# DECADAL ANALYSIS OF TWIN BIRTHS IN NIGERIA WITH ITS SPACE-TIME TREND.

[1]Aderemi, T., [2]Osaro-Martins, B., and [3]Akomolafe, A. A.

1. Department of Statistics, Faculty of Physical Science, Federal University of Technology, Akure, Nigeria.
2. Department of Educational Management, Faculty of Education, Lagos State University, Ojo.
3. Department of Statistics, Faculty of Physical Science, Federal University of Technology, Akure, Nigeria

Corresponding Author: taiwoaderemi41@gmail.com

## Abstract

Nigeria has one of the highest twin birth rates in the world, yet it faces significant challenges with high twin mortality. This study explores the spatial and temporal dynamics of twin births in Nigeria between 2008 and 2018, focusing on survival outcomes and contributing factors. Leveraging data from the Nigeria Demographic and Health Surveys (NDHS), a Bayesian space-time model with Gaussian intrinsic Conditional Autoregressive (iCAR) priors was applied, using Integrated Nested Laplace Approximation (INLA) to analyze twin birth rates, survival patterns, and regional disparities.

Results indicate a modest increase in the national twin birth rate, from 3.3% in 2008 to 3.6% in 2018. South West region consistently recorded the highest twin birth rates, rising from 4.3% in 2008 to 4.8% in 2018, followed by the South-South and South-East regions. The state level in-depth analysis showed that Ekiti, Bauchi, and Enugu exhibited exceptionally high twin birth rates throughout the period under review. Despite this growth, twin mortality remained critically high, with over 70% of twins not surviving across both years. A slight improvement in twin survival was observed, increasing from 25.5% in 2008 to 26.4% in 2018.

Spatial analysis revealed significant regional disparities, with states like Delta and Kogi showing a marked decline in twin birth rates over the decade, while states like Ekiti, Bauchi, and Enugu maintained persistently high rates.

The persistently high mortality rate among twins emphasizes the urgent need for targeted healthcare interventions, particularly in regions with higher twin birth rates. Enhanced healthcare strategies are essential to reduce mortality and improve the well-being of twins in Nigeria. This study also recommends further research into the underlying causes driving twin birth rates and survival outcomes, aiming to better inform healthcare policies and practices.



ISSN NUMBER: 1116-249X

Keywords: Twin Births, Genetics, child mortality, Survival outcomes, Spatial Distribution.

## Introduction

Nigeria is not only known for its vibrant population and rich cultural diversity, but it has also drawn attention for its unique demographic patterns, most notably the high rate of twin births. This study aims to explore the fascinating aspects of twin births in Nigeria, offering a comprehensive examination of the existing data and its implications. Globally, Nigeria has one of the highest rates of twinning. As stated by Samson et, al. (2014), the Nigerian population is recognized for its exceptional fertility rate, averaging 5.3 children per woman. The Northern region has a notably high birth rate, with women consistently exhibiting the highest total fertility rate (Igbodike et al., 2024). Consequently, Nigeria has a high twinning rate, estimated at 45 twin births per 1,000 live births, which is one of the highest in the world (Samson et al., 2014). This phenomenon may be attributed to a combination of genetic, environmental, and cultural factors, alongside the prevalent practice of polygamy in certain parts of the country.

Moreover, the prevailing gender ideology in Nigeria, which prioritizes male authority in decisions about family size and composition, might also contribute to the elevated incidence of twinning. Research conducted in a rural Ekiti Yoruba community in southwestern Nigeria indicated that attitudes towards family size and composition were more influenced by age than by gender, suggesting that both women and men subscribed to the dominant gender ideology (Smits & Monden, 2011).

Twins, defined as two children born from the same pregnancy, come in two distinct types: identical twins, or monozygotic (MZ) twins, and fraternal twins, known as dizygotic (DZ) twins. Monozygotic twins result from a single fertilized egg splitting into two after conception, typically sharing 100% of their genetic makeup. As a result, they exhibit identical blood groups, genotypes, and genders. However, variations in genetic makeup can occur post-split, leading to differences in physical characteristics, health conditions, or personalities. In contrast, dizygotic twins are conceived when two separate eggs are fertilized by two different sperm cells during ovulation. These twins share only 50% of their genes, with the possibility of having similar or different genotypes, blood groups, and genders.



ISSN NUMBER: 1116-249X

Recent research published in the Journal of Human Reproduction indicates a significant increase in the birth rate of twins, which surged by 42% between 1980 and 2015, resulting in an average of 1.6 million twins born annually during the 2010s (Rettner et al., 2021). One major contributing factor to this increase is the utilization of medical techniques, particularly in vitro fertilization (IVF). Furthermore, data from the Osaka University Twins Research suggests that the combined ratio of monozygotic and dizygotic twins to singletons is approximately 1 to 100. While the ratio remains consistent for monozygotic twins across different ethnicities, dizygotic twins exhibit varying ratios, with estimates ranging between 15 and 20 per 1,000 in Nordic countries and 6 to 10 per 1,000 in Japan. This variation is partly attributed to ethnicity and the increasing use of assisted reproductive technology.

In conclusion, the issue of twin births in Nigeria is a complex and multifaceted phenomenon, influenced by various genetic, environmental, and cultural factors, including the widespread practice of polygyny and the dominant gender ideology. As Nigeria continues to experience demographic shifts, understanding the mechanisms of twin births will be crucial for shaping public health policies and interventions aimed at improving maternal and child well-being. Consequently, Nigeria boasts one of the world's largest twin populations, making it an ideal region for investigating the genetic and environmental factors influencing twinning (Hur et al., 2013). Thus, gaining a deep understanding of the dynamics surrounding twin births, including their spatial distribution and temporal fluctuations, is of paramount importance. However, there is a notable gap in comprehensive research utilizing a fully Bayesian spatio-temporal model to explore these dynamics. Moreover, existing studies predominantly focus on time-series analysis, neglecting the advantages offered by concurrent space-time analysis. Therefore, the primary challenge addressed in this study revolves around the necessity to evaluate and comprehend the spatio-temporal dynamics of twin births in Nigeria through a robust and comprehensive methodology. This includes identifying the varying rates and distributions of twin births across distinct locations and time intervals within the country, as well as discerning the specific challenges associated with twin births in Nigeria. Therefore, this study aims to address the need to evaluate and comprehend the spatio-temporal dynamics of twin births in Nigeria through a robust and comprehensive methodology. Specifically, it will investigate the spatial and temporal patterns of twin births and identify statistically significant factors influencing twin birth rates and survival outcomes between 2008 and 2018. Additionally, the study will examine the challenges associated with twin births,



ISSN NUMBER: 1116-249X

including healthcare access, socio-economic conditions, and maternal health, with the goal of providing critical insights for healthcare interventions and policy development.

## Methods

## Study setting

The data for this research were extracted from two waves of the Nigerian Demographic and Health Survey (DHS), which comprehensively covered the entire population of Nigeria. The DHS granted approval for the use of the 2008 and 2018 survey datasets in this research. These surveys provide cross-sectional data on various demographic and health indicators and were conducted by the National Population Commission of Nigeria. Specifically, the 2008 survey included information from 24,132 births, while the 2018 survey covered 8,365 births.

### Incidence of twin births and explanatory variables

The primary response variable in this study is the incidence of twin births. The analysis investigates several factors associated with twin births, including maternal height, body mass index (BMI), mother's age, birth order, place of residence, ethnicity, place of delivery, state, and region.

Data management and analysis were performed using STATA and R statistical software packages. The 'child record' datasets from each survey were downloaded from the DHS program website in STATA format. Unnecessary variables were systematically removed, and the datasets were subsequently merged for analysis. Figure 1 illustrates the administrative divisions of Nigeria (Gayawan et al., 2014).



ISSN NUMBER: 1116-249X

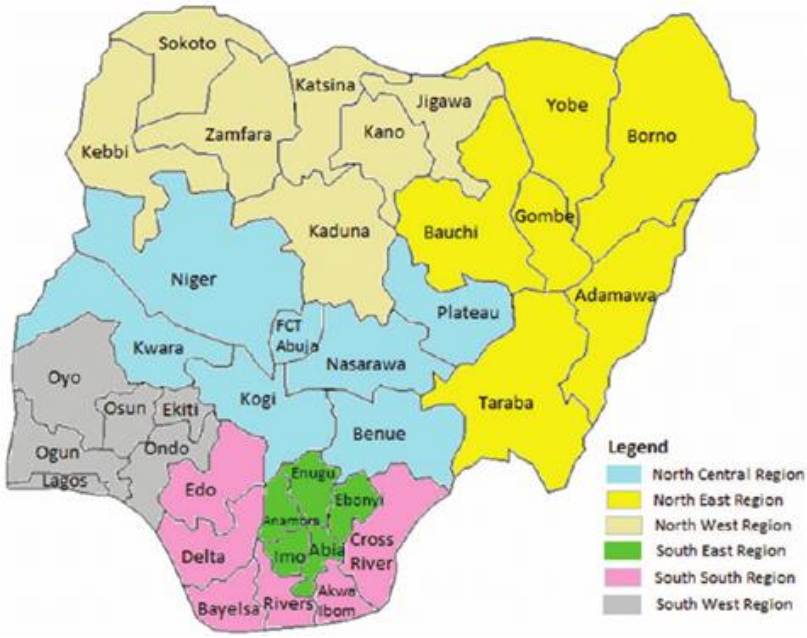


**Fig.1: Illustrates the administrative setting of Nigeria according to the Zones**

## Bayesian space time modelling

To model the occurrence of twin births, Bayesian space-time modelling was employed. it a statistical approach used to analyze data that vary across both space (geographical areas) and time (temporal periods). This method combines the principles of Bayesian inference with space-time analysis to understand complex patterns and relationships in data that evolve over time and across different locations., given the binary nature of the response variable (whether a child is a twin or not). This modelling approach is designed to capture the prevalence of twin births across different states in Nigeria and over distinct time periods.

The spatial random effects were modelled using the intrinsic conditional autoregressive (iCAR) model, which allows for the inclusion of spatial dependence among neighbouring states. This spatial component is crucial for accounting for potential correlations between regions that may influence the likelihood of twin births.

To address temporal variations, a structured temporal effect was incorporated into the model. This effect capture changes in the prevalence of twin births over time, providing insights into how trends may have evolved across the two DHS survey periods (2008 and 2018).



ISSN NUMBER: 1116-249X

By integrating both spatial and temporal components, the Bayesian space time model offers a comprehensive understanding of the factors influencing twin births, while also accounting for the complex interplay between geography and time.

The mathematical formulation for your Bayesian space time model;

The model's structure is as follows:

$Y_{ij}$ ~binomial ($n_{ij}$,$\pi_{ij}$)

Where: $Y_{ij}$ is the number of twin births in state $i$ during period $j$

$n_{ij}$ is the total number of births in state $i$ during period $j$ .

$\pi_{ij}$ is the probability (or prevalence) of twin births in state $i$ during period $j$

Logit Link Function:

$$logit(\pi_{ij}) = \alpha + \phi_i + \gamma_j + \theta_{ij}$$

Where:$\alpha$ is the overall intercept.

$\phi_i$ represents the spatial random effects, which capture spatial dependence between neighbouring states.

$\gamma_j$ represents the temporal random effects, capturing trends over time.

$\theta_{ij}$ is the space-time interaction effect, accounting for interactions between spatial and temporal components.

**Random Effects**

Spatial Effect ($iCAR$ Model):$\phi_i \sim iCAR\ (0, \sigma^2\ \phi)$



ISSN NUMBER: 1116-249X

Where $\phi_i$ is the spatial random effect for state $i$ , which follows an intrinsic Conditional Autoregressive ($iCAR$) model with variance $\sigma^2\ \phi$ .

Temporal Effect:$\gamma_j\ \sim\ iCAR\ (0, \sigma^2\gamma)$

Where $\gamma_j$ is the temporal random effect for period $j$ , also modelled using the $iCAR$ model.

Space-Time Interaction: $\theta_{ij} \sim\ Normal\ (\ 0, \sigma^2\theta)$

Where $\theta_{ij}$ represents the space-time interaction effects, assumed to follow a normal distribution with variance $\sigma^2\theta$

## Results

**Temporal Changes in twin births in Nigeria between 2008 and 2018.**

The results reported in Table 1 presents the distribution and trends of twin births in Nigeria over the study period from 2008 to 2018. The data indicate a gradual increase in the overall rate of twin births, rising from 3.3% in 2008 to 3.6% in 2018. This suggests a slight upward trend in twin birth prevalence over the decade. Temporally, studies have demonstrated oscillations in twinning frequencies throughout time. The result agreed with (Iyiola et al., 2013). Who indicated a possible rise in twining rate in some certain locations in the country.

In 2008, there were 795 twin births, comprising 3.3% of the total births but only 25.5% of the twins survived the child mortality, while a significant 74.5% did not survive, indicating a high child mortality rate among twins. In 2018, out of the total twin births, 26.4% were alive at under five years of age, while 73.6% died. Although there was a marginal improvement in survival rates (from 25.5% to 26.4%), the data underscore a persistently high child mortality rate among twins, with over 70% of twin births resulting in child deaths in both years.

The data revealed a slightly higher proportion of male twin births compared to female twin births in both survey years. In 2008, 51.2% of twin births were male, compared to 48.8% female. This ratio remained relatively stable in 2018, with 50.5% male and 49.5% female twin births. The



ISSN NUMBER: 1116-249X

observed gender distribution aligns with the findings of Sunday-Adeoye et al., (2008), which reported similar gender proportions, with 30.49% of twins being male and 28.01% being female.

The data also highlight a decline in twin birth rates in rural areas (71.6%,56.4%) in 2008 to 2018 compared to urban areas (28.4%,43.6%), which saw an increase in twin birth rates over the study period. This trend is consistent with Sunday-Adeoye et al. (2008), who reported higher twinning rates in rural hospitals compared to urban hospitals, suggesting potential differences in healthcare access, maternal nutrition, and other socio-environmental factors between urban and rural settings. According to (Akinboro et al., 2008). urban areas tend to have lower twinning rates than rural areas, probably owing to variations in nutrition and lifestyle.

The South West region consistently exhibited the highest percentage of twin births, increasing from 4.3% in 2008 to 4.8% in 2018. According to Omonkhua et al., (2020), it has been suggested that certain plants in Western Nigeria contain compounds similar to hormones that increase follicle-stimulating hormone levels, thereby elevating the rate of dizygotic twinning in the population. The study also noted increases in twin birth rates in the North West (from 2.6% to 3.6%) and North East (from 3.0% to 3.5%) regions, while the South-South, North Central, and South-East regions experienced slight declines from 2008 to 2018.The result agreed with Arzimanoglou et al., (2003), The twinning rate of 30.6 per 1,000 (one in 33) observed in the study is lower than the 53 per 1,000 deliveries (one in 19) reported among the Yoruba population in Western Nigeria and the one in 24 reported among the Igbos. However, it is higher than the one in 76 reported from a comparable institution in Maiduguri, Nigeria.

The data also highlighted that twin births delivered at home were the most common, with rates of 56.9% in 2008 and 44.9% in 2018, followed by government health facilities (27.1% in 2008 and 34.7% in 2018) and private health facilities (16% in 2008 and 20.4% in 2018). This indicates an improvement in the rates of deliveries in government health facilities from 2008 to 2018. Similarly, there was a notable increase in the utilization of private health facilities in 2018 compared to 2008, reflecting a shift in maternal healthcare preferences in Nigeria

The result on the tribes showed that the highest twin birth rates are observed among the Yoruba (4.0%, 5.4%) regardless of their location. This tribe's high twinning rates are supported by Smits & Monden (2011) who attributed the high dizygotic twinning rate in the Yoruba population to



ISSN NUMBER: 1116-249X

genetic factors followed by the Tiv_ Igala (4.2%,4.1%), and Igbo (4.3%, 3.3%) ethnic groups. In Hausa Fulani tribe, the twin birth rate increased from 2.5% to 3.3%, indicating that the proportion of twin births increased despite the lower total number of twin births. Conversely, the Ijaw_Ibibio saw the twin birth rate dropped from 3.6% in 2008 to 2.5%, indicating a lower proportion of twin births in 2018.

The data showed the state level, Bauchi State had the highest proportion of twin births in 2008 at 7.8%, but this declined to 3.6% in 2018. Conversely, Ekiti State saw a significant increase in twin births, rising from 3.3% in 2008 to 9.0% in 2018, making it the state with the highest proportion of twin births in 2018. Similarly, Enugu state (9.0%) shared the same twin births rate with Ekiti State in 2018. Other states that showed notable increases in twin births include Ebony state (5.5% ,7.8%), Cross River state (3.7% ,5.6%), Gombe (3.9%, 5.6%), Rivers state (5.5%, 6.9%), Sokoto state (4.4%,5.1%) and Osun (3.4%,4.1%).

Conversely, states such as Abia state (3.9%, 0.9%), Delta state (2.7%, 0%) and Kogi state (2.3% ,0.0%) experienced significant declines in the proportion of twin births over the same period. The complete absence of twin births in Delta and Kogi states in 2018 raises concerns and suggests possible demographic shifts, potentially influenced by factors such as the herdsmen crisis or changes in fertility patterns.



ISSN NUMBER: 1116-249X

**Table 1: Temporal changes in twin births (2008 – 2018)**

| Variable | Category | WAVE1 2008 N (%) | WAVE2 2018 N (%) |
|---|---|---|---|
| **Child is twin** | Alive | 203(25.5) | 80(26.4) |
| | Died | 592(74.5) | 223(73.6) |
| | Total | 795(3.3) | 303(3.6) |
| **Sex** | Male | 407(51.2) | 50.5 |
| | female | 388(48.8) | 49.5 |
| **Place of residence** | Rural | 569 (71.6) | 171 (56.4) |
| | Urban | 226(28.4) | 132(43.6) |
| **Geo Political zone** | NC | 152(3.5) | 24(2.7) |
| | NE | 164(3.0) | 46(3.6) |
| | NW | 178(2.6) | 100(3.6) |
| | SE | 80(4.0) | 51(3.5) |
| | SS | 108 (4.0) | 20(3.1) |
| | SW | 113 (4.3) | 62 (4.8) |
| **Place of delivery** | Home | 452(56.9) | 136(44.8) |
| | Govt Health Facilities | 216(27.1) | 105(34.7) |
| | Private Health facilities | 127(16) | 62(20.5) |
| **Ethnicity** | Hausa_Fulani | (2.5) | (3,3) |
| | Igbo | (4.3) | (3.3) |
| | Ijaw_Ibibio | (3.6) | (2.5) |
| | Tiv_Igala | (4.2) | (4.1) |
| | Yoruba | (4.0) | (5.4) |
| **State** | Abia | 20 (3.9) | 2(0.9) |
| | Adamawa | 16 (3.3) | 2(2.2) |
| | Akwa Ibom | 30 (3.1) | 2 (1.2) |
| | Anambra | 14(1.7) | 16(4.8) |
| | Bauchi | 26(7.8) | 10(3.6) |
| | Bayelsa | 32(3.4) | 12(4.1) |
| | Benue | 6(1.4) | 12(4.4) |
| | Borno | 18(1.9) | 8(3.2) |
| | Cross River | 34(3.7) | 8(6.7) |
| | Delta | 16(2.7) | 12(4 .1) |
| | Ebonyi | 23(5.5) | 16(7.8) |
| | Edo | 20(2.1) | 18(4.4) |
| | Ekiti | 14(3.3) | 6(9.0) |
| | Enugu | 31(6.9) | 8(9.0) |
| | Gombe | 32(3.9) | 6(5.6) |



ISSN NUMBER: 1116-249X

| | | | |
|---|---|---|---|
| | Imo | 26(4.2) | 18(4.6) |
| | Jigawa | 26(5.2) | 0(0.0) |
| | Kaduna | 48(2.3) | 18(3.2) |
| | Kano | 20(2.3) | 14(3.9) |
| | Katsina | 18(1.9) | 10(3.0) |
| | Kebbi | 34(3.0) | 22(4.6) |
| | Kogi | 16(2.3) | 0(0.0) |
| | Kwara | 14(3.7) | 4(3.5) |
| | Lagos | 16(2.0) | 8(2.2) |
| | Nassarawa | 30(3.3) | 4(2.3) |
| | Niger | 14(3.0) | 6(4.0) |
| | Ogun | 17(3.3) | 2(1.7) |
| | Ondo | 9(3.0) | 6(3.0) |
| | Osun | 11(3.4) | 9(4.1) |
| | Oyo | 26(2.6) | 4(1.5) |
| | Plateau | 21(4.8) | 8(3.8) |
| | Rivers | 22(5.5) | 14(6.9) |
| | Sokoto | 18(4.4) | 6(5.1) |
| | Taraba | 18(4.2) | 6(3.9) |
| | Yobe | 28(3.7) | 4(1.7) |
| | Zamfara | 8 (2.0) | 8(2.1) |
| | FCT Abuja | 23 (4.3) | 6(2.5) |

Figure 2 showed the trend of twin births across the states in the period under review. In 2008 states Bauchi, Jigawa, Sokoto, Enugu, Ebonyi, Rivers had high rate of twin births while states like Ekiti, Enugu, Ebony, Rivers, Sokoto had high twin birth rate in 2018. However, state like Enugu, Ebonyi, Rivers Imo Ekiti, Bauchi and Sokoto maintain high rate of twin births in the period under review.



ISSN NUMBER: 1116-249X

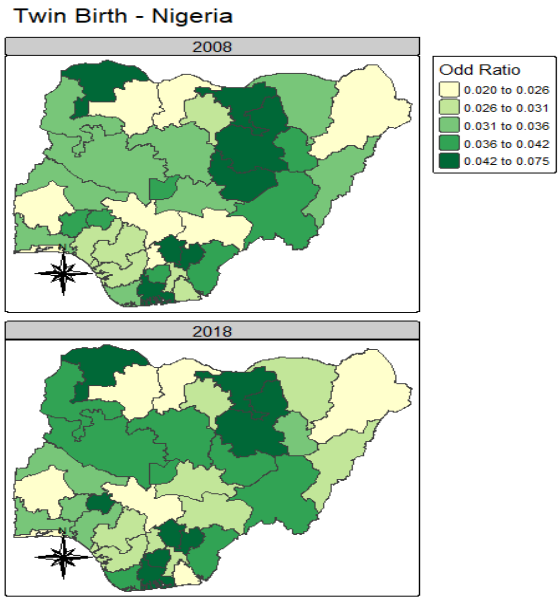


**Figure 2: Maps of Nigeria showing the yearly spatial effects for twin births**

**Specific linear effects of twin births result**

Children living in rural areas had 13.5% lower odds of being twins (OR:0.865CL:0.735,1.017) this result was not statistically significant.

Children of mothers with primary education had 6.7% lower odds of being twins (OR: 0.933, CI: 0.775, 1.122), but this result was not statistically significant. Children of mothers with secondary education had 8.3% higher odds of being twins (OR: 1.083, CI: 0.875, 1.339), but this result was also not statistically significant. Children of mothers with higher education had 43.2% higher odds of being twins (OR: 1.432, CI: 1.003, 1.903), and this result was statistically significant.

Children from poorer households had 9.3% higher odds of being twins (OR: 1.093, CI: 0.907, 1.316), but this result was not statistically significant. Children from middle-income households had 2.4% lower odds of being twins (OR: 0.976, CL :0.792,1.202), but this result was also not statistically significant. Children from richer households had 2.4% lower odds of being twins (OR: 0.976, CL:0.769,1.237), which was not statistically significant. Children from the richest households had 13.1% lower odds of being twins (OR: 0.896, CL:0.666,1.205), but this result was not statistically significant.



ISSN NUMBER: 1116-249X

Children of mothers aged 24-35 years had 10.3% lower odds of being twins (OR: 0.897CL:0.712,1.129) compared to those of mothers under 23 years, but this result was not significant. Children of mothers aged over 36 years had 21.6% lower odds of being twins (OR: 0.784, CL:0.599,1.027), but this result was also not significant.

Children of mothers with normal BMI had 45.2% significantly higher odds of being twins (OR: 1.452, CL:1.143,1.845). Children of overweight mothers had 60.5% higher odds of being twins (OR: 1.605, CL:1.220,2.114), and children of obese mothers had 100.4% higher odds (OR: 2.004, CL:1.450,2.77). Both results were statistically significant.

Children of 2nd and 3rd birth orders had significantly higher odds of being twins (OR: 3.056, CL:2.247,4.164). The children of 4th birth order had even higher odds of being twins (OR: 7.514, CL:5.467,10.348) compared to 1st birth order children.

The odds ratio (OR: 0.908, CL:0.713,1.157) showed that children of mothers with average height have 9.2% lower odds of being twins compared to children of short mothers however this result is not statistically significant. The odds ratio (OR: 1.049.CL: 0.820, 1.345) showed that children of mothers with above-average height have 4.9% higher odds of being twins compared to children of short mothers but is also not statistically significant. The odds ratio (OR:1.196, CL:0.826,1.733) showed that children of tall mothers have 19.6% higher odds of being twins compared to children of short mothers. this result is not statistically significant.

All regions (North-East, North-West, South-East, South-South, and South-West) show significantly lower odds of twin births compared to the North central. All results are statistically significant.

Children of mothers from Hausa_Fulani had 24.7% significantly higher odds of being twins (OR: 0.753, CL:0.597,0.951) compare to Ijaw_Ibibio children and the result is statistically significant. Children of Tiv_Igala mothers had 8 % lower odds of being twins (OR:0.920, CL:0.614,1.380) compare to Ijaw_Ibibio children. Children of Igbo mothers had 7.4% higher odds (OR: 1.074, CL:0.731,1.579). Both results were not statistically significant. Children of mothers from Yoruba had 24.7% significantly higher odds of being twins (OR: 1.071, CL:0.761,1.506) compare to children of mothers from Ijaw_Ibibio.



ISSN NUMBER: 1116-249X

**Table 3: The odd ratio (OR) for the fixed effects estimates at 95% CI for twin births**

| | Child is twin | | |
|---|---|---|---|
| **Variables** | **OR** | **LCI** | **UCL** |
| | | | |
| **Place of residence** | | | |
| Urban (ref) | 1.000 | | |
| Rural | 0.865 | 0.735 | 1.017 |
| **Education** | | | |
| No education | 1.000 | | |
| Primary | 0.932 | 0.775 | 1.121 |
| Secondary | 1.080 | 0.873 | 1.336 |
| High | 1.380 | 1.002 | 1.901 |
| **Wealth index** | | | |
| Poorest | 1.000 | | |
| Poorer | 1.092 | 0.906 | 1.315 |
| Middle | 0.975 | 0.791 | 1.200 |
| Richer | 0.975 | 0.769 | 1.235 |
| Richest | 0.893 | 0.665 | 1.202 |
| **Mothers 'age (years)** | | | |
| Under23 (ref) | 1.000 | | |
| Under 35 | 0.893 | 0.710 | 1.125 |
| Over 36 | 0.781 | 0.600 | 1.022 |
| **BMI** | | | |
| Underweight (ref) | 1.000 | | |
| Normal | 1.452 | 1.143 | 1.846 |
| Overweight | 1.605 | 1.220 | 2.11 |
| Obesity | 2.004 | 1.449 | 2.77 |
| **Birth order** | | | |
| Ist birth (ref) | 1.000 | | |
| $2^{nd}$ & $3^{rd}$ birth | 3.056 | 2.247 | 4.164 |
| $4^{th}$ birth | 7.514 | 5.467 | 10.348 |
| **Mother's height** | | | |
| Short | 1.000 | | |
| Average | 0.908 | 0.714 | 1.157 |
| Above average | 1.049 | 0.819 | 1.344 |
| Tall | 1.196 | 0.826 | 1.733 |
| **Ethnicity** | | | |
| Ijaw_Ibibio | 0.753 | 0.597 | 0.951 |



ISSN NUMBER: 1116-249X

| | | | |
|---|---|---|---|
| Hausa_fulani | 0.921 | 0.614 | 1.380 |
| Tiv_igala | 1.074 | 0.731 | 1.579 |
| Igbo | 1.071 | 0.761 | 1.506 |
| Yoruba | 1.071 | 0.761 | 1.506 |
| **Region** | | | |
| North central | 1.000 | | |
| North_east | 0.000673626 | 7.47526E-05 | 0.005608155 |
| North_west | 0.003745367 | 0.000602397 | 0.021889763 |
| South_east | 0.002295724 | 0.000305733 | 0.016127359 |
| South_south | 0.001403875 | 0.000201853 | 0.009079685 |
| South_west | 0.005050526 | 0.00072076 | 0.033200035 |

## Discussion

This study has successfully examined the spatial and temporal dynamics of twin births in Nigeria, providing insights into survival outcomes and identifying key factors influencing these patterns between 2008 and 2018. Through the application of a Bayesian space-time model with Gaussian intrinsic conditional autoregressive (iCAR) priors, the research highlighted both the regional disparities in twin birth rates and the persistent challenge of high twin mortality.

The analysis revealed a modest increase in the national twin birth rate, from 3.3% in 2008 to 3.6% in 2018, with the South West region consistently exhibiting the highest rates. States such as Ekiti, Bauchi, and Enugu were found to have notably high twin birth rates throughout the decade, while regions like Delta and Kogi experienced a decline. These regional disparities underscore the importance of localized healthcare interventions, tailored to address the specific needs of high twin birth rate regions.

The study identified several statistically significant variables contributing to twin births, including maternal body mass index (BMI), birth order, and environmental conditions. These factors varied across regions, further reinforcing the need for targeted healthcare and educational strategies to improve maternal health and child survival.

Despite slight improvements in twin survival rates (from 25.5% in 2008 to 26.4% in 2018), the persistently high twin mortality rate—over 70% of twins not surviving—remains a critical issue. This finding reflects significant challenges, such as inadequate healthcare access, socio-economic



ISSN NUMBER: 1116-249X

barriers, and environmental stressors, which disproportionately affect mothers of twins in high-birth regions.

## Conclusion

The findings from this study highlight an urgent need for enhanced healthcare interventions aimed at reducing twin mortality, particularly in regions with high twin birth rates. Targeted improvements in maternal and neonatal care, better healthcare infrastructure, and increased awareness of the unique healthcare needs of twins can contribute to reducing the high mortality rates. Further research is recommended to explore the underlying genetic, environmental, and healthcare factors influencing both twin births and survival, which will provide a foundation for more effective healthcare policies and interventions.

This study provides a comprehensive understanding of the dynamics of twin births in Nigeria. It emphasizes the need for immediate, region-specific healthcare strategies to address the high twin mortality rate and improve the survival and well-being of twins across the country. By addressing these challenges, Nigeria can significantly reduce twin mortality and improve maternal and child health outcomes.

## References

Akinboro, A., Azeez, M. A., & Bakare, A. A. (2008). Frequency of twinning in southwest Nigeria. *African Journal of Biotechnology*, 7(1), 1-6.

Arzimanoglou, A., Willemsen, R., & Devriendt, K. (2003). Genetics of human twinning. *Best Practice & Research Clinical Obstetrics & Gynaecology*, 17(2), 237-251.

Gayawan, E., Adebayo, S. B., & Aina, O. (2014). A Bayesian semiparametric survival analysis of under-five mortality in Nigeria. *Journal of Data Science,* 12(4), 581-596.

Hur, Y.-M., Shin, J. S., Kang, H. S., Song, T. B., & Boo, J. H. (2013). The number of twin births in Korea from 1981 to 2010. *Twin Research and Human Genetics,* 16(1), 313-317.

Igbodike, T. A., Kalu, C. O., & Azubuike, E. N. (2024). Fertility patterns in Nigeria: A regional analysis. *Nigerian Journal of Population Studies,* 19(3), 55-72.

Iyiola, O., Adeleke, A. M., & Iyiola, S. (2013). Twinning and perinatal outcomes in selected hospitals in Nigeria. *African Journal of Reproductive Health,* 17(4), 91-98.



ISSN NUMBER: 1116-249X

Omonkhua, A. A., Uhunmwangho, O., & Odigie, C. (2020). Increased rate of twinning among the Yoruba ethnic group: The impact of diet and environment. *Journal of Public Health in Africa, 11(2), 180-185.*

Rettner, R. (2021). Twin birth rates increased by 42% in the last 40 years. *Live Science.* Retrieved from https://www.livescience.com.

Samson, O. (2014). Population dynamics and fertility trends in Nigeria. *Journal of Population and Social Studies,* 23(2), 91-103.

Smits, J., & Monden, C. (2011). Twinning across the developing world. *PLoS ONE,* 6(9), e25239.

Sunday-Adeoye, I. A., Twomey, D. E., Egwuatu, V. E., & Okonta, P. I. (2008). The incidence of twinning in rural southeastern Nigeria. *The Nigerian Postgraduate Medical Journal,* 15(1), 25-28.



ISSN NUMBER: 1116-249X