



Environmental Degradation, Poverty, and Health Outcomes in Nigeria

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Abstract

This study investigated the effect of environmental degradation and poverty on health outcomes in Nigeria from 1981 to 2024. Utilizing secondary data from the Central Bank of Nigeria (CBN), World Bank, and National Bureau of Statistics (NBS). The study employed time series econometric techniques including the Augmented Dickey-Fuller (ADF) test for stationarity and the Autoregressive Distributed Lag (ARDL) model for long- and short-run analysis. Key findings indicate that poverty significantly reduces life expectancy in the long run, while environmental degradation such as carbon dioxide and oil spillage negatively impact both life expectancy and maternal mortality rates. Conversely, nitrogen oxide emissions demonstrated a mixed but sometimes beneficial effect on life expectancy. Additionally, economic growth was positively linked to health outcomes in the long term, while government health spending showed limited impact. The study concluded that urban poverty and environmental degradation significantly undermine health outcomes in Nigeria. It recommended integrated policy measures that promote inclusive urban development, strengthen environmental regulation, improve healthcare access, and invest in education and employment opportunities for sustainable urban living.

Keywords: Degradation, Environmental, Health Outcome, Poverty.

Introduction

Good health is a basic human right recognized throughout the world, regardless of ethnicity, religion, political affiliation, or socioeconomic level (World Health Organization [WHO], 2023). Health is not just the absence of sickness but also physical, mental and social well-being (Swain, 2016). It is also an important component of human capital as a healthy population is able to gain education, participate successfully in economic activities, and contribute to national development (Bloom et al., 2004; Hsiao et al., 2019). In contrast, poor health affects labor productivity, hampers the building of human capital and may perpetuate intergenerational poverty. This link is particularly relevant in developing countries where low access to healthcare, poor living circumstances, poverty and environmental concerns all combine to impact the health of the population. Children from impoverished homes are particularly at risk of the negative impacts on their survival, development, educational attainment and future productivity of poor nutrition, dangerous settings and lack of access to health care (Gupta et al., 2007).

The relevance of health for sustainable development is increasingly recognized in the global development agenda. Sustainable Development Goal 3 aspires to ensure healthy lives and promote well-being for all at all ages, with a target to reduce the global maternal mortality ratio substantially, end preventable deaths of newborns and children under five years old and improve environmental health. Some regions have made gains, but major gaps in health outcomes still exist within and within countries. Maternal and child mortality remain a major worldwide health problem, as identified by WHO, UNICEF, UNFPA, the World Bank Group and the United Nations Population Division. According to the 2025 inter-agency maternal mortality projections, more than 700 women died per day from preventable pregnancy- and childbirth-related causes in 2023, which is comparable to nearly one maternal death every two minutes globally

(WHO et al., 2025). These deaths have continued, highlighting the role of socioeconomic factors, access to health care, environmental quality and home living situations in shaping health outcomes.

Environmental degradation poses a serious risk to population health, as deterioration in the quality of air, water, and land can have immediate and long-term health consequences. Climate change, air pollution, contaminated water, soil degradation, and exposure to hazardous substances have been linked to respiratory diseases, cardiovascular disorders, reproductive health issues, and premature death (Manisalidis et al., 2020; United States Global Change Research Program [USGCRP], 2018). Short-term exposure to air pollution can cause coughing, wheezing, asthma episodes, respiratory irritation, and hospitalisation, while long-term exposure to particulate matter is associated with chronic respiratory and cardiovascular disorders and premature death. Environmental degradation may also reduce agricultural output and food security, thereby worsening nutritional status in communities whose livelihoods depend significantly on agriculture and natural resources (Baek et al., 2006; Lelieveld et al., 2015).

Historically, industrialisation and urbanisation have put pressure on natural resources and contributed to air, water and soil pollution. Industrial facilities, transport systems, energy generation, oil and gas operations, construction activities and waste disposal can produce pollutants such as nitrogen oxides, sulphur dioxide, particulate matter and greenhouse gases. “Fine particulate matter, especially PM_{2.5}, is a major public health concern because the small particle size allows it to enter deep into the respiratory system and is associated with cardiovascular and respiratory diseases.” Exposure during pregnancy and early childhood may impair reproductive and child health through environmental pollution. Furthermore, poor water quality and sanitation further increase susceptibility to infectious and water-borne diseases (Dhanya, 2015). Thus, environmental quality is not only an ecological issue but also a significant predictor of population health and human capital.

The environmental impact is especially acute in developing nations, where rapid urbanization is frequently coupled with poor infrastructure and a restricted ability to deliver basic services. Let’s take Nigeria for example. The World Bank reports that almost 63 percent of Nigeria's population was urban in 2024, indicating the ongoing shift of the country's demographic structure (World Bank, 2026). Rapid urbanization can raise the demand for housing, transportation, water supply, sanitation, power, waste management and health services. With urban growth, if infrastructure does not expand at a corresponding rate, there can be overcrowding, informal settlements, poor sanitation, trash accumulation, traffic pollution and greater exposure to environmental risks. These situations can have disproportionate impacts on low income households.

Poverty increases vulnerability to environmental and health concerns. Poor households have little access to safe housing, clean water, appropriate sanitation, nutritional food, health care and other protective services. They might also be situated in areas with an increased risk of exposure to flooding, garbage, air pollution, industrial emissions, and other environmental risks (UN-Habitat, 2016; World Bank, 2019). The link between poverty and environmental degradation can thus generate a mutually reinforcing loop. Poverty may drive dependence on ecologically degrading livelihood activities and environmental degradation may impact on agricultural output, disrupt livelihoods, raise health expense and diminish household income. Thus, environmental degradation can intensify poverty and poverty can heighten sensitivity to environmental threats.

Recent information reveals that poverty continues to be a major development concern in Nigeria. The World Bank’s October 2024 Nigeria Development Update predicted that the share of Nigerians living below the national poverty line had climbed from 40.1 percent in 2018 to around 56 percent, or about 129 million people. Part of this deterioration was attributed in the report to sluggish real income growth and the depreciation of buying power associated with rising inflation (World Bank, 2024). The most recent World Bank estimates of the poverty headcount in Nigeria, based on the international poverty line of \$3.00 per person per day in 2021 purchasing-power-parity terms, are those shown in the World Development Indicators (World Bank, 2026), with the latest available survey-based observation at 41.8 percent. While these poverty metrics have different poverty lines and techniques and cannot be directly compared, they indicate the extent of persistent socioeconomic vulnerability in the country.

Nigeria’s health indicators are a reflection of these socio-economic and environmental factors and their health effects. In 2024, Nigeria’s life expectancy at birth was around 54.6 years or about 55 years (rounded to the nearest entire number) (World Bank, 2026). This is an increase above very low levels recorded during certain earlier times but life expectancy remains very low. This suggests continued difficulty in obtaining favorable population health outcomes.

Similarly, the World Bank's World Development Indicators show that Nigeria's infant mortality rate in 2024 would be around 69.8 deaths per 1,000 live births, according to estimates of the UN Inter-agency Group for Child Mortality Estimation (World Bank, 2026). A high infant mortality rate is a marker of continued vulnerabilities related to mother and child healthcare, nutrition, home conditions, sanitation and environmental exposure.

Maternal health is also a key concern. The most recent internationally comparable estimates prepared by WHO, UNICEF, UNFPA, World Bank Group and UNDESA suggest that the maternal mortality ratio in Nigeria was around 993 deaths per 100,000 live births in 2023, with an uncertainty interval of around 718 to 1,540 deaths per 100,000 live births (WHO et al., 2025). The World Bank's World Development Indicators offer the same 2023 point estimate of 993 deaths per 100,000 live births (World Bank, 2026). This is still a long way from the Sustainable Development Goal target of less than 70 maternal deaths per 100,000 live births by 2030. The level of maternal mortality shows the continued relevance of access to health care, the quality of maternal services, socioeconomic situations, nutrition, environmental exposure and the wider living conditions of the women.

The environment presents another layer to Nigeria's health concerns. World Bank environmental data show that in 2024, Nigeria emitted around 0.57 metric tons of carbon dioxide per capita, without including emissions from land use, land-use change and forestry (World Bank, 2026). The World Bank's Sovereign ESG database indicates a mean annual exposure to PM_{2.5} of 56.53 micrograms per cubic meter in 2020, indicating the population's substantial exposure to fine particulate pollution (World Bank, 2026). Moreover, forest area covered around 23.2 percent of Nigeria's land area in 2023; and only about 32 percent of the population had access to safely managed sanitation facilities in 2024 (World Bank, 2026). The indications show that environmental pressures are not only greenhouse gasses but also include air pollution, deforestation, sanitation deficiencies, and other situations that may affect health. The structure of industrial and extractive activity that is typical of Nigeria also affects the country's environmental state. Environmental degradation is caused by oil exploration and production, oil spills, artisanal refining, flaring of gas, emissions from industry, automotive exhaust, generation of energy, open burning of waste, deforestation and poor waste management. Petroleum-related activities in the Niger Delta have long been associated with concerns about land and water contamination, air pollution, ecosystem damage and dangers to local livelihoods. Among government responses have been environmental protection laws such as the Endangered Species Decree (1990), the Federal Environmental Protection Agency Act (1990) and the Harmful Waste Decree (1990). More recent efforts have been directed at environmental regulation, cleanup, pollution control and mitigation of damaging petroleum-related activities. But ongoing environmental pressures indicate that governmental measures have not removed the exposure of vulnerable people to environmental hazards.

The link between environmental deterioration and poverty is particularly relevant in understanding health consequences in Nigeria. Poor households may not be able to move out of polluted or ecologically susceptible places, pay for greener energy sources, acquire appropriate healthcare or engage in preventive health measures. At the same time, environmental degradation can diminish household income by destroying agricultural land, fisheries, forests and other natural resources. These effects may increase health care costs and limit resources available for food, education and other investments in human capital. Therefore, poverty and environmental deterioration may together impact health outcomes rather than separately.

This relationship has important consequences for the health of mothers and children. Women and children in poor areas may be exposed to many and overlapping dangers, such as inadequate housing, contaminated water, poor sanitation, hunger, restricted access to health facilities and exposure to air and environmental contaminants. Such factors can raise the likelihood of infectious infections, respiratory sickness, pregnancy difficulties, low birth weight, premature birth, and infant death in people. The UNICEF 2024 evaluation of the state of Nigerian children also found ongoing issues related to poverty, nutrition, neonatal mortality, access to quality services, and other determinants of child well-being (UNICEF, 2024). These obstacles further support the rationale for understanding health consequences in the larger social and environmental context.

Moreover the links between poverty, environmental decline and health may function the other way. Poor health can impair an individual's ability to work, diminish household income, increase medical costs, and undermine the ability of households to overcome poverty. Illness can consequently cause large economic losses in households with already limited income. Environmental shocks can have similar consequences by disrupting livelihoods and raising household spending on health care, food, relocation or reconstruction. The resulting feedback processes show that poverty and

health may be mutually reinforcing. Environmental degradation may be another pathway through which socioeconomic vulnerability is communicated to health outcomes.

The significance of these relationships is also shown by Nigeria's recent growth experience. The World Bank said real economic growth in Nigeria accelerated to 3.4 percent in 2024, with growth in the fourth quarter climbing to 4.6 percent year-on-year. However, the World Bank also pointed out that improvements in macroeconomic conditions had not yet fully translated into improvements in household living standards, with poverty and high living costs continuing key concerns (World Bank, 2025). Important to keep in mind that aggregate economic growth does not automatically translate into better health outcomes. The distribution of income, environmental quality, access to health care, sanitation, housing and other basic amenities determine if economic gains are converted into increases in human welfare.

The literature as it stands usually sets out links between environmental deterioration, poverty and bad health outcomes. Research has related air pollution, deforestation, oil spills, bad sanitation and other environmental risks with increased illness and death and decreased life expectancy. Likewise, the empirical literature on the poverty-health relationship has typically shown that socioeconomic deprivation is a key driver of health, but the findings are not totally consistent. Some studies indicate strong negative impacts of poverty on health, whereas others reveal weak or statistically insignificant links depending on the health outcome, geographic region, period, and methods used. Poor health can also cause poverty through reduced productivity, loss of income and increased health expenditures, which is an example of reverse causality.

Despite the rising literature, significant empirical gaps still exist. First, many of the available research look at poverty and environmental deterioration separately, rather than their combined influence on health outcomes. Second, research on environmental degradation in Nigeria is generally limited to a single environmental problem (e.g., oil pollution, air pollution, deforestation or climate change) without considering the broader spectrum of environmental influences on population health. Third, methodological inconsistencies and changes in health indicators have created mixed empirical findings, making it difficult to determine whether the association is long run. Fourth, few studies are lengthy enough for a historical review that captures structural changes in Nigeria's economy, environment, population and health system.

The present study consequently concentrates on the dual effect of poverty and environmental degradation on health outcome in Nigeria. Such indicators as carbon dioxide emissions and other appropriate measurements of pollution can be used to quantify environmental degradation. Health consequences can be measured with such metrics as life expectancy, maternal mortality and newborn mortality. The socioeconomic part of the investigation is significant since poverty determines exposure to environmental dangers, access to health care, nutritional status, housing conditions and the ability of households to cope with disease. By examining these interactions from 1981 to 2024, we provide a long-term perspective on the evolution of socioeconomic conditions, environmental stressors and population health in Nigeria.

The study aims to investigate whether and how poverty and environmental degradation have contributed to Nigeria's health outcomes over the long term. By analysing life expectancy, maternal mortality and infant mortality within a framework that incorporates poverty and environmental degradation, the study seeks to provide empirical evidence to inform policies on poverty reduction, environmental protection, healthcare provision, human capital development and sustainable economic development. Such evidence is particularly pertinent given Nigeria's ongoing challenges, including rapid population growth, urbanisation, environmental strain, socioeconomic vulnerability and persistent maternal and child mortality.

Literature Conceptual

Environmental degradation.

Environmental degradation is defined as the worsening of environmental quality due to depletion, contamination or change of natural resources and ecological systems (Tyagi et al., 2014). This happens when human activities or natural processes impair the environment's ability to support human existence, economic activity and ecological systems. The major types are air pollution, water pollution, land degradation, deforestation, loss of biodiversity, pollution by oil and greenhouse gas emissions.

For the present study, environmental degradation is conceptualized as an undesirable deterioration in environmental conditions arising primarily from economic activities, industrialization, urbanization, energy consumption, petroleum activities and other human induced pressures that may have adverse effects on population health. Particular attention is given to emissions of carbon dioxide (CO₂), nitrogen oxides (NO₂/NO_x) and oil-related pollution as indicators of environmental pressure.

Carbon dioxide is the most major anthropogenic greenhouse gas and is strongly linked to fossil-fuel burning and industrial activity. The increase in atmospheric concentrations of greenhouse gasses drives global warming and climate change, which can indirectly affect human health through heat exposure, changes in disease patterns, food insecurity, water stress and extreme weather events (IPCC, 2021). While CO₂ itself is not usually the main pollutant causing local respiratory toxicity at ambient levels, it is used as a proxy for the intensity of fossil-fuel consumption and accompanying economic activities that may cause additional harmful air pollutants. Conversely, nitrogen oxides are a direct product of combustion and can cause respiratory discomfort and the development of secondary pollutants such as ozone and particulate matter. Oil spills form another key facet of environmental degradation in Nigeria that can contaminate soil and water, harm agricultural and fishing livelihoods and expose impacted populations to environmental and socio-economic dangers.

Environmental degradation can impact health through many pathways. Dirty air causes more contact with dangerous compounds that can lead to respiratory and cardiovascular problems. Secondly, contaminated water and soil may increase the exposure to infectious and harmful substances. Third, environmental deterioration can lead to decreased agricultural output and food availability, which can exacerbate nutrition. Fourth, environmental destruction may ruin the livelihoods of households and increase poverty, particularly in communities depending on farming, fishing, forestry, and other natural resources. Environmental deterioration is consequently not merely an ecological issue, but also a socioeconomic and public-health issue.

Poverty

Poverty is a lack of resources and opportunities, resulting in a minimum standard of living. Poverty is often quantified in monetary measures, such as by income or consumption, however modern conceptualizations understand poverty in multidimensional ways. This could be because of poor nutrition, poor housing, lack of access to health care and education, unclean drinking water, lack of sanitation, unemployment, social marginalization and vulnerability to economic and environmental shocks (Todaro & Smith, 2020; World Bank, 2019).

The multidimensional nature of poverty is particularly relevant for health outcomes. Low-income households may not be able to afford nutritious food, quality healthcare, safe housing, clean energy, and other goods and services necessary to sustain good health. Poverty may also enhance vulnerability to environmental dangers, as poor homes are more likely to be located in overcrowded settlements, places with poor drainage and sanitation, or near industrial and waste-disposal facilities. This may increase the direct and indirect exposure of the poor to environmental concerns. In increasingly urbanizing developing economies like Nigeria the link between poverty and environmental conditions can be particularly stark. Urban population growth may place additional demand on housing, transportation, water supply, sanitation, waste management, energy and health-care infrastructure. Where public infrastructure does not keep pace with population increase, low-income areas may suffer from overcrowding, inadequate sanitation, improper waste disposal, and greater exposure to air and water pollution (Adelekan, 2010; UN-Habitat, 2016). These disorders make people more vulnerable to infectious infections, malnutrition, respiratory sickness and other poor health outcomes.

Poverty can also cause environmental deterioration. Households in extreme economic deprivation may rely on environmentally intensive activities for their survival, such as the use of biomass fuels, informal garbage disposal, deforestation and other activities that can exert pressure on natural resources. Poverty in resource dependent societies might also stimulate practices that provide immediate revenue but have environmental implications over time. Environmental deterioration can therefore diminish agricultural output, fisheries and other forms of income, increasing poverty. This establishes a potential poverty-environment feedback loop in which poverty enhances environmental vulnerability and environmental degradation worsens poverty.

Health Outcomes

Health outcomes are the measurable states of health and well-being experienced by individuals or populations over a given period. They indicate the extent to which socioeconomic, environmental, behavioural and healthcare variables translate into actual population health. Health outcomes include mortality, morbidity, nutritional status, disease prevalence, life expectancy, maternal mortality and newborn mortality (Orji & Okechukwu, 2015). Many factors affect health. These include income, employment, education, housing, social status, access to health care, nutrition, environmental quality, social networks and geographical conditions (Marmot & Wilkinson, 2006). In this way, the social determinants viewpoint recognises that medical services alone cannot explain health outcomes, as the situations in which people are born, live, work and age also determine their health status.

This study conceptualises health outcomes in terms of life expectancy and maternal and infant mortality. These metrics reflect several aspects of population health. Life expectancy is the average number of years a person is expected to live at prevailing mortality levels, and it gives a broad picture of population health and longevity. Maternal mortality is an indicator of the risk of death related to pregnancy and delivery, and it is especially responsive to access to health care, the quality of maternal services, nutrition, socioeconomic conditions, and environmental vulnerability. The number of deaths during the first year of life is called infant mortality, and it is affected by maternal health, antenatal and postnatal care, nutrition, sanitation, household living conditions, and environmental exposure.

Health Outcomes, Poverty and Environmental Degradation

The conceptual link between environmental degradation, poverty and health outcomes is based on the assumption that environmental and socio-economic conditions jointly affect the health of a community. Health can be directly affected by exposure to contaminated water, polluted air, hazardous substances and other environmental hazards. It can also indirectly harm health by reducing agricultural production, undermining livelihoods, causing food insecurity and increasing household healthcare expenses.

Poverty is a primary transmission channel for this relationship. Poor households often lack the means to protect themselves against environmental risks and to access preventive or curative health care. They may live in environmentally sensitive areas, rely on polluting energy sources, lack sanitation and clean water, and face financial barriers to health services. Thus, the same environmental hazard may have more severe health impacts on poor households than on those with greater economic means.

The relationship can also be the other way round. Poor health can lead to reduced labor productivity and household income and higher health cost. Maternal or infant death can impose heavy social and economic costs on homes and communities, and illness can decrease an individual's capacity to participate in productive activities. Thus, ill health can worsen poverty, leading to a reciprocal relationship between poverty and health.

Hence environmental deterioration can reduce life expectancy through increased sickness and premature death, and poverty can exacerbate these effects through limited access to protective resources and health care. Environmental and socioeconomic factors can also influence maternal mortality through nutritional status, access to health services, exposure to pollutants and the quality of living situations. Infant mortality may be influenced through mother health, birth outcomes, nutrition, sanitation, water quality, infectious disease and exposure to environmental toxins.

Conceptual Frameworks

This study uses an eclectic theoretical framework that combines environmental, demographic, development and health economics views to explain the link between economic growth, population dynamics, environmental degradation, agriculture and public health in Nigeria. The Environmental Kuznets Curve (EKC) hypothesis (Kuznets, 1955; Grossman & Krueger, 1991) suggests an inverse U-shaped link between per capita income and environmental degradation. This hypothesis argued that environmental deterioration increases in the initial stages of industrialization and economic expansion due to intensive resource usage and expanding manufacturing outputs. However, at a certain level of affluence, the level of environmental deterioration starts to decrease due to structural changes toward cleaner technology, improved environmental regulations and increased public awareness and demand for environmental quality (Dinda, 2004). While critics suggest that the EKC hypothesis may not be universally applicable to all types of pollutants or in the setting of developing economies (Usenata, 2018), the framework is still theoretically and empirically relevant in discussing whether Nigeria's development trajectory is approaching an environmental turning point or is stuck in the resource-intensive rising phase of the curve.

The Brundtland Hypothesis (World Commission on Environment and Development [WCED], 1987) emphasises sustainable development, which implies that economic growth and environmental protection are mutually reinforcing through long-term institutional reforms, resource efficiency, and green investment (Bratt, 2012). However, this perspective offers a crucial lens for evaluating Nigeria's policy trade-offs between socioeconomic expansion and ecological preservation, despite complaints about possible conceptual ambiguities (Manns, 2010). Daly's Steady-State Hypothesis (Daly, 1973) argues that ongoing economic expansion is biophysically unsustainable in a finite planetary ecosystem. From this view, growth necessarily exacerbates environmental degradation and rejects the notion of an environmental turning point. However, due to its structural constraints when considering the growth imperatives and development transitions of emerging countries, it is more of a counterpoint than the primary analytical model for this study (Ray, 1998; Dinda, 2004).

The Malthusian Theory (Malthus, 1798) highlights the structural pressures of rapid population growth on agricultural output, land capacity and natural resources. Although technical advances have often prevented catastrophic population checks in wealthy industrial nations, the basic principles of Malthusian pressure remain highly relevant to Nigeria. The rapid rise in population puts considerable pressure on agricultural land and accelerates the depletion of environmental resources, making the country more vulnerable to food insecurity (Weil, 2013; Todaro & Smith, 2015).

According to the Grossman Health Capital Model (Grossman, 1972), health is a durable, depreciating capital asset that individuals inherit and actively accumulate or deplete over time by investments in medical treatment, nutrition, housing, and environmental quality. Subsequent theoretical extensions have introduced uncertainty, environmental shocks and larger socio-economic variables into the health production function (Phelps, 1976; Cropper, 1977; Fuchs, 2004). This methodology is useful for examining the direct impact of environmental degradation, conventional agricultural methods, and socioeconomic disparities on healthcare demand, labor productivity and aggregate health outcomes in Nigeria.

Jimoh and Helen (2025) examined the impact of environmental deterioration and urbanization on life expectancy in Nigeria between 1981 and 2023, using data from the Central Bank of Nigeria and World Development Indicators in a multiple linear regression framework. The results show that environmental deterioration had a significantly negative impact on life expectancy, but urbanization and population expansion both had beneficial impacts, indicating that population scale can promote the improvement of healthcare infrastructure.

Erondu and Nwakanma (2025) investigated the link between environmental degradation, socio-political instability and public health crises in Nigeria using a qualitative Human Security and Political Ecology approach. Their study revealed that major ecological destruction, such as oil pollution in the Niger Delta and desertification in the north, is a direct cause of respiratory and water-related morbidities and a catalyst for socio-political upheaval. Adeyanju et al. (2025) evaluated the impacts of rapid urban expansion and industrial activities in the oil and gas, manufacturing, and construction sectors on environmental degradation and public health hazards in Nigeria. The research found that poor waste management and industrial emissions have degraded air and water quality, causing vector-borne infections and respiratory illnesses.

Ucheje and Ikebude (2024) conducted a narrative review that synthesized the influence of industrial air pollution on public health in Nigerian urban centers, including Lagos and Port Harcourt. They found that high levels of particulate matter and sulfur dioxide, resulting from industrialization and urban sprawl, significantly contribute to chronic obstructive pulmonary disease (COPD), asthma, and premature mortality.

Echendu et al. (2022) investigated the environmental justice implications of air pollution, climate change and ecosystem health in the Niger Delta region. The study emphasised the region's contribution to national economic output and demonstrated that heavy fossil fuel burning, gas flaring and artisanal refining impose significant environmental 'bads' and disproportionate public health burdens on local indigenous inhabitants. Atuyambe et al. (2021) conducted a narrative assessment of the health effects of particulate matter and air pollution within the framework of climate change in Africa. The findings highlighted an increased risk of chronic respiratory and cardiovascular diseases among urbanising populations, calling for multi-sectoral transitions to renewable energy.

Pona et al. (2021) reviewed data from the Institute for Health Metrics and Evaluation (IHME) from 2007 to 2017 to assess environmental risk variables and disability-adjusted life years (DALYs) in Nigeria. Their empirical study confirmed that ambient and household air pollution, unsafe water and sanitation are major contributors to national respiratory illnesses, cardiovascular disease and diarrheal morbidity.

Berazneva and Byker (2018) used the impact of forest loss on child health with regional fixed effects and maternal fixed effects using Nigeria Demographic and Health Survey (DHS) datasets (2008 and 2013). They found that deforestation 2 years before delivery increased the odds of infant death by 9% to 14% and substantially increased malaria incidence in children under age five.

Eze and Iheonu (2025) utilized 2023/2024 General Household Survey data of 4,779 households, and employed the Vulnerability as Expected Poverty (VEP) framework and probit regression to study the influence of health shocks on household vulnerability to poverty in Nigeria. They found that health shocks raise the likelihood of sliding into poverty by 5.3 to 5.4 percentage points, indicating that health insurance coverage is severely low at 2.2% and is not enough to provide protection.

Olaniyan (2025) investigated the effects of population growth and poverty on life expectancy at birth (LEB) in Nigeria from 1981 to 2023, applying the ARDL bounds test and an Error Correction Model. The results showed that population growth rates in urban and rural areas significantly depressed life expectancy, with the rural growth rate resulting in a 10.57% decline and the urban growth rate a 2.66% decline. However, the poverty rate was statistically insignificant in explaining long-run changes in life expectancy.

Idris (2023) employed time-series data from 1991 to 2021 to investigate the response of health indicators (such as life expectancy and carbon dioxide emissions) to poverty shocks in Nigeria using an Auto-Regressive Distributed Lag (ARDL) model. The study found that poverty shocks had a significant immediate effect on health outcome indicators, indicating the need for targeted government investments in healthcare infrastructure and facilities in neglected areas. Ubi and Ndem (2019) examined the link between poverty and health outcomes, especially life expectancy and infant mortality rates, in Nigeria between 1980 and 2018 using a Vector Autoregressive (VAR) econometric model. Their findings imply that shocks to poverty did not have statistically significant effects on life expectancy or infant mortality, but that changes in health outcomes were largely attributable to shocks to the health indicators themselves, suggesting that improvements in the health sector could produce positive trickle-down effects for poverty reduction.

Erondu and Nwakanma (2025) investigated the interrelated threats of environmental degradation, socio-political instability and public health challenges in Nigeria within the context of Human Security and Political Ecology frameworks. They examined secondary data and concluded that natural disasters like oil spills and desertification are responsible for high rates of death and morbidity, while economic shocks (removal of fuel subsidy and inflation) worsen poverty, food insecurity and institutional vulnerability.

To investigate the impact of healthcare development and environmental quality on Nigeria's economic performance, Musa et al. (2025) applied an Autoregressive Distributed Lag (ARDL) model to annual time-series data from 1986 to 2024. They found that health spending, immunization and labor force participation were positive drivers of growth, whereas carbon emissions and death rates were negative drivers. This calls for integrated funding policies for the environment and health.

Urhie et al. (2020) studied the association between economic growth, air pollution and health outcomes in Nigeria using data from 1980 to 2017. The health performance was measured by the life expectancy at birth. The economic growth was measured by GDP. The air pollution was measured by CO₂ emissions. Government investment on health is utilized as a moderating variable. The study employed path-based moderated mediation analysis and revealed that economic expansion was positively linked with health performance. Economic growth increased air pollution. The study thus showed that economic growth might affect health directly and also indirectly through environmental degradation. This offers the primary empirical basis for extending the approach to include additional environmental contaminants and socioeconomic determinants of health.

Nkalu and Edeme (2019) explored the impact of environmental hazards on life expectancy by employing time series data for Nigeria from 1960 to 2017 and a GARCH model. The results of the study revealed that CO₂ emissions from

the use of solid fuel had a substantial negative effect on life expectancy while income proxied by GDP showed a positive influence on life expectancy but was statistically insignificant. The study provides further evidence that environmental deterioration can have a negative effect on longevity and that environmental pollution variables should be included in a life-expectancy model.

Ogunjimi and Adebayo (2019) investigated the relationship between health expenditure, health outcomes and economic growth in Nigeria, 1981–2017. The Toda–Yamamoto causality framework and ARDL bounds testing were used to establish long-run relationships among the variables. The causation results demonstrated that there was a one-way causal relationship between health spending and real GDP on life expectancy, and that real GDP caused health expenditure. These results support the inclusion of economic growth and government health expenditure as key predictors of health outcomes.

Jimoh and Helen (2025) examined the relationship between environmental degradation, urbanization, population growth and life expectancy using data from the Central Bank of Nigeria and World Development Indicators (1981–2023) by applying multiple linear regression technique. Empirical studies show that environmental degradation considerably affects life expectancy (by about 3% for each 1% rise in degradation) although urbanization and population growth are positively related by allowing the development of healthcare infrastructure. Pona et al. (2021) analyzed IHME data from 2007 to 2017 to quantify the public health burden of environmental risk variables in Nigeria. Their thorough research found that household air pollution, ambient particulate matter and inadequate sanitation are the major causes of respiratory infections, cardiovascular illnesses and diarrheal morbidity. The empirical literature reviewed reveals three major research gaps. First, the existing studies do not adequately include multiple sources of environmental degradation, including carbon dioxide emissions, nitrogen oxides, forest depletion and industrial pollution, with economic and health indicators over a common and long period. Second, the results on the poverty-health nexus are mixed and inconclusive, with some studies reporting significant, insignificant and reverse-causality effects, thus requiring further empirical clarification. And third, most of the literature is based on linear or isolated analyzes of environmental degradation and poverty, with limited attention to their joint and dynamic interactions and the roles of other factors such as health expenditure, capital formation and demographic pressures in determining health outcomes, especially life expectancy, infant mortality and maternal mortality in Nigeria.

This study adopts an ex-post facto research design, a quasi-experimental approach, to examine the impact of independent factors on health outcomes. The design is suitable because the study relies on time series data, which are historical, immutable datasets obtained from relevant statistical agencies. Using these data, the study analyses relationships among poverty, environmental degradation, and health outcomes (Life Expectancy and Maternal Mortality) in Nigeria from 1981 to 2024.

Model Specification

This study adapts the framework of Urhie et al. (2019), who analyzed the relationship between economic growth and health performance in Nigeria over the period 1980–2017. The functional form of the model is expressed as:

$LEAB = f(GDP, CO_2, GEH)$. This framework enables the study to quantify both direct and indirect effects of environmental degradation and agricultural activities on health outcomes in Nigeria.

$LEAD = F(GDP, CO_2, GEH)$

where:

LEAB= Represents health variable

GDP=Represents economic growth

CO₂ =Represents air pollution variable

GEXH= denotes government expenditure on health

CO₂EKT*GEH =Represents the interaction between air pollution and government expenditure and μ denotes the error term.

Whereas the modified version of the model to capture the purpose of the study on the influence of pollutants and agriculture on life expectancy and Maternal Mortality rate in Nigeria would be represented as follows;

Model One: Life expectancy Model

$LEX = F(PM_{2.5}, N_2O, OSP, PVT, RGDP, GXH)$

$MMR = F(PM2.5, N_2O, OSP, PVT, RGDP, GXH)$

The mathematical form of the model is represented as thus:

$$LEX = \alpha_0 PM2.5^{\beta_1} N_2O^{\beta_2} OSP^{\beta_3} PVT^{\beta_4} RGDP^{\beta_5} GXH^{\beta_6}$$

$$MMR = \alpha_0 PM2.5^{\beta_1} N_2O^{\beta_2} OSP^{\beta_3} PVT^{\beta_4} RGDP^{\beta_5} GXH^{\beta_6}$$

The econometric form of the model is stated as follows:

$$LEX_t = \alpha_0 + \beta_1 PM2.5_t + \beta_2 N_2O_t + \beta_3 OSP_t + \beta_4 PVT_t + \beta_5 RGDP_t + \beta_6 GXH_t + \mu_t$$

$$MMR_t = \alpha_0 + \beta_1 PM2.5_t + \beta_2 N_2O_t + \beta_3 OSP_t + \beta_4 PVT_t + \beta_5 RGDP_t + \beta_6 GXH_t + \mu_t$$

Where:

LEX = Life Expectancy Rate

MMR = Maternal Mortality Rate

PM2.5 = Particulate Matter 2.5

N₂O = Nitrous oxide

OS = Oil Spillage

PVT = Poverty

GXH = Government Expenditure on Health

RGDP= Real Gross Domestic Product

The a priori assumption is that:

Variable	LEX	MMR
GXH	+	–
N ₂ O	–	+
OSP	–	+
PM2.5	–	+
PVT	–	+
RGDP	+	–

Authors Compilation

Description of Variables and Methodology (Compressed)

Dependent Variables

Life Expectancy at Birth (LEAB) measures the average number of years a newborn is expected to live, reflecting overall mortality conditions across age groups (WHO, 2022). Maternal Mortality Rate (MMR) captures deaths of women during pregnancy or childbirth, a major public health challenge particularly in developing countries (Steinberg, 1989; Wright, 1994).

Independent Variables

Poverty (PVT) influences health through poor housing, inadequate sanitation, unsafe water, malnutrition, and exposure to environmental hazards (Sanders, 2008; Montgomery & Hewett, 2005). Nitrous Oxide Emissions (N₂O) and Particulate Matter 2.5 refer to tiny atmospheric solid or liquid particles (aerosols)

with a diameter of 2.5 micrometers. Oil Spillage (OIL) captures environmental contamination from petroleum activities, expected to worsen health conditions in affected regions. Real Gross Domestic Product (RGDP) measures inflation-adjusted economic output and reflects the growth–health linkage. Government Expenditure on Health (GXH) includes public spending on healthcare services and related programs, expected to improve health outcomes.

Sources of Data

The study relies on secondary data from the Central Bank of Nigeria (2023), World Bank Global Economic Prospects (2023), and National Bureau of Statistics (2023).

Estimation Techniques

The analysis follows three stages: (i) Augmented Dickey–Fuller (ADF) unit root test to determine stationarity; (ii) co-integration test to examine long-run relationships; and (iii) model estimation using ARDL, VECM, or OLS to capture short- and long-run effects, depending on the integration properties of the variables.

Table 1 Descriptive Statistics

	MMR	LEX	PVT	PM2.5	N2O	OSP	RGDP	GXH
Mean	48.65	48.61	51.07	17452.65	32052.12	42680.18	36814.55	85.09
Median	46.67	46.67	48.40	12544.81	31510.00	31074.34	27113.00	28.89
Maximum	54.69	53.95	72.00	32702.31	46160.00	241617.6	71388.00	388.37
Minimum	45.64	45.64	30.00	3942.03	19225.22	665.03	1919.10	0.04
Std. Dev.	3.22	3.14	11.49	9830.39	9040.74	44910.84	22053.19	108.02
Skewness	0.65	0.61	0.52	0.36	0.18	2.42	0.42	1.05
Kurtosis	1.76	1.67	2.36	1.61	1.74	10.36	1.61	2.89
Jarque-Bera	5.623	5.69	2.55	4.30	2.99	135.74	4.61	7.82
Probability	0.06	0.06	0.28	0.12	0.22	0.00	0.09	0.02
Sum	2043.4	2041.5	2094.04	733011.3	1346189.	1792567.	1546211.	3573.79
Sum Sq. Dev.	425.08	404.11	5283.51	3.96E+09	3.35E+09	8.27E+10	1.99E+10	478434.4
Observations	44	44	44	44	44	44	44	44

Table 1 presents the descriptive statistics for the variables used in the study based on 44 observations. The mean values of MMR and LEX are 48.65 and 48.61, respectively, with corresponding standard deviations of 3.22 and 3.14, indicating relatively low variability. PVT has a mean of 51.07 and a standard deviation of 11.49, while PM2.5 and N2O have mean values of 17,452.65 and 32,052.12, respectively. OSP records the highest mean value of 42,680.18 and the greatest standard deviation of 44,910.84, suggesting substantial fluctuations in oil-spill pollution over the study period. RGDP has a mean of 36,814.55, while GXH averages 85.09 with a standard deviation of 108.02, indicating considerable variation in government health expenditure. The skewness statistics are positive for all variables, ranging from 0.18 for N2O to 2.42 for OSP, implying that the distributions are generally right-skewed, particularly OSP. The kurtosis values range from 1.61 to 10.36, with OSP exhibiting pronounced leptokurtosis, suggesting the presence of extreme observations. The Jarque-Bera probabilities indicate that PVT, PM2.5, and N2O are approximately normally distributed at the 5 percent level, whereas MMR, LEX, OSP, RGDP, and GXH show departures from normality. Overall, the descriptive statistics reveal considerable variation among the environmental, economic, and health-related variables, particularly OSP and GXH, which may reflect changes in environmental conditions, economic activity, and public health spending over the study period.

Table 2: ADF Stationarity Test for Life expectancy Model:

Variables	Level		1 st Difference		Order
	T-Stat.	5% Critical Value	T-Stat.	5% Critical Value	
PM2.5	-0.514919	-2.935001	-5.753136	-2.936942	I (1)
GXH	-3.677068	-2.957110	-	-	I (0)
LEX	-0.869726	-2.945842	-3.564171	-2.957110	I (1)
RGDP	-0.210002	-2.936942	-9.169886	-2.936942	I (1)
N ₂ O	-0.295719	-2.935001	-6.880641	-2.936942	I (1)
OSP	-4.183442	-2.935001	-	-	I (0)

PVT	-1.173874	-2.936942	-4.113739	-2.936942	I(1)
MMR	2.622968	-2.941145	-4.8087551	-2.936942	I(1)

Source: Authors compilation from Eview-10.05

Table 2 presents the Augmented Dickey-Fuller (ADF) unit-root test results for the life expectancy model. The results show that GXH and OSP are stationary at level, I(0), since their ADF test statistics of -3.6771 and -4.1834 are more negative than their respective 5% critical values. However, PM2.5, LEX, RGDP, N2O, PVT, and MMR are non-stationary at level but become stationary after first differencing, indicating that they are integrated of order one, I(1). Specifically, their first-difference ADF statistics are more negative than the corresponding 5% critical values. Thus, the variables are a mixture of I(0) and I(1) processes, with none integrated of order two, I(2). This combination of integration orders provides justification for employing the ARDL bounds-testing approach to cointegration for examining the long-run relationship among the variables in the model.

Table 3 ARDL Bounds Test for Life expectancy Model

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	5.023025	6
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Source: Authors' compilation from Eviews 10.05

From the bounds cointegration test above, the f-statistical value of 5.023025 is greater than the upper bound of the critical value of 3.61 at 5 percent. This suggests that there is evidence to reject the null hypotheses of no long-run relationship and accept the alternative hypotheses of the existence of a long-run relationship between the variables being tested. By implication, there is a long-run cointegration among the series in the hypotheses, and in the long run, changes in one variable are likely to have a long-run impact on the other variables. Since there is a long-run association, we then proceed to ascertain their long-run and error-correction regressions.

Table 4 Long Run result for Life Expectancy Model

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
URP	-0.182664	0.027652	-6.605877	0.0000
LOG(PM2.5)	-0.484943	0.812846	-0.596599	0.5575
LOG(N ₂ O)	19.671200	3.532611	5.568459	0.0000
LOG(OSP)	-0.452623	0.145783	-3.104766	0.0056
LOG(RGDP)	1.604222	0.650549	2.465952	0.0228
LOG(GXH)	-0.314621	0.200325	-1.570551	0.1320
C	-149.968518	27.581011	-5.437383	0.0000

Source: Authors' compilation from Eviews 10.05

Table 4 presents the long-run effects of urban poverty and environmental degradation on life expectancy in Nigeria. Poverty (PVT) exerts a significant negative effect on life expectancy at the 5% level, indicating that rising urban deprivation substantially reduces longevity, likely due to limited healthcare access, poor nutrition, and heightened disease exposure. Particulate matter 2.5 show a negative but statistically insignificant relationship, suggesting no meaningful long-run impact on life expectancy. Nitrous oxide (N₂O) emissions unexpectedly display a positive association with life expectancy, contrary to theoretical expectations that link air pollution to adverse respiratory and cardiovascular outcomes. Oil spillage (OSP) has a strong and significant negative effect, implying that increased spill incidents markedly reduce life expectancy through environmental contamination, food insecurity, and health risks.

Real Gross Domestic Product (RGDP) positively and significantly influences life expectancy, reflecting the role of economic growth in improving healthcare services, infrastructure, and living standards. Conversely, government expenditure on health (GXH) is negatively but insignificantly related to life expectancy, suggesting that inefficiencies and weak institutional management may undermine the effectiveness of public health spending in Nigeria.

Table 5: Short Run Result
Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEX(-1))	0.151102	0.125946	1.199741	0.2443
D(PVT)	0.009223	0.008203	1.124279	0.2742
D(PVT(-1))	-0.013408	0.015050	-0.890877	0.3836
D(URP(-2))	0.016118	0.009045	1.781958	0.0899
DLOG(PM2.5)	-0.426068	0.197157	-2.161055	0.0430
DLOG(N ₂ O)	1.190730	0.818105	1.455472	0.1611
DLOG(N ₂ O(-1))	2.780609	1.086682	2.558806	0.0187
DLOG(N ₂ O(-2))	-6.076569	1.117413	-5.438070	0.0000
DLOG(OSP)	-0.095583	0.034792	-2.747263	0.0124
DLOG(RGDP)	-0.142938	0.078411	-1.822922	0.0833
DLOG(RGDP(-1))	-0.098401	0.058744	-1.675094	0.1095
DLOG(RGDP(-2))	-0.164998	0.055438	-2.976264	0.0075
DLOG(GXH)	-0.066441	0.046384	-1.432402	0.1675
CointEq(-1)	-0.211176	0.032157	-6.566969	0.0000
R-squared	0.909428	Mean dependent var		48.81915
Adjusted R-squared	0.898914	S.D. dependent var		3.159568
S.E. of regression	0.104117	Akaike info criterion		-1.380083
Sum squared resid	0.216805	Schwarz criterion		-0.569630
Log likelihood	45.91161	Hannan-Quinn criter.		-1.089299
F-statistic	1943.028	Durbin-Watson stat		2.356107
Prob(F-statistic)	0.000000			

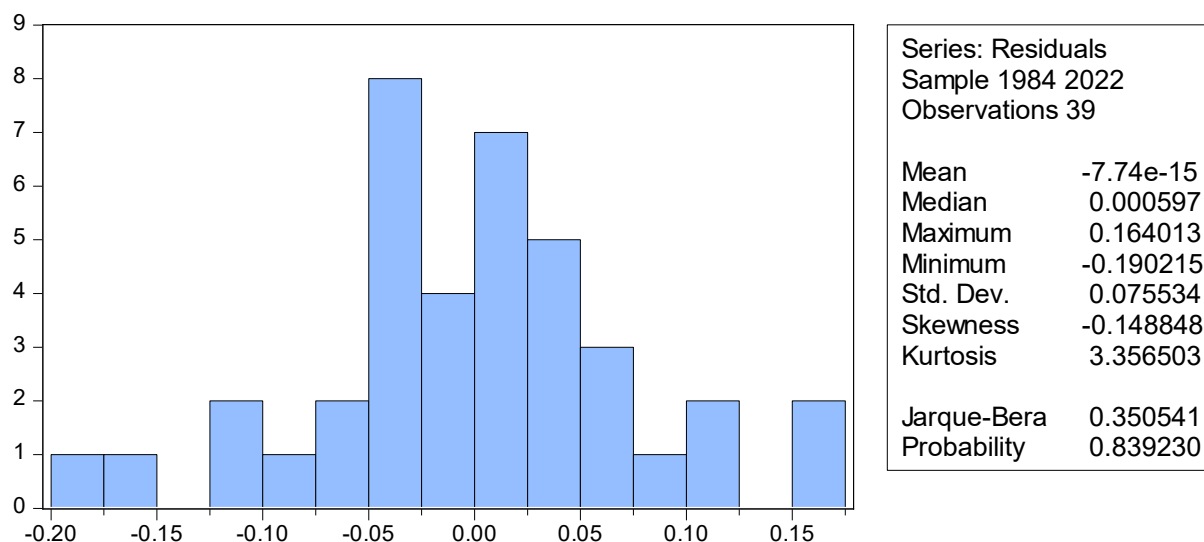
*Note: p-values and any subsequent tests do not account for model selection.

Source: Authors' compilation from Eview-10.05

The short-run results show strong explanatory power, with an R^2 of 0.909 and an adjusted R^2 of 0.899, indicating that about 89% of variation in life expectancy (LEX) is explained by the model. The Durbin–Watson statistic (2.356) suggests the absence of first-order autocorrelation, while the error correction term (ECT) is negative and significant at 5%, implying that deviations from long-run equilibrium are corrected at 21% per year. Lagged life expectancy is negative but insignificant, indicating weak persistence. Urban poverty (PVT) shows mixed but largely insignificant short-run effects, suggesting that immediate impacts may be moderated by social and institutional factors. Particulate matter (PM2.5) emissions exert a significant negative short-run effect, reflecting the immediate health consequences of pollution. Nitrous oxide (N₂O) emissions display mixed lag effects, with some significant relationships, possibly capturing the dual effects of industrialisation and environmental harm. Real GDP (RGDP) shows negative short-run effects, with the two-year lag significant, suggesting that rapid growth without environmental safeguards may temporarily reduce life expectancy. Government health expenditure (GXH) remains negative and insignificant, highlighting potential inefficiencies in public health spending.

Post Estimation Test:

i. Normality of the Residual Test



Normality of the residual of the regression is done to ascertain the validity of the regression. It is important because it helps the researcher to assess whether the assumptions underlying regression analysis hold true for the data selected in the study. Given the value of the Jarque-Bera statistic of 0.350541 and its probability value of 0.839230, we assert that the residuals are normally distributed.

ii. Serial Correlation Test:

Table 6: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.720519	Prob. F(2,18)	0.5000
Obs*R-squared	2.890815	Prob. Chi-Square(2)	0.2357

This study employed the Breusch-Godfrey Serial Correlation LM Test in testing the serial independence of the error term. Given the fact that the F-statistic value of 0.720519 and the observed R-squared value of 2.890815 are statistically insignificant with probability values of 0.5000 and 0.2357, we assert that there is no evidence of serial correlation in the residual of the study, and we conclude that the estimated equation is blue.

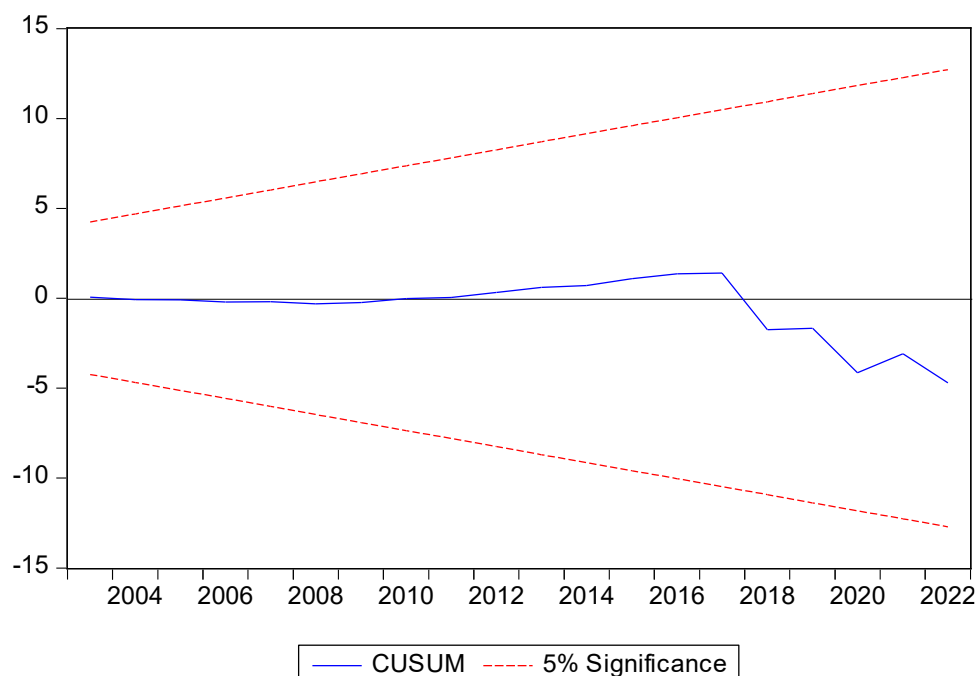
iii. Heteroskedasticity Test:

Table 7: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.874557	Prob. F(18,20)	0.6100
Obs*R-squared	17.17695	Prob. Chi-Square(18)	0.5110
Scaled explained SS	5.322492	Prob. Chi-Square(18)	0.9983

This study employed the Breusch-Pagan-Godfrey heteroskedasticity test in testing the equality of the variance of the residual. This test assess whether there is evidence of unequal variance of the residuals across different levels of the independent variables in regression analysis. Given the fact that the F statistic value of 0.874557, the Obs*R-squared value of 17.17695 and the scaled explained SS value of 5.322492 and their probability values of 0.6100, 0.5110, and 0.9983 are greater than the 0.05 threshold, we conclude that there is evidence of homoskedasticity in the residual, and we conclude that the estimated equation is blue.

iv. Model Stability Test:



The CUSUM test was employed to test the stability of the regression. A critical assessment of the CUSUM line above shows that the line is within the accepted margin. This implies that the estimate lies within the 95 percent confidence interval.

Model Two Estimation

Table 8: ARDL Bounds Test for Model Two

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	4.115507	6
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Source: Authors compilation from Eview-10.05

From the bounds cointegration test above, the F-statistic value of 4.115507 is greater than the upper bound of the critical value of 3.61 at 5 per cent. This suggests that there is evidence to reject the null hypotheses of no long-run relationship and accept the alternative hypotheses of the existence of a long-run relationship between the variables being tested. By implication, there is a long-run cointegration among the series in the hypotheses, and in the long run, changes in one variable are likely to have a long-run impact on the other variables. Since there is a long-run association, we then proceed to ascertain their long-run and error-correction regressions.

Table 9: Long Run result

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PVT	0.066836	0.027818	-2.402630	0.0237
LOG(PM2.5)	0.168439	0.065287	-2.579979	0.0159
LOG(N ₂ O)	-0.182087	0.061601	2.955917	0.0065
LOG(OSP)	-0.023701	0.005561	-4.262256	0.0002
LOG(RGDP)	5.940759	5.152760	1.152928	0.2594
LOG(GXH)	-1.295283	0.358089	-3.617209	0.0014
C	270.799323	510.014342	3.530964	0.0000

Source: Authors compilation from Eview-10.05

The long-run results indicate that poverty (PVT) significantly increases maternal mortality (MMR), with a 1% rise in urban poverty leading to a 6% increase in MMR, reflecting poor healthcare access, high costs, and low maternal health awareness in deprived urban areas. Particulate matter (PM_{2.5}) emissions also raise maternal mortality by 16%, consistent with environmental health risks such as heat stress and vector-borne diseases. Unexpectedly, nitrous oxide (N₂O) emissions and oil spillage (OSP) show reductions in maternal mortality by 18% and 2%, respectively, which contradict theoretical expectations and may result from data anomalies or confounding factors. Real GDP exhibits a positive but insignificant effect on MMR, suggesting that economic growth alone may not sufficiently improve maternal health due to inequitable resource distribution or inefficiencies. In contrast, government expenditure on health (GXH) significantly reduces maternal mortality, with a 1% increase in spending lowering MMR by 1.3%, highlighting the critical role of well-funded healthcare systems in improving prenatal and postnatal care and maternal outcomes.

Short Run Result

Table 10: Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MMR(-1))	0.719499	0.259913	2.768234	0.0103
D(PVT)	0.102309	0.023462	4.360599	0.0002
D(PVT(-1))	-0.067988	0.027587	-2.464480	0.0206
DLOG(PM2.5)	0.091352	0.309481	0.295177	0.7702
DLOG(N ₂ O)	1.371588	1.753728	0.782099	0.4412
DLOG(OSP)	0.026593	0.346410	2.142059	0.0481
DLOG(RGDP)	0.044340	0.117511	0.377323	0.7090
DLOG(RGDP(-1))	-0.256943	0.120730	-2.128248	0.0430
DLOG(GXH)	0.060935	0.096071	0.634266	0.5314
CointEq(-1)	-0.042454	0.044073	-0.963265	0.3443
R-squared	0.897034	Mean dependent var	48.86882	
Adjusted R-squared	0.874876	S.D. dependent var	3.242337	
S.E. of regression	0.232085	Akaike info criterion	0.215850	
Sum squared resid	1.184996	Schwarz criterion	0.940992	
Log likelihood	12.79093	Hannan-Quinn criter.	0.476025	
F-statistic	462.1632	Durbin-Watson stat	2.466910	
Prob(F-statistic)	0.000000			

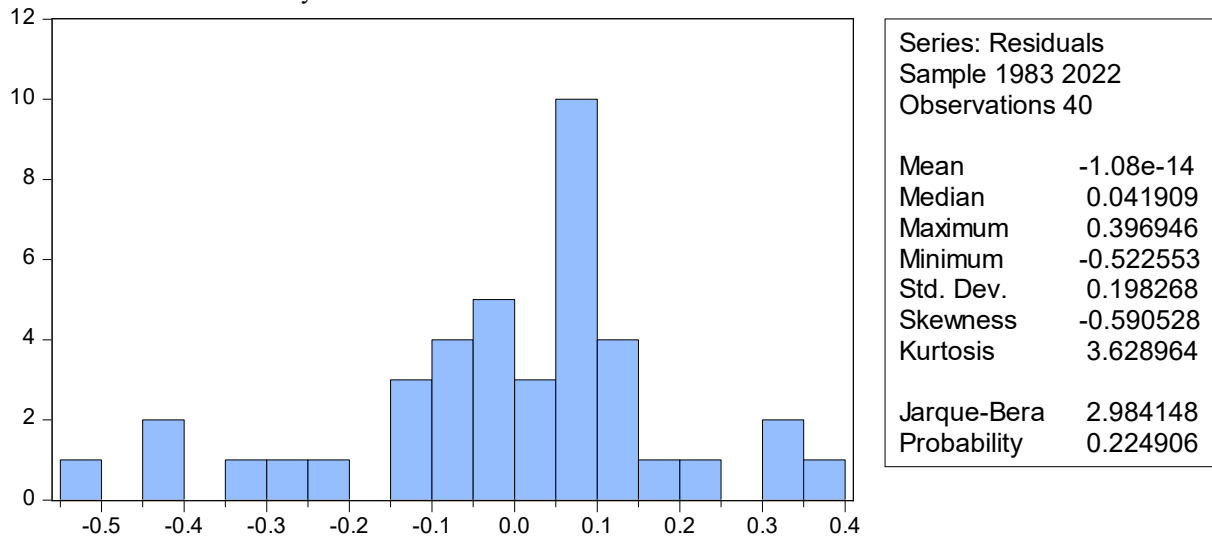
*Note: p-values and any subsequent tests do not account for model selection.

The short-run results show that the model explains about 87% of the variation in maternal mortality ($R^2 = 0.897$, adjusted $R^2 = 0.875$), with a Durbin-Watson statistic of 2.467 indicating no autocorrelation. The error correction term (ECT = -0.042, $p < 0.05$) suggests that roughly 4% of past deviations from long-run equilibrium are corrected each period, confirming model stability. Lagged maternal mortality significantly reduces current MMR, indicating partial

short-term persistence. poverty (PVT) has a positive and significant immediate effect (coefficient = 0.102), while its lagged value is negative, implying that urban deprivation raises maternal risk in the short term but may trigger compensatory effects over time. PM_{2.5} and N₂O emissions show positive but insignificant short-run impacts. Oil spillage (OSP) significantly increases MMR, with a 1% rise causing a 2% increase in maternal deaths, reflecting disruptions to healthcare and local living conditions. Real GDP from the previous year significantly reduces MMR by 25%, consistent with improved healthcare and living standards. Conversely, short-run government health expenditure (GXH) unexpectedly increases MMR, likely due to inefficiencies and mismanagement that limit the immediate effectiveness of funding.

Post Estimation Tests

i. Residual Normality Test:



Normality of the residual of the regression is done to ascertain the validity of the regression. It is important because it helps the researcher to assess whether the assumptions underlying regression analysis hold true for the data selected in the study. Given the value of the Jarque-Bera statistic of 2.984148 and its probability value of 0.224906, we assert that the residuals are normally distributed.

ii. Serial Correlation Test:

Table 11: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	17.347909	Prob. F(2,24)	0.7832
Obs*R-squared	15.19112	Prob. Chi-Square(2)	0.8995

This study employed the Breusch-Godfrey Serial Correlation LM Test in testing the serial independence of the error term. Given the fact that the F-statistic value of 17.347909 and the observed R-squared value of 15.19112 are statistically insignificant with probability values of 0.7832 and 0.8995, we assert that there is no evidence of serial correlation in the residual of the study, and we conclude that the estimated equation is blue.

iii. Heteroskedasticity Test:

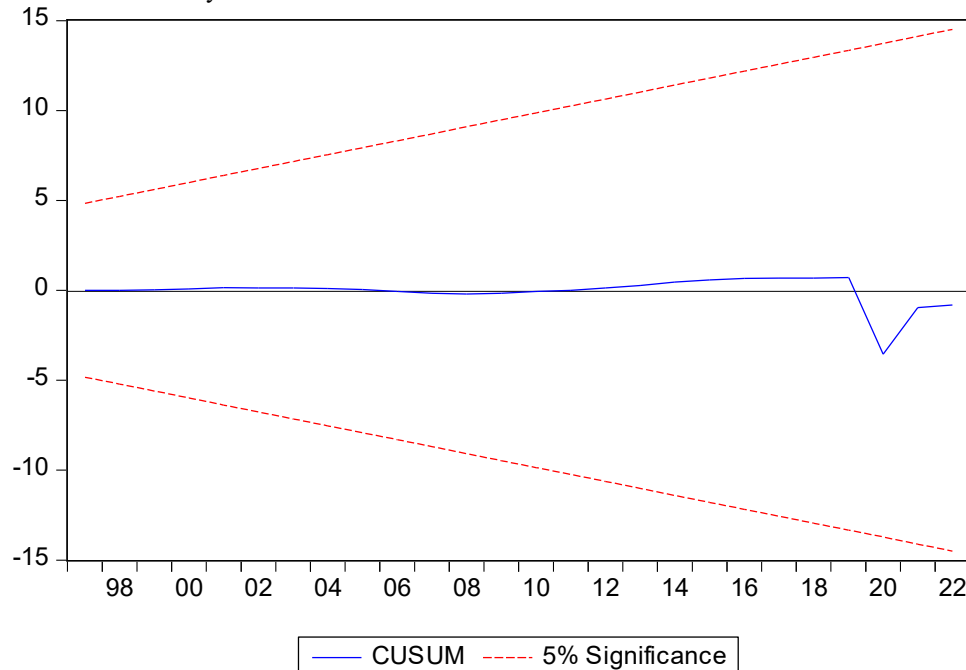
Table 12: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	4.677920	Prob. F(13,26)	0.0904
Obs*R-squared	28.02022	Prob. Chi-Square(13)	0.0990
Scaled explained SS	31.19116	Prob. Chi-Square(13)	0.0832

This study employed the Breusch-Pagan-Godfrey heteroskedasticity test in testing the equality of the variance of the residual. This test assesses whether there is evidence of unequal variance of the residuals across different levels of the independent variables in regression analysis. Given the fact that the F statistic value of 4.677920, the Obs*R-squared

value of 28.02022 and the scaled explained SS value of 31.19116 and their probability values of 0.0904, 0.0990, and 0.0832 are greater than the 0.05 threshold, we conclude that there is evidence of homoskedasticity in the residual, and we conclude that the estimated equation is blue.

iv. Model Stability Test:



The CUSUM test was employed to test the stability of the regression. A critical assessment of the CUSUM line above shows that the line is within the accepted margin. This implies that the estimate lies within the 95 percent confidence interval.

Summary

Human activities for development have led to significant environmental degradation, threatening present and future well-being. Rapid urbanization in Nigeria, unlike gradual urban growth in industrialized countries, has outpaced available resources, compounding social and environmental challenges. This study examined urban poverty, environmental degradation, and health outcomes in Nigeria from 1981 to 2024, using secondary data from the CBN, World Bank, and NBS. Time series data were analyzed with the Augmented Dickey-Fuller test for stationarity, and the ARDL approach was applied after confirming long-run cointegration. Key findings include:

- i. Life Expectancy: Poverty significantly reduced life expectancy in the long run; **PM_{2.5}** emissions were negative but insignificant long term and significant in the short run; nitrous oxide positively affected life expectancy long term; oil spills reduced life expectancy in both short and long run; RGDP improved life expectancy long term but had negative short-run lagged effects; government health spending had an insignificant negative impact.
- ii. Maternal Mortality: Poverty increased maternal mortality long and short term; **PM_{2.5}** significantly increased MMR long term; oil spills decreased MMR long term but increased it short term; nitrogen oxide reduced MMR long term but had an insignificant positive short-term effect.

Conclusion

This study examined the impact of environmental degradation and poverty on health outcomes in Nigeria over the period 1981–2024. The findings reveal that both urban poverty and environmental degradation significantly affect life expectancy and maternal mortality in Nigeria, confirming the intertwined nature of social, economic, and environmental determinants of health. Specifically, poverty was found to reduce life expectancy and increase maternal mortality, highlighting the vulnerability of the urban poor to inadequate healthcare, malnutrition, and poor living conditions. Environmental factors, including particulate matter and nitrous oxide emissions and oil spillage, also influenced health outcomes, though their effects varied in the short and long run. Economic growth positively influenced life expectancy, but lagged effects suggest that unregulated growth without environmental safeguards can

negatively affect health outcomes. Government expenditure on health showed a positive impact on maternal mortality in the long run, but its effect on life expectancy was limited, indicating challenges in fund allocation and implementation.

The study underscores that poverty and environmental degradation are critical barriers to achieving improved health outcomes in Nigeria. Addressing these challenges requires coordinated policy interventions that combine poverty reduction, environmental management, economic growth, and effective health system investments. By targeting both social and environmental determinants, Nigeria can enhance life expectancy, reduce maternal mortality, and improve the overall health of its population.

Recommendations

Based on the empirical results of your study on urban poverty, environmental degradation, and health outcomes in Nigeria (1981–2024), here are specific, evidence-based recommendations:

- i. Since poverty significantly reduces life expectancy and increases maternal mortality, the government should implement targeted poverty alleviation programs in urban centers, including cash transfers, food support, and subsidized healthcare.
- ii. Particulate matter (PM_{2.5}) emissions negatively affect both life expectancy and maternal mortality. Policies should promote cleaner energy sources, enforce emission standards, and support renewable energy adoption.
- iii. Nitrous oxide (N₂O) emissions had mixed effects; nonetheless, stricter industrial and transportation emission controls and improved monitoring of air quality are recommended.
- iv. Oil spills significantly reduce life expectancy and increase maternal mortality in the short run. Regulatory bodies should enforce stricter safety standards for oil extraction, improve spill response mechanisms, and rehabilitate affected communities.
- v. Real GDP increases life expectancy, but lagged economic growth can harm health outcomes if environmental controls are weak. Policy should ensure economic development aligns with environmental protection and public health investments.
- vi. While government spending on health reduces maternal mortality in the long run, its impact on life expectancy is minimal. Strengthen accountability, reduce corruption, and prioritize primary healthcare and preventive services to ensure spending translates into tangible health benefits.
- vii. Given the strong link between urban poverty and maternal mortality, expanding prenatal, delivery, and postnatal care services, particularly in underserved urban areas, is critical.
- viii. Educate communities on the health risks of pollution, unsafe waste disposal, and poor sanitation. This can help reduce exposure to environmental hazards, particularly for vulnerable groups like pregnant women and children.

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