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Trends in the Burden and Prevalence of Stroke in Nigeria (1990-2021): Insights from the Global Burden of Disease 2021 Study

Abstract

Background: Stroke remains a leading cause of death and disability worldwide, with low- and middle-income countries bearing a disproportionate share of the burden. In Nigeria, evidence on long-term national trends is limited and often fragmented, primarily from hospital-based studies. This study aimed to describe the burden and temporal trends of stroke in Nigeria between 1990 and 2021 using data from the Global Burden of Disease (GBD) Study 2021.

Methods: We conducted a secondary analysis of GBD 2021 data for Nigeria. Estimates were extracted for stroke incidence, prevalence, mortality, and disability-adjusted life years (DALYs), including years of life lost (YLLs) and years lived with disability (YLDs). Data were analyzed as absolute numbers and age-standardized rates per 100,000 population. Trends were examined from 1990 to 2021, stratified by sex, age group, and stroke subtype. Average annual percent change (AAPC) summarized temporal trends.

Results: Between 1990 and 2021, Nigeria recorded steady declines across all stroke indicators. Age-standardized mortality decreased by nearly 40%, from about 170 to 102 per 100,000, while DALYs fell by almost half, from over 3,600 to about 2,120 per 100,000. Incidence declined from 196 to 151 per 100,000, and prevalence showed a modest reduction. In 2021, men experienced higher mortality and DALY rates than women, while women had slightly higher prevalence. Ischemic stroke was the predominant subtype, contributing most cases and DALYs. Declines were greatest in younger and middle-aged adults, with slower gains in the elderly. Regionally, Nigeria outperformed neighbouring countries, while Chad showed worsening trends.

Conclusion: Nigeria has made progress in reducing stroke incidence, mortality, and disability over three decades. However, the persistent disability burden, sex disparities, and slower progress in older adults call for strengthened prevention, acute care, and rehabilitation services.

Keywords: Stroke, Nigeria, Global Burden of Disease, Mortality, Disability-Adjusted Life Years

Research Article

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Introduction

Background

According to the World Stroke Organization's Global Stroke Fact Sheet 2025, stroke is a primary global health challenge and a leading cause of both death and disability worldwide. The report highlights that stroke is the world's second leading cause of death and the third leading cause of combined death and disability, as measured by disability-adjusted life years (DALYs). In 2010 alone, the World Health Organization estimates that approximately 15 million people experience a stroke each year, with 5 million deaths and an additional 5 million survivors living with lifelong disabilities.

The Global Burden of Disease (GBD) Study 2021 indicates that stroke continues to rise in absolute numbers, now ranking as the third leading cause of DALYs and second leading cause of death worldwide. In 2021, there were an estimated 11.9 million new stroke cases, 93.8 million individuals living with stroke-related disability, and 7 million deaths (GBD 2021 Stroke Collaborators, 2024). Strikingly, 87% of stroke-related deaths and 89% of stroke-related DALYs occur in low- and middle-income countries like Nigeria. Although age-standardized incidence and mortality rates have decreased, absolute numbers have

escalated due to aging populations and population growth. Between 1990 and 2021, there was a 70% increase in new strokes, a 44% rise in stroke-related deaths, and a 32% increase in DALYs [1]. This report attributes this growing burden to demographic shifts, including population growth and aging, as well as greater exposure to key risk factors like hypertension where about 32.5% of Nigerian adults affected, approximately 27.5 million people [2,3], obesity [4], Diabetes [5], air pollution and smoking [6].

In Nigeria, stroke has become a major public health concern. A meta-analysis in 2019 reported a pooled crude incidence of 26 (12.8–39.0) per 100,000 person-years and a prevalence of 6.7 (5.8–7.7) per 1,000 population. The rural oil-producing South-South zone reported the highest prevalence (13.4/1,000) [7]. Hospital studies reveal a heavy early fatality burden, with 30-day case fatality rates ranging from 19% in Abuja [4] to 41% in Lagos [8]. Even in recent reports from Southeast Nigeria, early mortality remains approximately 23% despite modern care [9].

Despite the profound global impact of stroke, gaps persist in understanding its epidemiological trends and burden within Nigeria, evidence remains fragmented and often limited to hospital-based studies that do not capture the nationwide burden. Most existing research in the country has focused on small populations or single regions, providing little insight into long-term trends. Furthermore, while the GBD project provides comprehensive estimates, there has been no systematic synthesis or contextualization of these data specifically for Nigeria. This leaves a critical gap in understanding how the incidence, prevalence, mortality, and disability burden of stroke have evolved over time and how Nigeria compares with regional patterns.

This study aimed to describe the burden and temporal trends of stroke in Nigeria from 1990 to 2021 using data from the GBD 2021 study. Specifically, we present estimates of incidence, prevalence, mortality and DALYs, stratified by stroke type, age, sex and Average Annual Percent Change (APPC) which is the statistical measure that summarizes the trend of a rate over a period of years.

Method

Data Source and Study Design

This is a secondary analysis of the GBD Study 2021 dataset, which compiles comprehensive, standardized estimates of disease burden globally. We extracted stroke-related data for Nigeria from 1990 to 2021 using the GBD Results Tool developed by the Institute for Health Metrics and Evaluation (IHME).

Measures and Metrics

We extracted and analysed the following indicators: Incidence (Number of new stroke cases per year), Prevalence (Number of people living with stroke), Mortality (Deaths attributed to stroke), and DALYs (Sum of years of life lost (YLLs) and years lived with disability (YLDs). All estimates were expressed as absolute numbers and as age-standardized rates per 100,000 population.

Data Extraction and Stratification

Data were stratified by overall trend, sex, APPC, stroke type and broad age groups. We included data for the years 1990 to 2021. Rates were age-standardized using the GBD standard population, because Nigeria's population has grown and aged between 1990 and 2021. The numbers may look higher simply because there are more people or more elderly people, not because stroke risk actually increased, to avoid that we used age-standardization in order to remove this "population structure" effect and allows fair comparison over time.

Data Analysis

Descriptive analyses were conducted to examine time trends. We used line graphs to visualize changes over time and bar graphs to depict sex-specific differences for 2021, we also used Heat map to show which of the selected sub-Saharan countries improved and which got worse, forest plot for seeing which trends are statistically significant. Python codes were used to generate the visualizations online using Google colab (https://colab.research.google.com/). No inferential statistical analyses were performed, as this study is descriptive.

Result

The trends observed across all four-key metrics: incidence, prevalence, mortality, and DALYs paint a consistently positive and encouraging picture of stroke care and prevention in Nigeria over the past three decades (figure 1). The most striking feature across all charts is the downward trajectory of every line. The most dramatic improvement is visible in the mortality rate, which fell from approximately 170 deaths per 100,000 people in 1990 to just over 102 in 2021, a reduction of nearly 40%. Complementing the fall in deaths is the significant drop in DALYs, which nearly halved from over 3600 to just under 2120 per 100,000. Furthermore, the decline in incidence rates from 196 to 151 new cases per 100,000 indicates a success in primary prevention and finally, the prevalence rate, which measures the total number of people living with the consequences of stroke, also declined, albeit more gradually.

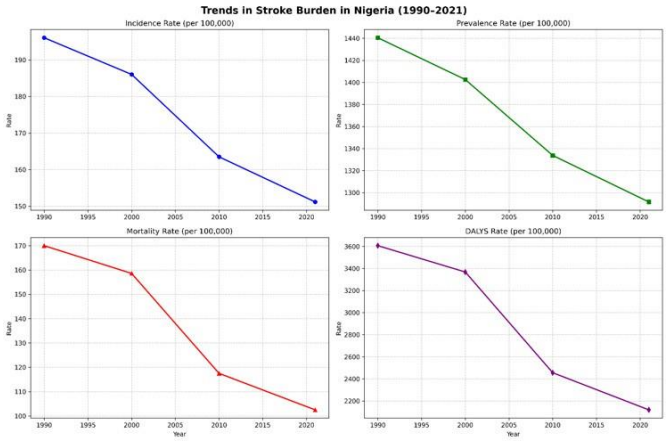

Figure 1: Line charts showing trends across all the metrics being studied

In figure 2, the 2021 data reveals a clear and distinct sex-based disparity in the experience of stroke burden in Nigeria. While the incidence is nearly identical between males and females, the outcomes and long-term impacts diverge significantly. The mortality rate for males (112.05 per 100,000) is markedly higher than for females (94.52 per 100,000). Males show a dramatically higher DALY rate (2385.89 vs. 1896.42 for females). Conversely, females show a higher prevalence rate (1319.30 per 100,000 vs. 1262.04 for males).

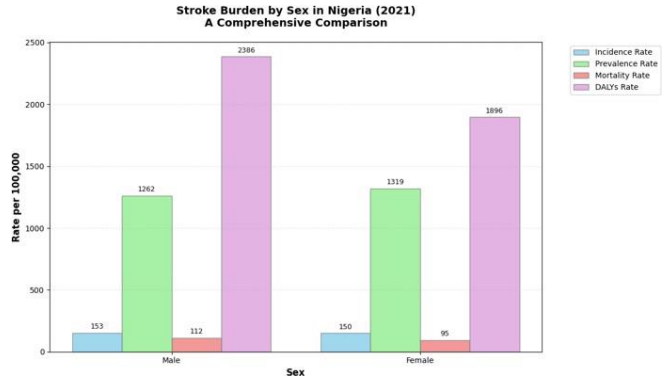

Figure 2: stroke burden comparison by sex (2021)

The visualization below (figure 3) shows that Ischemic stroke is by far the most common type people are living with (~987 per 100,000), dwarfing the prevalence of intracerebral (~238) and subarachnoid (~74) hemorrhages combined. This dominance is confirmed by the DALY rate, where ischemic stroke again claims the highest burden (~1097 per 100,000), representing the greatest loss of healthy life years due to both death and disability. Subarachnoid Hemorrhage has the lowest incidence (~4 new cases per 100,000), meaning it is the least common.

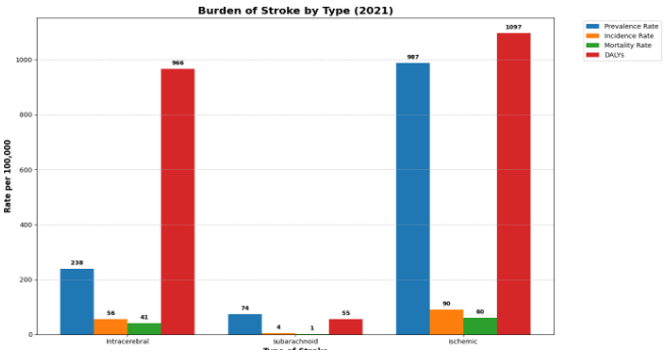

Figure 3: Stroke burden by type (2021)

The most striking pattern is the strong negative correlation between age and the rate of improvement (figure 4). For Deaths and DALYs, the AAPC becomes progressively more negative from the youngest age group (20-24) to the 50-69 group. For all metrics except Prevalence, the trend of accelerating improvement reverses sharply for the 70+ year's age group. The AAPC for Deaths in the elderly (-0.34%) is significantly higher (closer to zero) than in the 50-69 group (-0.53%). For Deaths and DALYs in the 20-24 and 25-29 age groups, the confidence intervals (the shaded area) cross the zero line. This means that while the central estimate suggests improvement, the trend is not statistically definitive. Stroke in young adults is a rarer event, leading to greater statistical uncertainty in measuring changes over time. The notable exception is the 70+ group for Prevalence, which shows minimal improvement (-0.05%), suggesting that the number of older people living with stroke consequences has remained stubbornly high.

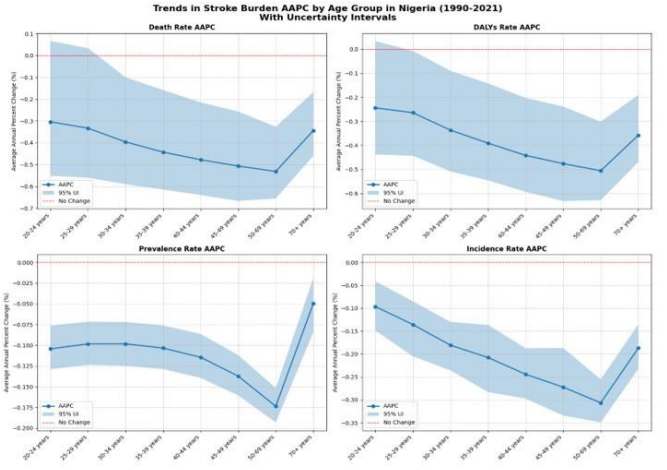

Figure 4: Stroke Burden by Age group

Nigeria emerges as the unequivocal regional leader in reducing stroke burden as shown below. Its performance on the grouped bar chart (figure 5) is outstanding. The country boasts the most negative AAPC values in three of the four key metrics: Deaths (-0.40%), DALYs (-0.41%), and Incidence (-0.23%). This indicates that Nigeria has not only

been highly successful in preventing new strokes but has also made remarkable strides in improving stroke care, leading to drastically fewer deaths and a significantly reduced overall burden of disability and premature mortality.

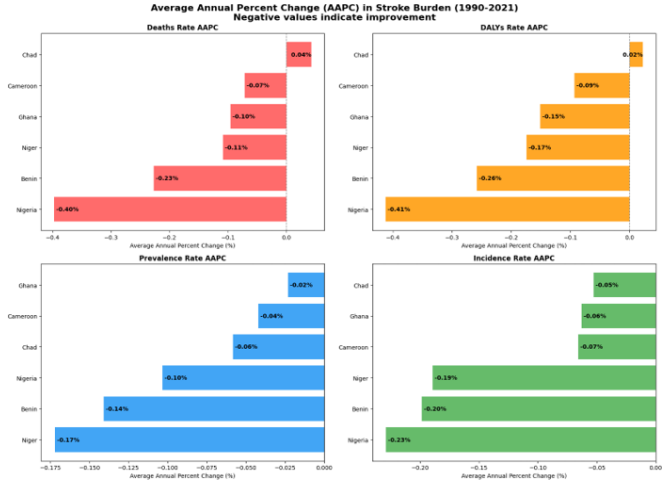

Figure 5: Stroke burden by AAPC

However, the progress is not universal, and the forest plot (figure 6) reveals critical nuances in the data. The forest plot for Death rates adds a layer of statistical certainty. It shows that the impressive improvements in Nigeria and Benin are robust; their entire confidence intervals (the horizontal grey lines) fall below zero. This means we can be statistically confident that the reduction in stroke deaths in these countries is a real trend. Conversely, the situation in Chad is a cause for serious concern. Chad is the only country with a positive AAPC value (0.04%) for stroke Deaths, indicating a worsening situation where stroke mortality is actually increasing annually. Furthermore, its confidence interval for Deaths is wide and crosses the zero line, stretching from negative (-0.19) to positive (0.34). The situation in countries like Cameroon, Ghana, and Niger is one of moderate progress with room for growth. These nations show negative AAPCs across most metrics, placing them in the “improving” category.

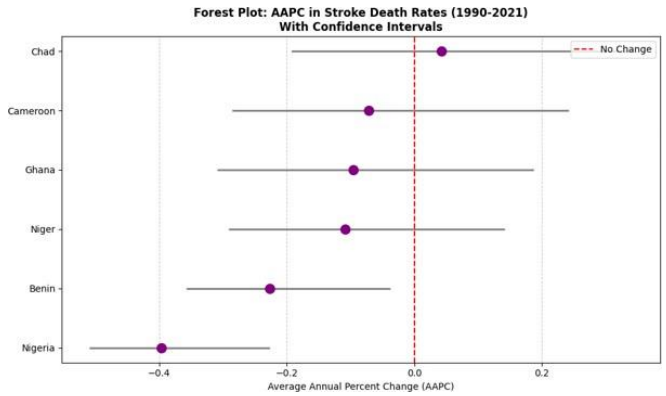

Figure 6: Stroke Mortality rates across some selected sub-saharan countries

The heatmap (figure 7) illustrates the AAPC in stroke-related DALYs, deaths, incidence, and prevalence between 1990 and 2021 across some selected Sub-saharan countries. Nigeria demonstrates the most pronounced decline across all measures, with AAPCs of –0.41 for DALYs, –0.40 for deaths, –0.23 for incidence, and –0.10 for prevalence, highlighting substantial progress in reducing both mortality and disability. Benin similarly shows consistent improvements, particularly in DALYs (–0.26) and deaths (–0.23). Ghana and Niger follow this pattern with modest but steady reductions across all metrics, suggesting positive though less dramatic progress. Cameroon also records improvements, albeit with smaller magnitude, especially in prevalence (–0.04).

In contrast, Chad stands out as the only country showing positive AAPCs for DALYs (+0.02) and deaths (+0.04), indicating a slight worsening in disease burden despite minor reductions in incidence and prevalence.

Figure 7: Heatmap of stroke burden in APPC

Discussion

This study provides an overview of the burden and long-term patterns of stroke in Nigeria from 1990 to 2021 using data from the GBD 2021 study. Our findings reveal a steady decline in incidence, prevalence, mortality, and DALYs over the past three decades, suggesting gradual but meaningful progress in lowering the country’s stroke burden. These trends mirror the global analysis by the GBD Stroke Collaborators (2024), which showed that while absolute numbers continue to rise due to population growth and aging, age-standardized rates of stroke mortality and DALYs have fallen. This points to improvements that go beyond any single factor; rather, they likely reflect a combination of better prevention, enhanced survival, and advances in long-term management.

The decrease in age-standardized incidence observed in

Nigeria contrasts with earlier systematic reviews that described either rising or stable rates across sub-Saharan Africa [4,10]. A plausible explanation for this difference is the recent progress in detecting and controlling key risk factors such as hypertension, diabetes, and obesity [3-5]. Typically, prevalence may increase when more people survive a stroke and live with its consequences. Interestingly, our results show that prevalence also declined, suggesting that the reduction in new cases was strong enough to outweigh the expected increase from better survival. Nonetheless, the persistence of relatively high prevalence indicates that many Nigerians who survive stroke continue to live with disability, a finding consistent with hospital-based studies reporting substantial residual impairments despite advances in acute care [11].

Among the four indicators, mortality showed the sharpest decline, dropping by almost 40% during the study period. This is consistent with global patterns, where improvements in acute management, broader access to antihypertensive and antithrombotic therapy, and better diagnostic tools have contributed to falling case-fatality rates [1]. However, hospital studies in Nigeria reveal that stroke-related deaths remain alarmingly high, ranging from 19% in Abuja [4] to more than 40% in Lagos [8]. These figures suggest that while population-level data reflect progress, outcomes at the clinical level remain constrained by limited stroke units, delayed hospital presentation, and gaps in specialized care [12].

The decline in DALYs reflects a major gain in reducing premature mortality, yet the sustained contribution of YLDs highlights the continuing rehabilitation challenge. This reinforces the urgent need for expanded neurorehabilitation services, physiotherapy-led programs, and innovative models such as community rehabilitation and tele-rehabilitation in Nigeria [13]. Without strengthening long-term care systems, the reduction in deaths could inadvertently lead to a growing population of survivors living with chronic disability.

Sex-based differences were also evident in our analysis. Higher mortality and DALY rates among men align with global reports of increased vascular risk and poorer stroke outcomes in males [13]. Conversely, the higher prevalence observed among women may be explained by longer survival after stroke, consistent with findings from African hospital cohorts where women outlive men despite similar incidence rates [7]. These disparities underscore the importance of tailoring prevention and rehabilitation strategies to sex-specific needs.

Our findings further establish that ischemic stroke is by far the dominant subtype in Nigeria, consistent with evidence from regional studies [10,14]. This pattern is likely linked to the widespread prevalence of uncontrolled hypertension and diabetes, both of which are well-recognized risk factors for ischemic events. In contrast, hemorrhagic stroke subtypes, though less common, remain associated with poorer acute outcomes and disproportionately high fatality rates. These results underscore the dual priorities for Nigeria: while continued investment in hypertension control remains essential, there is also an urgent need to improve access to neuroimaging and evidence-based acute interventions, such as thrombolytic therapy, for ischemic stroke.

Encouragingly, the steady reductions in mortality and DALYs observed among younger and middle-aged adults point to growing success in controlling modifiable vascular risks earlier in life. However, the markedly slower progress in individuals aged 70 years and above highlights the challenges of stroke management in an aging population. This trend is not unique to Nigeria, similar observations have been made across other low- and middle-income countries, where improvements in younger cohorts are often offset by stagnation among the elderly due to inadequate geriatric services and limited long-term care infrastructure [1].

At the regional level, Nigeria stands out for achieving the steepest reductions across DALYs, mortality, and incidence when compared with neighboring countries. In sharp contrast, Chad was the only country to show worsening trends, a finding that may reflect weaker health system capacity, delayed detection, and limited investments in stroke prevention and acute care [13]. Other countries, such as Cameroon, Ghana, and Niger, demonstrated modest but positive improvements, although their pace of progress lags behind Nigeria [15-17]. This regional variability highlights the importance of recognizing heterogeneity within West and Central Africa and points to the potential benefits of cross-country collaborations that strengthen prevention strategies, expand treatment capacity, and scale up rehabilitation services across borders.

Conclusions

Conclusively, this study demonstrates that Nigeria has made notable progress in reducing the burden of stroke over the past three decades, with consistent declines in incidence, prevalence, mortality, and DALYs. Despite these gains, the persistently high disability burden, sex and age disparities, and gaps in acute and rehabilitative care highlight the urgent need for strengthened prevention strategies, improved access to evidence-based treatments, and investment in long-term rehabilitation services.

Recommendations

To consolidate the gains achieved and further reduce the stroke burden in Nigeria, we recommend the following actions:

1. Strengthen primary prevention through nationwide hypertension screening, diabetes control, and lifestyle modification programs targeting modifiable risk factors.
2. Expand acute stroke care capacity by establishing dedicated stroke units, increasing access to neuroimaging, and ensuring availability of thrombolytic and antithrombotic therapies.
3. Invest in rehabilitation services, particularly physiotherapy and community-based neurorehabilitation, to reduce long-term disability and improve quality of life for stroke survivors.
4. Address disparities by developing tailored strategies for older adults and men, who bear disproportionate mortality and DALY burdens.

Acknowledgement

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Authors' contributions

IAA conceived the idea, design the study and analyze the secondary data, AA and NHM draft the introductory part and Methodology of the study, ZUD and BM extract data from GBD site, IMM and IAA draft the result, trend analysis and visualizations. All authors involve in the study discussions, conclusions, recommendations and approve the final version of the study.

Ethics approval and consent to participate

This study utilized publicly available secondary data from the Global Burden of Disease (GBD) study. The dataset is fully anonymized and contains no identifiable personal information. Therefore, ethical approval and informed consent were not required for this study.

Competing interests

All authors declared no competing interests

Clinical trial number

Not applicable

Funding

Not applicable

Data Availability declaration

The data that support the findings of this study are publicly available from the Global Burden of Disease study through the Institute for Health Metrics and Evaluation data repository (https://ghdx.healthdata.org/gbd-results-tool). No additional datasets were generated during the current study.

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