. What is your opinion about gas flaring on health & environment?
C	Assess disease prevention and treatment for diseases that are expected to increase as a result of gas flaring [13]	C15. Personal health C16. Family health
D	Compare the impact on health in gas flaring host communities and non-gas flaring host communities [10]	D9a. How does your company liaise with government? D9b. How does your company liaise with community? D10. What oil companies can do to alleviate the health effects of gas flaring in the community?
F	Evaluate the government's efforts in mitigating the adverse effects of gas flaring already being experienced by gas flaring host communities [12]	F9a. How government liaises with community? F9b. How government liaises with companies? F10. What government can do to alleviate health effects?

**No qualitative survey associated with section A (demographics) and E (another research objective)*

Table 2. Code systems for the responses

Section	Codes	Thematic response
B	1	Positive effect
	2	No adverse effect
	3	No idea/unsure
	4	General adverse, non-specific
	5	Specific ill-health
D & F	No	No idea
	Unsure	Do not know/unsure
	Yes	there is response

Analysis of Section C was mainly semi-quantitative, because participants were given 5 specific options to choose as many that applied. In section B, questions of knowledge and opinion were explicit while sections D and F, questions were indirect – re: "how does…" and "what do you think" to assess knowledge and opinion, respectively.

3. RESULTS

Word Cloud of section B questions show common knowledge that gas flare pollution and was detrimental to health, and respiratory diseases were the most cited ill-health (Fig. 1). On the analysis for evaluation of public health impact in community i.e. Section B questions of Table 1, common phrases in the expressions of the respondents i.e. to the questions were:

B9. What do you know as health impacts of gas flaring?

- Very hazardous
- Very dangerous
- Very detrimental
- This is the release of unwanted or excess gas to the atmosphere and they are dangerous to human health
- The gases flared serves as pollution to water and air
- Respiratory Problems
- Negative impact
- Pollutes the air and water hence it damages human health

B10. What is your opinion about gas flaring on health & environment?

- Very dangerous

- Very negative impact on health
- Stop gas flaring
- Detrimental to human health
- Pollutes the environment

When the various responses to question B10 were aggregated into positive, negative or no adverse effect; it was observed for instance that approximately 2% believed there were 'no adverse effects' while 17% had no opinion i.e. no response (Graph 1).

Section C was semi-quantitative and the analysis showed stress had the highest prevalence followed by respiratory problems. In the respondents (N = 488), stress was the most reported ill health and cancer the least in the respondents and their family members (Graph 2).

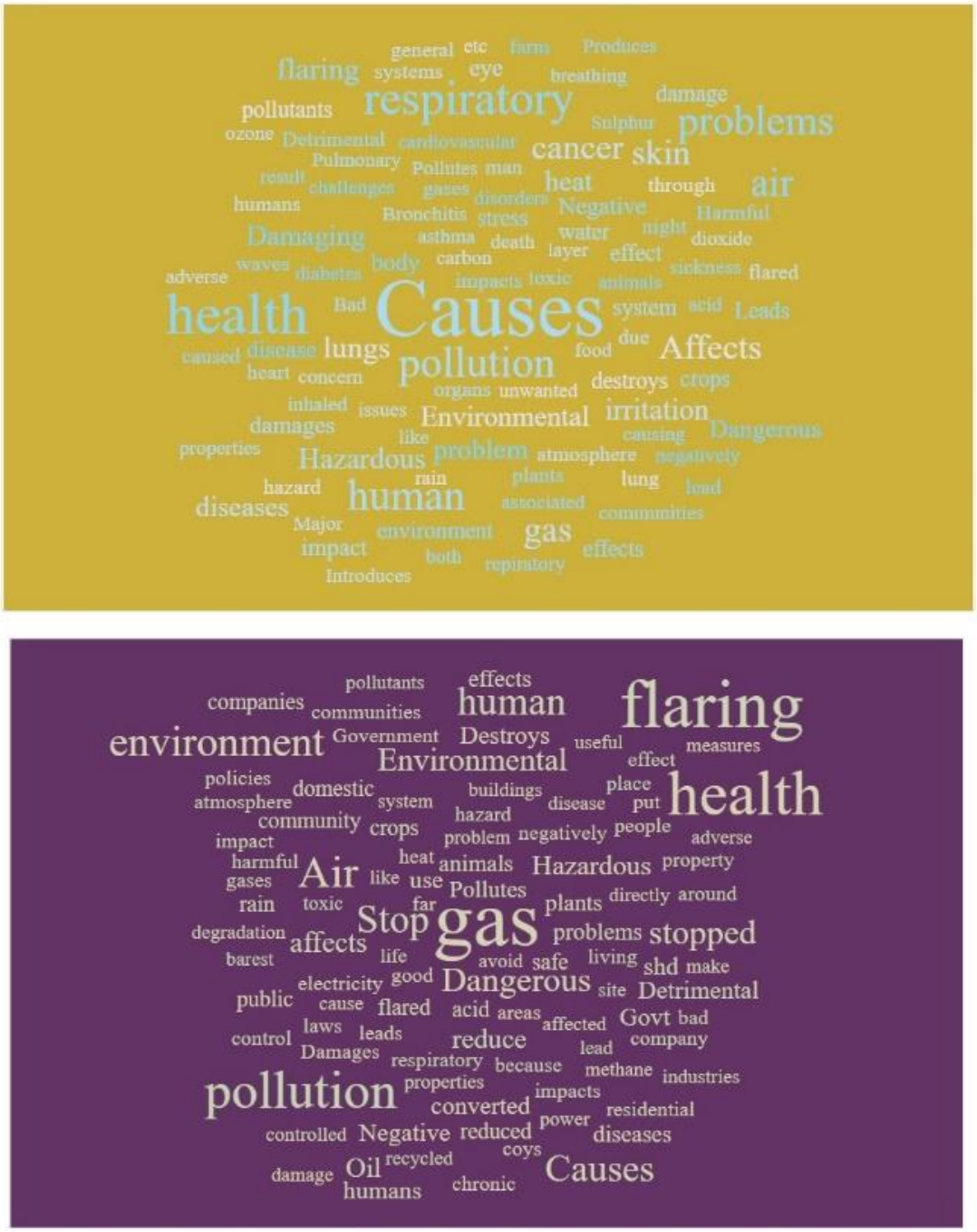
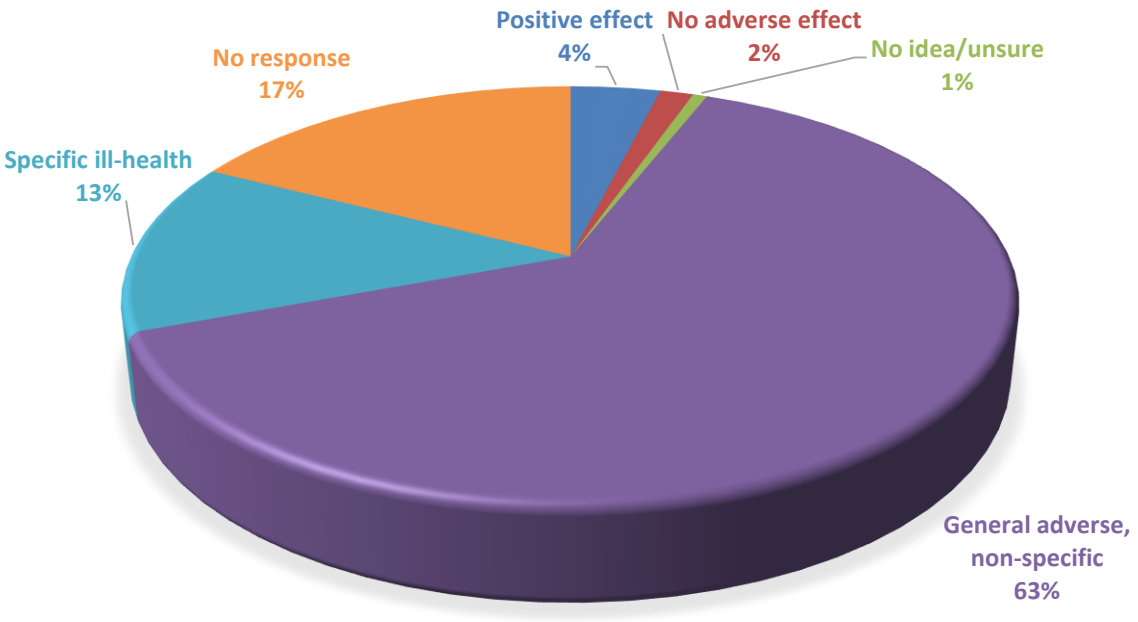
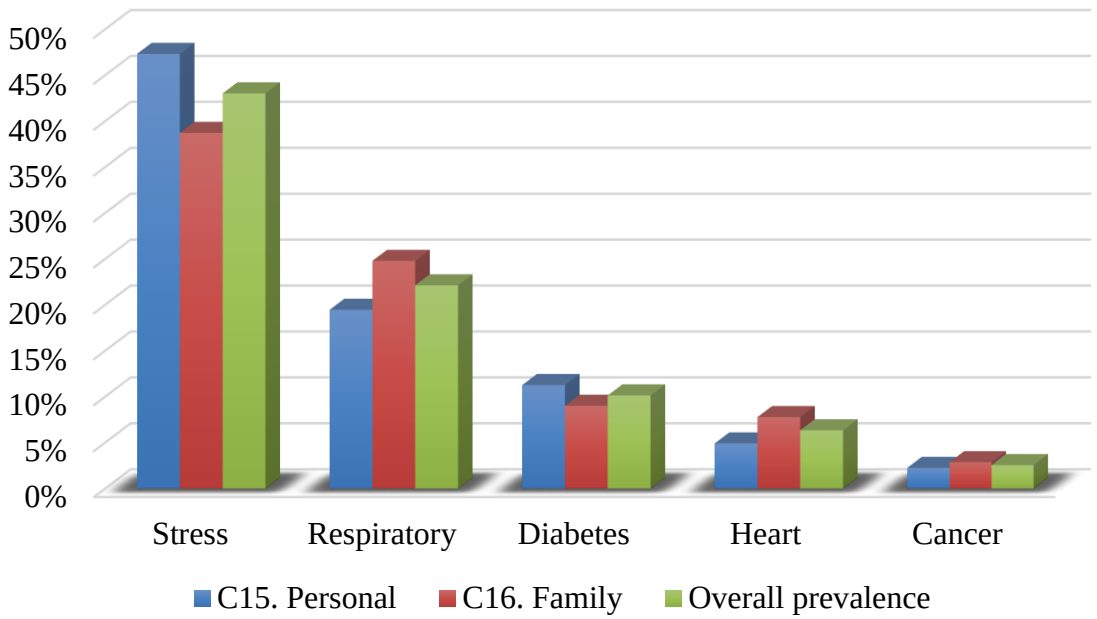


Fig. 1. Word Cloud of responses to question B9 & B10 (generated by *WordItOut*)



Graph 1. % Distribution of aggregated responses to question B10



Graph 2. Prevalence of specific ill-health as indicated by respondents

Section D assessed how the oil companies liaise with the community and what oil industries could do to alleviate known negative health impacts. Thematic analysis of Question-D9 shows that 'regular meetings' were common, while Question-D10 shows 'provision of medical facilities' and 'stop gas flaring' were the most common themes (Fig. 2). When responses were aggregated and quantified, the results show that 34% – 47% did not have opinion and indicated no response, no idea or "don't know/unsure" (Graph 3).

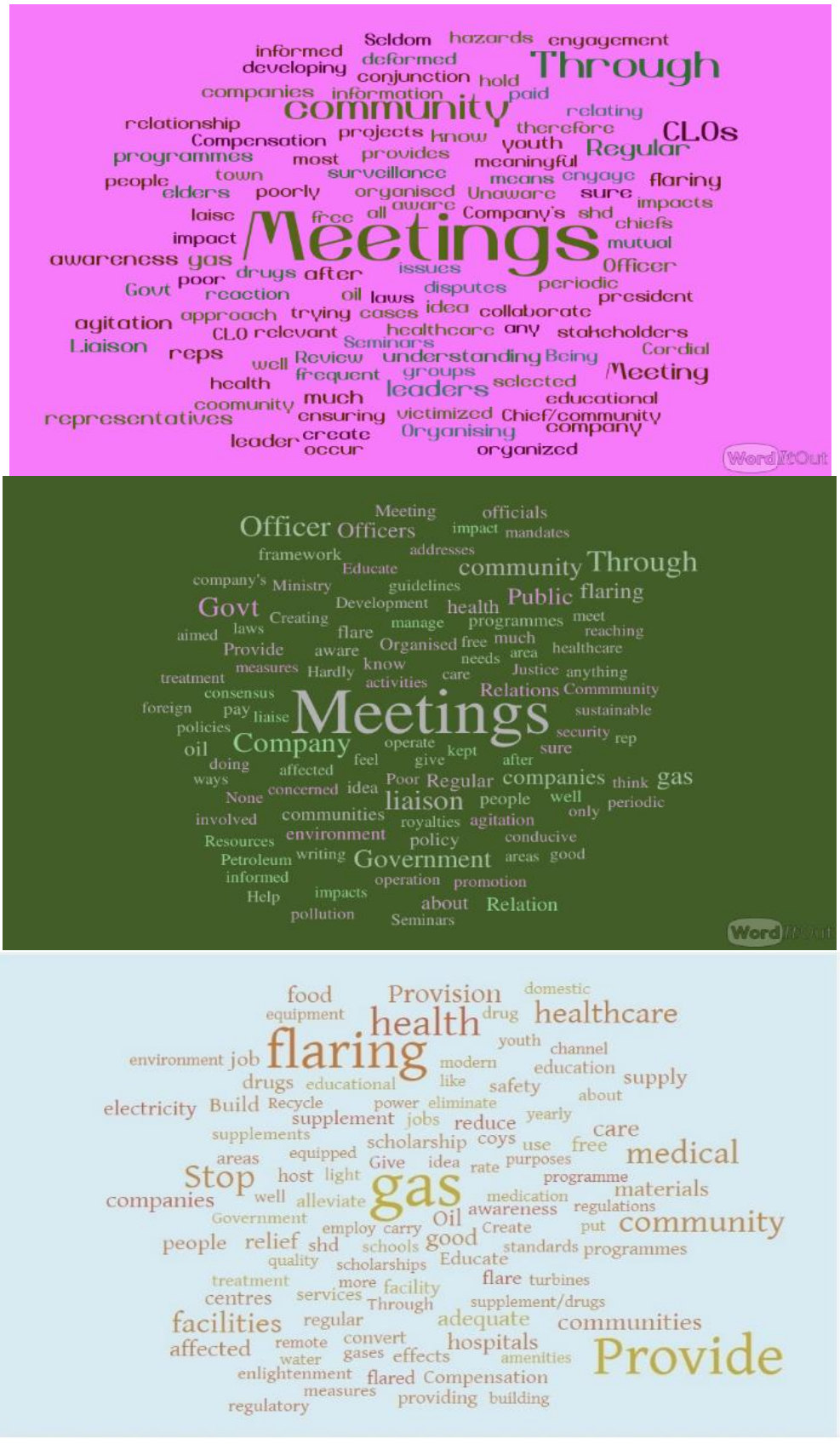
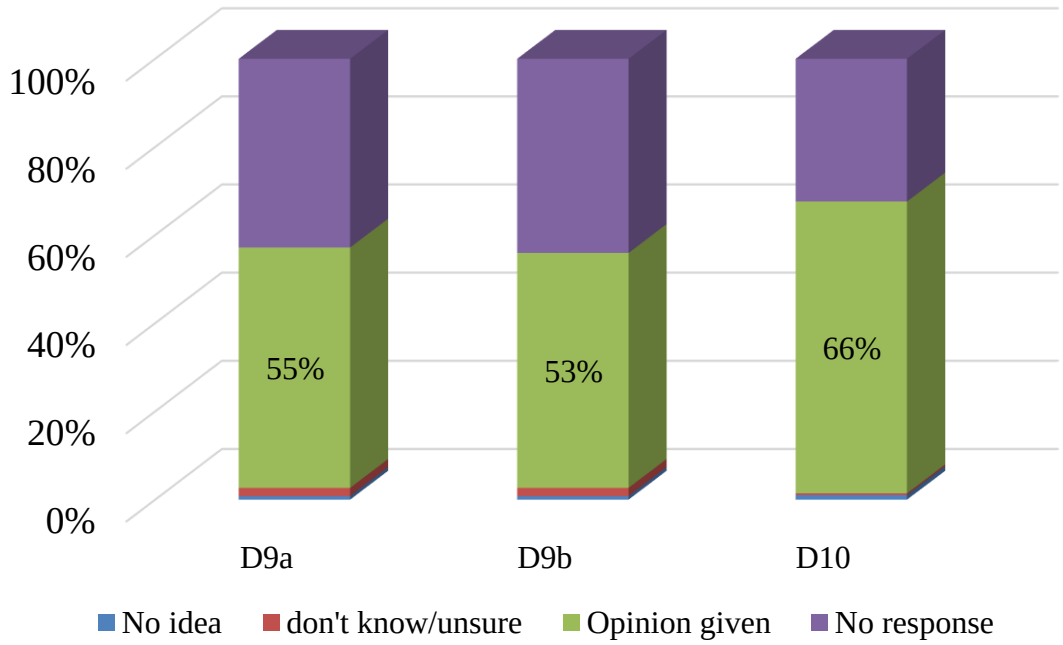


Fig. 2. Word Cloud of responses to question D9 & D10 (generated by *WordItOut*)



Graph 3. Distribution of aggregated responses to question on desired company programs

Section F assessed government's mitigation and adaptation programs and thematic analysis of Questin-F9 show, similar to D9, that 'regular meetings' were predominant, and also awareness through the news media. Question-F10 shows 'stop gas flaring' followed by 'provide health services' as two most prominent themes (Fig. 3). When responses were aggregated and quantified, result show as much as 39% – 63% had no opinion as indicated by no response, no idea or "don't know/unsure" (Graph 4).

Fig. 3. Word Cloud of responses to question F9 & F10 (generated by *WordItOut*)

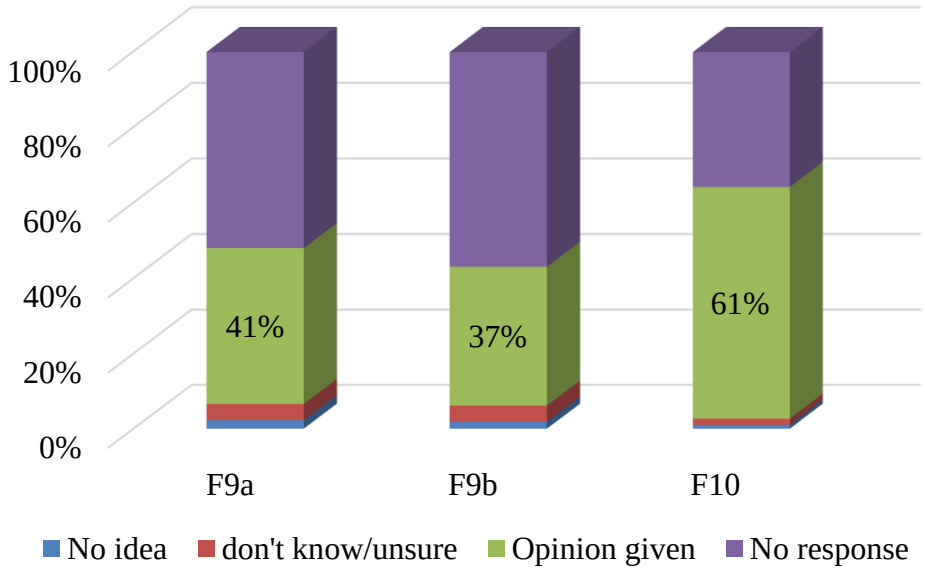
Further evaluation of the phrases on Sections D and F show similar themes albeit qualitatively. The common phrases among respondents i.e. based on responses to the questions were:

D9a. How does your company liaise with government?

- Regular Meetings
- Through the Public Relations Officer
- Government does not care about the community
- Not sure, or Don't know,
- Not aware, or No idea
- Very poor

D9b. How does your company liaise with community?

- Regular meetings
- Not sure, or Don't know
- No idea, or Not aware
- Very poor



Graph 4. Distribution of aggregated responses to question on desired government programs

D10. What oil companies can do to alleviate the health effects of gas flaring in the community?

- Stop gas flaring
- Adequate medical facilities
- Safety awareness should be carried out for the community
- Provision of job, relief materials and electricity
- Compensation
- By educating the community on the effects of gas flaring

F9a. How government liaises with community?

- Through community leaders, or "Liaison Officers"
- Through meetings, awareness campaign and news
- Through Seminars, news and organised meetings
- Through general educational info
- Not sure, or don't know,
- No idea

F9b. How government liaises with companies?

- Thru meetings
- Through the Public Relations Officer, &/or "Company Liaison Officer"
- Not sure, or don't know
- No idea, or None

F10. What government can do to alleviate health effects?

- Provision of health facilities and educate on the community on the effects of gas flaring
- Provide social services for its citizens
- Provide medications and equip the hospitals
- Provide more social amenities such as schools and hospitals
- Stop the oil companies from flaring gas
- Regulate and enforce laws on gas flaring
- Government has no regard for the people
- Make laws or policies to govern gas flaring operations
- Free medical services should be provided
- Channel the gas for useful purpose
- Provide health allowance

4. DISCUSSION

This research sought to ascertain the level of knowledge and opinions of the Delta community regarding impact of gas flaring and aim was to identify the risk awareness associated with gas flaring on human health. This study discriminated *knowledge and opinions of the community regarding the impact of gas flaring as well as necessary mitigation and adaptation programs* as

unknown phenomenon to explore. As mentioned, the broad ***research objective*** was to determine, albeit qualitatively, the knowledge and opinion of people in Delta region of Nigeria. In the study, it was ***presumed*** that knowledge is true, while opinion may depend on knowledge but is prone to bias [8].

Quantification of the aggregated themes showed that about 66% mentioned negative health impacts while up to 20% either explicitly do not believe or implies doubt. This estimated level of knowledge being majority is close to the quantitative results and can be related to the common knowledge that gas flare causes air pollution with negative public health impact [14]. Therefore, result of qualitative analysis is consistent with reports of high negative perception of respondents hazardous effects of gas flaring [15,16].

On the semi-qualitative evaluation of prevalence of 5 ill-health, results show that comparing all 5 diseases, prevalence in respondents and their family trail the same trend of stress being highest followed by sequence of respiratory disease, diabetes, heart disease and cancer. Studies in Nigeria have reported that high level of stress prevailing in healthcare workers [17,18] as well as respiratory and dermal diseases in Niger Delta [17,18]. However, in this study stress was the most prevalent and respiratory disease was second in the gas flaring communities and this is interesting, especially as these are self-reporting surveys and if we look again at reference 13, the researchers includes chest pain, asthma, difficulties in breathing.

The evaluations of companies' programs (Section D) and government's mitigation/adaptation efforts yielded similar theme. On quantification of aggregated themes, the results show a substantial proportion of respondents without opinion. Graph 3 & 4 respectively show that averaged proportion of respondents who have opinion on mitigation and adaptation programs of companies (58%) or government (46%) is merely average. These results corroborate previous observations about 'knowledge vs. opinion' discourse that highlights differences due to perception as well as in age and gender groups (in press), i.e. that there is no agreement regarding mitigation and adaptation programs by either gas flaring companies or the government. There is implicit suggestion that living or working near gas flare site may cause bias in opinion [19,20]. What this report contributes is the proportion of respondents without opinion regarding mitigation and adaptation programs on gas flaring. It is high and confounded e.g. by several socioeconomic variables including occupation and residence. Therefore, further studies are warranted and this is important for public health promotion.

5. CONCLUSION

This mainly qualitative study investigated common themes around knowledge of impact and prevalence of health problems due to gas flaring and evaluated, through the participants' opinion, the mitigation and adaptation programs of both government and the operating companies. Results show a high level of knowledge and while the majority may have opinions regarding what the government and/or companies are doing around mitigation and adaptation, there is lack of opinion e.g. on how company liaise with community or how government liaises with companies is considerably huge proportion of a cohort. Hence, awareness campaign and health promotion is warranted.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

Consent was implied by respondents freely collecting the survey and returning their completed questionnaire.

ETHICAL APPROVAL

This study was approved by Charles Sturt University (Ethics approval number: H20004) and used a mixed method approach of quantitative and qualitative analyses.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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