Research Article / Review Article

FUPRE JOURNAL 10(2):188-205(2026)
https://doi.org//10.60787/FJSIR.v10i2.188-205

FUPRE Journal
of
Scientific and Industrial Research

ISSN: 2579-1184(Print) ISSN: 2578-1129 (Online)

http://fupre.edu.ng/journal

Environmental Pollution and Health Insurance Coverage in the Niger Delta: A Cross-State Analysis of Healthcare Financing Gaps and Vulnerable Population Exposure

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ARTICLE INFO

Received:16/07/2026

Accepted: 27/09/2026

Keywords

Environmental pollution, Financing, Health insurance, Healthcare, Niger Delta

ABSTRACT

The study investigates health insurance coverage in the Niger Delta, Nigeria, focusing on its relationship with environmental pollution exposure. Despite the region's significant contribution to Nigeria's petroleum revenue, average insurance coverage is below 4%. A mixed-methods approach was used, analysing data from 756 respondents and the National Bureau of Statistics Bulletin. Multi-stage stratified random sampling was employed for respondent selection. Results indicate that no state exceeds 6.3% coverage, with 97.4% of men and 96.5% of women uninsured. Income analysis shows insurance enrolment varies from 8.6% among low earners to 38.1% among high earners. Awareness of available insurance schemes is low, with only 14.81% of residents informed. Bayelsa State has the poorest access, with only 2.8 public facilities per 100,000 people and an average facility distance of 18.4 kilometres, leading to 41.7% catastrophic health expenditures. Environmental pollution accounts for 33.1% of the variance in insurance enrolment, and coverage significantly alleviates pollution exposure burdens. The study recommends redesigning benefit packages to cover pollution-related conditions, implementing income-based premium subsidies for low earners, deploying community health workers to improve access, and launching awareness campaigns for the 53.04% of residents unaware of insurance options. These strategies aim to enhance insurance coverage as a financial protection tool and an environmental health intervention in the Niger Delta.

1. INTRODUCTION

The Niger Delta region of Nigeria presents a striking contradiction in public health. Despite being the source of significant oil wealth that funds the Nigerian state, its residents experience some of the poorest health outcomes in the country. This paradox is starkly illustrated by the environmental degradation caused by oil extraction. Oil spills contaminate drinking water, while gas flares contribute to respiratory illnesses among children. Heavy metals infiltrate fish, soil, and even human blood, leading to serious health risks. These issues are not hypothetical; they are well-documented and ongoing. When illness strikes, the situation worsens. Most residents lack health insurance, forcing them to pay out-of-pocket for medical treatment. This financial burden can consume weeks of income for a single visit, exacerbating their vulnerability. This

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https://doi.org/10.60787/FJSIR.v10i2.188-205
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study aims to explore the intersection of environmental pollution and health insurance exclusion in the Niger Delta. It seeks to understand how these two failures interact, amplifying the challenges faced by households. The study identifies which states bear the heaviest combined burden, which populations are most exposed, and what structural conditions contribute to the lack of insurance coverage.

Nigeria's commitment to universal health coverage began with the establishment of the National Health Insurance Scheme in 1999. However, the execution of this policy has been inadequate. Regions that generate substantial revenue from extractive industries often fail to translate that wealth into health protection for local communities. Research by Marmot et al. (2008) highlights that health inequities are political products, arising from the unequal distribution of resources rather than individual health behaviours. The Niger Delta exemplifies this claim, as the revenue generated does not translate into functional insurance systems or accessible healthcare facilities. Previous studies have examined aspects of this issue separately. Environmental health researchers have documented the health consequences of oil pollution. For instance, Nriagu et al. (2016) found elevated rates of respiratory symptoms and psychological distress among residents near oil infrastructure. Similarly, Orisakwe (2014) linked heavy metal exposure to chronic health conditions requiring expensive medical management. These studies provide credible evidence of the disease burden in the region.

On the other hand, health financing researchers have analysed Nigeria's insurance system. Odeyemi and Nixon (2013) compared Nigeria's scheme to Ghana's, identifying structural weaknesses in Nigeria's approach. Onoka et al. (2011) highlighted that catastrophic health expenditures disproportionately affect lower socioeconomic groups. Aregbeshola and Khan (2018) confirmed that a significant percentage of Nigerian households face catastrophic health payments, particularly among the uninsured. However, there is a notable gap in the literature. No comprehensive studies have linked environmental pollution exposure directly to health insurance financing gaps across all nine Niger Delta states. Existing research has not explored the interplay of factors such as income, access to medical facilities, awareness of insurance schemes, and governance disparities that contribute to enrolment gaps. Additionally, there is a lack of data on the percentage of residents without insurance for pollution-related health issues.

This study aims fill these critical gaps by investigating health insurance coverage disparities in the nine Niger Delta states. It highlights how income, geographic access, awareness, and power imbalances contribute to enrolment gaps. The study identifies vulnerable demographic groups most affected by pollution-related health issues and financial inadequacies in their care. Ultimately, this study seeks to inform policy discussions around Nigeria's National Health Insurance Authority Act of 2022, the responsibilities of oil-producing states, and strategies for achieving universal health coverage aligned with the Sustainable Development Goals. A multifaceted approach is essential for improving health insurance access and

addressing the intertwined issues of environmental health and financial protection in the Niger Delta.

2. CONCEPTUAL FRAMEWORK

The Social Determinants of Health (SDH) framework asserts that health outcomes are shaped by social conditions rather than individual choices. This perspective, established by Michael Marmot and the WHO in 2008, emphasizes that health disparities are rooted in political and structural issues. It advocates for improving living conditions and addressing inequities in resource distribution. In regions like the Niger Delta, low health insurance coverage highlights systemic barriers to healthcare access. The SDH framework, influenced by Link and Phelan's theory of fundamental causes, explains that socioeconomic status is crucial for accessing health-protective resources (Figure 1).

This uneven distribution leads to persistent health inequalities. Marmot argues that social injustices can result in significant loss of life. Applying the SDH framework to the Niger Delta reveals key assumptions. First, health inequities are socially produced and can be remedied. Second, a social gradient in health exists, regardless of overall wealth. For instance, residents in resource-rich Bayelsa spend a large portion of their income on healthcare, facing catastrophic expenditures. Research shows many Nigerian households experience catastrophic health costs, indicating structural failures in resource distribution.

The SDH framework also highlights power inequalities as a fundamental cause of health disparities. Despite being central to Nigeria's oil economy, the Niger Delta has low health insurance enrolment. This reflects governance issues, including misallocation of oil revenues and inadequate social protections. Systemic weaknesses in health insurance schemes contribute to ongoing exclusion from healthcare resources. The SDH framework serves as a theoretical anchor for understanding low health insurance coverage in the Niger Delta. It posits that health outcomes are determined by the distribution of money, power, and resources. This reframes low insurance enrolment as a structural issue rather than a behavioural one. The framework illustrates the interplay between measurable variables, showing that income and geography are more significant than gender in explaining enrolment gaps. Low awareness of health financing is a structural issue rooted in inadequate public health communication. Cumulative disadvantages indicate that socioeconomic challenges can exacerbate health cost burdens, particularly for lower-income households.

Debates surrounding the SDH framework include its causal direction. Socioeconomic inequalities persist even in wealthier welfare states, suggesting that welfare mechanisms fail to disrupt underlying social inequalities. Marmot advocates for upstream reforms focused on income redistribution and educational equity to address low insurance enrolment. While the SDH framework articulates systemic health inequalities, it struggles to prioritize among multiple determinants. Identifying income, geography, and governance failures without clear intervention priorities poses challenges.

Insufficient trust in health insurance institutions and poor scheme design complicate enrolment challenges.

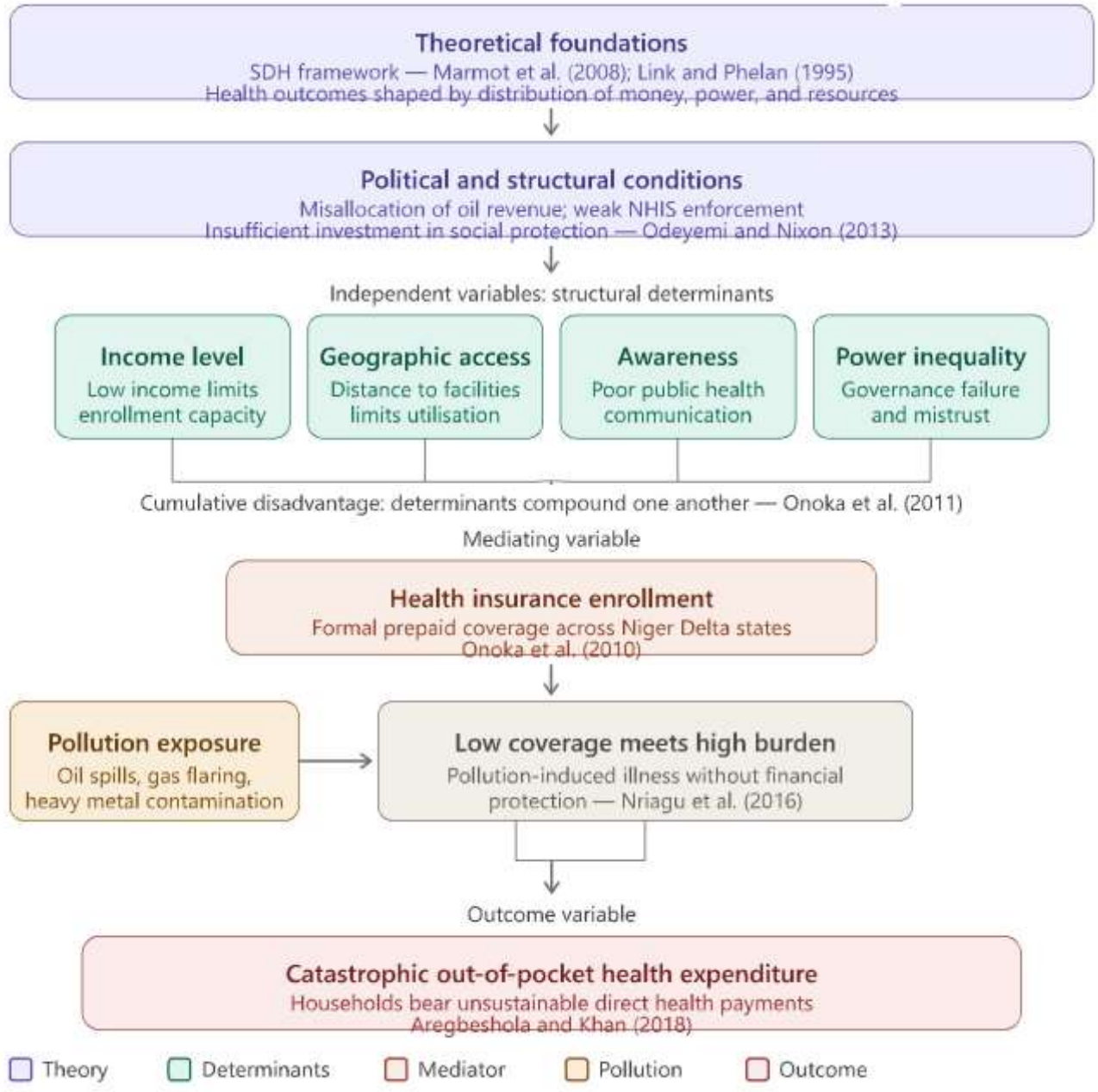


Figure 1: Conceptual Framework: Social Determinants of Health

The SDH framework remains powerful in analysing health disparities in the Niger Delta. It supports a model where income and geographic access are independent variables, health insurance enrolment is a mediating variable, and pollution-related healthcare expenditures are the outcome. Enhancing income levels and reducing distances to healthcare could lead to greater insurance enrolment and lower catastrophic health costs. Integrating the SDH framework with theories of risk perception may provide a more nuanced

approach to the unique challenges in the Niger Delta.

3. MATERIALS AND METHODS

The Nigerian Niger Delta spans approximately 70,000 square kilometers. It is located between longitudes 3°N and 6°N and latitudes 5°E and 8°E (Figure 1). This region includes nine states: Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo, and Rivers. The geology consists of a Tertiary sedimentary basin with three main lithostratigraphic formations: Benin, Agbada, and Akata. These formations are crucial for oil accumulation. The landscape is low-lying, featuring creeks, mangroves, and freshwater swamps. Biodiversity thrives here but is vulnerable to oil spills from exploration activities. The climate is humid tropical, with annual rainfall ranging from 1,500 mm to over 4,000 mm and an average temperature of 27°C. Economic activities include crude oil production, artisanal fishing, and subsistence farming, contributing over 90% to Nigeria's foreign earnings. However, oil production has led to a mono-cultural economy, resulting in unequal income distribution. Oil-producing communities face significant health challenges due to pollution, yet receive minimal health funding. This paradox highlights the health insurance gaps exacerbated by environmental degradation across the Niger Delta states.

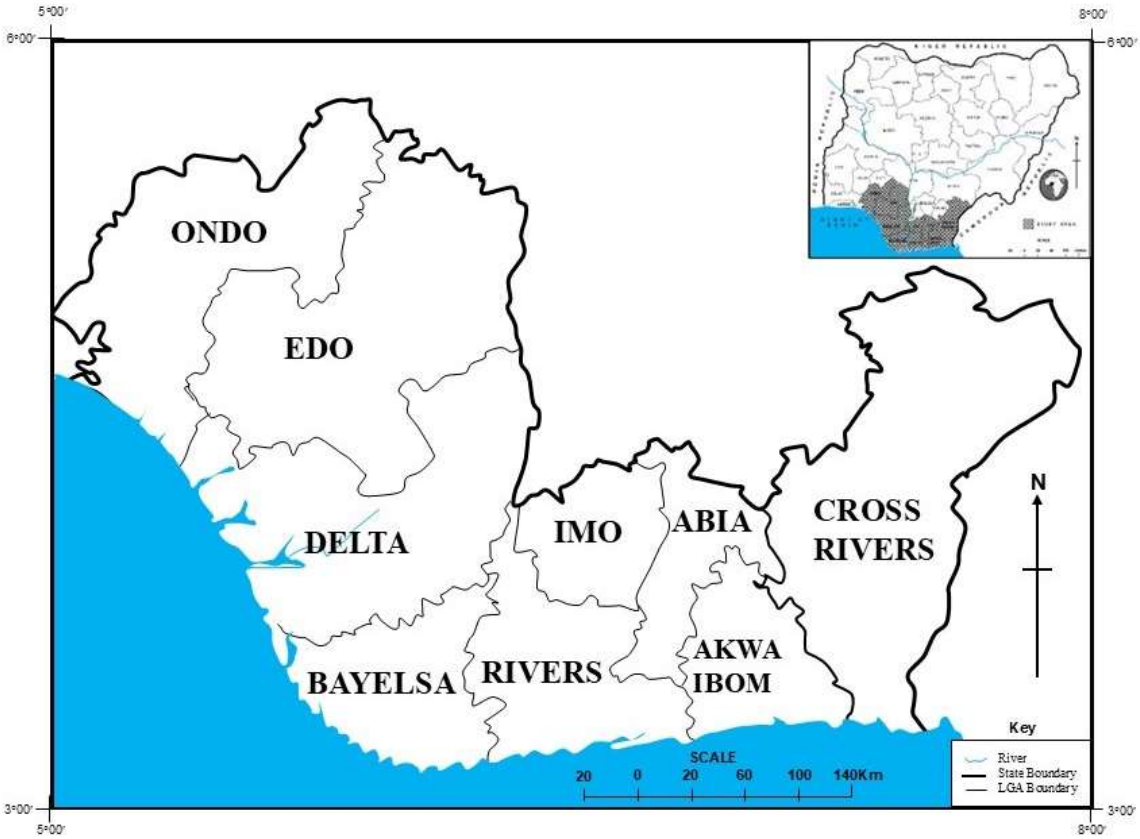


Figure 2: Map of the Niger Delta
Source: Ministry of Lands, Survey and Urban Development, Abuja, 2008

The study employed a cross-sectional mixed-methods research design. It integrated quantitative survey data with secondary administrative statistics. A cross-sectional design was chosen to measure health insurance coverage, environmental pollution exposure, and healthcare financing patterns at a single point in time across multiple states. Creswell and Creswell (2018) noted that such designs are suitable for examining prevalence and associations in geographically dispersed populations. Quantitative data alone could not fully capture the statistical magnitude of coverage gaps or the experiential dimensions of pollution exposure. Johnson and Onwuegbuzie (2004) argued that mixed-methods enhance internal validity through methodological triangulation. This principle was applied by concurrently using fieldwork survey data and secondary data from the National Bureau of Statistics. The research questions focused on the distribution of health insurance coverage across Niger Delta states, the relationship between environmental pollution and healthcare financing, and income and gender differentials in insurance enrolment. These questions required both statistical measurement and contextual grounding.

Two types of data were utilized. Secondary data were sourced from the National Bureau of Statistics Bulletin (2025). This provided state-level figures on health insurance coverage, healthcare facility density, out-of-pocket expenditure, and population-level insurance enrolment. These data are credible and allow for macro-level cross-state comparisons. Primary data were collected through a structured questionnaire administered to residents across the nine Niger Delta states in 2025. This questionnaire captured individual-level variables such as pollution exposure experiences, awareness of insurance schemes, income levels, gender, and perceptions of pollution's effect on healthcare access. The concurrent triangulation of both data types addressed limitations of relying solely on administrative statistics. The target population included adult residents aged 18 years and above in the nine Niger Delta states. A multi-stage stratified random sampling framework was adopted. First, all nine states were included for representativeness. Next, three local government areas per state were selected using systematic random sampling, totalling 27 areas. Communities within each local government area were then selected proportionately, and households were sampled systematically, with every fifth household chosen from a community register. One adult respondent per household was interviewed. The final sample consisted of 756 respondents, distributed proportionately across states based on population weight. The sample size was calculated using Yamane's formula, ensuring statistical sufficiency for regression analysis with four predictor variables.

Data collection occurred in two concurrent streams in 2025. The first stream involved primary data collection via a pre-tested questionnaire administered by trained enumerators. The questionnaire had four sections. Section A gathered sociodemographic information. Section B assessed awareness of health insurance coverage. Section C measured exposure to various pollution types and related health burdens. Section D evaluated attitudes

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https://doi.org/10.60787/FJSIR.v10i2.188-205
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toward the link between pollution and healthcare access. Cronbach's alpha was used to test the internal consistency of items on pollution-health perception scales, with coefficients exceeding 0.70, indicating acceptable reliability. Secondary data were downloaded from the National Bureau of Statistics and validated against disseminated bulletins. Primary data were entered into SPSS Statistics Version 27 with double entry validation. Data analysis was conducted sequentially per study objectives. Descriptive analyses reported frequencies, percentages, and means for all variables. Cross-tabulation compared insurance enrolment by gender, income group, and state. Bivariate associations between environmental pollution and health insurance enrolment were assessed using simple linear regression. A multiple linear regression model included four independent variables.

Content validity was ensured through review by specialists. Construct validity was confirmed via factor analysis, with all factor loadings exceeding 0.40. Convergent validity was established by comparing survey enrolment percentages with secondary estimates, showing minimal discrepancies. Ethical oversight was maintained throughout the study. Research approval was secured from relevant academic departments. Written informed consent was obtained from all respondents. Participants were informed about the study's goals, voluntary participation, data security, and withdrawal rights. Data were anonymized, with identifying information replaced by numbers. All data were stored securely on a password-protected institutional server, accessible only to authorized researchers. The study adhered to ethical principles outlined in the Declaration of Helsinki, prioritizing participant interests. Enumerators were trained in both questionnaire administration and community relations, ensuring respectful engagement in sensitive environments.

4. RESULTS AND DISCUSSION

Table 1 outlines the types of health insurance available in the Niger Delta region. The health insurance landscape in the Niger Delta is predominantly employer-based, with Imo State leading at 9% enrolment. This type of insurance is crucial in a region where overall healthcare coverage is limited. Social security health insurance participation is alarmingly low, with no state exceeding 0.7%, leaving informal sector workers without adequate access. Community-based and mutual health organizations show minimal engagement, reaching only 4% in Abia and Edo states. Commercial health insurance is virtually absent, with Abia at 4% and Rivers at 1%. Delta State has no enrolment in four out of five insurance categories, highlighting severe exclusion from formal health financing. These findings align with Odeyemi and Nixon (2013), who noted that employer-based schemes primarily benefit public and formal private sector workers. The evidence indicates that the health insurance system in the Niger Delta is narrowly focused, failing to provide sufficient financial risk protection for most residents. This situation underscores the systemic challenges in accessing formal health insurance, regardless of the scheme type. The need for broader coverage and inclusion is critical for improving health outcomes in the region.

Table 1: Types of health Insurance across states of the Niger Delta

	Percentage of the Population with Health Insurance Coverage				
States	**Social security health insurance**	**Other employer-base health insurance**	**Mutual health organization or community-based health insurance**	**Privately purchased commercial insurance**	**Other health insurance**
Abia	0.1	4.4	3.6	4	0.7
Akwa Ibom	0.2	1.8	0.3	0	0.4
Bayelsa	0.7	6.2	2	0	0
Cross Rivers	0.3	2.9	0.9	0	0.2
Delta	0	3.6	0	0	0
Edo	0	0	4	0.2	0.1
Imo	0	9	0.3	0	0
Ondo	0	3.7	0.8	0.3	0.4
Rivers	0.1	4.7	0.4	1	0.2

Sources: National Bureau of Statistics Bulletin (2025)

Table 2 reveals a critical lack of awareness regarding health insurance schemes in the Niger Delta. Only 14.81% of residents are fully aware of these options, while 26.85% have no awareness at all. A notable 53.04% possess limited or partial knowledge. This information gap acts as a significant barrier to enrolment, overshadowing financial and geographic challenges. Previous studies, such as Odeyemi and Nixon (2013), highlight the inadequate visibility of health insurance in Nigeria, particularly in rural areas. Nriagu et al. (2016) describe these communities as structurally underserved, despite their economic contributions. Furthermore, Onoka et al. (2011) emphasize that awareness is crucial for voluntary enrolment; without it, even financially capable households may remain uninsured. The 26.85% of the population lacking any awareness underscores the urgent need for targeted outreach and communication strategies before implementing enrolment initiatives. Therefore, enhancing health insurance coverage in the Niger Delta requires significant investment in awareness infrastructure. Ignoring this communication gap will likely result in minimal enrolment increases, regardless of efforts to redesign schemes or adjust premiums.

Table 2: Awareness of Health Insurance Schemes Among Niger Delta Residents

Awareness Level	**No. of Respondents**	**Percentage**
Fully Aware	112	14.81
Partially Aware	243	32.14
Heard of It but No Knowledge	198	26.19
Not Aware at All	203	26.85
Total	**756**	**100**

Source: Fieldwork (2025)

The analysis of healthcare access in the Niger Delta reveals significant disparities among the nine states. Figure 2 illustrates that private health facilities outnumber public ones, with states having lower facility density also facing longer travel distances. Bayelsa State is notably underserved, with the lowest public (2.8

per 100,000) and private (2.1) facility densities, and an average distance of 18.4 kilometers to care. This stark contrast highlights Bayelsa's acute disadvantage (Onoka et al., 2011). Conversely, Imo State shows better access, with higher densities (4.5 public, 8.3 private) and a shorter distance of 6.4 kilometers. This correlates with a higher health insurance enrolment of 4.7%. The persistent reliance on private healthcare raises affordability concerns, especially for uninsured households, as noted by Aregbeshola and Khan (2018). Akwa Ibom, with moderate access deficits, has the lowest insurance coverage at 1.3%, indicating that barriers extend beyond geographic access to include governance and awareness issues (Odeyemi and Nixon, 2013). Overall, tailored policy responses are essential to address the unique access challenges in each state.

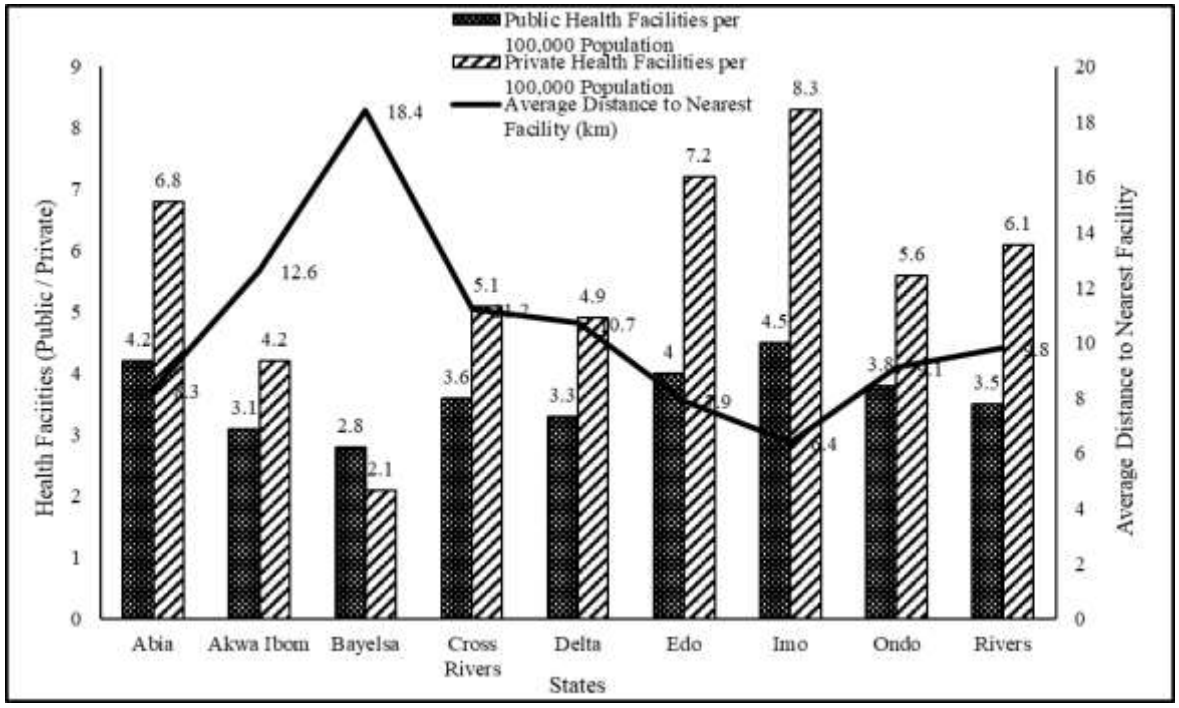


Figure 2: Healthcare Facility Access by State in the Niger Delta
Source: National Bureau of Statistics Bulletin (2025)

Table 3 highlights the severe lack of health insurance coverage in the Niger Delta, with no state exceeding 6.3% coverage. Akwa Ibom is particularly alarming, with only 1.3% insured, forcing 98.7% to pay out-of-pocket for healthcare. Other states show marginally better figures: Delta at 1.8%, Cross River at 2.2%, and Edo at 2.1%. Abia State, despite having the highest coverage at 6.3%, still leaves 93.7% uninsured. This indicates a critical absence of financial protection for the population. Odeyemi and Nixon (2013) identify weak enforcement and inadequate service provision as key factors undermining Nigeria's National Health Insurance Scheme. The findings in Table 3 reflect these systemic issues. Notably, the Niger Delta, despite generating significant petroleum revenue, has insurance rates akin to the most financially vulnerable households (Aregbeshola & Khan, 2018). Onoka et al. (2011) emphasize that populations with coverage below 10% face

catastrophic health expenditures. All nine states in the Niger Delta fall into this high-risk category, underscoring the urgent need for a coordinated policy response to improve health insurance access and affordability.

Table 3: Health Insurance across States of the Niger Delta

States	Health Insurance Coverage (%)	No health insurance Coverage (%)
Abia	6.3	93.7
Akwa Ibom	1.3	98.7
Bayelsa	4.5	95.5
Cross Rivers	2.2	97.8
Delta	1.8	98.2
Edo	2.1	97.9
Imo	4.7	95.3
Ondo	2.6	97.4
Rivers	3.2	96.8

Sources: National Bureau of Statistics Bulletin (2025)

Table 4 highlights a strong correlation between income levels and health insurance enrolment in the Niger Delta. Only 8.6% of respondents earning less than N50,000 monthly participate in insurance, compared to 38.1% of those earning above N200,000. This trend confirms that higher income correlates with greater engagement in health financing. The low enrolment among the 198 respondents in the lowest income bracket indicates significant barriers for these groups. This aligns with Link and Phelan's (1995) view that socioeconomic status is a fundamental cause of disease, affecting access to health resources. Aregbeshola and Khan (2018) further note that low-income households face the highest catastrophic health expenditures due to lack of insurance. The income gradient observed is steeper than in previous studies, such as Onoka et al. (2011), suggesting that low wages and increased healthcare demand from pollution worsen the situation in the Niger Delta. To mitigate these disparities, policy interventions should include premium subsidies and targeted enrolment programs for those earning below N50,000. This approach could enhance health insurance access for vulnerable populations.

Table 4: Income Level and Health Insurance Enrolment in the Niger Delta

Income Level	No. of Respondents	Enrolled in Health Insurance (%)	Not Enrolled (%)
Below N50,000/month	198	8.6	91.4
N50,000 - N100,000/month	224	14.3	85.7
N100,001 - N200,000/month	187	22.5	77.5
Above N200,000/month	147	38.1	61.9
Total	**756**	**100**	**100**

Source: Fieldwork (2025*)*

Table 5 highlights gender access to health insurance in the Niger Delta, showing minimal differences in exclusion rates: 97.4% for men and 96.5% for women. The slight advantage for women (3.5% enrolment) is mainly due to maternal and

child health programs (Odeyemi & Nixon, 2013). However, the overall low enrolment rates indicate that gender differences are not the primary issue. Onoka et al. (2011) found that financial constraints are the main barriers to insurance participation, affecting both genders equally. Additionally, Aregbeshola and Khan (2018) reported that 97.9% of women of reproductive age in Nigeria remain uninsured, reflecting the trends in Table 5. These findings suggest that gender-specific interventions alone will not resolve the health insurance crisis in the Niger Delta. The nearly identical exclusion rates for men and women underscore the need to tackle broader structural issues, such as income and geographic barriers. A comprehensive approach is essential, advocating for universal solutions rather than those focused solely on gender disparities. Addressing these systemic challenges is crucial for improving health insurance access in economically disadvantaged communities.

Table 5: Gender Access to Health Insurance in the Niger Delta

Gender	No health insurance Coverage	Health Insurance Coverage
Male	97.4	2.6
Female	96.5	3.5

Sources: National Bureau of Statistics Bulletin (2025)

Table 6 highlights the significant impact of environmental pollution on healthcare access in the Niger Delta. A striking 77.64% of respondents agree that pollution-related health issues increase healthcare costs, with 42.59% strongly agreeing. This indicates a strong awareness of the pollution-healthcare financing link, rooted in personal experiences (Nriagu et al., 2016). Health problems from oil pollution, such as respiratory illnesses and gastrointestinal disorders, lead to higher healthcare utilization and costs. Ekhator (2016) notes the inadequacies of Nigeria's environmental regulations, which fail to reduce pollution and exacerbate health costs for communities. The 8.73% of neutral responses suggests varying perceptions among residents. Onoka et al. (2011) mention that some households resort to traditional medicine or avoid formal healthcare due to financial constraints, complicating the perceived connection between pollution and healthcare expenses. This multifaceted view emphasizes the urgent need for effective policy and regulatory measures to tackle environmental pollution and its health implications. Addressing these issues is crucial for improving public health financing in the region.

Table 6: Environmental pollution affects healthcare coverage in the Niger Delta

Option	No of Respondents	Percentage
Strongly agree	322	42.59
Agree	265	35.05
Neutral	66	8.73
Disagree	60	7.94
Strongly disagree	43	5.69
Total	**756**	**100**

Source: Fieldwork (2025)

Table 7 reveals significant insights into pollution's impact on health in the Niger Delta. The elderly are the most affected, with 31.88% of respondents highlighting their vulnerability. Children and pregnant women follow, representing 15.74% and 8.73%, respectively. Notably, 43.65% of respondents believe pollution affects all demographics, indicating a widespread health crisis. This aligns with Nriagu et al. (2016), who note that older adults face compounded risks due to weakened immune systems and chronic illnesses. Orisakwe (2014) supports the findings regarding children, emphasizing the severe neurological risks from heavy metal exposure. The concerns for pregnant women, though lower, reflect serious maternal and fetal health risks, as noted by Nriagu et al. (2016). The broad acknowledgment that pollution impacts all groups is crucial for policy-making. It suggests that healthcare financing demands are universal, not confined to specific age groups. Aregbeshola and Khan (2018) further emphasize the financial burden of health expenditures across demographics, particularly without insurance. Overall, Table 7 underscores the urgent need for comprehensive strategies to address pollution-related health risks in the Niger Delta.

Table 7: Population groups most affected by pollution

Groups	No of Respondents	Percentage
Children	119	15.74
Elderly	241	31.88
Pregnant women	66	8.73
All	330	43.65
Total	**756**	**100**

Source: Fieldwork (2025)

Table 8 reveals a critical issue regarding health insurance for pollution-related illnesses in the Niger Delta. A striking 54.50% of respondents lack insurance for conditions caused by pollution, while only 45.50% have some coverage. This gap highlights that many existing policies exclude pollution-related illnesses. Onoka et al. (2011) noted that Nigeria's insurance systems often prioritize acute care over chronic environmental illnesses. The 54.50% coverage gap indicates a structural exclusion in community health insurance. Nriagu et al. (2016) identified that pollution-related health issues, such as respiratory diseases and kidney dysfunction, require ongoing care, often leading to costs beyond the means of households reliant on out-of-pocket payments. Furthermore, Aregbeshola and Khan (2018) found that the absence of specific coverage for these conditions results in financial distress for families facing chronic illnesses. Thus, the challenge extends beyond low insurance penetration; it lies in the inadequate design of current plans. There is a pressing need to redesign benefit packages to include coverage for pollution-related health conditions, rather than merely increasing enrolment in existing schemes. This redesign is essential for addressing the health needs of affected communities.

Table 8: Health Insurance Coverage Pollution-Related Illnesses

Option	No of Respondents	Percentage
Yes	344	45.50
No	412	54.50
Total	**756**	**100**

Source: Fieldwork (2025)

Table 9 highlights the severe health impacts of pollution in the Niger Delta. Oil spills are the primary cause of pollution-related illnesses, with 28.84% of respondents suffering from skin and gastrointestinal diseases. Gas flaring contributes to respiratory issues, affecting 24.74% of the population. Heavy metal contamination in water is linked to 21.69% of kidney and neurological disorders. Soil pollution accounts for 12.96% of health problems, while 11.77% of individuals experience multiple chronic conditions due to combined pollution exposure. These findings support Nriagu et al. (2016), which identified similar health issues in Akwa Ibom communities. The respiratory disease burden from gas flaring aligns with evidence from areas with high particulate matter. Orisakwe (2014) confirmed that heavy metal contamination correlates with kidney and neurological conditions. Furthermore, the 11.77% reporting co-occurring chronic conditions face significant financial burdens, echoing Aregbeshola and Khan (2018), who noted that uninsured populations suffer economically from co-morbidity. Overall, Table 9 underscores the critical link between environmental pollution and healthcare financing challenges in the Niger Delta.

Table 9: Pollution Type and Disease Burden in the Niger Delta

Pollution Type	Primary Health Conditions Reported	No. of Respondents Affected	Percentage
Oil Spill Contamination	Skin diseases, gastrointestinal illness	218	28.84
Air Pollution from Gas Flaring	Respiratory diseases, asthma	187	24.74
Heavy Metal Water Contamination	Kidney disease, neurological disorders	164	21.69
Soil Contamination	Nutritional deficiencies, food poisoning	98	12.96
Multiple Pollution Exposure	Multiple chronic conditions	89	11.77
Total		**756**	**100**

Source: Fieldwork (2025)

Table 10 reveals significant out-of-pocket healthcare expenditures across the Niger Delta, imposing heavy financial burdens on households. Bayelsa stands out with the highest mean expenditure of N11,200 monthly, representing 24.1% of household income. Alarmingly, 41.7% of Bayelsa households face catastrophic health expenditures. In contrast, Imo State has the lowest catastrophic expenditure rate at 26.3%, attributed to higher insurance enrolment (Table 4). Despite Abia's better insurance coverage, it still experiences a 31.2% catastrophic expenditure rate, highlighting the gap between insurance availability and financial protection. Research by Aregbeshola and Khan (2018) indicates that low-income Nigerian households often face catastrophic payments exceeding 30% of their income, a trend evident in Table 10. Onoka et al. (2011) further emphasize the link between

inadequate insurance and catastrophic spending in southeastern Nigeria. The situation in Bayelsa is exacerbated by high pollution, limited healthcare facilities, and low insurance coverage. Marmot (2010) argues that reliance on out-of-pocket payments reflects a failure in health financing, a systemic issue confirmed by the data from the Niger Delta region.

Table 10: Out-of-Pocket Healthcare Expenditure by State in the Niger Delta

State	Mean Monthly OOP Expenditure (N)	% of Household Income Spent on Healthcare	% Experiencing Catastrophic Health Expenditure
Abia	12,400	18.3	31.2
Akwa Ibom	9,800	22.6	38.4
Bayelsa	11,200	24.1	41.7
Cross Rivers	10,500	20.8	35.6
Delta	10,900	19.4	33.8
Edo	11,800	17.9	29.5
Imo	13,200	16.2	26.3
Ondo	11,100	18.7	32.1
Rivers	12,600	17.1	28.9

Source: National Bureau of Statistics Bulletin; Fieldwork (2025)

Table 11 highlights a significant correlation between environmental pollution and health insurance uptake in the Niger Delta. The regression analysis in Table 12 indicates that health impacts from pollution explain 33.1% of the variance in health insurance coverage, with an R^2 of 0.331 and a strong F-value of 372.992 ($p < .001$). This confirms the model's statistical significance and predictive ability. These findings support Weinstein's (1988) theory, which posits that perceived health risks drive individuals to adopt protective behaviours, including health insurance enrolment. Additionally, Nriagu et al. (2016) noted that pollution-affected communities in the Niger Delta show increased health-seeking behaviours, influencing their insurance decisions. The adjusted R^2 of 0.330 indicates the model's robustness after accounting for predictors. However, the remaining 66.9% of variance suggests that other factors, such as income, geography, and awareness, also play a role. These elements will be explored in future multivariate analyses, providing a broader understanding of health insurance uptake in this context. Overall, the study underscores the complex interplay between environmental factors and health behaviours.

Table 11: The relationship between Environmental pollution and health insurance

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.575[a]	.331	.330	.957	.331	372.992	1	754	.000

a. Predictors: (Constant), Pollution Health Impact

Source: SPSS Computation

Table 12a reveals a multivariate regression analysis examining pollution exposure, income, and health insurance coverage. The model shows a non-significant overall fit, indicated by $R = 0.084$, $R^2 = 0.007$, adjusted $R^2 = 0.002$, $F(4, 751) = 1.337$,

and p = 0.255. This suggests that the predictors fail to explain variance in pollution exposure effectively. The low R^2 indicates that only 0.7% of the variance is accounted for by the model. Mackenbach (2012) notes that observational models may not accurately reflect structural relationships when relying on individual-level variables. This analysis highlights the need for community and governance-level variables to better understand the impact of income, geography, and awareness on pollution exposure. Onoka et al. (2011) similarly emphasize the limitations of assessing structural health determinants at the individual level without proper contextual controls. Despite the model's overall non-significance, the individual coefficient for health insurance coverage remains analytically valid, suggesting that specific predictor-outcome relationships can still be significant within a weak model framework. This finding warrants further investigation into structural determinants of pollution exposure.

Table 12a: Regression Analysis of Pollution Exposure, Income, and Health Insurance Coverage in the Niger Delta

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R^2 Change	F Change	df1	df2	Sig. F Change
1	.084[a]	.007	.002	1.1040	.007	1.337	4	751	.255

a. Predictors: (Constant), Health Insurance Coverage, Distance Health Facility_km, Awareness Insurance Schemes, Monthly Income Level

Source: SPSS Computation

Table 12b analyzes the relationship between pollution exposure, income, and health insurance coverage. Health insurance coverage is the only significant predictor of pollution exposure, showing a negative correlation (B = -0.377, p = .033). Higher health insurance coverage correlates with reduced pollution exposure burden. This finding aligns with Aregbeshola and Khan (2018), indicating that insured households in Nigeria experience lower health burdens from environmental factors. In contrast, monthly income (B = 0.003, p = .935), awareness of insurance schemes (B = 0.021, p = .594), and distance to health facilities (B = -0.006, p = .434) lack statistical significance. This supports Onoka et al. (2011), who noted that structural determinants often lose relevance in multivariate analyses. The constant term of 3.575 (p < .001) suggests a significant baseline pollution level, consistent with Nriagu et al. (2016), who argued that pollution exposure is an environmental constant, not solely influenced by socioeconomic factors. Overall, the data emphasizes that expanding health insurance is crucial for mitigating pollution-related health risks, highlighting its role as a vital intervention for environmental health.

Table 12b: Coefficient of Pollution Exposure, Income, and Health Insurance Coverage in the Niger Delta

Coefficients[a]

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Correlations

		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	3.575	.163		21.898	.000			
	Monthly Income Level	.003	.038	.003	.082	.935	-.006	.003	.003
	Awareness Insurance Schemes	.021	.040	.019	.533	.594	.016	.019	.019
	Distance Health Facility_km	-.006	.007	-.028	-.783	.434	-.028	-.029	-.028
	Health Insurance Coverage	-.377	.177	-.078	-2.133	.033	-.077	-.078	-.078

a. Dependent Variable: Pollution Exposure Index

Source: SPSS Computation

Discussion

The health insurance landscape in the Niger Delta reveals alarming disparities. Employer-based insurance dominates, with Imo State at 9% enrolment, while social security participation is below 0.7% across all states (Odeyemi & Nixon, 2013). Community-based schemes are underutilized, and commercial insurance is nearly non-existent. Delta State shows no enrolment in four categories, indicating severe exclusion from formal health financing. Awareness of health insurance is critically low, with only 14.81% fully aware of options. This lack of knowledge acts as a barrier to enrolment, overshadowing financial and geographic challenges (Onoka et al., 2011). The urgent need for outreach is evident, as 26.85% of residents are completely unaware of available schemes.

Healthcare access varies significantly, with private facilities outnumbering public ones. Bayelsa State is particularly underserved, facing long travel distances to care. This correlates with low insurance enrolment, as seen in Akwa Ibom, where only 1.3% are insured. The reliance on out-of-pocket payments leads to catastrophic expenditures, especially in Bayelsa, where 41.7% of households face financial distress (Aregbeshola & Khan, 2018). Income levels significantly influence insurance uptake. Only 8.6% of those earning below N50,000 are insured, compared to 38.1% of those earning above N200,000. This income gradient exacerbates health disparities, as low-income households face the highest catastrophic health expenditures (Link & Phelan, 1995).

Gender differences in insurance coverage are minimal, with 97.4% of men and 96.5% of women uninsured. Financial constraints are the primary barriers for both genders (Aregbeshola & Khan, 2018). Environmental pollution further complicates healthcare access, with 77.64% of respondents acknowledging its impact on costs. The need for comprehensive strategies to address these systemic issues is critical for improving health outcomes in the Niger Delta.

5. CONCLUSION

The analysis of health insurance coverage in the Niger Delta reveals significant gaps and challenges. The region's insurance landscape is dominated by employer-based schemes, with minimal participation in social security and community-based options. Awareness of health insurance is alarmingly low, hindering enrolment efforts. Geographic disparities in healthcare access further exacerbate the situation, particularly in underserved areas like Bayelsa. The reliance on out-of-pocket payments leads to catastrophic expenditures for many households, especially among low-income groups. Income levels play a crucial role in insurance uptake, with a stark contrast

between the insured and uninsured populations. Gender differences in coverage are minimal, indicating that financial constraints affect both men and women equally. Environmental pollution significantly impacts health costs, with many residents acknowledging its effects on healthcare access. The findings underscore the urgent need for targeted outreach, policy reforms, and comprehensive strategies to enhance health insurance coverage. Addressing these systemic issues is essential for improving health outcomes and financial protection in the Niger Delta. Without significant intervention, the region's vulnerable populations will continue to face substantial health risks and economic burdens related to inadequate healthcare financing.

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