PAJRI
PAN-AFRICAN JOURNAL OF RESEARCH AND INNOVATION

Pan-African Journal of Research and Innovation in Environmental, Earth Sciences and Geosciences

ISSN: 3413-9431 | Vol. 1, Issue 1 | www.pajri.com | DOI: https://doi.org/10.0000/0000

Socio-Economic Vulnerability and Policy Gaps: Challenges of Roadside Vendors Exposed to Vehicular Air Pollution in Urban Nigeria.

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Received: 2026-09-06 | Accepted: 2026-09-23 | Published: 2026-09-27

ABSTRACT

Roadside vending is a common livelihood activity in urban Nigeria, providing employment for millions of informal sector workers. However, vendors operating along busy roads are exposed to high concentrations of vehicular-induced particulate matter, presenting significant health risks. This study examined the socio-economic vulnerabilities, coping strategies, and policy awareness of roadside vendors exposed to vehicular air pollution along Iwofe Road in Obio-Akpor Local Government Area, Rivers State, Nigeria. A descriptive cross-sectional survey was conducted among 280 roadside vendors selected from a population of 350. Data were collected using a structured questionnaire and analyzed using descriptive statistics and thematic analysis. Variables assessed included socio-demographic characteristics, protective measures, barriers to protection, awareness of government policies, and vendors' recommendations for intervention. Findings revealed significant socio-economic vulnerability, with 75% of vendors earning ₦5,000 or less daily. Only 35% used face masks, with cost identified as the primary barrier (55%). Umbrellas (60%) and handkerchiefs (45%) were the most commonly used protective measures, though largely ineffective against particulate matter. Notably, 82% of vendors were unaware of any government policies on air quality. Vendors recommended stricter vehicle emission controls (45%), subsidized protective gear (30%), relocation to safer zones (25%), and regular road cleaning (20%). Thematic analysis revealed a clear shift from personal to government responsibility in proposed solutions. The study reveals a population caught between awareness and helplessness, characterized by low protective capacity, weak policy implementation, and economic constraints that trap vendors in hazardous environments. Effective interventions must address both the structural determinants of pollution and the socio-economic barriers to protection, with emphasis on affordable protective resources, policy enforcement, and inclusive urban planning.

KEYWORDS: *Socio-economic vulnerability, roadside vendors, vehicular emissions, policy gaps, protective measures, urban air pollution*

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1. Introduction

Urban air pollution has become one of the most pressing environmental health crises of the 21st century. In 2023, the World Health Organization reported that 99.9% of the global population breathes air that exceeds its recommended safety limits, with air pollution ranking among the top ten global health risk factors (WHO, 2023). Global estimates indicate that approximately 7 million premature deaths are attributable to air pollution annually (WHO, 2023), also, a 2025 World Bank report further revealed that air pollution results

in economic losses equivalent to nearly 5% of global GDP, driven by reduced productivity, rising healthcare costs, and shortened life expectancy (World Bank, 2025). The burden falls disproportionately on low- and middle-income countries, where 90% of air pollution related deaths occur (WHO, 2014). In Africa, exposure to air pollution ranks as the second leading risk factor for death, contributing to as many as 1.1 million premature deaths each year, with Egypt, Nigeria, and South Africa consistently exhibiting the largest disease burdens on the continent (Health Effects Institute, 2024).

Nigeria, as Africa's most populous nation and largest economy, faces acute urban air quality challenges driven by rapid urbanisation, explosive vehicular growth, and industrial expansion. The transport sector has been identified as a primary source of air pollution in the country, with over 12 million vehicles operating on Nigerian roads (National Bureau of Statistics, 2022). Studies in Lagos have demonstrated that vehicular emissions are a key driver of ambient air quality degradation in Nigerian cities, with pollutants including $PM_{2.5}$, PM_{10}, nitrogen dioxide, and sulphur dioxide frequently exceeding safe thresholds (Oyedepo et al., 2023).

Roadside vending constitutes a major economic activity in Nigerian cities, providing livelihoods for millions of informal sector workers. The International Labour Organization estimates that the informal sector accounts for over 60% of urban employment in sub-Saharan Africa (ILO, 2018). However, vendors who operate along busy road corridors are exposed to high concentrations of vehicular induced particulate matter (PM2.5 and PM10) and other pollutants, with significant health implications (Olowoporoku, Longhurst, & Barnes, 2012; Okonkwo, 2020). A 2023 study in Akure, Ondo State, found that street entrepreneurs are severely affected by road traffic pollutants, with 12.45% reporting high nasal discharge, 12.21% reporting throat irritation, 12.21% reporting frequent coughing, 4.72% experiencing breathlessness, and 4.11% reporting asthmatic conditions (Olowoporoku & Adebayo, 2023). Similarly, research in Ghana documented an 82% prevalence of respiratory symptoms among roadside vendors, with significant declines in lung function observed over the course of work shifts (Amegah & Jaakkola, 2023).

The health effects of exposure to vehicular emissions are well established in the scientific literature. Particulate matter, particularly fine particles (PM2.5), can penetrate deep into the respiratory tract, causing respiratory infections, cardiovascular diseases, and premature mortality (Achilleos, 2017; Jingli et al., 2020). Systematic reviews have confirmed that long-term $PM_{2.5}$ exposure is associated with increased morbidity and mortality from both cardiovascular and respiratory diseases in low- and middle-income countries (Brauer et al., 2022). The WHO's 2021 Global Air Quality Guidelines recommend annual average $PM_{2.5}$ concentrations not exceeding 5 µg/m³ and 24hour averages not exceeding 15 µg/m³ thresholds that are routinely exceeded in Nigerian urban corridors (WHO, 2021). Studies in Nigerian cities have reported elevated levels of respiratory symptoms among populations exposed to traffic related pollution (Nwachukwu & Ugwuanyi, 2010; Oladapo, Ndokiari, & Obunwo, 2017).

Despite growing awareness of air pollution risks, roadside vendors face numerous barriers to self-protection. These include low and irregular incomes, limited awareness of specific health risks, lack of access to protective equipment, and weak policy enforcement (Babalola & Babalola, 2013; Onyenechere, 2010). A 2026 study in Akure's major food markets found that only 20.83% of vendors recognised exposure to environmental pollutants such as formaldehyde, indicating critically low awareness levels (Oluwadare et al., 2026). In Calabar's Watt Market, awareness of air quality interventions was found to be extremely limited, with 98% of respondents unaware of existing measures, and behavioural adaptation was rare, observed in only 12.5% of cases (Ekanem & Udoh, 2024). Research in Imo State revealed that among transport workers who did employ protective strategies, only 7.2% wore sunglasses and 6.9% used protective glasses, with most relying on inadequate measures (Nwachukwu et al., 2023). These findings underscore the profound vulnerability of informal workers who have little choice but to accept hazardous working conditions.

Nigeria's regulatory framework for air quality control has historically faced significant enforcement challenges. The Federal Ministry of Environment reported that the transportation sector accounts for 41% of CO_2, 83% of CO, 59% of NO_2, and 98% of SO_2 and particulate matter emissions (Federal Ministry of Environment, 1994). However, enforcement of emission standards has remained weak, and the National Environmental Standards and Regulations Enforcement Agency (NESREA) has encountered substantial difficulties in monitoring and regulating pollution sources (NESREA, 2007). In January 2023, the Federal

Government inaugurated the National Emissions Control Programmes, including the Generator Emission Control Programme and Vehicular Emission Control Programme, with NESREA tasked with setting national emission standards and developing a reliable national database management system (Federal Government of Nigeria, 2023). A review of NESREA's permitting and licensing regulations commenced in 2023, with new regulations targeted for July 2024 to strengthen enforcement tools and address emerging environmental challenges including climate change (NESREA, 2024). Nonetheless, resource constraints and limited institutional capacity continue to impede effective implementation.

This study examined the socio-economic vulnerabilities, coping strategies, and policy awareness of roadside vendors exposed to vehicular air pollution along Iwofe Road in Obio-Akpor Local Government Area, Rivers State, Nigeria. By documenting the lived experiences of this vulnerable population, the findings provide evidence-based insights for designing targeted interventions which includes enhanced health education, provision of protective equipment, and strengthened regulatory enforcement which will safeguard the health and livelihoods of Nigeria's roadside vendors.

2. Materials and Methods

2.1 Study Design and Setting

A descriptive cross-sectional survey design was employed. The study was conducted along Iwofe Road in Obio-Akpor Local Government Area, Rivers State, Nigeria. Iwofe Road is a major urban roadway serving as a key transport corridor characterized by heavy traffic, limited green spaces, and significant roadside vending activity.

2.2 Study Population and Sampling

The study population comprised 350 roadside vendors who had been operating along Iwofe Road for at least six months. Sample size (280) was determined using the Taro-Yamen formula (1967): $n = N / (1 + N\varepsilon^2)$. Vendors were selected using stratified random sampling to ensure representation across different vending categories (food, clothing, electronics, and other goods).

2.3 Data Collection

Data were collected using a structured questionnaire comprising five sections: (A) demographic information, (B) protective measures and coping strategies, (C) barriers to protection, (D) awareness of government policies, and (E) recommendations. The questionnaire was validated through face and content validity, with pilot testing among 10 vendors. Data collection was conducted by the researcher and four trained research assistants between August and September 2025.

2.4 Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics (frequencies, percentages, means, and standard deviations) were calculated. Open-ended responses were analyzed using thematic analysis to identify recurring patterns and themes.

2.5 Ethical Consideration

Informed consent was obtained from all participants after a full explanation of the study purpose, procedures, risks, and benefits. Participants were assured of anonymity, confidentiality, and their right to withdraw at any time without penalty. No personal identifiers were collected. Data were stored securely and will be retained for five years before destruction. The study posed no more than minimal risk to participants, and no compensation was provided.

3. Results

3.1 Socio-Economic Profile

Table 1: Occupational and Economic Profile of Vendors

Variable	Category	Frequency (n=280)	Percentage (%)
Vending Duration	<6 months	28	10
	6 months - 2 years	70	25
	3-5 years	112	40
	>5 years	70	25
Goods Sold	Food/Drinks	140	50
	Clothing/Accessories	56	20
	Electronics/Repairs	28	10
	Other	56	20
Daily Income	< ₦2,000	84	30
	₦2,000 - ₦5,000	126	45
	₦5,001 - ₦10,000	56	20
	> ₦10,000	14	5

Table 1 presents the occupational and economic profile of vendors. Half of all vendors (50%) sold food and drinks, 20% sold clothing and accessories, 10% sold electronics and repairs, and 20% sold other goods. A significant majority (65%) had been vending for more than three years, indicating long-term exposure. Daily income was low, with 75% earning ₦5,000 or less per day (30% < ₦2,000, 45% ₦2,000-₦5,000), 20% earning ₦5,001-₦10,000, and only 5% earning more than ₦10,000 daily.

3.2 Protective Measures and Coping Strategies

Table 2: Protective Measures Used by Vendors

Protection Method	Frequency (n=280)	Percentage (%)
Umbrella/Sunshade	168	60
Handkerchief over nose	126	45
Face mask	98	35
Relocate stall temporarily	42	15
None	56	20

Table 2 shows the protective measures used by vendors. Umbrellas/sunshades were the most commonly used measure (60%), followed by handkerchiefs over the nose (45%), face masks (35%), temporary relocation of stalls (15%), while 20% used no protection. Notably, food vendors (50% of sample) faced dual health risks: inhalation of pollutants and potential contamination of their products with dust and toxins.

3 Barriers to Effective Protection
Table 3: Barriers to Protective Measures

Barrier	Frequency (n=280)	Percentage (%)
Cost of protective gear	154	55
Lack of awareness	56	20
Discomfort	42	15
"No need" (minimal risk)	28	10

Table 3 presents the barriers preventing vendors from adopting effective protective measures. The cost of protective gear was the most significant barrier (55%), followed by lack of awareness (20%), discomfort (15%), and perception that protection was unnecessary (10%). The predominance of cost as a barrier reflects the low daily income of vendors, with 75% earning ₦5,000 or less.

3.4 Awareness of Government Policies

Table 4: Awareness of Government Policies on Air Quality

Awareness Category	Frequency (n=280)	Percentage (%)
No Awareness	230	82
Some Awareness	50	18
Details Mentioned:		
Occasional traffic police checks	22	8
Ban on roadside burning	14	5
Don't know details	14	5

Table 4 reveals a profound policy awareness gap. The vast majority of vendors (82%) reported no knowledge of any government policies or initiatives aimed at improving air quality or controlling pollution. Among the 18% who claimed some awareness, only 5% could specifically mention "ban on roadside burning," while 8% mentioned "occasional traffic police checks" without understanding them as environmental measures. This indicates that policy communication to reach the grassroots level should be taken seriously

3.5 Vendor Recommendations

Table 5: Vendor Recommendations to Reduce Pollution

Suggested Solution	Frequency (n=280)	Percentage (%)
Stricter vehicle emission controls	126	45
Free/subsidized protective gear	84	30
Relocate vendors to safer zones	70	25
Regular road cleaning	56	20
Public awareness campaigns	42	15

Table 5 presents vendors' recommendations for reducing pollution impact. The most frequently mentioned solutions were stricter vehicle emission controls (45%), followed by free/subsidized protective gear (30%), relocation to safer zones (25%), regular road cleaning to reduce dust (20%), and public awareness campaigns (15%). This pattern indicates that vendors are not passive victims but active agents who recognize both personal and systemic solutions.

3.6 Support for Relocation

Table 6: Support for Relocation to Safer Zones and Reasons for Opposition (n = 280)

Panel A: Support for Relocation	**Frequency**	**Percentage (%)**
Yes	98	35.0
No	182	65.0
Total	**280**	**100.0**
Panel B: Reasons for Opposing Relocation (n = 182)	**Frequency**	**Percentage (%)**
Fear of losing customers	91	50.0
No alternative location provided	55	30.2
Current location is free/cheap	36	19.8
Total	**182**	**100.0**

Table 6 presents vendors' support for relocation to safer zones and the reasons cited by those who opposed it. The majority of vendors (65%, n = 182) opposed relocation, while 35% (n = 98) supported it, citing health priority as their primary motivation.

Among the 182 vendors who opposed relocation, economic concerns were paramount. Half (50%, n = 91)

feared losing their customer base, which represents their primary source of income and livelihood. A further 30.2% (n = 55) reported that no alternative location had been provided or identified by authorities, leaving them with no viable option to relocate to. The remaining 19.8% (n = 36) noted that their current location was free or cheap, and moving would impose additional financial burdens they could not afford.

These findings indicate that opposition to relocation is not rooted in stubbornness or resistance to change, but in pragmatic economic survival considerations. Vendors are making rational trade-offs between environmental health risks and immediate economic necessity.

4. Discussion

This study reveals a population of roadside vendors characterized by profound socio-economic vulnerability, low protective capacity, and significant policy awareness gaps. These findings have critical implications for public health interventions and urban policy in Nigeria.

4.1 Socio-Economic Vulnerability and Health Risks

The economic profile of vendors reveals extreme financial precarity, with 75% earning ₦5,000 or less daily. This finding aligns with the World Bank (2016) report that the informal sector in sub-Saharan Africa employs over 60% of urban workers, with most earning less than $2 per day. The low income creates a vicious cycle: economic necessity forces vendors into hazardous roadside locations, and low income prevents them from affording protective equipment, leading to illness, medical expenses, and further financial hardship (Babalola & Babalola, 2013).

The long term exposure documented in this study (65% vending for more than three years) compounds health risks. Research has shown that chronic exposure to particulate matter increases the risk of respiratory diseases, cardiovascular problems, and premature mortality (Zhang, Hong, & Liu, 2017; Achilleos, 2017). Food vendors (50% of the sample) face additional risks of product contamination, as dust and toxins can settle on uncovered food, posing health hazards to both vendors and customers (WHO, 2013).

4.2 Inadequate Protective Measures

The low adoption of effective protective measures, particularly face masks (35%), despite high awareness of pollution (85% identified vehicle exhaust as a source), indicates a gap between knowledge and action. This aligns with the Health Belief Model (Janz & Becker, 1984), which suggests that perceived barriers (cost) often outweigh perceived benefits of protection when resources are limited. The reliance on umbrellas (60%) and handkerchiefs (45%) measures largely ineffective against particulate matter—reflects vendors' attempts to protect themselves with available, affordable resources.

The cost barrier identified by 55% of vendors is consistent with studies in similar contexts. Onyenechere (2010) noted that poverty is the most significant barrier preventing roadside vendors from escaping pollution-heavy environments.

4.3 Policy Awareness and Implementation Gaps

The finding that 82% of vendors were unaware of any government policies on air quality indicates a profound failure of policy communication and grassroots engagement. This is despite the existence of regulatory frameworks, including the National Environmental Standards and Regulations Enforcement Agency (NESREA, 2007) Act and the Federal Ministry of Environment's air quality guidelines. The lack of awareness suggests that policies exist on paper but have not been effectively translated into practical action or communicated to affected communities.

The low awareness (5%) of specific regulations such as the ban on roadside burning is particularly concerning. This ban addresses a pollution source that vendors themselves ranked as least severe, indicating a mismatch between regulatory priorities and community perceptions of risk. This disconnect may undermine compliance and community support for environmental policies.

4.4 Demand for Systemic Change

Vendors' recommendations reveal a clear shift from individual responsibility to government accountability. The top recommendation such as stricter vehicle emission controls (45%) which addresses the source of pollution rather than its effects. This indicates that vendors recognize the limits of personal protective measures and demand systemic solutions (WHO, 2017). The request for subsidized protective gear (30%) acknowledges the economic barriers to personal protection, while the call for relocation to safer zones (25%) reflects the need for urban planning that separates commercial activities from pollution sources.

The opposition to relocation (65%) is instructive. Rather than indicating resistance to change, it reflects rational economic concerns: fear of losing customers, lack of viable alternatives, and inability to afford higher-cost locations. This aligns with the Environmental Justice Theory (1980), which emphasizes that vulnerable populations are often forced to make trade-offs between economic survival and environmental health.

4.5 Implications for Policy and Practice

The findings have several implications for policy and practice:

1. **Address the Socio-Economic Determinants of Vulnerability**: Interventions must move beyond individual level education to address the structural drivers of exposure, including low income, lack of alternative livelihoods, and inadequate urban planning (World Bank, 2015).
2. **Strengthen Policy Communication and Enforcement**: Regulatory agencies must invest in grassroots engagement and clear communication of environmental policies. This could be achieved through community meetings, vendor associations, and accessible materials in local languages (NESREA, 2007).
3. **Provide Subsidized Protective Equipment**: Government and NGOs should establish programs providing affordable or free high quality masks and covered display units for vendors, addressing the primary barrier of cost (CDC, 2018).
4. **Implement Inclusive Urban Planning**: Urban planners should designate safe vending zones away from heavy traffic, with clear policies on tenure security and affordability to ensure vendors' acceptance of relocation (UN-Habitat, 2016).
5. **Establish Multi-Sectoral Collaboration**: Addressing roadside pollution requires collaboration between transportation, environment, health, and urban development sectors, with clear accountability mechanisms.

5. Conclusion

This study reveals that roadside vendors along Iwofe Road are caught in a web of socio-economic vulnerability, inadequate protection, and policy gaps that compound their exposure to vehicular air pollution. While vendors demonstrate high awareness of pollution risks, economic constraints and weak policy implementation prevent them from adopting effective protective measures. The gap between policy existence and grassroots awareness (82% unaware of government initiatives) indicates systemic communication failures that undermine the effectiveness of existing regulations.

The vendors' recommendations particularly the emphasis on stricter vehicle emission controls and subsidized protective gear provides a clear mandate for government action. Addressing roadside vendors' vulnerability requires comprehensive interventions that address both the structural determinants of pollution (vehicle emissions, urban planning) and the socio-economic barriers to protection (cost, awareness). Effective solutions must be developed in partnership with vendors, recognizing their agency and expertise in identifying practical, context-appropriate interventions.

This study contributes to the growing body of evidence on informal sector vulnerabilities in Nigeria and provides a basis for evidence based policy reforms to protect the health and livelihoods of roadside vendors. Future research should explore alternative livelihood opportunities for vulnerable groups and evaluate the effectiveness of targeted interventions in reducing pollution exposure.

6. Recommendations

1. **Strengthen Policy Enforcement:** The National Environmental Standards and Regulations Enforcement Agency (NESREA) should enhance enforcement of vehicular emission standards and conduct regular monitoring of air quality in high-traffic areas.
2. **Establish Subsidized Protection Programs:** Government agencies and development partners should implement programs providing free or subsidized high-quality masks and covered display units to vendors.
3. **Improve Policy Communication:** Regulatory agencies should develop accessible communication strategies, including community meetings, market association engagement, and materials in local languages, to increase awareness of air quality policies.
4. **Designate Safe Vending Zones:** Urban planning authorities should identify and develop designated vending zones away from heavy traffic, with consideration for vendors' economic viability through affordable fees and customer accessibility.
5. **Implement Green Infrastructure:** The Rivers State Ministry of Environment should establish green buffer zones (trees and vegetation) along major roads to absorb pollutants and mitigate exposure.
6. **Develop Alternative Livelihood Programs:** Governments and NGOs should develop vocational training and microfinance programs to provide vendors with alternative, less hazardous livelihood options.
7. **Establish Mobile Health Services:** Health authorities should establish mobile health outreach programs for early detection and treatment of pollution-related illnesses among vendors.
8. **Conduct Longitudinal Research:** Future research should monitor long-term health outcomes of vendors and evaluate the effectiveness of interventions in reducing pollution exposure and improving health outcomes.

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