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Assessment of the Impact of Oil and Gas Pollution on Public Health in the Niger Delta Region of Nigeria

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Abstract

The commercial exploration and exportation of oil and gas is the primary source of revenue to the Nigerian government. However, the Niger Delta region, which is abundant in oil and gas reserves in the country, remains in poor socioeconomic outlook. This study extends the literature of oil pollution by investigating the impact of oil spillage and gas flaring on public health in the Niger Delta. A descriptive-explorative design was selected to discuss the subject matter. Cross-sectional primary data were collected from 200 participants who were selected from four oil-producing communities in the region (in Delta and Ondo states). The data were collected with the aid of self-designed semi-structured questionnaire. Data were analyzed with a mix of frequency counts, percentages and t-test. Findings showed that there is incessant outbreak of diseases within the sampled communities with a number of elderly residents being present with long-term illnesses. It was ascertained that the continuous, unchecked release of oil-related pollutants has deteriorated public health in the Niger Delta. Policymakers are therefore nudged to reconsider compensation and phasing-out schemes to restore healthy living to the people of oil-abundant communities.

Keywords: oil pollution, public health, t-test, government intervention, Niger Delta

1. Introduction

Since the commercial production and exportation of crude oil resources began in Nigeria in the 1970s, the attention of the Federal Government of Nigeria has been majorly concerned with maximizing the oil proceeds (Akinwumiju et al., 2020; Ratcliffe, 2019). However, the socioeconomic wreckage to the oil-abundant areas, which is the aftermath of the continuous oil and gas exploration, has been markedly ignored (Anyanwu et al., 2023; Amnesty International, 2020). In this study, the socioeconomic wreckage, as pronounced by oil pollution,

is considered to affect the public health profile of the people of oil-abundant areas of Nigeria which are together referred to as the Niger Delta. More specifically, this study investigates the impact of oil and gas pollution on public health developments in the oil-rich Niger Delta region of Nigeria.

Some stylized facts from Amnesty International (2020) on the relationship between oil pollution and health developments have it that people living in the oil-producing Niger Delta have shorter life expectancy (49 years) than average person in Nigeria (56 years). Also, Orisakwe (2021) stated that about half of the Niger Delta region is affected by daily oil and gas activities. These activities have rather registered double-edged impact in the region. While it remains the greatest source of government revenue (Akinwumiju et al., 2020), the region is inundated with incessant oil pollution which spells bad health trajectories for its inhabitants and residents (Orisakwe, 2021). The mechanism of oil pollution-public health nexus is explained by some building blocks. First, about 70% of oil and gas production in the Niger Delta involves offshore activities (Ele, 2022). Second, the major source of water for the people of Niger Delta is their rivers: for drinking, cooking, washing and cleaning (Akpan et al., 2022). Third, more than 75% of the Niger Deltans are farmers and fishermen/fisherwomen (Ewim et al., 2023). Fourth, when there is occurrence of oil spillage or unchecked release of crude oil from the underground pipes, it directly litters the people's farms and rivers (Sam et al., 2024). This impoverishes the people as their major source of livelihood is destroyed. Furthermore, while in the condition of recognizing their new spillage-caused reality, the poor people with dependence on river as source of water are reduced to drink and clean themselves with the polluted water (Anyanwu et al., 2023). This subjects the people of Niger Delta to a variety of health risks (Anyanwu et al., 2023; Akpan et al., 2022; Orisakwe, 2021).

In addition, the people of oil-present communities are affected by flared gases which are the second most impactful variant of oil pollution after spilled oil (Ukhurebor et al., 2024). Unlike oil spillage which affects people's health conditions indirectly, the gas flaring exercise directly impacts the air intake and therefore causes immediate breathing problems for the people (Ukhurebor et al., 2024). All scientific evidence indicates that flared gases are waste products which should be ejected at a distance very far from human habitation (see for example Moosazadeh et al., 2024; Alimi & Gibson, 2022; Amaechi & Ekene, 2016; Emam, 2015). Yet, most of the gas flaring technology is situated close to the residences of the people of Niger Delta. As a result, chronic illnesses are rife among the Niger Deltans, making their life expectancy to be below the national average (Alimi & Gibson, 2022; Amnesty International, 2020).

Despite the developments around the public health impact of oil pollution, the Nigerian government still permits the pollution to exist. There have been a number of clean-up initiatives to stop the oil spillage and phasing-out schemes to end the gas flaring. Yet, near-zero success has been recorded (Sam et al., 2024; Anyawu et al., 2023; Amnesty International, 2020). Beyond these stylized facts, this study was intended to empirically stretch the literature on the impact of oil pollution on public health profile of the people of Niger Delta, Nigeria. More specifically, a semi-structured questionnaire was designed and administered in order to collect primary data from 200 participants (indigenes and non-indigenes) living in four local

communities that are vulnerable to oil pollution in the Niger Delta. The statistical results reflected that there were bad trajectories around the health of the participants – especially the elderly ones aged 60 years and above who have been exposed to oil spillage or gas flaring or both within the sampled communities.

The remainder of this paper is organized into four sections. Section 2 takes a brief look at the existing literature. Section 3 outlines the methodology while Section 4 presents empirical results and discusses the findings. Finally, Section 5 concludes the study and offers recommendations for policy action.

2. Literature Review

Orisakwe (2021) searched and reviewed the evidence on the environmental and public health impact of crude oil production in Nigeria. The search was conducted on different research databases including Google Scholar, Scopus and PubMed. Findings showed that oil production is an environmental stressor to the people living in the oil communities. In addition, chemical pollutants ejected in the process of oil and gas production constitute health hazards to the people. Orisakwe (2021) therefore called for government-sponsored remediation strategies to checkmate the public health malady occasioned by oil and gas production. It is noteworthy that Orisakwe (2021)'s findings were an extension of Nriagu et al. (2016) who sampled a cross section of 600 participants from five oil-abundant local government areas of Akwa Ibom State, Nigeria. Nriagu et al. (2016) collected data from the participants via a structured questionnaire whose contents were focused on self-rated illnesses and diseases and exposure to oil pollution by the participants. It was found that there was prevalence of disease symptoms and public health deterioration among the participants. In essence, Orisakwe (2021) and Nriagu et al. (2016) concluded that normalcy to public health cannot restore to the Niger Delta until persistent oil pollution in the area is completely abated by government-financed schemes.

Ajayi-Temitope (2022) considered the environmental impact of oil pollution in the Niger Delta. The relevance of this study was related to its adoption of structural equation modeling technique in its methodology. Having collected qualitative responses of 200 participants drawn from Ondo and Delta states, Ajayi-Temitope (2022) showed that oil spillage and gas flaring have consistently impacted the land, water and air of the people of Niger Delta. As a result, the area is susceptible to high incidence of environmental hazards and consequential public health imbalances. A semblance to Ajayi-Temitope (2022)'s findings were presented by Ogbenetega (2022) whose preoccupation was maternal exposure to oil pollution within the Niger Delta. Oghenetega (2022) conducted a prospective cohort study which selected a total of 1720 pregnant women as the participants. However, only 1418 women retuned the completed questionnaire. The participants' responses were combined with available medical records to form data analysis which was anchored by multivariate log-binomial logistic model. Findings showed that women with high exposure to oil pollution experienced higher incidence of postpartum hemorrhage, caesarean sections, premature rapture of membrane. It follows that oil pollution distorts health outcomes for pregnant women in the Niger Delta (Oghenetega, 2022).

Ukhurebor et al. (2023) assessed the impact of petroleum spills on the people of the Niger Delta. The authors implemented a mix of critical review and field survey in order to reconcile the

mitigation efforts of oil companies on the health risks caused by oil and gas spills within the oil-producing areas. Findings showed that communicative responses of oil companies to compensate the victims of oil pollution less than offset consequential health risks of the pollution. Ukhurebor et al. (2023) argued that the incessant community clashes and violence against the oil companies are linked to the far-reaching impact of the oil pollution. More notably, the host communities consider the oil companies as anti-community development. The survey outcomes of Ukhurebor et al. (2023) revealed that there was sheer dislike for the oil companies by the general people in the community. These findings have comparable perspectives as those of Babatunde (2020) and Obida et al. (2018). While existing evidence established that there tends to be compensation from the oil companies, the host communities consider the compensation as inadequate to fully mitigate the health risks that they have been subjected to. Babatunde (2020) added that the sheer community dislike extends to the government which the people consider as being on the side of the oil companies. Relatedly, Aidonojie et al. (2023) argued the view that gas flaring directly destroys the ecosystem which culminated into environmental complications and public health hazards for the Niger Deltans.

Ewim et al. (2023) offered a secondary analysis of wastewater issues due to oil spills and pollution in the Niger Delta. The authors obtained data from various secondary sources such as official reports, satellite imagery and research articles. Ewim et al. (2023) identified a synergy of evidence on the occurrence of wastewater as a result of oil spills. Moreover, it was noted that there is lack of concerted efforts of regulatory agencies towards mitigating the pollution and setting the host communities on the path of development. Ewim et al. (2023) particularly explained the case of breakdown of law and order in the Niger Delta due to frequent clashes between the community youths and the oil companies. Given the findings, it was recommended that community-led, rather than government-led, remediation strategies should be implemented so that the wastewater incidence is managed within the Niger Delta (Ewim et al., 2023). On the same note, Bello and Nwaeke (2023) provided a case-study evidence that pipeline vandalism, crude oil theft and communal violence are issues that cannot be separated from oil and gas pollution in the Niger Delta. That is, as the oil pollution destroys the farmlands and hinders people from farming, there are threats to their livelihood and risks to their health (Bello & Nwaeke, 2023). With only negligible trust on the government for remediation on the oil-induced problems, the people resort to self-generated mechanisms. This is an indication of the breakdown of social contract between the people and the government/oil companies (Bello & Nwaeke, 2023).

Sam et al. (2024) considered the socioeconomic impact of oil pollution in the Niger Delta, with a focus on the health trajectories of the affected people. Mixed methods were used to collect the data, including key informant interviews, focus group discussions and household surveys in the oil-rich Ogoniland communities of Rivers State, Nigeria. The data collection spanned between July 2018 and March 2019. Findings pointed that 99.6% of the participants attested that they perceived the smell of crude oil or other petroleum products in the air they breathed. The researchers also reported that there was visible presence of black particles on the participants' nostrils. This signposts the quality of air intake by the respondents. Previously, Bruederle and Hodler (2019) estimated the impact of oil spills on neonatal and infant mortality

in the Niger Delta. The authors combined Demographic and Health Surveys with the spatial data from the Nigerian Oil Spill Monitor. It was found that there was higher mortality (38.3 deaths per 1000) in the population of neonatal and infant children in pollution-exposed areas relative to other areas. While the cause of these deaths cannot be completely linked to oil pollution, the environmental and epidemiological hazards occasioned by oil pollution are too damning to be excused from the high infant mortality in the high-exposure areas – the incidence of infant mortality is particularly pronounced in the areas that are most exposed to oil spills (Bruederle & Hodler, 2019).

3. Methods

This study took insights from the descriptive survey design such that perspectives of residents of the Niger Delta region were considered. This is with respect to the felt consequences of oil and gas pollution on public health developments in the region. The oil and gas pollution was dichotomized as having two variants: oil spillage and gas flaring. The literature is replete of the prevalence of these two pollution sources in the oil-producing area of Nigeria (see Section 2 above). To gather perspectives of the residents, a semi-structured questionnaire was designed and administered by the researcher. The questionnaire has four sections labeled A to D. Section A asks for the respondents' demographic information; Section B contains items asking for respondents' experience or otherwise of oil spillage or gas flaring in their environment. Section C asks for the respondents' opinions on the outlook of public health in their area. Finally, Section D surveys the respondents' stance on the link between oil pollution and public health in their location. The entire people living in the Niger Delta form the population of this study. However, given its scope, the study selected a sample of 200 respondents using the simple random sampling technique. The sample was selected from four oil-abundant communities (50 each) in Delta state (Afiesere and Edjeba communities) and in Ondo state (Ilaje & Ese-Odo communities).

Following Ahmed (2024)'s revision of Cochran (1977)'s formula for sample size determination, the sample size used in this study closely adopted the recommendation of Cochran (1977). According to Cochran, the sample size is obtained using the formula:

$$n_0 = \frac{z^2 pq}{e^2}$$

where n is the sample size, z is critical value of the desired confidence level, e is the margin of error or level of significance, p is the degree of variability of an attribute and q is $1 - p$. In this study, p is defined as oil pollution in the population. The chosen confidence level is 95%, making the critical value to be 1.96. The probability value or the level of significance is 0.05. Also, following the report of Amnesty International (2020), about 15% of the people of the Niger Delta have their residences close to the sites of oil pollution. Thus, p is taken as 15% or 0.15, making q to be 0.85. Inserting these values into the Cochran's formula yields the sample size (n) as 195.92. Therefore, the sample size used in this study was approximated to 200.

Due to the sensitivity of the subject matter of this study, gatekeepers were used to facilitate the

instrument administration. The present researcher approached two local leaders in each community who volunteered to introduce the researcher to the general residents. This eased the questionnaire administration process. The retrieval rate was 100% as all the voluntary participants returned the filled questionnaire they collected. It is worthy of note that no monetary inducement was used to attract the participants on this study. Having collected and sorted the completed questionnaires, the qualitative data were transformed into an Excel spreadsheet. The data output on Sections A to C on the questionnaire were analyzed using frequency counts and percentages. The data collected on Section D were analyzed using the t-test technique. This technique was invoked so that the differences in respondents' opinions were empirically validated or disputed. In short, the t-test results were interpreted at 5% level of significance. This means that findings are said to be significant if the computed probability value (p-value) is less than 0.05. Otherwise, findings are considered non-significant.

4. Empirical Analysis and Discussion of Findings

The analysis began with description of demographic characteristics of participants in this study. It was gathered that 65% are female while 35% are male. The unequal gender distribution of the respondents was by chance as no specific criterion was used to represent more female that male. Nevertheless, the warm reception received by the researcher from female folks in the sampled oil communities might have played a role in the differential of gender distribution of the respondents. It was also revealed that 60% of the participants were indigenous residents of the communities while 40% were non-indigenous residents. The researcher considered it worthy to include 80 non-indigenous respondents (40% of the sample) in this study in order to capture less-biased opinions with respect to developments around oil and gas production and the pollution it causes.

The mean age of the respondents was 25±12 years. This indicates that a number of the participants were youthful even though they were predominantly married (80% claimed to be married). The participants' households were large with average family having at least five members. The major occupations of the participants were farming (45%) and fishing (40%). This signposts that the respondents' sources of likelihood might be affected by incidents of oil spillage and gas flaring which are by-products of oil and gas exploration. On the health profile of the participants, 40% mentioned that they considered the available health facilities as distant form their houses; 25% suffered from terminal diseases which caused them 2-3 visits to the hospital per week. When the respondents were asked of their experience on outbreak of diseases within the community, they unanimously responded in the affirmative. The list of such mentioned diseases included cholera, chicken pox, flu and most recently COVID-19. The participants also claimed to sense that oil pollution in their communities was part of immediate and remote causes of diseases in their communities.

Although more than half of the participants agreed to have been affected by oil spillage and gas flaring, they reported that they have experienced the occurrence of oil spillage (68%) more than that of gas flaring (55%). This was consistent with the physical observation of the researcher during the data collection process. Also, when the participants were asked of how they were affected by the oil pollution, majority (77%) stated that their rivers were constantly

destroyed in each episode of oil spillage. And given that river is the primary source of water in the community, the residents were predisposed to unsafe potable water. This has untoward consequences on their health profile and outlook. This confirms the earlier conclusions of Akpan et al. (2022) and Ewim et al. (2023). On the impact of gas flaring, the respondents complained of low-quality air which they inhaled. The flared gases escape to the environment, causing environmental inconvenience for the locals. Some elite participants reported that public health in the visited communities required emergency attention of the government. This was because the polluted air has caused serious health conditions for the community residents – the elderly of at least 60 years of age were disproportionately affected by this. On the common diseases suffered by the elderly participants, 32% mentioned lung-related diseases, 28% stated heart-related diseases, 25% reported skin-related diseases and the remaining participants listed an array of other diseases such as tuberculosis and glaucoma. It is noteworthy that these common diseases are related to exposure to unhealthy air (see for example Ukhurebor et al., 2024 and Moosazadeh et al., 2024), so oil pollution is a candidate explanation for the breakdown of public health in the oil communities.

Then, the participants' opinions on the link between oil pollution and public health was subjected to a t-test analysis (Table 1). The opinions were grouped as being in agreement or otherwise. While 52% agreed, 33% disagreed and 15% were undecided. On a three-point scale, "agree" was rated 2, "undecided" was 1 and "disagree" was rated 0. The mean opinion was 1.37, suggesting that the participants generally tend to agree that oil pollution has impact on deteriorating public health. To ascertain whether this average opinion might have occurred by chance, the SPSS software was used to code the ungrouped opinions. The t-statistic was computed as 3.56. Given that the t-statistic was in excess of 2.0, there was a pointer that the mean opinion would be reproduced in repeated sample. More empirically, the t-critical value of 1.87 was below the statistical value. This confirmed that majority of the participants agreed to oil pollution being a significant cause of public health deficiency in the general community. Alternatively, the computed p-value was 0.02 which was less than the chosen 5% level of significance. In other words, the analytical approach in this study hinges on 95% confidence that the findings may be untrue only on 5% of repeated samples. This is a standard practice in the report of studies investigating human opinions (Anyanwu et al., 2023). More specifically, while both oil spillage and gas flaring are (jointly) statistically significant in impacting public health, oil spillage is a greater correlate. This is due to higher t-statistic (3.77 versus 2.84 for gas flaring) and lower p-value (0.01 versus 0.03 for gas flaring). In short, the statistical results validate the participants' opinions that oil spillage has greater influence on public health than gas flaring.

Table 1: T-test analysis of respondents' opinions on oil pollution-public health nexus

	Mean opinion	t-statistic	Standard error	p-value
Oil spillage	1.41	3.77*	0.87	0.01
Gas flaring	1.25	2.84*	0.92	0.03
Oil spillage and oil flaring	1.37	3.56*	0.89	0.02

* indicates that the mean opinion is significant at 5%

Source: Field Report, 2024.

5. Conclusive Summary

In recent past, the side effects of oil and gas exploration in Nigeria have generated local and international attention. This is connected with the provision that the people of Niger Delta region are characterized by poor socioeconomic outlook, despite the abundance of oil resources on their land. This study was developed to explore the impact of oil pollution on public health in the oil-producing region of Nigeria. Having collected and analyzed the cross-sectional data, it was ascertained that oil spillage and gas glaring are significant factors shaping poor health conditions among the people. The main causes of this are related to colored water (due to spilled oil) and unhealthy air (due to flared gases). That is, having no access to government-provided potable water or housing scheme, the people of Niger Delta are reduced to drinking from unwholesome water from the polluted rivers and inhaling polluted air. It therefore follows that unchecked oil and gas pollution holds explanation for incessant occurrence of communicable diseases in the oil-rich region. Also, the elderly in the region suffer from an array of terminal illnesses which are linked to long-term consumption of polluted air. It is therefore recommended that various compensation schemes should be implemented to improve living conditions of the people of Niger Delta. As these schemes have been passed by successive governments in the country, their implementation should rather be the top priority. More importantly, the distribution of compensation to affected victims should follow means-tested approach such that individuals whose health are directly affected by the oil pollution receive due compensation. Over the long term, clean-up schemes to phase out oil spillage and gas flaring should be given serious consideration by the Federal Government of Nigeria.

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Data Availability Statement

The data that support the findings of this study are available on request.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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