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Statistical Analysis of Child Stunting in Nigeria

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ABSTRACT

Stunting in children under five in Nigeria is a primary cause of childhood morbidity, resulting in lasting effects on cognitive development, academic achievement, adult economic productivity, and parental reproductive results. The study identifies the hotspots of stunting as well as the extent to which economic, social-demographic, and environmental factors contribute to stunting in different locations with the aids of binary logistic regression model. Based on data from the Nigeria Demographic and Health Survey (NDHS), the analysis identifies the primary demographic and socioeconomic determinants that have a major impact on the nutritional outcomes of children, such as the child's current age, wealth index, maternal education, and media access. Stunting is more common in some areas, particularly in the northern and rural regions, according to the results, which show notable regional variations. Stunting's spatial patterns are also impacted by environmental variables and health care accessibility. According to the report, nutrition programs, maternal education, healthcare access, and region-specific treatments should all be strengthened. The evidence-based study maps the hotspots of stunting and investigates the causes of stunting in children.

KEYWORDS: Stunting, Logistic Regression, Spatial Pattern, Children Under Five

I. INTRODUCTION

Appropriate nourishment is essential to people health and wellbeing. It affects economic productivity, educational attainment, and overall well-being of the population, making it a pillar of national growth (Schnettler, et al., 2019). Early childhood severe stunting often results in deficiencies in cognitive development, academic performance, adult economic output, maternal reproductive effects, and a high strain on the health care system and general wellbeing of a child (De, Onis and Branca, 2016; Dewey, and Begum 2011; Black et al., 2013; Fagbami et al.,2020; Handan et al., 2026]. World Health Organization (WHO) states that approximately 45 percent of deaths below the age of five years are related to stunting (WHO, 2021). This unsettling figure shows just how dire the situation is and how badly it needs to be addressed. Child stunting can be considered as a key indicator of the health status of a nation as well as its socio-economic development. As a term for stunting in infants under five, child stunting is a very important issue for the country's social and economic growth. Child stunting remains one of the leading public health challenges, particularly in low- and middle-income economies, such as Nigeria. Nigeria has a population of over 200 million people, and the rates of child stunting in Nigeria are among the highest in the world. UNICEF says that Nigeria has a child stunting rate of 102 per 1,000 live births in recent years and that 10% of all child deaths in the world happen in Nigeria (UNICEF, 2021). This is a very high rate that shows there are problems with healthcare, the economy, and the environment. The issue is further exacerbated by systemic factors within the healthcare system, including inadequate healthcare infrastructure, insufficient numbers of skilled healthcare personnel, and insufficient access to necessary healthcare services [Akombi, et al., 2019].

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II. RELATED WORKS

The factors that contribute to childhood stunting in Nigeria have been thoroughly examined by researchers including (Gayawan, et al., 2019; Ahmed, et al.,2023; Amusa, et al., 2023; Ukwajunor et al., 2023). The authors evaluated and analyzed the spatial disparity of children stunting at the national level using data from the 2018 Nigeria Demographic and Health surveys (NDHS) and the most effective spatial analytic tools. According to their findings, the incidence of stunting fluctuated significantly by region and was highest in Nigeria's northern regions. The studies found maternal education, household economic status, and access to better sanitation as important sociodemographic and environmental variables. Using geographic information systems (GIS) and spatial regression methods, the authors were able to pinpoint regions that required immediate strategy of rescue. According to Shamsuddin, et al., 2022 reviews of spatial analysis application in childhood stunting studies emphasizes on how crucial it is to use spatial analysis to identify hotspot locations, risk factors associated with childhood stunting, and the geographic distribution of stunting cases. Moreover, Dmello et al., 2023 scoping review on geospatial analysis of stunting among under five children established the usefulness of the geospatial analytic techniques in describing and assessing the features, magnitude, and depths of the nutritional burden among children under five. Socioeconomic factors such as poverty, low maternal education, and food insecurity promote high rates of child stunting and mortality (Olofin, et al., 2013; Almasi, et al., 2019; Blom, et al., 2022), environmental factors include poor sanitation, limited access to safe drinking water, and extreme pollution intensify the issue (NPF, 2019). Infectious disorders such malaria, pneumonia, diarrhea, and measles are the most frequent causes of stunting in children. These infections often rise due to low immunization rates and inadequate access to healthcare (WHO, 2021). In spite of advancements over the past few decades, the decrease in child stunting has not been encouraging for accomplishing global objectives, such as the Sustainable Development Goals (SDGs) (UNICEF, 2021). Immunization programs, nutrition programs, the strengthening of a healthcare system, sanitation, and hygiene (WASH) programs are just a few of the several interventions that have been implemented with varying degrees of success in the fight against the illness (Adeyonu, et al.,2022). Several empirical studies have established the multifaceted determinants of child stunting, among the causative factors include parental educations, climatic conditions, household wealth, dietary diversity, access to adequate health facilities, prevalence to infectious diseases among others (Takele, et al., 2022; Mahapatara et al., 2023; Bonell et al., 2024; Ogundeji, et al., 2025) Child stunting remains a critical global health challenge, yet most existing studies rely on static risk estimates and overlook the spatial – temporal nature of environmental exposures and socioeconomic disparities (Usman, et al., 2026). Geospatial analysis focus on the application of different statistical techniques for the analysis of data pertaining to area-specific, topographic-specific, and temporal and spatial correlation associations between the available facts. This research focuses on regional pattern and contributing variables of child stunting in Nigeria. Additionally, it examines the main indicators of stunting in children below five.

III. METHODOLOGY

A geospatial procedure was used for investigating child stunting in Nigeria by combining geospatial and statistical modeling techniques. The methodology was made up of three main parts: The study of regional disparities and the socio-economic factors that lead to child stunting used both binary logistic regression and spatial statistical integration.

A. Data and Study Variables

The current study utilizes validated ethical secondary data from the 2018 Nigeria Demographic and Health Survey (NDHS). The National Population Commission of Nigeria implemented these surveys with financial and technical assistance from The Demographic and Health

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Surveys Program. A two-stage sampling design was used in each wave to determine participating households for the survey. In the first stage, clusters (enumeration areas) were chosen from the census data of the country, and in the second stage, participating households were determined. It looks at a wide range of health and population measures, such as maternal and child health indicators and household characteristics. The data set has anthropometric measurements of kids aged 0 to 59 months and a lot of information about mothers and the socioeconomic status of their households.

B. Response Variables

Child Stunting: This variable shows whether a child under five years old is stunted or not, based on the data from the NDHS 2018 dataset. The variable is appropriate for a binary logistic regression model in defining main socio-demographic and environmental risk factors for stunting. Additionally, since the data are spatial, the indicators of stunting can be utilized in geospatial analysis techniques to investigate trends, patterns, clustering, and regional disparities in child stunting in Nigeria.

C. Predictor Variables

The independent variables explored in this study are classified under background characteristics, socio-demographics and bio- demographics (which are health related) categories. These include the type of place of residence (urban or rural), access to healthcare, sanitation, and education; the highest educational level of the mother or caregiver, and the region and state of residence, which reflect disparities in culture, resources, infrastructure, and food security. Household factors such as the wealth index combined, which aggregates household assets and living conditions.

Child-specific characteristics include the current age of the child, with weaning periods being most vulnerable; the duration of breastfeeding, where exclusive and extended breastfeeding provide strong protection; and birthweight, which indicates early growth potential. Health-related factors such as recent diarrhea, fever, and cough are included because infections reduce appetite, deplete nutrients, and raise metabolic demands, thereby increasing stunting risks. Additionally, maternal access to media is considered important for exposure to health and nutrition information, while age group classifications (e.g., 0–5, 6–23, and 24–59 months) capture variations in growth and dietary needs. Finally, the source of drinking water, categorized as improved or unimproved, is included because unsafe water increases risks of infections that worsen nutrition.

D. Analytical Framework

The data analysis involved the following stages: statistical modeling based on the model of binary logistic regression to identify the consequences of socio-demographic factors; the geospatial methods to chart and investigate spatial distribution.

E. Logistic Regression Analysis

Binary logistic regression model was used to find the most important socio-demographic and environmental factors that cause child stunting. Stunted status was the dependent variable, and it was defined as stunted (1) or not stunted (0) based on WHO-recommended Z-scores for stunting. The dependent variable was a binary variable, with stunting status determined by the hw70 variable according to WHO criteria, categorizing children with height-for-age Z-scores below -2 standard deviations as stunted (1) and those above as not stunted (0).

Gen stunting_status = hw70 < -200 if hw70 != .label define stunting_status 0 "Not Stunted" 1 "Stunted" (1)

label values stunting status

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Independent Variables: The predictors encompassed socio-demographic variables, specifically the child's age, sex, maternal education, household wealth index, place of residence, and region. The logistic regression model is defined as:

$$Logit(p) = log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n \quad (2)$$

p is the probability of the event occurring (dependent variable = 1), β_0 denotes the intercept, and $\beta_0, \beta_1, \cdots, \beta_n$ are the coefficients for the independent variables $X_1, X_2, \ldots, X_n$.

IV. RESULTS AND DISCUSSION

The results obtained in this research is discussed in this section:

A. Demographic Characteristics and Relationship with Stunting

Table 1 shows the descriptive analysis of the distribution of child stunting based on a variety of socio-demographic, health, and environmental factors. The children are divided into two groups: Not Stunted and Stunted. This statistical summary helps us understand how stunting is spread across different groups and makes it easier to find groups that are at risk.

Table 1: Summary Statistics of the Demographic Characteristics

Characteristic	Not Stunted		Stunted	
	Freq.	%	Freq.	%
Type of Place of Residence				
Urban	3,231	74.05	1,132	25.95
Rural	3,985	57.77	2,913	42.23
Region				
north central	1,434	72.02	557	27.98
north east	1,052	52.18	964	47.82
north west	1,208	43.42	1,574	56.58
south east	1,281	80.97	301	19.03
south south	970	77.85	276	22.15
south west	1,271	77.31	373	22.69
Highest Educational Level				
no education	2,055	47.33	2,287	52.67
Primary	1,199	63.31	695	36.69
Secondary	3,075	76.80	929	23.20
Higher	887	86.88	134	13.12
Wealth index combined				
Poorest	1,041	46.16	1,214	53.84
Poorer	1,209	53.26	1,061	46.74
Middle	1,594	64.12	892	35.88
Richer	1,770	75.35	579	24.65
Richest	1,602	84.27	299	15.73
Respondent Currently Working				
No	2,047	59.89	1,371	40.11
Yes	5,169	65.91	2,674	34.09
Current age of child				
0	1,923	79.73	489	20.27
1	1,486	62.49	892	37.51
2	1,155	53.67	997	46.33
3	1,256	57.91	913	42.09
4	1,396	64.93	754	35.07

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Duration of Breast Feeding				
ever breastfed, not	4,493	60.89	2,886	39.11
never breastfed	106	59.55	72	40.45
still breastfeeding	2,617	70.65	1,087	29.35
Size of Child at Birth				
very large	751	70.65	312	29.35
larger than average	1,718	63.02	1,008	36.98
Average	3,884	65.43	2,052	34.57
smaller than average	604	56.66	462	43.34
very small	166	52.37	151	47.63
don't know	93	60.78	60	39.22
Had diarrhea recently				
No	6,471	65.86	3,355	34.14
yes, last two weeks	745	51.99	688	48.01
don't know	0	0.00	2	100.00
Had Fever in the last two weeks				
No	5,513	66.18	2,817	33.82
Yes	1,703	58.14	1,226	41.86
don't know	0	0.00	2	100.00
Had Cough in the last two weeks				
No	5,974	63.88	3,378	36.12
Yes	1,242	65.09	666	34.91
don't know	0	0.00	1	100.00
Access to media				
No	1,147	48.23	1,231	51.77
Yes	6,069	68.32	2,814	31.68
Age Group				
0	266	59.11	184	40.89
20-24	1,209	60.75	781	39.25
25-29	2,081	64.95	1,123	35.05
30-34	1,755	66.83	871	33.17
35-39	1,267	65.68	662	34.32
>=40	638	60.08	424	39.92
Source of Drinking Water				
Protected	5,155	68.35	2,387	31.65
Unprotected	2,061	55.42	1,658	44.58
States				
Sokoto	122	44.20	154	55.80
Zamfara	181	50.00	181	50.00
Katsina	194	42.64	261	57.36
Jigawa	149	37.53	248	62.47
Yobe	140	42.81	187	57.19
Borno	195	57.35	145	42.65
Adamawa	179	62.81	106	37.19
Gombe	189	51.50	178	48.50
Bauchi	181	43.41	236	56.59
Kano	242	44.57	301	55.43
Kaduna	203	50.50	199	49.50
Kebbi	117	33.72	230	66.28

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Niger	307	72.92	114	27.08
Fct Abuja	208	77.90	59	22.10
Nasarawa	184	67.40	89	32.60
Plateau	138	54.98	113	45.02
Taraba	168	60.00	112	40.00
Benue	273	78.90	73	21.10
Kogi	158	79.80	40	20.20
Kwara	166	70.64	69	29.36
Oyo	244	68.35	113	31.65
Osun	188	78.33	52	21.67
Ekiti	188	78.66	51	21.34
Ondo	171	78.80	46	21.20
Edo	115	81.56	26	18.44
Anambra	341	85.25	59	14.75
Enugu	199	83.61	39	16.39
Ebonyi	326	75.64	105	24.36
cross river	114	74.03	40	25.97

B. Nature of disparity of Stunted and Non-Stunted Children

The Table 2 shows the summary statistics of both stunted and non-stunted children in Nigeria highlighting a big difference in child nutrition in Nigeria between the regions.

Table 2: Summary Statistics of the Stunted and Non-Stunted Children in Nigeria

Variables	Mean	Std. Dev	Skewness	Kurtosis
Total Freq. of stunted Children	1,089.04	931.55	1.05	0.10
Total freq. of not stunted children	1,942.7	1,692.92	1.29	0.73

C. Logistic Regression Model

Table 3 above showed the output of a logistic regression model that focuses on analyzing the factors linked with child stunting.

Table 3: Logistic Regression Model for Child Stunting

Stunting Status	Odds Ratio	Std. Err	z	P>|z|	[95% Conf. Interval]	
Region						
North east	1.2529	0.2516	1.12	0.262	0.8449	1.8571
North west	2.1145	0.4263	3.71	0.000	1.4239	3.1390
South east	0.7771	0.1707	-1.15	0.251	0.5051	1.1954
South south	1.0954	0.2603	0.38	0.701	0.6875	1.7454
South west	1.0091	0.2201	0.04	0.967	0.6580	1.5476
Type of Residence						
Rural	1.0256	0.0613	0.42	0.672	0.9121	1.1532
Educational level						
Primary	0.84847	0.05893	-2.37	0.018	0.74047	0.9722
Secondary	0.61788	0.0439	-6.77	0.000	0.53749	0.7102
Higher	0.37719	0.0451	-8.15	0.000	0.29836	0.4768
Wealth index						
Poorer	0.9859	0.0686	-0.20	0.839	0.8600	1.1301
Middle	0.8680	0.0698	-1.76	0.079	0.7413	1.0164
Richer	0.6416	0.0610	-4.66	0.000	0.5324	0.7732

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Richest		0.4709	0.0550		-6.44	0.000	0.3744		0.5922
Working status									
Yes		1.0726		0.0554		1.36	0.175	.96933	1.1868
Child's birth age									
1		2.6845	0.2095		12.65	0.000	2.3037		3.1284
2		4.0483	0.4262		13.28	0.000	3.2934		4.9762
3		3.1717	0.3410		10.73	0.000	2.5690		3.9159
4		2.2921	0.2507		7.58	0.000	1.8497		2.8403
Breast feeding									
Never breastfed		0.9556	0.1661		-0.26	0.794	0.6796		1.3436
Still breastfeeding		0.9016	.07614		-1.23	0.220	0.76405		1.0639
Size at Birth									
Larger than average		1.2651	0.1132		2.63	0.009	1.061575		1.5078
Average		1.3238	0.1095		3.39	0.001	1.125563		1.5570
Smaller than average		1.6823	0.1779		4.92	0.000	1.367405		2.0698
Very small		2.4331	0.3644		5.94	0.000	1.814142		3.2632
Don't know		2.1408	0.4243		3.84	0.000	1.451636		3.1574
Had diarrhea									
Yes, last two weeks		1.3009		0.0884		3.87	0.000	1.1385	1.4864
Had fever									
Yes		0.9799	0.0542		-0.37	0.714	0.8792		1.0921
Had cough									
Yes, last two weeks		0.9794	0.0634		-0.32	0.749	0.8626		1.1121
State									
Zamfara		0.9138	0.1565		-0.53	0.599		0.6532	1.2783
Katsina		1.2575		0.2057		1.40	0.161	0.9126	1.7328
Jigawa		1.4097	0.2412		2.01	0.045	1.0080		1.9715
Yobe		1.7088	0.3013		3.04	0.002	1.2094		2.4144
Borno		1.1109	0.1949		0.60	0.549	0.7876		1.5671
Adamawa		0.9442	0.1728		-0.31	0.754	0.6596		1.3516
Gombe		1.3608	0.2330		1.80	0.072	0.9728		1.9035
Bauchi		1.9391	0.3231		3.97	0.000	1.3988		2.6882
Kano		1.2487	0.1984		1.40	0.162	0.9145		1.7050
Kaduna		1.0118	0.1720		0.07	0.945	0.7250		1.4121
Kebbi		1.7303	0.3037		3.12	0.002	1.2266	2.4408	
Niger	0.7305	0.1404		-1.63	0.103	0.5011		1.0649	
FCT Abuja		0.8057	0.1776		-0.98	0.327	0.5230		1.2413
Nasarawa		1.2733		0.2609		1.18	0.238	0.8521	1.9027
Plateau		1.7626	0.3630		2.75	0.006	1.1771		2.6392
Taraba		1 (omitted)							
Benue		0.5700	0.1184		-2.71	0.007	0.3794		0.8565
Kogi	0.6650	0.1590		-1.71	0.088	0.4161		1.0627	
Kwara		1 (omitted)							
Oyo		1.6035	0.3160	2.40	0.017	1.0897		2.3597	
Osun	0.7849	0.1778		-1.07	0.285	0.5035		1.2237	
Ekiti	0.9310	0.2108		-0.32	0.753	0.5973		1.4512	
Ondo	0.7654	0.1778		-1.15	0.250	0.4854		1.2071	
Edo		0.5799		0.1676	-1.88	0.059	0.3291		1.0220
Anambra		0.7914	0.1693		-1.09	0.274	0.5203		1.2037

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Enugu		0.7235	0.1734		-1.35	0.177	0.4522		1.1575
Ebonyi		0.9786	0.1946	-0.11	0.913	0.6627		1.4450	
Cross river		0.8464	0.2241		-0.63	0.529	0.5036		1.4224
Akwa ibom		0.7298	0.1801		-1.28	0.202	0.4499		1.1840
Abia		1.1751	0.2781		0.68	0.495	0.7390		1.8687
Imo		1 (omitted)							
Rivers		0.7115	0.1718		-1.41	0.159	0.4432		1.1423
Bayelsa		0.8855	0.2108		-0.51	0.610		0.5553	1.4123
Delta		1 (omitted)							
Lagos		0.8627		0.1921		-0.66	0.507	0.5576	1.3349
Ogun		1 (omitted)							
Access media									
Yes		0.9880	0.0607		-0.20	0.845	0.8758		1.1146
AGE_GROUP									
20-24	0.8928	0.1068	-0.95	0.344	0.7061	1.1289			
25-29	0.8653	0.1009		-1.24	0.215		0.6884		1.0876
30-34	0.8316	0.0994		-1.54	0.123	0.6580		1.0512	
35-39	0.7792	0.0959		-2.02	0.043	0.6121		0.9920	
>=40	0.8157	0.1071		-1.55	0.121	0.6306		1.0552	
water source									
unprotected	1.0388	0.0554		0.71	0.475	0.9356		1.1532	
_cons	0.2324	0.0551		-6.16	0.000		0.1460		0.3699

D. Spatial Statistical Integration

Figure 1 portrayed the map that shows a topographical graphical representation of the forecasting probability of child stunting in Nigeria for children below five years.

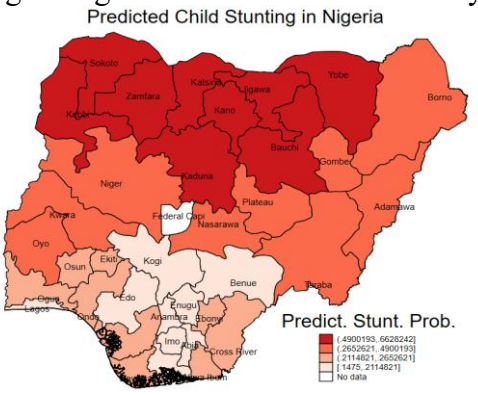
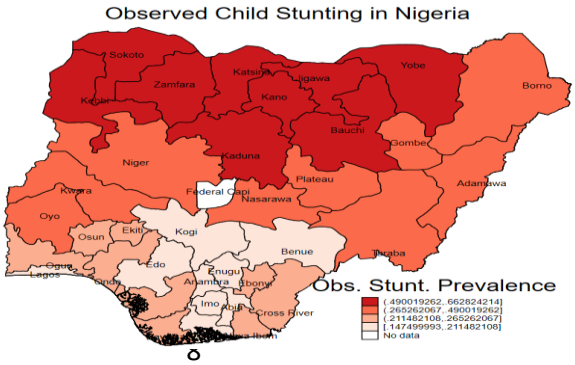


Figure 1: Predicted Child Stunting Probabilities in Nigeria by State



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Figure 2: Observed Stunting Prevalence in Nigeria by State

The map titled "Observed Child Stunting in Nigeria" in Figure 2 visually represents the geographic distribution of stunting prevalence among children across Nigerian states.

E. Comparison between the observed and Predicted Stunting Prevalence

The comparison between the observed and predicted child stunting prevalence maps in Nigeria reveals a strong spatial correspondence, indicating that the predictive model performs well in capturing the geographic pattern of stunting across the country. Both maps show a clear north-south divide, with the northern regions exhibiting significantly higher rates of child stunting compared to the southern regions. This consistency suggests that the model effectively identifies areas where children are most vulnerable to chronic undernutrition. In contrast, the southern regions, including states such as Lagos, Ekiti, Anambra, and Enugu consistently show lower stunting prevalence in both observed and predicted distributions. The alignment between observed and predicted values in these areas underscores the model's accuracy in detecting low-risk zones as well.

F. Discussion of the Results

Table 1 reflects that stunting is much more common in rural areas (42.23%) than in urban areas (25.95%). The disparity implies that children in rural settings are more exposed to poverty-related issues, lack of appropriate healthcare facilities, unhealthy sanitation and nutrition while in urban settings, the infrastructure is usually enhanced with access to social services, and exposure to health education. There is also a strong disparity in regional stunting. Northern regions have the highest prevalence of stunting while the southern regions record significantly low rates. The higher prevalence of vulnerability to stunting in the North could also be due to conflict, food insecurity, and low maternal education. The stunting rate among children of working mothers is 34.09 percent, as compared to 40.11 percent of children whose mothers are not working at the moment. This could be attributed to the fact that working mothers help in household income and thus enhancing food security although this may be different in relation to the quality of employment and time that a mother has to care about her child. Child stunting also accumulates depending on the age of the child with the highest rate of 46.33 percent and 42.09 percent at age 2 and 3 respectively and slightly decreasing in later ages. The lowest stunting rates of 29.35 percent are among children still being breastfed with the highest rates of 39.11 percent among children ever breastfed but not currently breastfeeding. The number of the group of never breastfed children is minimal, but the stunting rate remains high (40.45%). These findings support the need to maintain breastfeeding in the first years of a child which leads to the best growth and immune system. The results of the size of the baby at birth highlight the impact of prenatal nutrition and maternal health on child health. A history of recent childhood illnesses, particularly diarrhea and fever, is associated with heightened stunting. Additionally, the mother's age, access to media resources and source of drinking water influence the prevalence of stunting. The trends may be linked to maternal experience, physical development, and financial stability. The results in Table 3 showed that some socio-economic, demographic, and child-specific variables considerably affect the risk of stunting, whereas others do not have any significant impact. The area of residence is influential in determining stunting to an immense degree. Children in the North West have more than twice the likelihood of being stunted as compared to the reference region, North Central (OR = 2.11, $p < 0.001$). Contrastingly, the children in the North East, South East, South South and South West do not differ significantly with the reference except that the North East has 25 percent higher odds of stunting which is not significant. Residence type is not significantly related to stunting, rural

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or urban. Maternal education shows to be a potent stunting protective factor. The protective effect is stronger when education levels are higher: odds of stunting are 38% ($p < 0.001$) lower with secondary education and 62% ($p < 0.001$) lower with higher education. Another influential determinant is the household wealth. Children in richer households are 36 percent less likely to be stunted than those in the poorest households ($p < 0.001$) and those in richest households are 53 percent less likely ($p < 0.001$). The odds of stunting decrease by 13 percent in middle-income households, although this difference is not significant ($p = 0.079$), whereas households that are poorer than the poorest do not differ on average. Stunting is strongly predicted by the age of child in years (birth age). Children between one and four years old are more likely to be stunted than the comparison group (probably older children, at least five years old), with odds of 2.68, 4.32, 3.17, and 2.29, respectively, highly significantly ($p < 0.001$). This indicates that the early stages of child development are the most vulnerable with the risk of growth faltering. However, there is no relevant association between breastfeeding status and stunting. Size at birth and recent sickness also reflects a strong and consistent association with stunting. Significant differences are witnessed at the state level. Children in Jigawa, Yobe, Bauchi, Kebbi, Plateau, Benue and Oyo differ considerably vis-a-vis the reference state (Taraba or another omitted category). Such geographic variations suggest region specific determinants of stunting that could need region specific interventions. Overall, the key predictors of child stunting in this analysis are region of residence (especially the North West), maternal education, household wealth, age of child, weight at birth, recent experience of diarrhea, and some disparities between states. These findings indicate that the priorities of the intervention to reduce stunting need to be set to improve maternal education, increase household economic status, better prenatal and early childhood nutrition, prevent diarrheal diseases, and direct targeted intervention at the regions and states at risk of stunting. From the results in figure1, the northern parts of Nigeria are overrepresented in the high expected stunting rates, these states are colored using different red shades, from the map, the likelihood of stunting that is expected to occur were represented darker shades reflecting higher probabilities while lighter shades showed the states with probability of lower risks. It was deduced that states in the North West and North East reflected the predicted probabilities of between 70-90 percent. Conversely, the southern part of Nigeria has substantially lesser child stunting predictive probabilities. States like Lagos, Ogun, Osun, Anambra, Enugu, Rivers, Cross River are indicated in pale color implies stunting likelihoods of up to 20 percent to 30 percent. These areas have relative advancement in socioeconomic status, enhanced health and nutrition provisions, enhanced maternal education, food security and superior infrastructure. The middle belt states have intermediate risks with orange color. These are the states that constitute a transition zone, as they resemble both the north and the south in patterns of development indicators. This sharp contrast creates a vision of a nation where the geography is a key factor that impacts on the health of the children. On the whole, the map indicates an apparent north-south inequality in the projected burden of child stunting in Nigeria. The presented visualized data highlight the necessity of geographically specific interventions and policies that are urgent. Based on the map in Figure 1, stunting occurs mostly in the northern part of Nigeria especially in the North West and North East geopolitical zones. The states are historically affected by a number of issues such as poverty, food insecurity, low maternal education, limited access to healthcare services, and in case some of the states, insecurity and insurgency among others that are leading to chronic undernutrition among children.

However, states such as Kaduna, Niger and Plateau have moderate stunting prevalence as seen through the lighter shades of red. Conversely, the South West, the South South, and some of the South East of Nigeria has a much lower prevalence of child stunting. The states that show the lightest colors are FCT, Lagos, Ogun, Osun, Ekiti, and Edo, Delta, Rivers, and Enugu with the lowest reported prevalence of stunting. These states tend to be more urban and have an

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infrastructure that is relatively better, literacy rates, access to healthcare is better and their economies are diversified that promote food security and welfare of children. On the whole, Figure 2 represents a strong visual aid that policymakers, health professionals, and development partners can use to understand the importance of regionally specific and equity-minded approaches to fighting child stunting and long-term human development in Nigeria.

V. CONCLUSION

Spatial mapping was an invaluable resource because it enabled possible identification of areas with high burden and substantiating the reliability of the predictive model. The study verifies that child stunting in Nigeria is affected by a multifaceted interplay of geographic, socioeconomic, and health-related factors. There is a big difference in the number of stunted children between the north and south. This is because of systemic problems with maternal education, poverty levels, access to healthcare, and child feeding practices. Socioeconomic status and maternal education provide protective benefits; however, health shocks such as diarrhea and adverse birth outcomes markedly elevate vulnerability. The close match between the observed and predicted stunting prevalence maps shows that the predictive model is strong. It accurately reflects the actual prevalence of stunting in Nigeria, serving as a dependable instrument for pinpointing high-risk regions and informing policy measures to mitigate childhood undernutrition.

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