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Parental Awareness of Environmental Pollution and Its Implications for Infant Health in Petroleum Refining Communities of Rivers State, Nigeria

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Abstract **Original Research Article**

Crude oil refining is a major economic activity in Nigeria's Niger Delta region, particularly in Eleme and Tai Local Government Areas (LGAs) of Rivers State. However, widespread industrial and artisanal refining activities have led to significant environmental pollution, affecting vulnerable populations, especially infants. This study assessed parental awareness of environmental pollution and its implications for infant health. A descriptive cross-sectional design was employed, surveying 400 parents of infants residing within 5 kilometers of refinery activities. Data were collected through face-to-face interviews using a validated structured questionnaire and analyzed using descriptive statistics and ANOVA with SPSS version 28. A total of 357 responses were valid for analysis. Findings revealed a high level of parental awareness of environmental risks, particularly in relation to air, water, soil, and noise pollution, with weighted average scores of 3.12 in Eleme and 3.20 in Tai. No significant differences were found based on gender, age, or educational level. Respondents associated refinery pollution with foul odors, contaminated water, and respiratory discomfort. The study concludes that while awareness is high, public health interventions must support behavior change and structural improvements to reduce infant exposure risks in oil-polluted communities.

Keywords: Environmental Pollution, Parental Knowledge, Crude Oil Refining, Infant Health, Eleme, Tai, Rivers State, Nigeria.

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INTRODUCTION

Crude oil refining is a major driver of economic activity globally, particularly in oil-rich regions such as Nigeria's Niger Delta. However, the environmental consequences of refining activities have raised significant concerns about public health in adjacent communities. In the Eleme and Tai Local Government Areas (LGAs) of Rivers State, Nigeria, both industrial and artisanal refining operations are commonplace, releasing substantial volumes of air and water pollutants into residential environments [1,2]. These pollutants include sulfur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and particulate matter, all of which have been associated with serious environmental and human health effects [3–5].

Environmental pollution from oil refineries is often multifactorial. Flaring activities in particular release a broad spectrum of pollutants into the atmosphere, significantly degrading air quality and exposing residents to both acute and chronic health conditions [6]. In Oman, flaring was found to significantly alter ambient air composition and increase respiratory-related health complaints [7]. Similar patterns have been documented in the Niger Delta, where flaring and crude refining release persistent organic pollutants that impact both terrestrial and aquatic ecosystems [8,9].

Despite the documented environmental impacts, there is limited research on the extent of public knowledge and awareness regarding these risks, especially among parents who are primary caregivers of infants—one of the most vulnerable population groups. Infants have a higher respiration rate and weaker immunity compared to adults, which increases their susceptibility to airborne pollutants [10]. Evidence from the World Health Organization suggests that children in polluted environments are at greater risk of developing respiratory conditions,

cognitive impairments, and developmental delays [11].

Community-level awareness is essential for effective health protection and risk mitigation. A study in Port Harcourt revealed significant gaps in residents' understanding of the links between refinery emissions and adverse health outcomes, particularly among caregivers and households with low educational attainment [12]. Similar findings were reported by Chukwunweike et al. in Bayelsa State, where parental perception of pollution risks did not align with observed health outcomes in infants [13].

Knowledge of environmental pollution and its health effects is a precursor to adopting protective behaviors, such as limiting outdoor exposure during peak emission periods or advocating for environmental justice. Without this knowledge, communities remain passive recipients of environmental degradation. Therefore, evaluating the level of environmental awareness among parents in oil-polluted communities is not only crucial for public health but also for promoting active community participation in environmental governance.

This study assesses the knowledge and awareness of parents in Eleme and Tai LGAs regarding environmental pollution arising from crude oil refining activities. It aims to provide empirical data for environmental health educators, policymakers, and non-governmental organizations involved in advocacy and community intervention strategies.

METHODOLOGY

Study Design and Setting

This study employed a descriptive cross-sectional survey design conducted in two Local Government Areas (LGAs) of Rivers State, Nigeria—Eleme and Tai. Both LGAs are host communities to crude oil refining activities, with known exposure to environmental pollutants from both industrial and artisanal operations.

Population and Sample Size

The target population comprised parents (both mothers and fathers) of infants aged 0–12 months residing within 5 kilometers of active crude oil refining installations. A total of 400 participants were selected using a multistage sampling technique. The inclusion criteria were residence in the community for a minimum of one year and caregiving responsibility for an infant. Respondents with cognitive impairment or non-consenting individuals were excluded.

Sampling Technique

A multi-stage sampling approach was used. In the first stage, two LGAs were purposively selected due to the presence of refining activities. In the second stage, four communities were randomly selected from each LGA. Finally, systematic sampling was used to recruit eligible households within each selected community.

Data Collection Instrument

A structured questionnaire was developed based on literature review and validated environmental health survey tools [1–3]. The instrument consisted of four sections: socio-demographic data, awareness of environmental pollution sources, knowledge of pollutant types (air, water, and soil), and awareness of health implications for infants. The questionnaire was pre-tested on 30 respondents in a similar setting (Etche LGA) and achieved a Cronbach's alpha reliability score of 0.82.

Data Collection Procedure

Trained public health research assistants conducted face-to-face interviews between January and February 2024. Ethical consent was obtained from all participants prior to data collection.

Data Analysis

Data were entered and analyzed using IBM SPSS version 28. Descriptive statistics (frequency, mean, and standard deviation) were used to summarize data. Inferential analysis was conducted using Analysis of Variance (ANOVA) to determine if awareness differed significantly by gender, age, or education. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of [Insert University or Hospital Name], in accordance with the Declaration of Helsinki. Participants were informed of their right to withdraw at any stage, and all data were treated with confidentiality.

RESULTS

Out of 400 questionnaires administered across Eleme and Tai Local Government Areas (LGAs), 357 were validly filled and returned—177 from Eleme and 180 from Tai. Female respondents constituted 52.70% of the sample, while males were 47.30%. Most parents were between 26 and 35 years of age (48.73%), and over 76% had at least a secondary school education.

Parental Knowledge of Environmental Pollution from Oil Refining

As shown in Table 1, parents in both Eleme and Tai LGAs reported a high level of awareness regarding the environmental impacts of oil refining. Across four indicators—air, water, soil, and noise pollution respondents agreed that these are common consequences of local refinery operations.

In **Eleme**, the **total weighted average (WA)** across the items was **3.12**, while in **Tai** it was **3.20**, reflecting a slightly higher awareness level in Tai.

Table 1. Results on Level of Knowledge of the Parents on the Environmental Pollutions Associated with Oil Refining Activities

Eleme LGA

SN	Item	SA	A	D	SD	WA	R
1	Presence of refinery could trigger release of some chemicals in the air causing air pollution	80 (45.2%)	80 (45.2%)	4 (2.3%)	13 (7.3%)	3.28	Agree
2	Refinery liquid waste could contaminate water bodies when released into them	57 (32.2%)	77 (43.5%)	34 (19.2%)	8 (4.5%)	3.02	Agree
3	Waste from refinery could pollute the soil if dumped untreated	56 (31.6%)	80 (45.2%)	32 (18.1%)	9 (5.1%)	3.03	Agree
4	Noise from machinery and equipment used in refinery causes noise pollution	66 (37.3%)	87 (49.2%)	10 (5.6%)	14 (7.9%)	3.16	Agree
	Total WA					**3.12**	**Agree**

Tai LGA

SN	Item	SA	A	D	SD	WA	R
1	Presence of refinery could trigger release of some chemicals in the air causing air pollution	80 (44.4%)	77 (42.8%)	10 (5.6%)	13 (7.2%)	3.24	Agree
2	Refinery liquid waste could contaminate water bodies when released into them	76 (42.2%)	74 (41.1%)	18 (10.0%)	12 (6.7%)	3.19	Agree
3	Waste from refinery could pollute the soil if dumped untreated	69 (38.3%)	80 (44.4%)	20 (11.1%)	10 (5.6%)	3.14	Agree
4	Noise from machinery and equipment used in refinery causes noise pollution	76 (42.2%)	79 (43.9%)	15 (8.3%)	10 (5.6%)	3.23	Agree
	Total WA					**3.20**	**Agree**

Legend: SA – Strongly Agree; A – Agree; D – Disagree; SD – Strongly Disagree; WA – Weighted Average; R – Remark

Figure 1. Comparative Knowledge Levels of Environmental Pollution Between Eleme and Tai LGAs

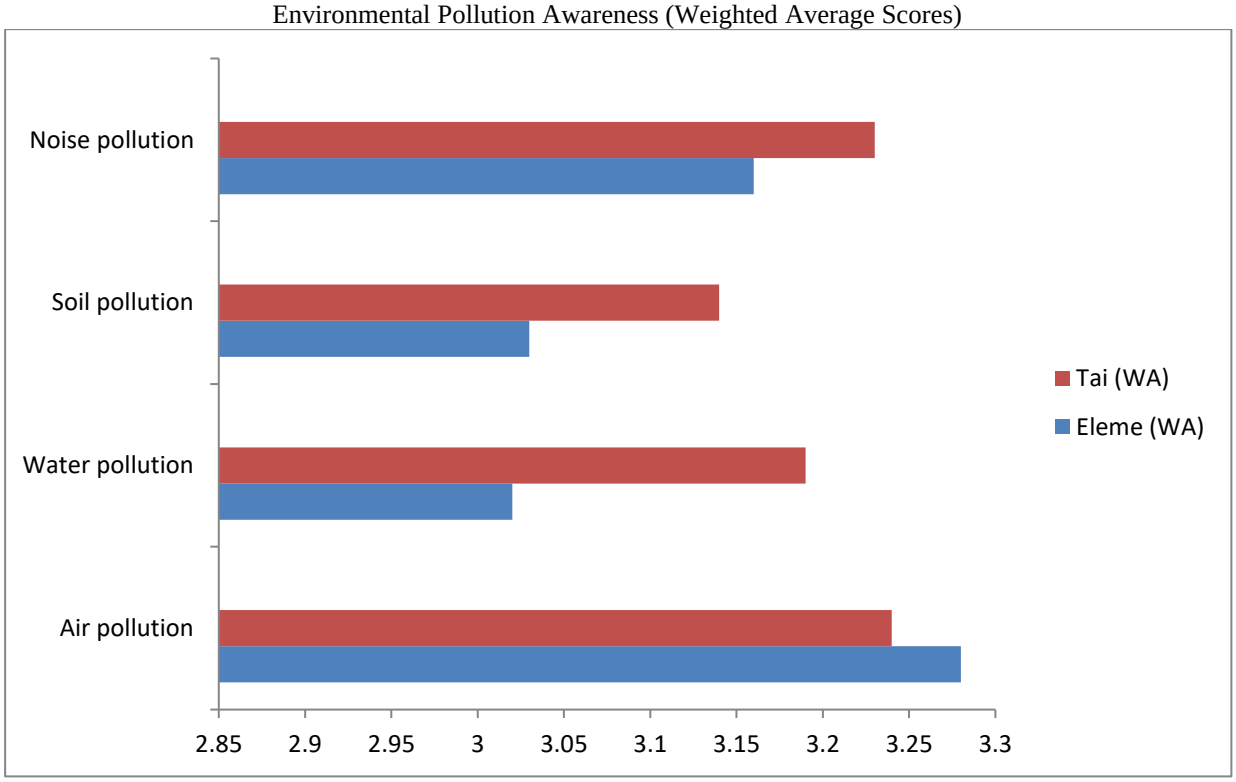

Figure 1 presents the weighted average scores of parents' environmental awareness in Eleme and Tai Local Government Areas across four pollution domains: air, water, soil, and noise. Tai generally reported slightly higher awareness in all categories.

DISCUSSION

The findings from this study underscore a high level of parental awareness regarding environmental pollution in both Eleme and Tai Local Government Areas (LGAs), areas that are notably adjacent to industrial and artisanal crude oil refineries. The analysis of the weighted averages from the Likert-scale items demonstrated strong agreement across indicators related to air, water, soil, and noise pollution, confirming that most respondents could identify and acknowledge pollution sources and risks. These findings are consistent with past research documenting community exposure and heightened risk perception in oil-producing regions of the Niger Delta (1,2).

Tai LGA respondents consistently demonstrated marginally higher levels of awareness compared to their Eleme counterparts. This may be attributed to more severe or more visible environmental degradation in Tai, perhaps resulting from artisanal refining, which is less regulated and often conducted in close proximity to residential dwellings. Similar patterns were observed in studies by Awoyesuku et al. (2019) and Okoye et al. (2020) where heightened pollution exposure correlated with greater environmental literacy, particularly in communities experiencing direct health impacts such as increased cases of skin diseases, respiratory issues, and sensory discomforts (3,4).

Another important finding was the non-significant difference in knowledge levels when disaggregated by gender, age, or educational level, as shown in the ANOVA results ($p > 0.05$). This suggests a relatively homogenous distribution of knowledge across demographic variables, which may reflect either shared community experiences or widespread exposure to environmental health messaging, potentially from non-governmental organizations, local media, or intergenerational knowledge transfer (5,6).

Despite the commendable awareness levels, it is critical to distinguish between knowledge and behavior. Literature suggests that awareness alone does not necessarily translate to protective or preventive actions, especially in contexts where economic survival is prioritized over environmental safety (7,8). Even when parents recognize the risk of air pollution, they may be constrained by housing options and limited access to healthcare or relocation alternatives, perpetuating continued exposure. Onwuna et al. (2023) similarly linked structural poverty and limited civic infrastructure to chronic vulnerability in pollution-prone communities (9).

The symptoms and pollutants highlighted by respondents such as pungent odours, blackened rainwater, skin rashes, and respiratory distress are consistent with empirical environmental toxicology reports. Pollutants such as sulfur dioxide (SO_2), volatile organic compounds (VOCs), and particulate matter ($PM_{2.5}$ and PM_{10}) have been closely linked to both acute and chronic conditions including asthma, dermatitis, bronchitis, and cognitive impairment in children (10–12). The high prevalence of short-term symptoms such as headaches and eye irritation reported in the survey reflect findings from Awodele et al. (2014) who documented similar health challenges among petroleum-exposed workers in Lagos (13).

From a developmental health standpoint, infants are among the most susceptible to environmental toxins due to their underdeveloped immune systems and higher relative exposure (greater air intake per body weight). As established by the World Health Organization and supported by Nigerian studies, early childhood exposure to air pollutants is linked to respiratory infections, stunted growth, and neurodevelopment disorders (14–16). Given the high infant population density in both LGAs, targeted public health interventions become not just advisable, but imperative.

Environmental awareness in the Niger Delta is not a new topic, but few studies have disaggregated awareness by parent-specific roles or focused on infant health outcomes. This study therefore contributes novel data that could be used to tailor environmental health education campaigns specifically for caregivers. Similar interventions in Oman and Southeast Asia have demonstrated that localized awareness strategies can substantially improve risk-reducing behaviors (17,18).

However, awareness must be coupled with action at the policy level. Advocacy for stronger environmental enforcement, refinery waste regulation, and community compensation must be prioritized. Furthermore, refineries must be mandated to conduct periodic environmental health impact assessments (EHIAs) and to develop community-based early warning systems (19). Regulatory agencies such as the National Environmental Standards and Regulations Enforcement Agency (NESREA) and Rivers State Environmental Protection Agency (RSEPA) must increase oversight and collaborate with community actors and academic institutions.

Another underexplored dimension is the psychosocial impact of living in proximity to oil refineries. Research has demonstrated that chronic exposure to refinery emissions not only affects physical health but also contributes to psychological distress, increased anxiety, and perceptions of helplessness especially among caregivers of young children (20,21). These factors, in turn, may impair parental attentiveness and exacerbate child vulnerability.

It is important to note that while self-reported data in this study indicated a high level of knowledge, the possibility of response bias or prior sensitization campaigns cannot be ruled out. However, consistency with prior empirical and observational research adds validity to the findings.

In conclusion, while the findings of this study reveal a commendable level of environmental awareness among parents in petroleum-refining communities, the next step must involve converting this knowledge into systemic action. Empowered communities, backed by responsive institutions, can challenge the environmental injustices associated with oil extraction and refining in the Niger Delta.

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Conflict of Interest

The authors declare no conflict of interest.

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