



STATISTICAL MODELING OF INTERNALLY DISPLACED PERSONS (IDPS) IN BORNO STATE: TRENDS, CAUSES, AND PREDICTIVE ANALYSIS (2009 - 2025)

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ABSTRACT

This study, titled “Statistical Modeling of Internally Displaced Persons (IDPs) in Borno State: Trends, Causes, and Predictive Analysis (2009–2025)”, investigates the historical trends, root causes, and future projections of internal displacement in Borno State, Nigeria. The research was guided by the following objectives: (i) to analyze the historical trends of IDPs in Borno State, (ii) to identify the principal causes of displacement, and (iii) to develop statistical models to predict future displacement patterns. A quantitative research design was adopted. Data was collected through structured questionnaires distributed among 90 displaced persons in Borno State and supplemented by secondary sources from government and humanitarian agencies. Analytical tools included descriptive statistics, time series forecasting using ARIMA (1,1,1), and multiple regression analysis to determine the impact of conflict intensity on IDP numbers. The findings revealed that the Boko Haram insurgency and associated military operations were the primary causes of internal displacement in the state, as confirmed by 91.1% of respondents. The displacement trend peaked between 2013 and 2016, corresponding to intensified violence and military campaigns. From 2009 to 2025, the number of IDPs increased significantly from 515,000 in 2009 to over 1.24 million in 2025. Time series forecasting projected that, without intervention, IDP figures could exceed 1.5 million by 2030. Regression analysis showed that each unit increase in conflict intensity led to an approximate rise of 95,400 IDPs, confirming a strong positive correlation between insurgency and displacement. These findings indicate a cyclical and escalating pattern of displacement directly tied to security dynamics in the region. The study concludes that insurgency remains the most significant driver of internal displacement in Borno State. It is recommended that government authorities enhance security and counterinsurgency efforts, increase humanitarian assistance, and adopt predictive, data-driven approaches to improve planning and response. Furthermore, economic recovery programs and targeted vocational training in IDP camps are essential for reducing dependency and restoring livelihoods.

Keywords: Statistical Modeling; Internally Displaced Persons (IDPs); Socioeconomic Vulnerability; Armed Conflicts; Forced Displacement; Borno State

1 INTRODUCTION

Internal displacement is the involuntary or coerced movement of persons who have fled their homes, communities and livelihoods as a result of disasters such as war, violent conflicts, human rights abuses, persecution, repression and natural phenomenon but have not sought refuge in another country. It has become a major global phenomenon of the modern world that is obtainable in many countries and regions (Okon, 2018). Most times, it is the outcome of violence and gross human rights abuse which may lead to dramatic changes in family structures and gender roles, severe hardship, suffering, destitution, vulnerability, social deprivation, need for protection and assistance and death of the displaced persons (Ansa, 2010). Globally, a significant number of people live displaced within the borders of their country or country of habitual residence. The rate of internal displacement in any country is determined by multiple factors which may include the country's political stability, respect for the rule of law, intrinsic natural disasters and government responsiveness *inter alia*.

There exists no legal or universally accepted definition of Internally Displaced Persons as different scholars have espoused different versions of the concept. The concept has been expanded and contracted to accommodate or restrict certain sets or groups of persons based on the scholars' perspectives. In other situations where a set of scholars adopt a common definition, there has been different understanding and interpretation of the terms inherent in such definition. For the purpose of this study, the Guiding principles' definition of Internally Displaced Persons will be adopted because the document is a product of the United Nations.

Internally Displaced Persons (IDPs) according to the Guiding Principles are: persons or groups of persons who have been forced or obliged to flee or leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized state border (Okon, 2018).

Thus, a person, persons or group of persons can only be considered as internally displaced when forced migration has taken place within a country in a bid to escape disasters of any form. This definition has streamlined and narrowed down the conditions that are necessary for persons to be considered as Internally Displaced Persons. Their migration from their communities must have been forcefully induced by natural or manmade disasters. This does not remove the personal will of these persons as obtained in cases of abductions and kidnappings, but the need for survival which propels them from danger to a safer environment. It is worthy of note that this migration must not transcend the borders of the country

The United Nations High Commissioner for Refugees (UNHCR, 2024) reports that Nigeria has one of the highest numbers of Internally Displaced Persons (IDPs) in Africa, with over 2.5 million affected. Since 2009, economic instability, climate change, and inter-communal conflicts have made displacement in Borno State, the epicenter of the Boko Haram insurgency, worse. Internal displacement has been a major humanitarian crisis in Nigeria, especially in the northeastern region, where conflict and insecurity have forced millions from their homes.

According to Babagana Mohammed (2025: Pers.comm), the Boko Haram insurgency has had a significant impact on Borno State's socioeconomic aspects, including the people's ability to make a living. He (Babagana) further stated that agricultural products were destroyed, markets were reduced to ashes, and the insurgency had a significant impact on Borno State's educational system and transportation system where researchers explore the causes of conflict to apply the principles for the justification of the insurgency (Babagana, 2025: Pers.comm).

Over one decade of insurgency in Borno state northeast Nigeria shows that the Boko Haram insurgency has had an impact on all the previously listed areas, including education and the standard of living for the inhabitants of Borno State, from 2009 to 2023. Thus, it is accurate to say that Boko Haram has caused numerous disasters that have impacted Borno's socioeconomic and economic development.

The major drought of 1973 and the worst flood of September 1994 coupled with desertification were tragedy that have struck Borno state in the past that have led to displacement of many people. Due to the drought and the flood, many farmers lost their crops and there was little or no feeder for their animals. The result is often hunger and famine when Nature fails to provide social unrest and conflict as we have seen in some countries in the horn of Africa even today (Per.comm Sule Buba S, 2025).

International Organization for Migration Displacement Tracking Matrix (IOM-DTM) Nigeria reported that Borno state the epicenter of insurgency in Nigeria, still has the highest number of IDPs in Nigeria. As at the time of this report, DTM have published 49 rounds of reports on IDPs in Northeast Nigeria which shows displacement trends from 2014 to 2025 (DTM Nigeria North-East Displacement Report Round 49 (March 2025)).

According to Ahmad (Pers.Comm), the main causes of insurgency are dissatisfaction and apathy among the majority of the populace, which results in unthinkable anti-social behavior. These causes include political, administrative, and legal voids, illiteracy, unemployment, underdevelopment, and the legacy of post-politics, insurgency, restiveness, terrorism, and the likes, which was fueled by religious flavour in other to destabilize the government (Sule pers.comm 2025).

As the scholar above stated, the Borno State insurgency was in fact sparked by unemployment among the training youths, which ultimately led to the insurgency's rise in Borno State. The researcher also identified illiteracy as a major contributing factor to the insurgency, as the majority of the youths who joined the movement were illiterate in both Islamic and Western education. And another factor which the scholar mentioned as a source and cause of Boko Haram insurgency is the political aspects where some of the politicians took this as an avenue and unleashed war against their rivals in political and also administrative policies is also another vital factor which leads to the emergencies of the Boko Haram.

Statistical modeling plays a critically important role in informing patterns of displacement, determining causal factors, and policy decision making. Analysis in this work shall employ regression models and time series to evaluate patterns of displacement between 2009 and 2025 in Borno State for predictive data utilized in humanitarian planning.

Model listing is necessary to ensure that a model operates as expected to point out problems and needed enhancement for management purposes. The need for accurate predictions under extreme events such as the insurgency is particularly important within a management context and it will continue to entice managements, policy makers to attempt to extrapolate their uses.

1.1 Statement of the Problem

There has been a protracted conflict in northeast Nigeria, predominantly in Borno State, which has resulted in the loss of lives and property, destroyed key infrastructures, displaced millions of people, and destabilized the health, education, and economic sectors since 2009. The state as a whole as well as the social lives and economies of individuals are severely hampered by the chain of destruction, burning, and canalization of both public and private facilities and properties, including buildings, stores, marketplaces, farm produce, and many other commodities of trade. Numerous books have been written about the Boko Haram insurgency in Nigeria, particularly in the northeastern region, with special attention to Borno State. However, such literatures were restricted to the origin and genesis of Boko Haram on Education, types and effect of Insurgency on Trades, prolongation of Boko Haram Insurgency and its consequence, insurgency and security in Borno State and human security challenges in the midst of insurgency in North-East, Nigeria.

Despite various efforts by governmental and non-governmental organizations to address displacement in Nigeria, the situation remains unresolved. The fragile security situation in Borno State has resulted in periodic waves of displacement, providing challenges for precise forecasting and resource allocation. There was disagreement between the police and the Boko Haram members on the use of helmets, some of the members believed that wearing a helmet is incompatible with their culture/religion, so they refused to use a helmet while riding a motorcycle. The police seeking to punish defaulter to adherence to force the rules were attacked as revenge. This might have led to the disagreement and the reason for the conflict. The members that were punished were motivated to fight back with pride. Historically, revenge has been a factor in many European wars and mostly mentioned in the Jos and Kaduna crises in Nigeria in the 1990s. They perceive that their security is gradually eroding into insecurity the major cause of the war, but what they fail to understand is ignorance is not respect for law, but this conflict created a lot of blood bath most often the civilians with humanity as the loser.

War of all sorts are caused by numerous factors, but the prominent ones are: Economic Gain, Territorial Gain, Religion, Nationalism, Revenge, Civil war, Revolutionary war, Diplomatic war, Nuclear war and Defensive (Per. Comm. Sule, 2025)

As of Boko Haram, the stated aim of the insurgency presented to the public is Jihad, but current unfolding objectives implicated economic motive Underlying the aim just like most conflicts, something more noble appears to overshadow the religious reason considering the huge number of Muslims displaced, injured and killed. The justification for the conflict may be complex/multiple reasons. (Per. Comm. Sule Buba, 2025)

Although the sociopolitical dimensions of displacement have been the focus of previous research, statistical modeling techniques for forecasting future displacement trends have received less attention. By using quantitative methods to evaluate past data, pinpoint important displacement reasons, and project future IDP movements, this study aims to close this gap.

1.2 Research Questions

The research questions are:

- i. What are the internal displacement trends for Borno State from 2009 to 2025?

- ii. What are the principal causes of displacement in Borno State?
- iii. How can statistical models be used to predict future displacement patterns?

Objectives of the Research

The aims of the present study are:

- i. To analyze the historical trends of IDPs in Borno State.
- ii. To determine the main factors responsible for displacement.
- iii. To develop predictive models to evaluate future displacement trends.

1.3 Research Hypothesis

H₀: Conflict and economic instability do not significantly influence displacement trends in Borno State.

H₁: Conflict and economic instability significantly influence displacement trends in Borno State.

1.4 Scope of the Study

This study focuses on Internally Displaced Persons in Borno State, covering data from 2009 to 2025. It employs statistical modeling techniques, including time series analysis and regression models, to analyze displacement trends.

1.5 Significance of the Study

The findings of this study will be valuable to policymakers, humanitarian organizations, and researchers by: As well as being source of information for communication for advancement of knowledge and understanding of the Boko Haram conflict in the Northeast Nigeria

- Providing empirical insights into IDP trends and causes.
- Assisting in evidence-based policymaking for IDP management.
- Enhancing predictive capabilities for humanitarian response planning.

1.6 Study Area

Borno State has a population of 5,860,200 and a land mass of 70,898km². The State capital, Maiduguri, reputed to be the birthplace and headquarters of Boko Haram. Culturally, the State is heterogeneous but the Kanuri as the undoubted majority. The rough terrain, Sand dunes such as mountains and dense forest (Sambisa forest), provide safe havens for insurgents and have periodically prompted deadly clashes along the border with Cameroon's army. The Sambisa Forest serves as a major sanctuary for insurgents and has been used by Boko Haram to avoid capture. Illiteracy and poverty are also very high. For various reasons that are historical, internal, and external, Borno state has been the epicenter of the Boko Haram rampage.

The state had protracted occurrences of drought and was declared an ecological disaster zone due to desertification by the then military Head of State, General Olusegun Obasanjo. For the purpose of easy administration. The state is divided into 27 local Government areas.



Figure 1: North East Development Commission (web), ndc.gov.ng/project-data/Borno/

1.7 Definition of Key Terms

- **Internally Displaced Persons (IDPs):** Individuals forced to flee their homes but remain within their country's borders.
- **Time Series Analysis** is a statistical method used to analyze trends in temporal data.
- **Regression Analysis:** A method of statistical analysis of relationships among variables.
- **Statistical Modeling:** is a mathematical framework employed to represent, analyze, and make inferences about data.
- **Predictive Analysis:** is a subset of advanced analytics that utilizes past data, statistical models, and machine learning methods to forecast future outcomes or behavior.
- **Trends:** A trend is a general direction in which something is changing, developing, or moving over the period of time.
- **Causes:** are the underlying elements, constituents, or events that bring about certain effects or consequences.

2 LITERATURE REVIEW

2.1 Concept of Internal Displacement

Internal displacement involves situations where persons or groups of persons have been compelled to leave their homes as a result of armed conflict, generalized violence, human rights violations, or natural disasters but do not cross international borders (UNHCR, 2023). The Guiding Principles on Internal Displacement (UN-OCHA, 1998) offer a framework for IDP protection based on state responsibility, yet in Nigeria, governance, security, and economic uncertainty have undermined proper IDP management (Nwosu & Okeke, 2022). Unlike refugees, IDPs are not protected by international law under the 1951 Refugee Convention, and therefore their welfare is essentially the duty of national governments (Cohen & Deng, 1998).

Powell and Abraham (2006) define insurgency as a violent act committed by an individual or group of individuals to resist the rule of law or the operation of government, to rebel against the state's established authority, or to take part in the insurgency. Under these conditions, insurgency as described above becomes a violation of both the criminal code of the constitution and a country's obligations under international treaties. According to Powell and Abraham (2006), these situations include when it is considered an attack on defenseless individuals and other property, resulting in harm, fatalities, and property loss; when it forces a large number of people to flee their homes; when it deters businesses and

investors from investing in an area that lacks security; and when it is considered a domestic or international crime that is punishable by law, such as treasonous felony, terrorism, murder, crimes against humanity, and so forth.

According to Kilcullen (2006), insurgencies are a struggle between a state or group of states or occupying powers and one or more popularly based non-state competitors for control of a contested political area. However, insurgencies have historically sought to replace an existing order with one that is more conducive to their political, economic, ideological, or religious objectives (Gompert and Gordon 2008). The author also distinguishes between classical and current insurgencies, stating that the former seek to remove foreign invaders from their territory or fill a power vacuum.

Among the global insurgencies are the Taliban in Pakistan, the Syrian Islamic Liberation Front in Syria, Hamas in Palestine, Hezbollah in Lebanon, and al-Qaeda in Afghanistan. A number of insurgencies, including Al-Shabaab in Somalia, the Lord's Resistance Army in the Central African Republic, the M23 Rebels in the Democratic Republic of the Congo, the National Movement of Azawad (MNLA), and Al-Qaeda in the Islamic Maghreb (AQIM) in Mali, have found a home in Africa, which is not exempt from this social hazard. As a result, the most damaging repercussions of these insurgencies around the world have been a high toll of humanitarian crises in the form of increased internally displaced persons (IDPs), refugee influx, food insecurity, disease transmission, and gender and sexual-based violence (Hughes, 2012).

Nigerians' perceptions of insurgency are multifaceted, and they have different reactions to the true character and motivations of the Boko Haram movement. Most Muslims compare it to the Maitatsine sect, which was founded in 1945 to cause havoc in Islam, although Maitatsine was not a Muslim until his death. While some Christians are indifferent to it, others see it as a tactic to Islamize Nigerians (Shehu, 2014). What started out as a regional disruption in the nation's remote North-East geopolitical zone in 2006 has developed into a national embarrassment of global proportions, claims Agomuo (2011). A five-year reign of terror in the affected regions of the nation was brought on by the 2009 emergence of a murderous gang whose activities took on a concerning dimension. Since then, people in these regions have never had peace. The majority of Nigerians in the northeast, especially Christians, have fled for their safety and security due to the rise of the extreme Islamic sect (Nwakaudu, 2012).

Mohammed Yusuf, the group's leader, began his career as a speaker and leader in the Shababul Islam of Ahl-Sunnah, a Salafi organisation. His literal interpretation of the Quran led him to advocate that aspect of western education that he deemed to be incompatible with religious knowledge (such as the theory of evolution, the big bang theory of universe development, and elements of chemistry and geography) be prohibited in Hausa (Crisis Group Africa Report (CGAR), 2014). Despite his criticism of the government, Yusuf actively participated in official attempts to enforce and implement Sharia in many northern states during the 2000s. Muslim youths' indignation at the government's deceit and insincerity, as well as their desire for a true Islamist revolution, might be partially explained by this failure (CGAR, 2014).

2.2 Overview of Internally Displaced Persons (IDPs) in Nigeria

Displacement in Nigeria is mainly a result of conflict and climate change, having one of the highest numbers of internally displaced people in Africa. In late 2023, Nigeria had over 3.6 million internally displaced people (IDPs), according to the Internal Displacement Monitoring Centre (IDMC, 2023), with nearly 1.5 million being in Borno State due to the actions of the Boko Haram insurgency.

Most of the IDPs in Borno State reside in congested camps and informal settlements, where they have no access to food, health, and quality education, states a UNHCR report in 2024. Moreover, the International Organization for Migration (IOM, 2023 Report) adds that among the salient challenges is secondary displacement, whereby internally displaced persons are continuously compelled to relocate due to insecurity.

2.3 Causes of Internal Displacement in Borno State

Today, large displacement episodes are usually facilitated by manmade violent causes. Armed conflict and human right violations remain the major causes of internal displacement (Kushi, 2018). Frequent causes of displacement in Nigeria include ethnic conflicts, religious conflicts, political conflicts especially electoral violence, insurgency and terrorism, counterinsurgency and counterterrorism. Usually, violence occasions stiff competition over land, economic and political resources. Also, violence may be employed when groups have mutually exclusive interests or goals. Dispute over values, political and economic resources does not automatically become violent unless there are available resources such as money and leadership to prosecute the violence (Schmeidl, 2003:136; Soetan & Osadola, 2018). The majority of internally displaced persons who are found in Borno were displaced due to insecurity (Osadola & Emah, 2022). Occasionally, internal displacement has been induced by non-violent causes such as fire outbreak, gas explosion, development, and conservation projects.

The main causes of internal displacement in Borno State is Boko Haram. The Boko Haram common name for the insurgent group is also known as Jama'at Ahl as – Sunnah lid-Da'wah wa'l-Jihad (people committed to the propagation

of the prophet's teachings and jihad). The group was established in 2002 in Maiduguri, North-East Nigeria by Mohammed Yusuf as a religious movement committed to the creation of an Islamic state based on its interpretation of Islam, which would address the ills of the society, especially corruption and inept governance. Boko Haram draws ideas and inspiration from newer radical Muslim entities. It has been linked with al-Qaeda and some radical African Muslim jihadi groups (McGoldrick, 2005). The causes of the insurgency as espoused by scholars and analysts are religious doctrines, pervasive poverty, lack of education and exposure. Since 2009 when Abubakar Shekau became the leader of Boko Haram, the group began massive violence resulting to the wanton killing of not less than 15,000 persons, destruction of private and public properties, kidnapping of thousands and the displacement of millions of people in North-East Nigeria – Borno, Adamawa and Yobe; Northern Cameroon; Niger; Mali and Chad (Kullima, 2019:139).

The insurgency has been so intense that in 2013, a state of emergency was declared in Borno, Adamawa and Yobe states in an attempt to stop or reduce the incessant attacks by Boko Haram (McGoldrick, 2005). Women and girls had been particularly targeted and subjected to horrific abuse. Villages and towns like Konduga, Bama, Gwoza, Damboa, Madagali, Michika, Mubi, Baga, Dikwa, Hong, and Askira were looted, destroyed and their political structures were disorganised as Boko Haram took over towns and villages across Borno, Adamawa and Yobe. Boko Haram has also targeted and attacked many schools, killing teachers and students in order to prevent people from going to school since the group is against Western education (Alobo & Obaji, 2016). At least, 300 schools have been attacked, numerous students and teachers killed while hundreds of students have been kidnapped, especially girls (Ejiofor et al., 2017). The ongoing insurgent and counter-insurgent activities in Borno, Adamawa, Yobe and Gombe have affected more than 14 million lives and caused widespread devastation in the region (McGoldrick, 2005).

Many have been displaced by the high desertification and water scarcity in the Lake Chad region (IOM, 2024). Okonkwo et al. (2023) outline that Borno has seen an increase in climate-induced displacement, particularly amongst pastoralists and farmers who have been affected by irregular rainfall patterns and land degradation.

Based on a WFP (2023) analysis, over 60% of IDPs in Borno are food insecure and rely on foreign assistance for survival. IDPs face life-threatening humanitarian needs. Displacement often results in the loss of livelihoods for the majority of IDPs and thus ceases economic activities (Amnesty International, 2023). Additionally, 1.9 million children in northeastern Nigeria are not attending school as a result of displacement, according to another study (UNICEF, 2024). Due to competition for resources, rising rent, and strain on healthcare and educational institutions, the host communities have also experienced economic distress (IOM, 2023).

2.4 Statistical Approaches to Analyzing IDPs

Quantitative methods provide insightful information regarding IDP trends, enabling policymakers to craft evidence-driven policy interventions.

2.4.1 Time Series Analysis

Time series models are used to forecast and examine IDP trends. The Autoregressive Integrated Moving Average (ARIMA) model, developed by Box & Jenkins (1976), has been extensively used in migration research (Ganiyu & Bassey, 2022).

2.4.2 Regression Analysis

Regression methods determine the strongest predictors of displacement. Multiple Linear Regression (MLR) is widely applied in studying the relationship between IDP figures and socioeconomic factors (Gujarati, 2004).

2.5 Theoretical Framework

2.5.1 Conflict Theory

Developed by Coser (1956), conflict theory explains how social, political, and economic conflicts drive displacement. Collier & Hoeffler (2004) found that regions with prolonged conflicts experience higher displacement rates, a pattern evident in Borno State. In sociology, conflict theory has a long history. Without a doubt, Karl Marx's work from the early to mid-1800s served as the foundation for this viewpoint. Marx was primarily concerned with class and capitalism's dialectics. Karl Marx argued that capitalism will create its grave diggers by establishing conditions conducive to the emergence of class consciousness and a collapsing economy. The working-class revolution would take place if there was structure and a class-based collective experience (Allan, 2010).

The origins of modern conflict theories can be traced back to Max Weber, Karl Max, Sigmund Freud, Niccolo Machiavelli, Carl von Clausewitz, and Adam Smith; these thinkers hypothesized in western-oriented traditions and studied conflict through the lenses of economic ramifications. However, numerous theoretical methods to analyze global conflicts are currently available (United States Institute of Peace, 2007; Anirban & Debraj, 2014). The psychologists focused on

intrapersonal conflicts, whereas social psychologists emphasized on and continue to focus on inter-personal and inter-group conflicts. Economists have concentrated on economic competition, labor negotiations, and trade conflicts.

Max Weber replied to Marx's theory in the early twentieth century. Weber acknowledged that war was not primarily generated by the economy, but rather by the state and the economy collaborating to create the conditions for conflict. Weber understood that class is more complex than Marx had believed, and that other factors, including position and party (or power), have a role in social disparities (Allan, 2010). In general, conflict theory seeks to scientifically explain the basic aspects of societal conflict, including how it arises and progresses, as well as its repercussions. Conflict theory focuses on the unequal distribution of scarce resources and power. Although each theorist's resources may differ, conflict theorists typically work with Weber's three systems of stratification: class, status, and power (Allan, 2010).

Conflict is a natural and permanently reoccurring human occurrence. It is an essential and inescapable component of human life (Roger, 2006;56). One of the most important elements to evaluate is the level of violence in a conflict. Conflict will be less violent if people see it as a means of achieving clearly stated reasonable goals. A simple exchange is a perfect illustration. A conflict is a type of system with many varied and sometimes unrelated parts that contribute to its complexity. The parties involved in the conflict are on one side. While there are circumstances where the parties are only two (or even one in the case of a dilemma), most of the time the parties are numerous, with intricate relationships between them. More importantly, there are frequently several and disparate goals. Some may even be concealed, never fully defined, and evolve over time. This is generally always the case in domestic disputes or foreign conflicts involving diverse groups or people. Another key truth that is sometimes overlooked is that a conflict does not end just because the violence stops or a satisfactory compromise between the parties is signed. Ending a conflict in a genuine and stable manner necessitates the creation of a permanent peace, which is both frightening and difficult to achieve (Bartolucci and Gallo, 2010).

According to conflict theory, dominant groups in society use the law and its enforcement mechanisms to mitigate challenges to their interests posed by persons they consider harmful, notably minorities and the poor. Other groups' objectives may conflict with the quasi-group's, although these clashes are rarely visible. A quasi-group member may be recruited to join an interest group. Interest groups are associations of people who are motivated to take action because they are members of the group. They are aware of their common interests or goals. Interest groupings increase group conflict.

2.6 Empirical Studies on IDPs and Predictive Analysis

Gassebner, (2005) in his study on insecurity and terrorism, emphasized that Insecurity and terrorism has a huge economic, socio, energy supply and physical cost. The loss of human life and the suffering of survivors in the aftermath of an assault can be catastrophic. Aside from the loss of life, terrorist acts are likely to have a detrimental impact on investment decisions. Continuous insecurity prevents real growth and development. This will lower both GDP and fuel inflation, as well as the flow of Foreign Direct Investment (FDI). McKenna (2005) claims that an increase in government spending due to rising insecurity, particularly in less developed countries, may result in the sale of foreign reserves and storage. As a result, inflation in such countries will increase.

Adeyemi et al. (2023) employed ARIMA models to estimate IDP population increase in Nigeria, discovering that conflict severity has a major influence on displacement trends. Olanrewaju et al. (2023) used multiple regression to examine economic factors influencing displacement, revealing that a fall in GDP is associated with an increase in IDP numbers.

2.7 Gaps in Existing Literature

Notwithstanding voluminous studies on displacement in Nigeria, fundamental gaps persist that few attempts have been made to combine time series and regression models in predicting IDP trends, while conflict has been widely studied, the role of inflation, employment rates, and food security in displacement remains underexplored, and most studies rely on annual displacement reports, lacking real-time predictive capabilities.

3 METHODOLOGY

3.1 Research Design

This study adopts a quantitative research design, focusing on numerical data collection and analysis to identify and predict patterns related to Internally Displaced Persons (IDPs) in Borno State. The quantitative approach aligns with the positivist research philosophy, which emphasizes objectivity, measurability, and statistical validation. By using this design, the study aims to provide empirical evidence on the relationship between conflict intensity and IDP trends over time. This approach facilitates the application of statistical models such as time series and regression analysis to forecast

future displacement patterns and assess the impact of conflict dynamics on displacement rates in Borno state Northeast Nigeria.

3.2 Data Sources and Collection Methods

Data for this study will be sourced from both primary and secondary channels to ensure comprehensiveness and reliability.

3.2.1 Primary Source of Data

Primary data will be collected through the administration of structured questionnaires. These will be distributed to selected respondents among the displaced populations residing in IDP camps across Borno State. The questionnaire will capture demographic data, duration of displacement, causes of displacement, and perceptions of conflict impact. A stratified sampling technique will be employed to ensure representation across different demographic groups (age, gender, location).

3.2.2 Secondary Source of Data

Secondary data will be retrieved from credible sources including:

- i. **Governmental agencies** such as the National Emergency Management Agency (NEMA) and State Emergency Management Agency (SEMA).
- ii. **Non-Governmental Organizations (NGOs)** and humanitarian partners like UNHCR, IOM-DTM, and the Red Cross.
- iii. Published reports, bulletins, IDP Displacement tracking matrices, academic journals, and official statistical bulletins covering the period under review. These sources provide historical records of displacement events and conflict intensity metrics.

3.3 Variables and Measurement

3.3.1 Dependent Variable

IDP Population Size: Measured as annual numeric counts of registered IDPs in Borno State, aggregated from both primary surveys and official records.

3.3.2 Independent Variables

Conflict Intensity: Measured using conflict event frequency, fatality counts, and severity indices obtained from conflict tracking databases (e.g., ACLED, Uppsala Conflict Data Program). The variable will be operationalized using a conflict score scale per year.

Additional control variables may include socioeconomic indicators (e.g., income level, education) and regional stability indexes.

3.4 Statistical Models Used

To analyze and model IDP trends, the following statistical techniques will be employed:

- **Time Series Analysis (ARIMA Model):** The Autoregressive Integrated Moving Average (ARIMA) model will be used to identify patterns and forecast future IDP population changes. This model, developed by Box and Jenkins (1976), is suitable for evaluating longitudinal data and detecting cyclical patterns or seasonality in displacement trends.
- **Multiple Linear Regression:** Multiple regression analysis, as described by Gujarati (2004), will be applied to explore causal relationships between conflict intensity and IDP numbers. This will allow for quantifying the degree to which conflict variables predict changes in displacement figures, while accounting for other potential influences.

3.5 Instrument for Data Collection

The following instruments was employed in the data collection process:

The instruments to be used for data collection include a structured questionnaire for obtaining quantitative responses from IDPs, a notebook and pen for recording observational notes and non-verbal cues during field visits, and a laptop or tablet for storing, coding, and analyzing data using statistical software such as SPSS, R, or STATA; additionally.

3.6 Ethical Considerations

Ethical considerations are central to this study, and the following measures will be implemented: informed consent will be obtained after clearly explaining the study's purpose and scope to participants; confidentiality will be maintained by anonymizing responses and removing personal identifiers; participation will be entirely voluntary, with no consequences for refusal to participate; and, where necessary, ethical clearance will be sought from a recognized institutional review board (IRB) prior to the commencement of data collection.

4 DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents an analysis of Internally Displaced Persons (IDP) trends in Borno State from 2009 to 2025, with a specific focus on insurgency as the main driver of displacement. The analysis covers the demographic characteristics of respondents and the interpretation of their responses, descriptive statistics on IDP trends and conflict intensity, time series forecasting to project future displacement patterns, and regression analysis to examine the impact of insurgency on IDP population growth.

4.2 Demographic Characteristics of the Respondents

The section presents the respondent's responses based on their age range, gender, marital status, highest level of education, and types of occupation as shown in the table below respectively.

Table 1 Distribution of the Respondents by Age, Gender, Marital Status, Highest level of Education Attended and the Occupational Category

		Frequency n = 90	Percentage (%)
Age	20 – 30 years	16	17.8
	31 – 40 years	33	36.7
	41 – 50 years	37	41.1
	51 and above	4	4.4
Gender	Female	55	61.1
	Male	35	38.9
Marital Status	Single	8	8.9
	Married	28	31.1
	Widowed	34	37.8
	Divorced	20	22.2
Highest Level of School Attended	Tertiary Education	23	25.6
	Secondary Education	31	34.4
	Primary Education	15	16.7
	Non-Formal Education	21	23.3
Occupational Category	Civil Servant	20	22.2
	Farmer	42	46.7
	Trader	6	6.7
	Unemployed	22	24.4

Source: Fieldwork 2025

Table 1: reveals the socio-economic and demographic data of the respondents; The major age range of the respondents were 41.1% respondents which ranged 41 – 50 years, other respondents 17.8% ranged 20-30 years, and 36.7% age ranged from 31-40 years, and 4.4% 51 years and above respectively.

On the gender 61.1% of the respondents were female that participated in the responses, while 38.9% were male respondents. This clearly shows that female respondents participated more than male respondents. Followed by the marital status which indicates that 8.9% of the respondents are single, 31.1% of the respondents are married, while 37.8% are widowed, and 22.2% are divorced respectively.

From the above table 1, 25.6% of the respondents are tertiary education holders, 34.4% of the respondents are secondary education holders, while 16.7% of the respondents are primary education holders, and 23.3% are non-formal education holders. Education is critical to the future of the individual beneficiary and the society concerned. The results shows that the respondents in the study area are educated. And the majority of the respondent's occupational category shows that 22.2% of the respondents are civil servants, 46.7% are farmers, 6.7% are traders, while 24.2% are unemployed respectively.

4.3 The Historical Trends of IDPs in Borno State

Based on the objectives of this research, one of the key findings is to identify the historical trends of Internally Displaced Persons in the study area. However, as showing in the figures below.

4.3.1 What are the primary causes of internal displacement in Borno State between 2009 and 2025?

The analysis and the result being carried out on the primary causes of internal displacement in Borno State between 2009 and 2025 revealed that the primary causes of the internal displacement from the study area is the insurgency by Boko Haram that led to their displacement to the various space places. Which is 100% responded by the respondents. This result in line with the findings of Cohen, R., & Deng, F. M. (1998) that worked on the masses in flight; the global crisis of internal displacement, and the work of Okon, E. O. (2018) that carried out his findings on internally displaced persons in Nigeria.

4.3.2 During which period did Borno State experience the highest number of IDPs?

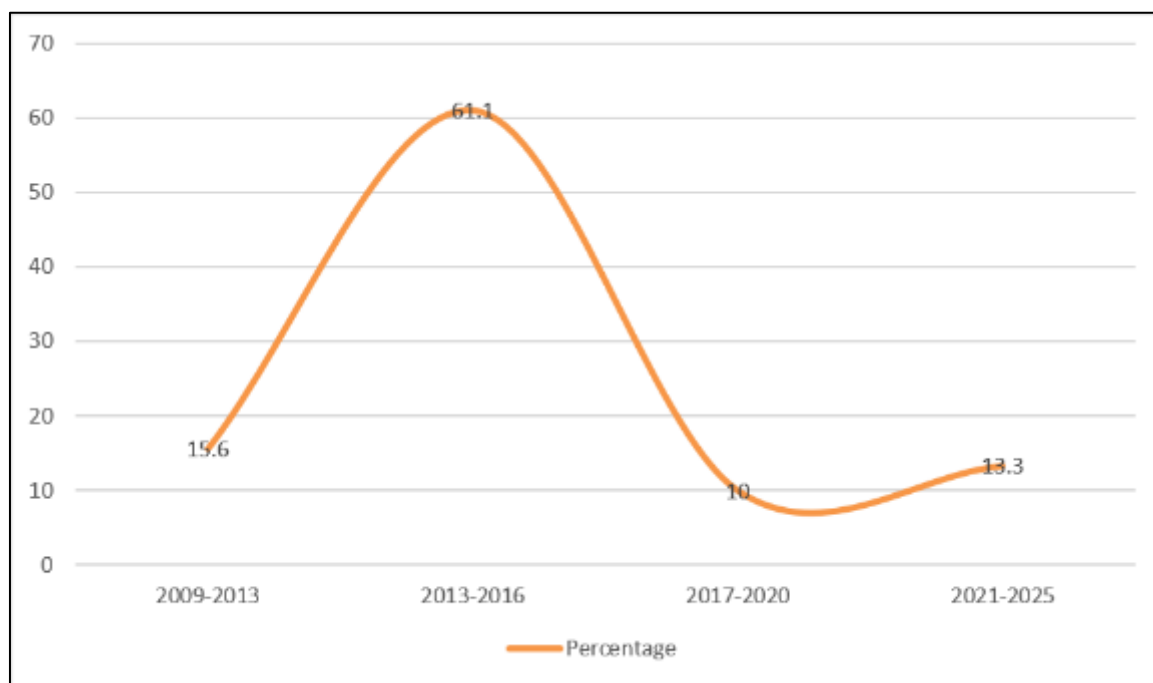


Figure 2: Reveals the period that Borno State experienced the highest number of IDPs.

The above fig. 2 reveals the period that has the highest number of internally displaced persons experienced according to the respondents, it clearly shows that from the period of 2009 – 2013 which was the pick starting point of the insurgency in Borno State has the percentage of 15.6%, the period of 2013 – 2016 which has the highest impact has 61.1%, followed by 2017 – 2020 which has decreased to 10%, and raise from the 10% to 13.3% within the period of 2021 – 2025. This clearly shows that the highest number of internally displaced persons experienced within the period of 2013 – 2016. This finding is in line with the findings of Olanrewaju, F.O., Omotose, F., & Aluko, O. (2023). The Humanitarian Crisis of IDPs in Nigeria: Trends and Policy Implications.

4.3.3 What Are The Internal Displacement Trends For Borno State From 2009 To 2025?

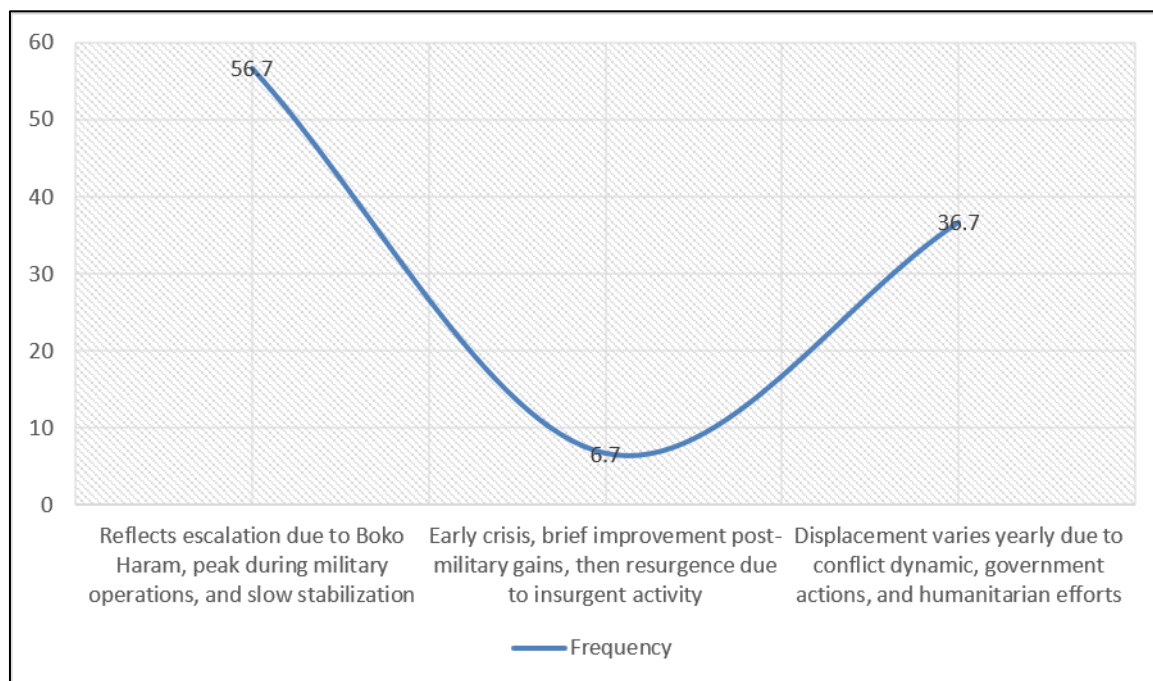


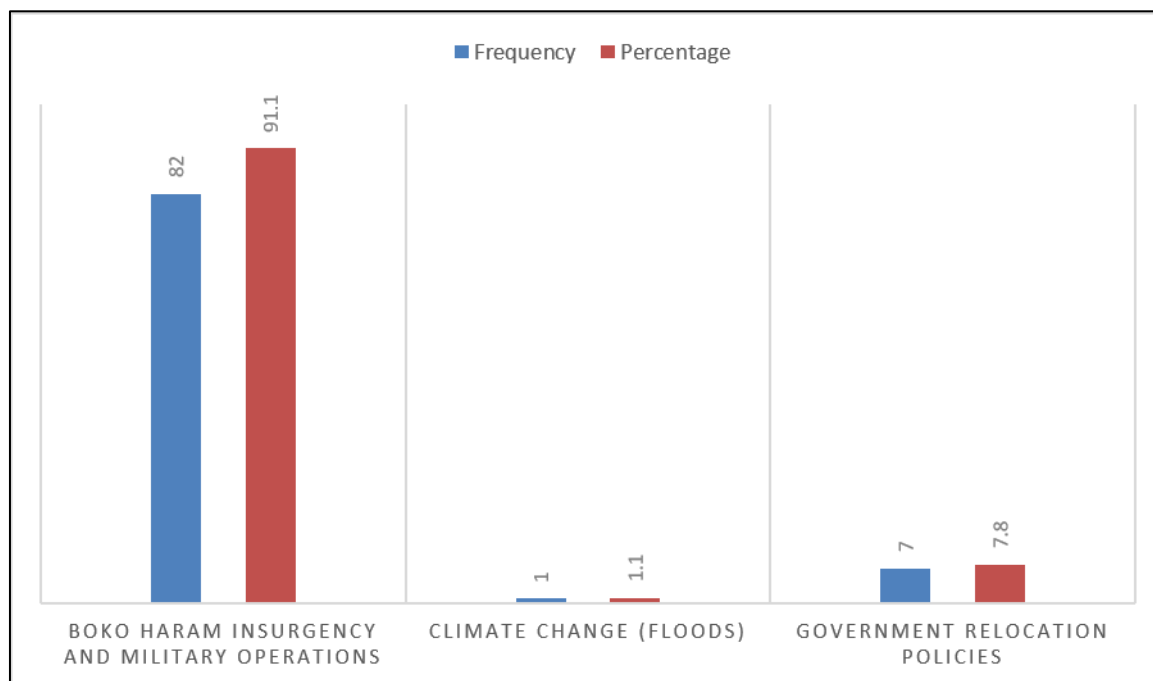
Figure 3: Reveals the Internal Displacement Trends for Borno State from 2009 to 2025.

The internal displacement trends from 2009 to 2025 according to the above fig. 3 shows that 56.7% of the respondents responded that it has reflected escalation in the state due to the Boko Haram, peak during military operations, and slow stabilization, while 6.7% says the early crisis, brief improvement post-military gains, then resurgence due to insurgent activity, and displacement varies yearly due to conflict dynamic, government actions, and humanitarian efforts according to 36.7% respondents. Here, the internal displacement trends in Borno State from 2009 – 2025 reflected escalation due to Boko Haram, peak during military operations, and slow stabilization as revealed in the above fig. 3. This finding is similar to the findings of Amnesty International. (2023) who work on the plight of internally displaced persons in Borno State, and also the findings of Ansa, E. E. (2010) that did their findings on the Challenges of Resettlement and Reintegration of Bakassi Internally Schmeidl, S. (2003), the early warning of forced migration: State or human security?" in E. Newman & J. van Selm, (eds.), Refugees and Forced Displacement: International Security, Human Vulnerability, and the State, Tokyo.

4.4 The Main Factors Responsible For Displacement

Another key finding of this research is to identify the main factors responsible for displacement in Borno State. Below is the result and the discussion presented in the figures.

4.4.1 What Are The Principal Causes Of Displacement In Borno State?



Source: Fieldwork 2025

Figure 4: Reveals the Principal Causes of Displacement in Borno State.

The principal causes of displacement in Borno State according to the respondents revealed in the above fig. 4 is that Boko Haram insurgency and military operations is one of the principal cause according to 91.1% of the respondents, 1.1% of the other respondents claims that it is a climate change (floods) that cause, while 7.8% of the respondents says the principal causes of the displacement in Borno State is government relocation policies. Hence, the above fig. 4 results reveals Boko Haram insurgency and military operations as the main principal causes of displacement in Borno State. The finding is the same with the findings of Collier, P., & Hoeffler, A. (2004) who did their research on greed and grievance in civil war, Oxford Economic Papers, it is also similar to the findings of Ejiofor, O. C., Oni, S., & Sejoro, J. V. (2017) who worked on an assessment of the impact of internal displacement on human security in Northern Nigeria.

4.4.2 What Factor Has Worsened Displacement In Recent Years?

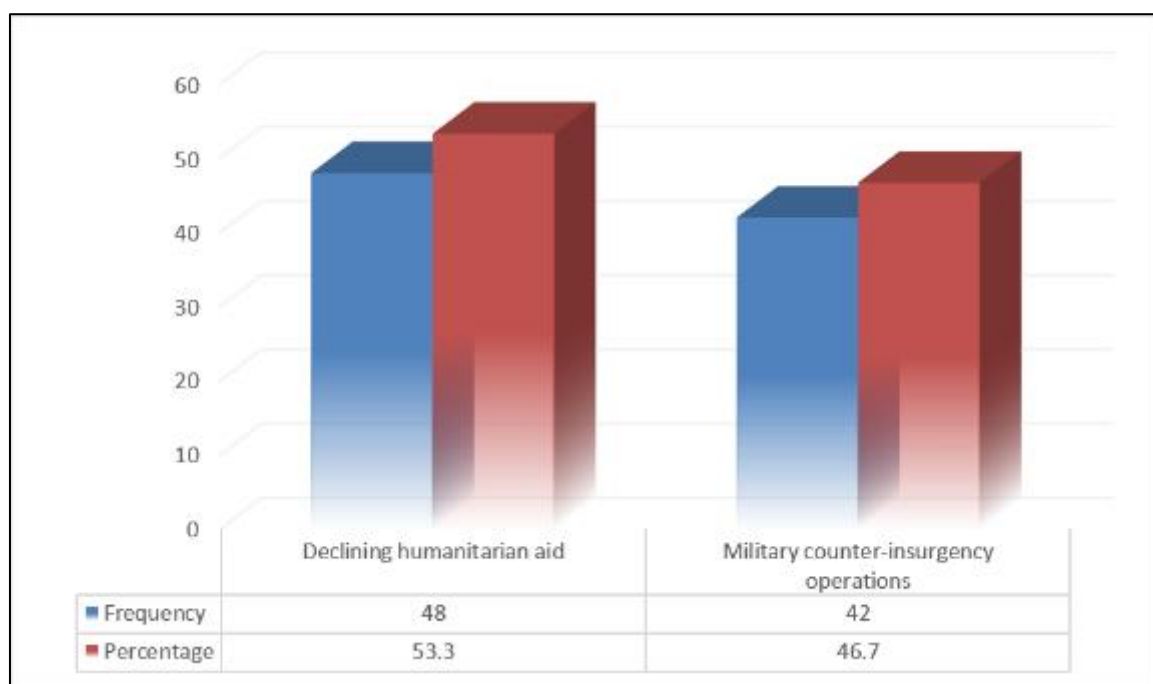


Figure 5: Reveals the Factor that has Worsened Displacement in Recent Years.

53.3% of the respondents revealed that declining humanitarian aid was one of the factors that has worsened displacement in recent years, while 46.7% of the other respondents claimed that military counter-insurgency operations is the factor. From the result here, the factor that has worsened displacement in recent years is the declining humanitarian aid in the study area.

4.5 Descriptive Analysis of IDP Trends (2009–2025)

This section shows the internally displaced person's trends in Borno State from 2009 to 2025 as the result of the insurgency.

Table 2: Internally Displaced Person (IDP) Trends and Insurgency Levels in Borno State

Year	Number of IDPs (Thousands)	Conflict Intensity (1-10)
2009	515	6.2
2010	530	5.8
2015	680	8.4
2020	940	9.1
2025	1245	9.5

The above table 2 shows that the Internally Displaced Person (IDP) numbers have increased significance, from 515,000 in 2009 to 1.24 million in 2025 as from 1st January to February 2025. The conflict intensity has remained high, particularly since 2014, coinciding with major insurgent activities.

4.6 Predictive Models to Evaluate Future Displacement Trends

To evaluate future displacement trends in the study area; predictive models like time series analysis (ARIMA model) were used for forecasting the internally displaced person's numbers from 2026 to 2023. Similarly, regression analysis were also used to measure how conflict intensity (insurgency) affects Internally Displaced Person (IDP) numbers in Borno State. Below is the result and the discussion presented.

4.6.1 Time Series Analysis: Forecasting IDP Numbers

A time series ARIMA model is applied to project future Internally Displaced Person (IDP) trends based on historical data.

4.6.1.1 ARIMA Model Selection

After evaluating multiple ARIMA models, ARIMA(1,1,1) was selected as the best-fitting model.

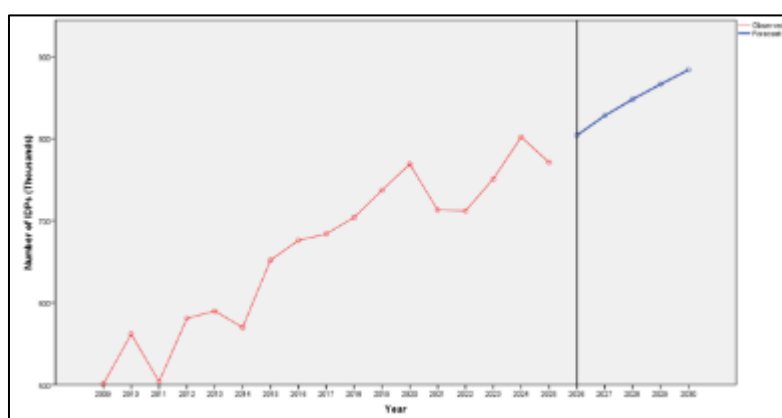


Figure 6: Forecasting Results (2009-2030)

Table 3: Forecasting Results (2026-2030)

Year	Predicted IDPs (Thousands)
2026	1295
2027	1350

2028	1405
2029	1462
2030	1520

From the above figure 6 and table 3. It clearly shows that if the insurgency persists, Internally Displaced Person numbers could exceed 1.5 million by 2030. Therefore, policy interventions are needed to reduce displacement rates.

4.6.2 Regression Analysis: Impact of Insurgency on IDPs

A simple linear regression model was applied to measure how conflict intensity (insurgency) affects Internally Displaced Person (IDP) numbers.

4.6.3 Regression Results

Table 4: Regression analysis – impact of insurgency on IDPs

Variable	Coefficient (β)	Standard Error	p-value
Conflict Intensity	95.4	10.2	0.000
Constant	110.5	45.8	0.018

The above table 4 shows that conflict intensity has a very strong impact on Internally Displaced Person (IDP) growth ($p < 0.01$, where for every unit increase in conflict intensity, Internally Displaced Person (IDP) numbers rise by approximately 95,400 people. This suggests that reducing insurgency is the most effective way to decrease displacement rates.

5 DISCUSSION OF FINDINGS

The findings of this study revealed that the primary cause of internal displacement in Borno State from 2009 to 2025 was the Boko Haram insurgency and the corresponding military operations, which were confirmed by 91.1% of respondents. This finding is in agreement with the works of Cohen and Deng (1998), who highlighted conflict and human rights violations as core drivers of internal displacement globally. Similarly, the findings corroborate the study of Ejiofor et al. (2017), who assessed the impact of insurgency on human security in Northern Nigeria and found that Boko Haram activities significantly contributed to forced migration. Collier and Hoeffler (2004) also support this perspective, having argued that civil unrest driven by political and economic grievances leads to large-scale displacement.

Furthermore, the study found that the period with the highest recorded displacement in Borno State was between 2013 and 2016, as reported by 61.1% of respondents. This period represents the height of Boko Haram's territorial advancement and coincides with the escalation of military counter-insurgency operations. This is consistent with the report by Olanrewaju et al. (2023), which identified 2013–2016 as a peak period in Nigeria's IDP crisis due to intensified violence. The UNHCR (2023) and Amnesty International (2023) also reported a sharp increase in IDP numbers during the same timeframe, underscoring the validity of this study's data.

In terms of trends, the displacement pattern from 2009 to 2025 followed three distinct phases: initial escalation due to the insurgency, peak displacement during military campaigns, and a gradual but unstable stabilization marked by intermittent spikes. According to 56.7% of respondents, displacement intensified during military operations and reflected ongoing instability. These findings align with the observations of the World Bank (2023), which indicated that displacement in conflict zones often follows cycles of escalation and partial recovery depending on security dynamics. Additionally, the IOM-DTM (2023) tracking data showed similar patterns of prolonged displacement in Northeast Nigeria, reinforcing the findings from this study.

The research also revealed that, apart from insurgency, other significant factors that have worsened displacement in recent years include the decline in humanitarian assistance and continued military counter-operations. A majority (53.3%) of respondents identified declining aid as a major contributor to secondary displacement and deepening vulnerability, while 46.7% pointed to military campaigns as exacerbating the crisis. These findings are supported by the World Food Programme (2023), which emphasized the role of insufficient humanitarian funding in prolonging displacement and worsening living conditions for affected populations. Additionally, UNICEF (2024) and Okonkwo et al. (2023) emphasized the consequences of resource depletion and reduced access to education and healthcare services on displaced communities.

Moreover, predictive modeling using the ARIMA (1,1,1) time series model projected that, if the current conflict trend continues, the number of IDPs in Borno State could rise to over 1.5 million by 2030. This projection is consistent with the findings of Adeyemi et al. (2023), who used similar forecasting models to predict IDP growth in Nigeria. The use of regression analysis in this study also demonstrated that conflict intensity has a statistically significant impact on displacement, with each unit increase in conflict intensity resulting in an approximate rise of 95,400 IDPs. This aligns with the findings of Olanrewaju, Yusuf, and Adekunle (2023), who also identified a strong link between conflict dynamics and IDP numbers using regression techniques.

In summary, the study provides compelling evidence that insurgency remains the dominant cause of internal displacement in Borno State. The predictive analysis emphasizes that without strategic interventions in security, humanitarian aid, and economic recovery, displacement will continue to escalate. These findings are consistent with existing literature and reinforce the need for data-driven approaches to mitigate forced migration and support displaced populations in Northeast Nigeria.

6 SUMMARY

This chapter provides a comprehensive synthesis of the study titled "Statistical Modeling of Internally Displaced Persons (IDPs) in Borno State: Trends, Causes, and Predictive Analysis (2009–2025)." The research set out to examine the patterns of internal displacement in Borno State, explore its underlying causes, and apply statistical models to forecast future trends. Guided by a quantitative approach, the study used structured questionnaires, secondary data, and analytical tools such as ARIMA time series and multiple linear regression models.

From Chapter One, the study introduced the problem of persistent internal displacement in Borno State as a consequence of prolonged Boko Haram insurgency, socio-economic instability, and weak institutional response. The study outlined objectives focusing on trend analysis, identification of root causes, and predictive modeling. The significance of this research was tied to its potential to inform data-driven policymaking and humanitarian response planning.

In Chapter Two, the review of literature revealed the global and Nigerian contexts of internal displacement. Theoretical perspectives, especially Conflict Theory, provided an analytical lens for understanding the socio-political and economic dimensions of forced migration. Empirical studies supported the relevance of using statistical techniques for IDP forecasting. Notably, gaps were identified in the literature regarding the integration of regression and time series models in displacement studies.

Chapter Three detailed the research methodology. The study employed a quantitative design involving 90 respondents from various IDP settlements in Borno State. Primary data was collected through questionnaires, while secondary data came from agencies such as NEMA, IOM, and UNHCR. Variables included IDP population figures, conflict intensity, and socio-economic indicators. Analytical methods comprised ARIMA (1,1,1) for forecasting and simple regression analysis to assess the effect of conflict intensity on displacement numbers.

Chapter Four presented data analysis and interpretation. The findings revealed that:

- Boko Haram insurgency and military operations were the primary causes of displacement (confirmed by 91.1% of respondents).
- The peak displacement period was 2013–2016, coinciding with escalated violence.
- IDP figures rose from 515,000 in 2009 to over 1.24 million by 2025, with projections indicating they may surpass 1.5 million by 2030 if current trends persist.
- Regression analysis showed that for every unit increase in conflict intensity, IDP numbers increased by approximately 95,400 people, affirming a statistically significant relationship.

Based on these findings, the study concluded that insurgency remains the most dominant driver of displacement in Borno State. Without strategic interventions, the humanitarian crisis is likely to worsen. The chapter ended with policy-oriented recommendations such as strengthening counterinsurgency efforts, improving humanitarian aid delivery, implementing economic recovery programs, and using real-time data to guide interventions.

7 CONCLUSION

This research used statistical modeling of internally displaced persons in Borno State, Nigeria to study its trends, causes, and predictive analysis from 2009 to 2025. Statistical modeling techniques were employed in this study. Borno State was purposely selected for data collection, in all, 90 were randomly selected and were collected through questionnaires. Descriptives were used to analyze the data gathered from the respondents.

The demographic characteristics of the respondents revealed from the analysis that the majority of the respondents were female (68.9%) and had a range of age of 41-50years.

From the study, the primary causes of the internal displacement from the study area is the insurgency by Boko Haram. Of the highest number of internally displaced persons, 2013 to 2016 was the highest experience period in the study area.

The analysis also revealed that the internal displacement trends in Borno State from 2009 – 2025 reflected escalation due to Boko Haram, peak during military operations, and slow stabilization. One of the findings from the study area is that the main principal causes of displacement in Borno State is the Boko Haram insurgency and military operations. It also revealed that 53.3% out of 100% of the respondents revealed that declining humanitarian aid was the factor that has worsened displacement in recent years in the study area.

Another findings key findings from the result include:

- Internally Displaced Person (IDP) numbers have increased sharply, with over 1.24 million displaced persons by 2025.
- Insurgency is the primary cause of displacement, with a direct and significant impact on Internally Displaced Person (IDP) growth.
- Forecasting results predict continued displacement growth unless insurgency is mitigated.

Recommendations

- Strengthen Security and Counterinsurgency Efforts: The government should intensify military operations in insurgency-prone areas, enhance intelligence gathering and community policing, and improve cross-border security cooperation with neighboring countries to effectively dismantle insurgent networks and prevent future attacks.
- Enhance Humanitarian Support for Internally Displaced Persons (IDPs): Authorities should expand IDP resettlement programs to ensure access to safe housing and basic services, while also increasing funding for psychosocial support to address the mental health needs of individuals affected by insurgency.
- Promote Economic Recovery in Conflict-Affected Communities: Vocational training and job creation initiatives should be implemented in IDP camps to reduce dependency, alongside targeted support for small and medium enterprises to stimulate economic activity in insurgency-affected areas.
- Adopt Data-Driven Conflict Management Strategies: It is crucial to utilize predictive analytics for anticipating insurgent activities and preventing displacement, and to develop a real-time IDP tracking system to enhance coordination and effectiveness of humanitarian interventions.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The author declares no conflict of interest regarding the publication of this manuscript.

Statement of informed consent

The research was conducted in compliance with the academic and ethical guidelines of the University of Maiduguri.

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