# Impact of Brain Drain on the Performance of the Health Sector in Nigeria

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## ABSTRACT

This study investigates the impact of brain drain on Nigeria's health sector output from 1990 to 2022. Employing a quantitative approach, the study analyzed secondary data to assess the relationship between brain drain, government health expenditure, net emigration, and death rate (a proxy for health sector output). While prior studies offer valuable insights, gaps remain in evaluating the **effectiveness of policy measures** and understanding the **interplay between push and pull factors** using frameworks like the **Push and Pull Theory.** The study utilized the Autoregressive Distributed Lag (ARDL) model to control for potential heterogeneity and co-integration. The findings indicate a significant negative correlation between brain drain and health sector output. To mitigate brain drain and enhance health system sustainability, the study recommends increasing healthcare worker salaries, improving working conditions, and offering career development opportunities. Additionally, bonding agreements, diaspora engagement through telemedicine and knowledge transfer, and increased health budget allocation are proposed as crucial strategies.

**Keywords:** ARDL, Brain Drain, Health Sector Output, Push and Pull Theory, Quantitative Analysis, Healthcare Workers

## INTRODUCTION

With its vast population of over 214 million, Nigeria requires a substantial healthcare workforce to meet the nation's health needs. However, the country is grappling with a severe shortage of healthcare professionals, particularly in rural areas. This shortage is exacerbated by the ongoing brain drain, a phenomenon where skilled healthcare workers emigrate to developed countries for better opportunities. Numerous factors contribute to this exodus, including inadequate compensation, poor working conditions, and a lack of government support. The consequences of this brain drain are far-reaching, leading to a decline in healthcare quality, increased mortality rates, and limited access to care for many Nigerians. Studies have shown that a significant proportion of Nigerian medical doctors aspire to work abroad. Okonkwo (2018) reported that 88% of Nigerian medical doctors aim to practice overseas, and Nweke and Iheonu (2021) documented a substantial increase in the number of Nigerian doctors relocating to the United Kingdom. This trend has further weakened the already fragile Nigerian healthcare system.

The shortage of healthcare professionals, particularly medical doctors, is a critical concern. The Nigeria Medical Association (NMA) estimates that it will take over 15 years to train enough physicians to meet the population's needs (Kareem, 2021). Moreover, the doctor-to-patient ratio in Nigeria is significantly lower than the World Health Organization's recommended standard (Adeloye, Adedimeji, Uthman, Mokuolu, and Afolabi, 2017), giving rise to medical tourism in Nigeria, as wealthy individuals seek medical treatment abroad due to the lack of skilled healthcare professionals domestically. This not only drains the country's economy but also exacerbates the existing shortage. To address this pressing issue, it is imperative to

understand the underlying factors driving the emigration of healthcare professionals from Nigeria. By analyzing the push and pull factors, policy-makers can develop effective strategies to retain talent, improve working conditions, and ultimately enhance the overall quality of healthcare in the country.

### Statement of Problem

Nigeria's healthcare system faces a significant challenge due to a severe shortage of healthcare professionals, particularly medical doctors. The country's doctor-to-patient ratio falls well below the World Health Organization's recommended standard, resulting in inadequate access to quality healthcare for its large population. This shortage is further exacerbated by the persistent issue of brain drain, where highly skilled healthcare workers emigrate to developed countries in search of better opportunities. The loss of these professionals has a detrimental impact on the country's healthcare infrastructure, leading to compromised healthcare delivery and poor health outcomes. The brain drain of healthcare professionals has far-reaching consequences for Nigeria's health sector. The exodus of skilled workers creates a significant void in the healthcare workforce, particularly in specialized areas like surgery. This shortage limits access to essential medical services and can lead to increased mortality rates. Additionally, the economic cost of training healthcare professionals who subsequently emigrate represents a significant loss of investment for the country. While the negative impact of brain drain on Nigeria's healthcare system is well-documented, there is a need for further research to specifically examine its effects on health sector output. This includes exploring the relationship between brain drain and key health indicators such as mortality rates, morbidity rates, and life expectancy. Additionally, the study will investigate the impact of brain drain on different regions of Nigeria, considering variations in healthcare infrastructure and access to services. By gaining a deeper understanding of the specific consequences of brain drain, policy-makers can develop targeted interventions to mitigate its negative effects and improve the overall health of the Nigerian population.

## LITERATURE AND THEORETICAL REVIEW

### Brain Drain

Brain drain refers to the emigration of highly skilled and educated individuals from one country to another, often for better economic, professional, or quality-of-life opportunities. It typically results in a loss of intellectual and technical talent for the home country, impacting its socio-economic development. According to the Oxford English Dictionary, brain drain is "the emigration of highly trained or qualified people from a particular country." Carrington and Detragiache (1998) define brain drain as the "international transfer of human capital, predominantly from developing to developed countries, where skills and education of migrants are highly valued." Grubel and Scott (1966) describe brain drain as the "departure of educated or talented individuals from one region to another for better opportunities."

### Skilled Migration

Skilled migration refers to the movement of individuals with specialized expertise, technical skills, or professional qualifications, usually to countries or regions with higher demand and better economic incentives for their skills. Unlike brain drain, skilled migration does not always have negative implications and may lead to mutual benefits for both the sending and receiving countries. The International Organization for Migration (IOM) defines skilled migration as "the movement of persons possessing expertise, qualifications, or skills that are in demand in the receiving country." Docquier and Rapoport (2012) describe skilled migration as "a significant component of international labor mobility, involving the relocation of workers with high levels of education and technical competence." Chiswick (2005) explains it as "the migration of individuals with above-average education and training for higher-income or career-oriented opportunities."

## Talent Flight

Salt (1997) defines talent flight as a "subtype of skilled migration, focusing on the loss of innovative and creative capabilities. "Talent flight is "the migration of people with significant creative, artistic, or entrepreneurial capabilities to regions or organizations offering more conducive opportunities" (Business Dictionary).

## Overview of the Nigerian Health Sector

The Nigerian health system is structured into three tiers: primary, secondary, and tertiary care. Governance and service delivery are shared among federal, state, and local governments. While the Federal Ministry of Health sets policies and regulations, states and local governments primarily manage health services (WHO, 2020).

Nigeria faces significant health challenges. Life expectancy is low at 55 years, maternal mortality is high at 512 deaths per 100,000 live births, and under-five mortality is 100 per 1,000 live births (World Bank, 2021). Despite progress in immunization and disease eradication, issues like underfunding, inadequate infrastructure, and limited access to essential healthcare persist. The country also grapples with high maternal and infant mortality rates, as well as the prevalence of infectious diseases such as malaria, HIV/AIDS, and tuberculosis (World Health Organization, 2020). The distribution of healthcare workers in Nigeria is uneven, with a concentration in urban areas and a shortage in rural regions. This imbalance, coupled with brain drain, exacerbates the challenges faced by the health sector. To address these issues, Nigeria needs to invest in healthcare infrastructure, strengthen the health workforce, and implement effective health policies. Additionally, community engagement and health education are crucial for improving health outcomes and reducing the burden of disease.

## Global Perspective on Brain Drain

Countries like India, the Philippines, and Ghana also face significant healthcare worker migration. The factors driving this migration are many-sided and include limited career opportunities, inadequate compensation, poor working conditions, and a desire for a better quality of life (Docquier & Marfouk, 2004). Examining these cases reveals common push and pull factors, providing a comprehensive understanding of the problem. Several countries have successfully mitigated brain drain. Cuba, for instance, focuses on training a large domestic healthcare workforce and promoting international collaboration for knowledge exchange (World Bank, 2021). Analyzing these success stories can provide valuable insights for developing effective strategies in Nigeria. International collaborations, such as exchange programs, mentorship opportunities, and joint research projects, can foster knowledge transfer and encourage skilled professionals to stay or return to their home countries.

## Case Studies of Countries that Have Successfully Mitigated Brain Drain

Several countries have implemented strategies to alleviate brain drain.

1. Cuba: Cuba has a robust system of medical education and training, coupled with a strong emphasis on social responsibility. The government provides scholarships and other incentives to medical students, with the expectation that they will serve in underserved areas upon graduation (Carrington & Kerr, 1993).
2. Singapore: Singapore has invested heavily in education and research, creating a conducive environment for innovation and entrepreneurship. The government offers attractive incentives, such as competitive salaries, excellent working conditions, and opportunities for career advancement, to retain

talent.

## Conceptual Framework

### Brain Drain

The concept of brain drain, the emigration of highly skilled individuals from developing to developed countries, has been a subject of concern for decades. As Oldfield et al. (1963, as cited in Osigbesan, 2021) noted, the Royal Society's investigation in the 1960s highlighted the significant loss of scientists from the UK to North America, underscoring the long-standing nature of this phenomenon. The World Health Organization (WHO, 2010) defines brain drain as the emigration of highly trained medical personnel from developing countries to developed ones. However, this definition understates the broader impact of brain drain, which extends beyond the medical field to include a wide range of skilled professionals. As Docquier and Marfouk (2004) argue, brain drain not only depletes the number of skilled individuals but also diminishes a nation's collective knowledge, skills, and experience. This loss can significantly hinder healthcare delivery, innovation, and overall economic development. The uneven distribution of healthcare professionals, with a surplus in developed nations and a critical shortage in developing ones, creates significant health inequities. Carrington and Kerr (1993) highlight the consequences of this imbalance, including reduced access to essential healthcare services and compromised care quality. Furthermore, Bhargava, Desai, and Lundberg (2017) emphasize the erosion of healthcare capacity in countries experiencing brain drain, affecting service provision, research capabilities, and ultimately, population health outcomes.

The motivations behind brain drain are complex and multifaceted. Push factors, such as limited opportunities, low wages, and political instability, drive individuals to seek better prospects abroad. Conversely, pull factors, such as higher salaries, advanced research facilities, and improved quality of life, attract them to developed countries. De Haas (2010) highlights the negative consequences of skilled migration, including reduced access to healthcare services and decreased innovation. However, it's important to acknowledge the potential benefits of brain drain, such as remittances sent by migrants and the return of skilled individuals with new knowledge and expertise. Historically, brain drain has been exacerbated by factors such as colonialism and globalization. The transatlantic slave trade, as described by Adi (2012), Whatley and Gillezeau (2011), and Ukwandu (2020), represents a historical example of forced migration that depleted Africa of its skilled workforce. To address the brain drain challenge, a multifaceted approach is required. This includes investments in education and healthcare, improved working conditions, and policies to encourage the return of skilled migrants. By understanding the complex factors driving brain drain and implementing targeted interventions, countries can mitigate its negative impacts and harness its potential benefits.

### Death/Mortality Rate

The death rate, or mortality rate, is a critical demographic indicator that measures the number of deaths within a population over a specific period. It is typically expressed as the number of deaths per 1,000 individuals per year (World Health Organization, 2021). Accurate calculation of death rates relies on reliable data from healthcare providers, civil registration systems, and vital statistics agencies (CDC, 2021). However, under-reporting and misclassification of deaths can distort these estimates. The concept of tracking deaths has ancient roots, with civilizations like the Egyptians keeping records for various purposes. In the 17th century, John Graunt's work on mortality tables laid the foundation for calculating death rates. William Farr's contributions in the 19th century further advanced the field by advocating for reliable death registration systems and age-adjusted death rates. Several assumptions underpin the calculation and interpretation of death rates:

**Accurate Reporting**: Reliable data collection is essential to avoid under-reporting and misclassification of deaths (Murray, Kulkarni, Lopez and Ezzati (2013).

**Population Stability**: The population within the study period should remain relatively stable, without significant migration or changes in age structure (Preston, Younquist, and Oeppen, 2001); United Nations Population Division, 2019).

**Standardized Definitions**: Consistent definitions and classifications of causes of death are necessary for accurate comparisons across populations (Murray et al., 2013; Mathers and Salomon, 2009; World Health Organization, 2016).

The death rate serves as a valuable indicator of the performance of a health sector. A well-functioning healthcare system is expected to correlate with lower death rates. As Ayanian, Weissman, Schneider, Ginsburg, Zaslavsky and Unwin, (2017) demonstrated, access to healthcare, particularly for individuals with chronic conditions, is crucial in reducing mortality rates. By providing early diagnosis, treatment, and preventive care, healthcare systems can significantly impact public health outcomes.

In the context of healthcare workforce migration, understanding the relationship between death rates and health sector output is essential. The emigration of skilled healthcare professionals can weaken healthcare systems, potentially leading to increased mortality rates. By analyzing death rates, policymakers can assess the impact of brain drain and implement strategies to mitigate its negative consequences.

**Empirical Literature**

Nigeria's healthcare system is grappling with a significant challenge posed by brain drain, the emigration of highly skilled healthcare professionals to developed countries. Several studies have delved into the causes and consequences of this phenomenon. Udom, Efi, and Baridam (2024) examined the impact of brain drain on healthcare service delivery in Akwa Ibom State, Nigeria. Their research highlighted key push factors, such as poor working conditions, low salaries, and political instability, as well as pull factors like better pay and advanced facilities. The study revealed challenges like under-staffing and increased workloads for remaining healthcare workers. Earlier, Akinwale and George (2023) investigated the impact of brain drain on healthcare delivery among public healthcare workers in Nigeria. Their study found widespread concern among healthcare workers regarding the severity of brain drain, primarily attributed to poor working conditions, low salaries, and limited professional development opportunities.

In a broader context, Abubakar, Dalglish, Angell, Sanuade, Abimbola, Adamu, and Zanna, (2022) set forth strategies for improvement with key challenges identified, including inadequate funding, poor infrastructure, and limited access to quality care. To gain a deeper understanding of the factors influencing the emigration of healthcare professionals, Amorha, Irobi, and Udoh (2022) investigated the brain drain potential among final-year pharmacy students in Nigeria. The study assessed factors influencing their intentions to emigrate, providing insights into the causes and consequences of brain drain. Dahiru, Alkali, Adebayo and Lawal, (2022) investigated reasons why Nigerian medical personnel are leaving the country and the impact of this brain drain on the quality of healthcare delivery. The study found that brain drain negatively affects healthcare quality, mediated by job satisfaction. Adeyemi, Akowe, Ebenezer, and Attah (2018) took a broader perspective, analyzing brain drain's causes, effects, and implications on Africa's economic development. The study highlighted concerns over the outflow of skilled individuals to developed nations, emphasizing economic, political, and social factors driving this phenomenon. Urbanski (2022), comparing the push and pull factors affecting migration, looked at the factors that drive migration between Poland and Romania, with a particular emphasis on push and pull factors. The study sought to determine the overall and individual impact of these factors on migration activities. Primary data were gathered from migrants in both

countries through a structured questionnaire, resulting in two hundred and ninety-eight (298) and two hundred and eighty-eight (288) responses from Poland and Romania, respectively. The research applied the push and pull migration framework, ensuring the validity, reliability, and factor analysis of the model. Hypotheses were examined using multiple regression analysis. The research findings are noteworthy and in line with earlier studies conducted on the subject. The hope of better job opportunities and a better life abroad, for example, are pull factors that have a greater effect on migration than push factors like social and political issues in the country of origin. The above study was done on a different region of the world and considered only the factors that encourage migration from Romania to Poland.

Zeng, Musiega, Oyasi, Di Giorgio, Chuma, Lu, and Ahn, (2022), seeking an "understanding of the performance of county health service delivery in Kenya, employed a mixed-methods approach, combining quantitative and qualitative data, to provide a comprehensive understanding of the challenges and opportunities facing the Kenyan healthcare system. The study found that the performance of county health service delivery in Kenya is uneven, with some counties experiencing significant improvements in access to healthcare services while others continue to face challenges. It also identified several factors that contribute to these disparities among counties which include variations in resource allocation, workforce capacity, and infrastructure developments. There is an emphasis on the importance of a multi-pronged approach to improving county health service delivery in Kenya and the need for collaboration between national and county governments.

While these studies offer valuable insights into the multifaceted issue of brain drain in the Nigerian healthcare sector, further research is necessary to explore the long-term effects of brain drain and the effectiveness of policies aimed at mitigating its impact. To understand the complex factors driving migration, including the brain drain of healthcare professionals, the Push and Pull Theory provides a useful framework. This theory, rooted in Ravenstein's Laws of Migration, posits that migration decisions are influenced by a combination of factors that either push individuals away from their home countries or pull them towards destination countries. This theory has been extensively developed and refined over the years. E. Lee's seminal work in 1966 provided a systematic framework for understanding migration decisions, emphasizing the role of economic factors. Lee identified push factors, such as unemployment, poverty, and political instability, as negative conditions that compel individuals to leave their home countries. Conversely, pull factors, including higher wages, better job opportunities, and improved living standards, attract migrants to destination countries.

Subsequent research has expanded the scope of the Push and Pull Theory to a broader range of factors. Greenwood's work in 1969 recognized the importance of social and political considerations, while Harris and Todaro's 1970 study delved into the dynamics of rural-to-urban migration. Stark and Bloom's 1985 research highlighted the interconnectedness of source and destination regions, emphasizing the need for policies that address the needs of both. Massey, Goldring, and Durand. (1994)'s work, particularly their concept of cumulative causation, further enriched the theory by emphasizing the role of social networks, cultural ties, and institutional structures in shaping migration patterns. Barbier's 1997 study introduced environmental factors as both push and pull factors, recognizing the impact of climate change and natural disasters on migration decisions. More recently, Gibson and McKenzie's 2011 research focused on the migration of highly skilled individuals, highlighting the role of unmet needs and individual-level factors. The Push and Pull Theory provides a valuable framework for understanding the complex factors that drive migration. However, it is important to acknowledge that the theory has limitations and that migration decisions are often influenced by a multitude of factors that may not be fully captured by the traditional push-and-pull dichotomy.

Applying this theory to the Nigerian context, we see that the country experiences both internal and international migration. Several factors contribute to this migration, including economic disparities, political

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instability, and social inequalities. Push factors, such as unemployment, poverty, and limited opportunities, compel individuals to seek better prospects elsewhere. Pull factors, such as higher wages, better job opportunities, and improved living standards, attract Nigerians to countries with more developed economies. The brain drain of highly skilled professionals, particularly in the healthcare sector, is a significant challenge for Nigeria. Push factors, such as low wages, poor working conditions, and inadequate infrastructure, drive healthcare workers to seek better opportunities abroad. Conversely, pull factors, such as higher salaries, advanced technology, and better working conditions, attract Nigerian healthcare professionals to developed countries. To address the challenges posed by migration, Nigeria needs to implement comprehensive policies that address the root causes of migration, such as poverty, inequality, and corruption. By investing in education, healthcare, and infrastructure, the government can create opportunities and improve living conditions within the country. Additionally, policies that facilitate the return of skilled migrants and promote their reintegration into the Nigerian economy can help mitigate the negative impacts of brain drain.

## METHODOLOGY AND MODEL SPECIFICATION

To quantitatively assess the impact of brain drain on health sector performance in Nigeria, this study adopted a quantitative research design. An Autoregressive Distributed Lag (ARDL) model was employed to estimate the long-run and short-run relationships between brain drain, government expenditure on health, net migration, and health sector performance. This econometric technique is well-suited for analyzing the dynamic relationships between variables over time.

The study adapted the model of Adeyemi et al. (2018), which is given as:

$$RGDPt = \beta 0 + \beta 1BRt + IMQt + REMt + HCDt + INFRAt + \mu \quad (1)$$

Where:

RGDP = Real Gross Domestic Product

BR = Brain Drain

IMQ = Immigration Quota

REM = Workers' Remittances

HCD = Human Capital Development

INFRA = Infrastructure

$\mu$ = Error Term

However, this study adapts the model in the following form:

$$DRATE = BRDR + NEMIR + GHEXP \quad (2)$$

Where:

DRATE = Death Rate

BRDR = Brain Drain

NEMIR = Net Migration

GHEXP = Government Health Expenditure

The econometric function is specified as follows:

$DRATE = \beta0 + \beta1\ BRDR + \beta2\ NEMIR + \beta3GHEXP + \mu$ (3)

Where:

$\mu$ = Error Term

$\beta0$ is the constant or intercept of the regression model

$\beta1$, $\beta2$ and $\beta3$ are the coefficients or slopes of the regression models

The econometric model indicates the link between the observable dependent variable, the observable explanatory variables and the error term or stochastic term. Therefore, $\beta_0$ is the intercept which explains the Health Sector Performance when the explanatory variables are equal to zero; $\beta_1$, $\beta_2$ and $\beta_3$ are the coefficients of the explanatory variable explaining the effects on the dependent variable.

**Sources of Data and Measurement**

To estimate the model, time series data for the period 1990 to 2022 was collected from various sources. Data for health sector output, government expenditure on health, and net migration were sourced from the World Development Indicators (WDI) database. The data for Brain Drain, proxied by the emigration of health workers, was sourced from the World Health Organization (WHO) database.

## DATA ANALYSIS AND FINDINGS

To examine the research hypotheses, an econometric model was employed, utilizing time series data sourced from the World Development Indicators (WDI) database for the period 1990 to 2022. Additionally, data on brain drain, proxied by the emigration of health workers, was sourced from the World Health Organization (WHO) database. The research hypotheses were examined using ARDL regression analysis. The findings of the research underwent a comprehensive battery of supplementary evaluations to substantiate their validity.

**Descriptive Statistics of the Variables**

Descriptive statistics were employed to provide an overview of the key variables. Table 4.1 presents the mean, standard deviation, maximum, minimum, and other relevant statistical measures for each variable. This analysis offers insights into the central tendency, dispersion, and overall distribution of the data.

**Table 4.1: Showing the Descriptive statistics of the variables**

| | DRATE | BRDR | NEMIR | GHEXP |
|---|---|---|---|---|
| Mean | 15.52152 | 0.050576 | 1.14697 | 3.664848 |
| Median | 15.84 | 0.05 | -2.33 | 3.42 |
| Maximum | 18.58 | 0.09 | 11.52 | 6.93 |
| Minimum | 11.42 | 0.015 | -2.94 | 2.49 |

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| | | | | |
|---|---|---|---|---|
| Std. Deviation | 2.617875 | 0.023532 | 5.566919 | 0.807578 |
| Skewness | -0.21826 | 0.087656 | 0.896753 | 2.153772 |
| Kurtosis | 1.477366 | 1.721119 | 1.902202 | 9.295483 |
| Jarque-Bera | 3.449832 | 2.291121 | 6.080009 | 80.00856 |
| Probability | 0.178188 | 0.318046 | 0.047835 | 0 |
| Sum | 512.21 | 1.669 | 37.85 | 120.94 |
| Sum Sq. Dev. | 219.3046 | 0.01772 | 991.6989 | 20.86982 |
| Observations | 33 | 33 | 33 | 33 |

Descriptive statistics presented in Table 4.1 provide a summary of the statistical properties of the variables employed in the study. There is a notable variance between the standard deviations and the mean values across the variables, indicating varying levels of stability over time. DRATE and BRDR exhibit relatively lower variability, whereas NEMIR displays a high standard deviation, suggesting significant fluctuations. DRATE and BRDR are approximately symmetric, while NEMIR and GHEXP are positively skewed. The high kurtosis for GHEXP indicates the presence of potential outliers. Furthermore, the low probability values from the Jarque-Bera test for NEMIR and GHEXP indicate that these variables do not follow a normal distribution. This uneven distribution necessitates further tests to ascertain the stationarity of the parameters.

**Unit Root Test**

To establish the stationarity of the variables, this study adopts the widely used Augmented Dickey-Fuller (ADF) test. Unit root tests were conducted to determine if the variables were stationary or not, as presented in Table 4.2. The results of the unit root tests for all the variables were conducted using the Augmented Dickey-Fuller (ADF) test.

**Table 4. 2 Unit Root Result using Augmented Dickey-Fuller (ADF)**

| At Levels | | | | At first Difference | | | |
|---|---|---|---|---|---|---|---|
| **Variable** | **ADF stat** | **5% level** | **Prob. Value** | **ADF stat** | **5% level** | **Prob. Value** | **Order of Integration** |
| DRATE | -4.721 | -2.983 | 0.0001 | 0.957 | -2.986 | 0.9938 | I(0) |
| BRDR | -1.504 | -2.983 | 0.9975 | -12.635 | -2.986 | 0 | I(1) |
| NEMIR | -1.591 | -2.983 | 0.488 | -3.965 | -2.986 | 0.0016 | I(1) |
| GHEXP | -2.352 | -2.983 | 0.1556 | -3.744 | -2.986 | 0.0035 | I(1) |

*Source: Computation by researchers using Stata 15,2022*

**Decision Rule**

The decision rule for stationarity is as follows: if the t-statistic is greater than the critical value at a 5% significance level or the probability value is less than 0.05, the variable is considered stationary. Otherwise, differencing is required to achieve stationarity. Applying this decision rule to the results of the Augmented Dickey-Fuller unit root test, presented in Table 4.2, we find that the variables exhibited different orders of

integration. Specifically, Death Rate (DRATE) was found to be stationary at levels, while Brain Drain (BRDR), Net Migration (NEMIR), and Government Health Expenditure (GHEXP) became stationary after first differencing.

**Co-integration Test**

Given the mixed order of integration among the variables, the study employed the Autoregressive Distributed Lag Bound Co-integration test (Pesaran, Shin, and Smith, 2001) to determine the presence of a long-run relationship. The results of this test are presented in Table 4.3:

**Table 4.3 ARDL Bound Co-integration Test**

| **Estimated Model** | **F – statistics** | | |
|---|---|---|---|
| | K = 3 | 2.052 | |
| **Critical values** | **Lower Bound I(0)** | | **Upper Bound I(1)** |
| 1% | 4.29 | | 5.61 |
| 5% | 3.23 | | 4.35 |
| 10% | 2.72 | | 3.77 |

Source: Authors' computation using Stata 15, 2022.

The results of the co-integration test in Table 4.3 show that the value of the F-statistic is 2.052 for the model involving DRATE, BRDR, NEMIR, and GHEXP. Comparing this F-statistic to the critical values at the 5% significance level (3.23 for I(0) and 4.35 for I(1)), we find that 2.052 is below both the lower and upper bounds. This suggests that there is no co-integration among the variables at this level. Therefore, this study proceeds with the estimation of both the short-run and long-run ARDL regression estimates.

**Analysis of Estimates of Long and Short-Run ARDL Regression of the Model**

**Table 4.4: Long and Short Run ARDL Regression Estimates on the DRATE Model**

| **Variables** | **coefficients** | **Std. Error** | **T – statistics** | **Prob.** |
|---|---|---|---|---|
| ADJUSTED D. DRATE | -0.10588 | 0.001892 | -5.62 | 0.011 |
| LBRDR | -0.69756 | 0.004583 | -152.21 | 0.004 |
| LNEMIR | -0.00805 | 0.005781 | 1.39 | 0.397 |
| LGHEXP | -0.0644 | 0.005314 | -12.12 | 0.052 |
| **SHORT-RUN ESTIMATE** | | | | |
| D LBRDR | 0.002932 | 0.001397 | -2.1 | 0.028 |
| D LNEMIR | 0.004224 | 0.000131 | 32.14 | 0.02 |
| D LGHEXP | -0.00307 | 0.00034 | 9.02 | 0.07 |
| C | 0.056179 | 0.002609 | 21.53 | 0.03 |

| | |
|---|---|
| R – squared | 0.71 |
| Adjusted R – Squared | 0.68 |
| Durbin – Watson Statistics | 1.90456 |
| Heteroskedasticity | (Prob>chi2) 0.4167 |
| Normality test (Jacque Berra) | (Prob-chi2) 4.021 |

***Source: Authors' Computation using stata15, 2022***

## DISCUSSION OF FINDINGS

The results of the ARDL estimates presented in Table 4.4 reveal several key findings regarding the relationship between brain drain and death rates in Nigeria. In the long run, brain drain (LBRDR) has a significant and negative relationship with death rates (DRATE) at the 5% significance level. This counterintuitive finding suggests that other unmeasured factors may be influencing death rates, as increased brain drain would typically be expected to lead to higher mortality rates. Net migration rate (LNEMIR) exhibits a positive but insignificant relationship with DRATE in the long run. This implies that migration dynamics may not be directly contributing to changes in death rates, suggesting that other socioeconomic factors could be more influential. Government health expenditure (LGHEXP) has a negative and marginally significant relationship with DRATE in the long run. This finding aligns partially with theoretical expectations, as increased government health expenditure is anticipated to improve healthcare quality and availability, leading to lower death rates.

The absence of co-integration in the model suggests that there is no long-run relationship between the variables. Therefore, this study focuses on the short-run dynamics. In the short run, a positive and significant relationship exists between changes in brain drain (D LBRDR) and death rates (DRATE). This indicates that short-term fluctuations in brain drain have a statistically significant impact on death rates. When large numbers of Nigerian healthcare workers leave, the country faces a shortage of skilled professionals, particularly in specialized fields like surgery, cardiology, oncology, and pediatrics. This shortage reduces the availability of expert care and leads to increased patient mortality from both routine and complex health issues. For instance, a shortage of obstetricians may lead to higher maternal mortality rates, especially during childbirth complications. Furthermore, the remaining healthcare workers in Nigeria are often overwhelmed with a larger patient load due to the exodus of their colleagues. This leads to burnout, stress, and decreased quality of care. When doctors and nurses are stretched thin, they may not be able to provide the necessary attention to each patient, leading to diagnostic errors, delays in treatment, and poor health outcomes. An overburdened healthcare system results in longer wait times for treatment, particularly for critical care, which can increase the death rate, especially for emergencies like heart attacks, strokes, or road accidents.

Brain drain particularly affects access to specialized healthcare services. Specialists in areas like cancer treatment, advanced surgery, and infectious diseases are more likely to leave the country, resulting in gaps in specialized medical care. Without specialists, complex conditions may go untreated or be poorly managed. Consequently, the lack of specialized care increases mortality for patients suffering from conditions like cancer, cardiovascular diseases, and other chronic illnesses that require expert intervention. For example, fewer oncologists may result in delayed cancer diagnoses and treatment, leading to higher cancer-related deaths. As highly skilled healthcare professionals leave, Nigeria may increasingly rely on less experienced or under-qualified personnel to fill the gaps. Inadequate training or limited experience can lead to poor healthcare decisions, misdiagnoses, and inappropriate treatments. This can lead to an increase in medical errors and complications, directly contributing to higher mortality rates. For instance, surgical complications could arise from improperly trained personnel, resulting in patient deaths during or after operations.

Moreover, the brain drain has a more severe impact on rural areas, where healthcare access is already limited. Healthcare workers who remain in the country often prefer to work in urban areas, where facilities and opportunities are better. This creates a vacuum of healthcare professionals in rural areas, leaving these regions critically underserved. In rural areas, a lack of healthcare providers means people may have to travellong distances to get medical attention or may not seek care at all, leading to higher death rates from treatable conditions like infections, childbirth complications, and trauma. As healthcare professionals leave the country, Nigerians with critical or specialized healthcare needs often turn to medical tourism, seeking

care in other countries. This option, however, is costly and only accessible to wealthier citizens, leaving most of the population reliant on an under-resourced local healthcare system. The inability of many Nigerians to afford foreign medical care means that they may forgo treatment altogether, which increases the death rate among those with serious medical conditions who lack the means to travel abroad for care. A positive and significant relationship exists between D LNEMIR and DRATE. A unit increase in D LNEMIR results in a 0.0042 increase in DRATE. This finding conforms to a priori expectation as an increase in net emigration (Emigration of Nigerian health workers less immigration of foreign health workers) increases the death rate in Nigeria, suggesting that migration may place short-term strain on healthcare services, possibly due to demographic shifts.

Negative net emigration in the health sector refers to a situation where more healthcare professionals leave Nigeria than those who enter or return. This results in a net loss of medical personnel in the country. The effects of this phenomenon on Nigeria's health sector are profound, particularly in terms of increased death rates due to diminished healthcare capacity. With more healthcare workers leaving the country than entering, Nigeria faces a severe shortage of healthcare professionals. This shortage affects general practitioners, nurses, surgeons, and specialists in critical fields like cardiology, oncology, and emergency care. The resulting imbalance in healthcare workforce supply creates significant gaps in patient care. A shortage of healthcare workers results in reduced access to medical services, especially in public hospitals that serve most Nigerians. This leads to delayed treatment, mismanagement of health conditions, and higher mortality from preventable or manageable illnesses. D LGHEXP shows a negative and marginally significant relationship with DRATE at the 10% level, with a coefficient of 0.0031 and a p-value of 0.070. Increased government recurrent expenditure in the Nigerian health sector refers to a rise in spending on ongoing operational costs like salaries, wages, supplies, maintenance, and other day-to-day healthcare activities. This type of spending is essential for sustaining the health system.

An increase in recurrent expenditure can lead to better compensation for healthcare workers, which can help retain skilled professionals and attract new ones. With more healthcare workers available, access to healthcare services improves, leading to quicker diagnoses and more timely treatment of patients. This can reduce death rates from both acute conditions and chronic diseases. Furthermore, increased recurrent expenditure allows for the regular purchase of essential medical supplies and pharmaceuticals. Availability of essential medications and medical supplies can significantly reduce mortality rates, particularly from preventable or treatable conditions. Recurrent expenditure also covers the maintenance of health facilities and equipment, ensuring that hospitals, clinics, and primary health centres are operational and can serve the population. Well-maintained healthcare facilities are more likely to provide effective and timely care, especially in emergencies.

The econometric model indicates that increases in health expenditure led to lower death rates, as the benefits of such expenditures could reduce the migration of health workers. The model's R- squared value of 0.71 suggests a strong fit, and the Durbin-Watson statistic indicates no serial autocorrelation. Additionally, the absence of heteroskedasticity and the normality of residuals further support the model's appropriateness for policy recommendations.

## RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

**Improving Healthcare Worker Conditions**: The government should increase salaries, provide better working environments, and offer career development opportunities to healthcare professionals. This will help retain healthcare workers and reduce the outflow of talent. Additionally, introducing bonding agreements for healthcare workers trained with public funds can help ensure that they serve a certain number of years in

Nigeria before leaving for opportunities abroad.

**Leveraging the Diaspora**: The Federal Ministry of Health should implement programs that allow the Nigerian health diaspora to contribute through telemedicine, knowledge transfer, and short-term medical missions, thereby alleviating the brain drain's impact on health sector output.

**Increasing Healthcare Budget**: The government should raise the percentage of the national budget allocation to healthcare, ensuring that a larger portion is dedicated to salaries, supplies, and maintenance to keep the healthcare system functioning effectively.

**Policy Interventions**: The government should implement policies to reduce the outward migration of healthcare professionals by offering better remuneration, career advancement, and incentives for staying in the country. Increasing the number of medical professionals trained annually, potentially through partnerships with international institutions, can help offset the loss of those leaving.

### Contributions to Knowledge

This study has made significant contributions to the research on the effect of brain drain in the health sector on health sector output in Nigeria. It has made tremendous theoretical and empirical contributions. By shedding light on previously overlooked aspects of brain drain, this research provides more comprehensive recommendations that are based on the outcome of the study to policy-makers and stakeholders in the health sector. Unlike reviewed studies on brain drain that mostly concentrate on primary sources as a means of data collection, this research adopted secondary sources and explored variables which were not employed in previous studies. This means that most issues about brain drain ignore current trends based on empirical enquiry. Furthermore, the adoption of the death rate as a measure of health output adds depth to the analysis and uncovers a comprehensive and dynamic trend of brain drain. Additionally, the study used the most recent dataset on brain drain in the analysis, ensuring that the findings reflect current realities in Nigeria. This research contributes to the theoretical understanding of the effect of brain drain on health sector output in Nigeria, providing valuable guidance to policymakers on the most appropriate strategies and measures to put in place to prevent further loss of these much-needed professionals and to keep the Nigerian health sector system functional.

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