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Assessment of Parental Knowledge of Long-Term Health Risks in Infants Due to Environmental Pollution from Crude Oil Refineries in Eleme and Tai LGAs, Rivers State

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Abstract **Original Research Article**

Chronic exposure to environmental pollutants from crude oil refining poses significant health risks, particularly for infants. These risks often manifest as long-term developmental, respiratory, and neurological problems. In communities with prolonged exposure, such as Eleme and Tai Local Government Areas (LGAs) in Rivers State, Nigeria. This study assessed the level of parental knowledge concerning the long-term health risks in infants due to environmental pollution from crude oil refineries and examined whether socio-demographic factors such as gender, age, and educational level influence awareness levels. A descriptive cross-sectional survey was conducted among 357 parents of infants aged 0–12 months residing near crude oil refining facilities in Eleme and Tai LGAs. Data were collected using structured, interviewer-administered questionnaires and analyzed using IBM SPSS version 28. Descriptive statistics, t-tests, and ANOVA were employed to evaluate knowledge scores and demographic influence, with statistical significance set at $p < 0.05$. Parents in both LGAs demonstrated a high level of awareness regarding both short-term and long-term pollution-related health issues in infants, with Weighted Average (WA) scores above 3.00 in all categories. While Tai residents showed slightly higher knowledge scores (WA = 3.28) than Eleme (WA = 3.21), no statistically significant differences were found based on gender ($p = 0.148$), age ($p = 0.325$), or education ($p = 0.996$). Parental knowledge of long-term health effects of refinery pollution on infants is high and consistent across demographic groups. This widespread awareness highlights the potential of community-based experiences in cultivating environmental health literacy. However, knowledge must be paired with improved access to healthcare, environmental education, and supportive public health infrastructure to mitigate long-term risks in vulnerable populations.

Keywords: Environmental Pollution, Crude Oil Refining, Long-Term Health Risks, Infant Health, Parental Knowledge, Niger Delta, Nigeria.

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INTRODUCTION

Activities of refining crude oil in the Niger Delta region of Nigeria have resulted in chronic environmental pollution, particularly among individuals residing in the vicinity of refinery facilities. Artisanal and industrial activities of crude oil refining are commonplace in Eleme and Tai Local Government Areas in Rivers State. These activities release several toxic chemicals into the environment, such as volatile organic compounds, polycyclic aromatic hydrocarbons, sulfur oxides, and heavy metals (1–3). Long-term exposure to these contaminants has been associated with a range of long-term health effects, especially in infants and children.

Infants are also more physiologically vulnerable to environmental pollutants because of their ongoing developmental processes, incomplete immune systems, and

greater exposure levels relative to body weight. Long-term exposure to environmental pollution has been linked to chronic health effects like neurodevelopmental delay, chronic respiratory illness, hematologic dysfunction, and impaired mental function in children (4–6). Infant exposure, a period of particular vulnerability, can influence organ maturation, endocrine homeostasis, and immune function with consequences that will not become apparent until adulthood (7,8).

In spite of the known risks, few data exist on the awareness of parents on the long-term health effects of exposure to environmental pollution among refinery-near communities in Nigeria. Most of the research that has been conducted has either touched on short-term health effects or environmental awareness in general, but not specifically long-latency health effects among children (9,10). Among chronically environmentally polluted populations, awareness of such risks is relevant for their early detection, health-seeking behavior, and engagement in prevention activities.

Parental awareness is a key element in environmental health intervention, especially for infants, who are completely dependent on others for making health decisions. An aware parent will more likely track development milestones, pursue early intervention, and practice risk reduction. On the other hand, lack of parental awareness of chronic threats can postpone relevant health action, possibly exacerbating the negative outcomes of chronic exposure (11–13).

The objective of the study is to determine the knowledge of Eleme and Tai LGAs' parents about the long-term health consequences of environmental pollution by crude oil refining activities in infants. It also examines if there is any influence of socio-demographic characteristics like age, gender, and level of education on their knowledge. The result will inform evidence-based environmental health education and public health policy formulation for vulnerable groups in oil-producing states.

METHODOLOGY

Study Design and Setting

This study adopted a descriptive cross-sectional survey design to assess the knowledge of parents concerning the long-term health risks of environmental pollution from crude oil refining in infants. The research was conducted in Eleme and Tai Local Government Areas (LGAs) of Rivers State, located in the Niger Delta region of Nigeria. Both LGAs are well-documented for their intense industrial oil refining activities, involving both government-licensed and artisanal refineries, which significantly contribute to environmental pollution.

Target Population and Inclusion Criteria

The study population comprised biological parents or primary caregivers of infants aged 0–12 months who had resided for a minimum of one year in communities located within five kilometers of active refining operations. Respondents were required to be directly involved in daily infant care. Individuals who were not parents, had no caregiving responsibilities, or could not provide informed consent due to cognitive or communication limitations were excluded.

Sample Size and Sampling Technique

A total of 400 questionnaires were distributed using a multistage sampling method. In the first stage, Eleme and Tai LGAs were purposively selected due to their high levels of refinery activity. In the second stage, four communities were randomly selected from each LGA. In the final stage, systematic random sampling was used to select households within the selected communities. One eligible parent per household was invited to participate. Out of the 400 questionnaires distributed, 357 were completed and valid for analysis, representing a response rate of 89.25%.

Data Collection Instrument

A structured, interviewer-administered questionnaire was designed based on validated tools used in environmental health studies.

The questionnaire was pre-tested in Etche LGA, which shares similar environmental characteristics with the study areas. Feedback from the pre-test led to minor modifications for clarity. The Cronbach's alpha coefficient of internal consistency was calculated at 0.81, indicating high reliability.

Data Collection Procedure

Data were collected between January and February 2024. A team of trained public health research assistants, fluent in English and local dialects, conducted face-to-face interviews at respondents' residences. Verbal and written informed consent was obtained prior to participation. Each interview lasted approximately 25 minutes.

Data Analysis

Data were entered and analyzed using IBM SPSS version 28. Descriptive statistics (frequencies, percentages, means) were used to summarize respondent characteristics and awareness levels. Responses to knowledge-related questions were scored on a 4-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (4). Weighted Averages (WA) were computed for each knowledge item. A WA score of ≥ 2.50 was considered indicative of sufficient awareness.

Inferential analysis included t-tests and one-way Analysis of Variance (ANOVA) to assess whether awareness levels differed significantly across socio-demographic subgroups. Statistical significance was defined as $p < 0.05$.

Ethical Considerations

Ethical clearance for this study was obtained from the Research Ethics Committee of [Insert Institution Name], and all procedures were conducted in line with the Declaration of Helsinki. Participation was voluntary, and all responses were kept confidential. Data were anonymized and stored securely.

RESULTS

Response Rate and Participant Distribution

Out of 400 structured questionnaires administered across Eleme and Tai Local Government Areas (LGAs) of Rivers State, 357 were validated and used for analysis. This yields an effective response rate of 89.25%. Specifically, 177 responses were obtained from Eleme LGA and 180 from Tai LGA.

Demographic Characteristics of Respondents

The demographic details of participating parents are presented in **Table 1**. A slight majority of respondents were female (52.70%), with males accounting for 47.30%. In terms of educational attainment, most respondents held OND or HND qualifications (43.40%), followed by SSCE holders (33.33%), while 9.06% had no formal education. The majority of respondents (48.73%) were aged between 26 and 35 years, followed by 35.87% who were 36 years or older.

Table 1. Demographic Characteristics of Sampled Parents in Eleme and Tai LGAs (n = 357)

Variable	Category	Eleme (n = 177)	Tai (n = 180)	Total (n = 357)	Percentage (%)
Gender	Male	87	82	169	47.30
	Female	90	98	188	52.70
Educational Level	None	20	12	42	9.06
	SSCE	57	62	119	33.33
	OND/HND	68	87	155	43.40
	B.Sc	32	19	51	14.20
Age Group (Years)	18–25	30	25	55	15.40
	26–35	87	87	174	48.73
	36 and above	60	68	128	35.87

Knowledge of Short-Term Health Problems in Infants

Table 2 summarizes parental knowledge regarding short-term health effects of refinery pollution on infants. Commonly recognized symptoms included persistent coughing, skin rashes, diarrhea, and eye irritation. The average WA scores of 3.27 in Eleme and 3.20 in Tai indicate high awareness of acute pollution-related illnesses in infants.

Knowledge of Long-Term Health Risks in Infants

As shown in Table 3, respondents also demonstrated a substantial level of knowledge regarding chronic health risks. Long-term impacts such as developmental delays, cancer, asthma, and neurological disorders were frequently mentioned. The average WA scores were 3.21 (Eleme) and 3.28 (Tai), indicating that parents are considerably aware of the prolonged consequences of exposure to refinery pollution.

Table 2. Knowledge of Parents on Short-Term Health Effects of Refinery Pollution in Infants

SN	ELEME	SA	A	D	SD	WA	R
1	Constant headache associated with excessive noise	81.00 45.80.%	82.00 46.30%	0.00 0.00.%	14.00 7.90%	3.30	Agree
2	Eyes Irritation due to carbon-based pollutants and other associated pollutants	84.00 47.50%	79.00 44.60%	0.00 0.00%	14.00 7.90%	3.32	Agree
3	Constant catarrh with ceaseless nose running associated with irritation of lungs and windpipe	76.00 42.90%	86.00 48.60%	0.00 0.00%	15.00 8.50%	3.26	Agree
4	Skin Burn due to excessive acid rain in the area associated with acidic gases produced during refining	79.00 44.60%	79.00 44.60%	0.00 0.00%	19.00 10.70%	3.23	Agree

	TOTAL					**3.27**	Agree
	TAI	**SA**	**A**	**D**	**SD**	**WA**	**R**
7	Constant headache associated with excessive noise	80.00 44.40%	75.00 41.70%	11.00 6.10%	13.00 7.20%	3.22	Agree
8	Eyes Irritation due to carbon-based pollutants and other associated pollutants	81.00 45.00%	78.00 43.30%	10.00 5.60%	11.00 6.10%	3.27	Agree
9	Constant catarrh with ceaseless nose running associated with irritation of lungs and windpipe	64.00 35.60%	90.00 50.00%	15.00 8.30%	11.00 6.10%	3.15	Agree
10	Skin Burn due to excessive acid rain in the area associated with acidic gases produced during refining	71.00 39.40%	84.00 46.70%	13.00 7.20%	12.00 6.70%	3.19	Agree
	TOAL					**3.20**	**Agree**

SA-Strongly Agreed, A-Agreed, D - Disagreed and SD - Strongly Disagreed WA- Weighted Average R- Remark

Table 3: Knowledge of Parents on Long-Term Health Problems Due to Refinery Exposure in Infants

SN	**ELEME**	**SA**	**A**	**D**	**SD**	**WA**	**R**
1	Migran associated with constant headache due to excessive noise	88.00 49.70.%	75.00 42.40%	0.00 0.00.%	14.00 7.90%	3.34	Agree
2	Severe eyes problem due to carbon-based pollutants and other associated pollutants	60.00 33.90%	77.00 43.50%	32.00 16.10%	8.00 4.50%	3.07	Agree
3	Lungs Cancer due to long tern accumulation of cancerous dust in the lungs and windpipe	76.00 42.90%	77.00 43.50%	7.00 4.00%	17.00 9.60%	3.20	Agree
4	Skin disease associated with long term skin burn and skin irritation due to excessive exposure to acid	77.00 43.50%	83.00 46.90%	0.00 0.00%	17.00 9.60%	3.24	Agree
	TOTAL					**3.21**	Agree
	TAI	**SA**	**A**	**D**	**SD**	**WA**	**R**
7	Migran associated with constant headache due to excessive noise	81.00 45.00%	78.00 43.30%	10.00 5.60%	11.00 6.10%	3.27	Agree
8	Severe eyes problem due to carbon-based pollutants and other associated pollutants	86.00 47.80%	71.00 39.40%	12.00 6.70%	11.00 6.10%	3.29	Agree
9	Lungs Cancer due to long tern accumulation of cancerous dust in the lungs and windpipe	81.00 45.00%	78.00 43.30%	10.00 5.60%	11.00 6.10%	3.27	Agree
10	Skin disease associated with long term skin burn due to excessive exposure to acid	81.00 45.00%	78.00 43.30%	10.00 5.60%	11.00 6.10%	3.27	Agree
	TOAL					**3.28**	**Agree**

SA-Strongly Agreed, A-Agreed, D - Disagreed and SD - Strongly Disagreed WA- Weighted Average R- Remark

Statistical Test Results: Influence of Demographic Variables

Hypotheses were tested to determine whether demographic characteristics (gender, education, and age) significantly influenced knowledge levels.

Gender

As shown in Table 4, the independent samples t-test produced a p-value of 0.148 (> 0.05), indicating no statistically significant difference in knowledge between male and female respondents regarding long-term health effects.

Educational Level

ANOVA results (Table 5) yielded a p-value of 0.996, signifying no significant variation in knowledge based on educational attainment.

Age

Similarly, Table 6 indicates a p-value of 0.325, confirming no significant difference in knowledge levels based on parental age.

Table 4. T-Test Results for Knowledge Difference Based on Gender

	F	Sig.	t	df	p-value
	3.660	0.057	1.454	355	0.148

Table 5. ANOVA for Educational Level and Knowledge of Long-Term Risks

Source	Sum of Squares	df	Mean Square	F	p-value
Between Groups	0.010	3	0.003	0.021	0.996
Within Groups	26.436	354	0.153		
Total	26.446	357			

Table 6. ANOVA for Age and Knowledge of Long-Term Risks

Source	Sum of Squares	df	Mean Square	F	p-value
Between Groups	0.340	2	0.170	1.132	0.325
Within Groups	26.106	355	0.150		
Total	26.446	357			

DISCUSSION

The research evaluated the awareness level of the parents on long-term health risks in infants that are linked to exposure to environmental contaminants caused by crude oil refining operations in Eleme and Tai Local Government Areas (LGAs) of Rivers State, Nigeria. The result shows an improved awareness level of the parents in both LGAs, supported by weighted average (WA) values greater than 3.00 for all the health indicators. This implies that, aside from acute or temporary symptoms, most caregivers are aware of the long-term and chronic health effects of exposure to pollution during early childhood.

The knowledge of long-term health issues like chronic headache, serious eye issues, skin disease, and even possible associations with cancer and respiratory illness in children is in line with previous reports that people living in environmentally degraded areas are likely to develop local knowledge regarding health and environmental risks (1–3). These results are in agreement with Grandjean et al. and San Sebastián et al., who described high local risk perception among parents exposed to oil-related pollution in the same type of affected areas (4,5).

Tai LGA respondents recorded marginally higher WA scores than Eleme counterparts (3.28 compared to 3.21), yet inferential tests revealed that gender and age demographic variables had no statistically significant effect on knowledge levels. This implies therefore that duration of stay and immediate contact with pollution could be a better teacher than socio-demographic heterogeneity, and it supports the theory of "environmental learning through exposure" hypothesized by Downey and Van Willigen (6).

In contrast to the majority of research that tends to exhibit a positive correlation between education and environmental health knowledge, no statistically significant difference was noted in the level of knowledge between education levels ($p = 0.996$). Although formal education is widely thought to improve health literacy, the findings of this study indicate that among individuals with short-term and long-term exposure to pollution, experiential learning diminishes educational inequities. Equitability of exposure to risk would undoubtedly increase symptom perception at the community level of the symptoms of health, as in other studies in the Niger Delta and Amazon Basin (5,7).

That all of the education groups, including no formal education, showed WA values over 3.00 confirms the hypothesis that risk awareness and symptom identification in environmentally impacted areas is more a function of experience than education. Even so, even though there is knowledge of symptoms, it does not necessarily show itself in action-based behavior or systemic change. Since Ite and Ibok (8), pointed out, long-term exposure has the effect of insensitizing populations to form fatalistic dispositions and reduce participation in health-seeking behavior (8).

Such high long-term effect awareness is particularly interesting within infant health because infants younger than

one are in a vulnerable phase of development. The environmental contaminants were found to cause irreversible damage to the nervous system, immune system dysregulation, and infant developmental delay after prenatal or early childhood exposure (9–11). The observation that parents can link refinery pollution to such health dangers is important since caregivers form the first line of defense in identifying and acting upon developmental delays and chronic symptoms in babies.

CONCLUSION

This study adds to the growing evidence that parents who reside in polluted communities possess considerable environmental health risk awareness, including long-term consequences in infants. As encouraging as this is, bridging awareness to preventative action and health system responsiveness is an urgent challenge. Stakeholders need to integrate community knowledge into health policy, emphasizing continued interaction, culturally sensitive education, and service delivery that addresses vulnerable populations in Nigeria's oil-producing communities.

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