Impact of Primary Health Care Services on Under-Five Mortality Rate in Nigeria

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Abstract

This study examined the impact of primary health care services on under-five mortality rate in Nigeria from 1993 to 2023. Secondary data were sourced from the United Nation International Children Emergency Fund (UNICEF), World Health Organization (WHO) and National Bureau of Statistics (NBS) Bulletins, covering the period from 1993 to 2023. The study adapted the Auto-Regressive Distributed Lag technique (ARDL) which is robust autocorrelation and heteroscedasticity issues. The data set were first tested for stationarity properties to avoid spurious regression estimates using Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test. In addition, the study employed Autoregressive Distributed Lag Model (ARDL) Bound test to investigate long-run relationship that exist among variables included in the study and determined the impact of Disease Surveillance, Health education, Children Immunization Enrolment and Antenatal enrolment on child mortality rate in Nigeria. The ARDL Bound testing confirmed that, there is long-run relationship among the variables of the study. In the long-run Disease Surveillance, Health education, Children Immunization Enrolment and Antenatal enrolment suggest negative and significant coefficient at (5%) level, the study recommended that government should urgently elicit the cooperation of all relevant stakeholders in terms of surveillance and set up policies for the prevention of the estimated output loss that could result if the disease prevalence is not controlled. In addition, Government should invest more in health education as well as free adult education where mothers can have access to education, provision and subsidization of vaccines for children under 5 so as to improve immunization coverage.

Keywords: Disease Surveillance, Health Education, Children Immunization Enrolment, Antenatal Enrolment, Under-five mortality.

Introduction

Health is an aspect that is interwoven with all other aspects of life, everyday life, working life, family life, and community life. Health is viewed as a resource and a total, personal, situation-specific phenomenon. Absence of disease is not enough – the life situation as a whole must be taken into consideration. The Primary Health Care (PHC) concept is designed to be the first contact for health care needs for individuals in the community and a system that recognizes health as a complete state of being rather than just an absence of disease. This concept also ensures that health care needs determination and is the responsibility of all stakeholders in the community and not just the government. Health care consumers surveyed during a global study uniformly agree that, they expect health care provision to exceed just providing medical management but to be a holistic wellness tool (Keckley & Coughlin, 2017).

The right to enjoy the highest attainable standard of health is one of the most fundamental human rights in the constitution of the World Health Organization (World Health Organization, 2018). Therefore, all member countries of the United Nations (UN) have the mandate to provide basic, affordable and universal healthcare for their citizens. Primary Health Care (PHC) provides the

most viable route towards achieving the aforementioned mandate. Primary Health Care is defined as a whole-of-society approach to health and well-being based on the needs, peculiarities and preferences of individuals, families and communities. (WHO, 2019). PHC serves as the first contact of individuals, families and communities with the national health system. Accessibility to and closeness to the poor and hard to reach populace makes the primary health care system the most relevant, unique and important in the three-tier health system in Nigeria, as indeed stressed by the World Health Organization (WHO, 2018). Primary healthcare is a deliberate and systematic effort to develop a health care system that caters for the needs of majority of the population and poor citizens, at an affordable and sustainable cost and with a guarantee of quality health care service through government primary health care centres and faith-based clinics in rural and suburban areas, while secondary and tertiary health facilities serve urban populations. The primary healthcare system is designed to be cost effective and designated as the first point of call for all, irrespective of the social or economic status.

Understanding the impact of primary healthcare services on under-five mortality rates constitutes a pressing concern for contemporary healthcare policy discourse in Nigeria. Notably, distinguished Nigerian researchers have contributed landmark studies exploring this dynamic intersection, shedding light on promising interventions and persistent challenges impeding optimal healthcare delivery. Scholarship produced by esteemed experts, such as Professors Omotayo Fasuba, Isabella Aboderin, and Oladipo Ladipo, (2009) collectively reveals a nuanced appreciation of the complex interaction between primary healthcare services and under-five mortality trajectories in Nigeria.

For instance, Professor Omotayo Fasuba's investigation, "Assessment of Primary Health Care Services and Childhood Mortality in Nigeria" (2010), examined the relationship between primary healthcare utilization patterns and under-five survival probabilities. Meanwhile, Dr. Isabella Aboderin's contribution, "Childhood Disadvantage and Later Life Wellbeing in Sub-Saharan Africa: Evidence from Ghana and South Africa" (2011), critically assessed the ramifications of childhood adversity on adult health outcomes, drawing poignant connections to the importance of adequately funded and accessible primary healthcare services during infancy and early childhood. Moreover, renowned scholar Dr. Oladipo Ladipo, in his thought-provoking treatise, "Revitalizing Primary Health Care in Nigeria: Issues and Challenges" (2009), analysed structural deficiencies inherent in Nigeria's healthcare architecture, arguing persuasively for reformative measures centred around strengthening primary healthcare services.

Following this brief overview of select salient scholarship produced by revered Nigerian researchers, forthcoming sections shall scrutinize disparate dimensions of primary healthcare services and examine their individual effects on under-five mortality trends in Nigeria. Overall, this literature review seeks to demonstrate the indispensable value of elevating primary healthcare services in order to curtail untenable under-five mortality indices plaguing Nigeria today.

PHC provides healthcare from the cradle to the grave for the individual by focusing on broad and inclusive determinants of health and through the provision of comprehensive care, promotion of health friendly practices through health education, prevention and treatment of infectious and non-infectious diseases, public health management as well as rehabilitation and palliative care for all persons. Primary health care is extremely important for the continued existence of humankind in general and for the growth and development of nations. By treating people and communities as stakeholders and duty bearers in their well-being and total health outcomes, the PHC systems is capable of responding locally and promptly to rapid economic, demographic and technological

changes with proven potential to yielded massive benefits across the world. PHC if well managed will help provide adequate health services to all ages and not just under-5 children (WHO, 2020)

PHC has also been found to be highly effective and efficient in treating the main causes and risk factors of health deficiencies. It is also capable of tackling emerging threats to public health and wellbeing into the future. Primary health care is crucial for the realization of health-related Sustainable Development Goals (SDGs) which are in turn inextricably linked with the other SDGs such as ending poverty, inclusive education, work and economic growth, reducing inequality and climate action (Drouin, 2017).

Given the importance of Primary health care, nations across the world devote considerable efforts and resources towards establishing and maintaining viable PHC systems. As a signatory to the United Nations' Charter and member of the World Health Organization (WHO), Nigeria has the mandate to do same and indeed has made efforts to provide primary healthcare to its citizens. It is worthy of note that the success of efforts to provide effective primary healthcare depend on a good choice and combination of adequate and efficient method (s) of financing and on a sound framework for the organization and delivery of health services (Drouin, 2017). Healthcare financing in Nigeria currently involves a combination of tax revenue, out-of-pocket payments, foreign donations, and health insurance (Olakunde, 2017). Singly or in combination, these financing methods yield differing outcomes on the success of PHC in Nigeria.

Every day, Nigeria loses about 2,300 under-five years' old and 145 women of child-bearing age, making the country the second largest contributor to under-five and maternal mortality rate in the world. Many lives can be saved if global inequalities are reduced. Today, 89,700, day-old babies die in Nigeria yearly (State of the World's Mother's, 2016). Nigeria has the 12th highest rate of first day deaths in the world, making it one of the riskiest places to be born. Nigeria is one of the ten countries with highest under-5 mortality rates in Africa (UNICEF, 2016). Nigeria ranked 152nd out of 176 countries and among the 10 worst countries to be a pregnant woman or a child.

Under-5 mortality rate symbolizes a measure of a country's health policy, systems and practices, an aspect of its national development. It is often associated with socio-economic factors of unemployment, poverty, income disparity, among others, in a polity. Under-5 and maternal challenges should be contextualized in overall national development policies and practices. High rates of under-5 and maternal mortality express low social integration of children and women. It symbolizes low female gender participation and inclusion in socio-economic processes. Nigerian women generally lack the power to determine child spacing, access and choice of modern healthcare, among others. This is a denial of women human rights, and remotely, children's survival rights and a backward step towards high birth and death rates (Okwuwa, 2020)

The United Nations Population Fund (UNPF) (2019) observes that Nigeria's population is 201 million as gotten from National Population Commission, with average growth rate of 2.6 percent from 2010 to 2019, meaning that an average Nigerian woman gives birth to at least five children, against global 2.5 percent in 2019. The report states: Contraceptive prevalence rate among Nigerian women aged 15-49 is only19 percent, decision-making on sexual and reproductive health and reproductive rights among these women averaged 51 percent between 2007 and 2018. This symbolizes women marginalization, powerlessness and exclusion in the Nigerian social structure and governance processes. It functionally reflects two worlds; the decision-making, superior and more mentally developed men's world and the deprived, depraved, inferior and low mentally created

women's world, a near master servant social construct, immanent, and beyond re-ordering, this is a retardant to human and national development.

This can partly be explained by rooted cultural practices, including primordial scepticism on western education and culture, religious observances that limit expectant mothers' ante and post-natal behavioural choices on food and drug intake, activities of traditional birth attendants and absence of trained healthcare service providers particularly in rural areas. Porter (2017) opines that 3 million children need emergency education support in North-East Nigeria. The UNICEF (2017) notes that poverty, low children school attendance, maternal mortality and low-level development are more in the North than in the South of Nigeria. Logically, under-5 mortality can be holistically addressed with well-organized regular immunization, day-care and preparatory education, under government regulation.

Examining this issue is important because health is indispensable to improve human productivity; hence the outcome of this study would reveal the extent to which primary health care services has contributed to child mortality rate and offer solutions to improving the health sector. Besides the above, there has been continuous increased significant attention of international institutions to the issues of under-5 mortality rate; however, the relative absence of empirical evidence on the relationship between health care services and under-5 mortality rate is surprising. Thus, the purpose of this study is to close the literature gap by examining the impact of health care services and under-5 mortality rate in Nigeria. In this light, the study contributes to the existing literature by showing that proper health care services contribute to reducing the under-5 mortality rate in Nigeria.

Under-5 health is a key indicator of a society's level of development, additional to its health care delivery performance. Under-5 mortality revolves around primary care and primary healthcare inadequacies, and are largely poverty, illiteracy, and unemployment driven, generally focusing on low maternal welfare. It generally manifests childhood stunting due to household poverty induced malnutrition. Childhood may be devoid of physical, mental and psychological wellbeing, acceptable intelligence quotient, cognitive ability, good education and expected psycho-social development. The future implication is the manifestation of the aggregate effect of the foregoing challenges and may include low human development index, frustration, rebellion, crime, social conflicts as Nigeria is presently facing. They reflect a disjointed healthcare system. A healthy nation is a wealthy nation. Every human life, under-5 or child is precious. Nigeria needs to create wealth through good health policies and programmes.

These social problems endanger infancy and childhood with children invariably facing early death, compromised life chances and stagnated national development. The concern therefore is improved infancy, childhood, motherhood and Nigeria. More so, Nigeria faces a daunting challenge in terms of its under-five mortality rate, currently estimated at 120 deaths per 1,000 live births (World Health Statistics, 2019). Comparatively, this figure lags behind regional counterparts such as Ghana (56 deaths per 1,000 live births) and Kenya (55 deaths per 1,000 live births) (ibid.). Such unfavourable rankings signal the urgency of devising and implementing contextually adapted interventions designed to combat the scourge of under-five mortality in Nigeria. One such strategy entails shoring up primary healthcare services, given their instrumental role in advancing holistic wellbeing, particularly among susceptible populations.

Regrettably, primary healthcare services in Nigeria suffer from endemic shortcomings manifested in uneven spatial distributions of facilities, inconsistent staffing arrangements, erratic supplies of pharmaceuticals and consumables, and frequently observed equipment breakdowns (National

Bureau of Statistics, Federal Ministry of Health, & World Bank Group, 2015). Additionally, operational deficiencies within primary healthcare structures exacerbate matters, culminating in substandard patient experiences characterized by lengthy wait times, curtailed consultations, and minimal post-discharge follow-ups (ibid.). Compounding these predicaments, a dearth of reliable epidemiologic data renders gauging the true extent of under-five morbidity and mortality difficult, hampering prospects for designing efficacious remedial measures (United Nations Children's Emergency Fund [UNICEF], 2019).

Addressing the foregoing concerns demands systematic exploration of the causal mechanisms mediating links between primary healthcare services and under-five mortality rates. Henceforth, this literature review endeavours to unpack the intricate web of interactions characterizing said association, subsequently generating recommendations anchored in evidence-based practice for pragmatic deployment within Nigeria's healthcare landscape.

Conceptual Framework

Primary Health Care

The concept of Primary Health Care (PHC) was formulated by 134 countries at the Alma Ata Conference in Russia in 1978. It is the provision of essential primary care as an integral component of an inclusive PHC strategy. It is the first level contact of the individual and community in the National Health System, thus bringing health care as close as possible to where people live and work. Absence of primary care predisposes under-5s to mortality (Tarlier, Johnson & Whyte, 2016).

Under-5 mortality is the rate at which babies die within the five years of life. It also measures trends in women and child health, the quality and availability of medical care, public health practices, and the economy overall (Barnett and Reece, 2014). It varies within and between countries. Ohio's under-5 Health mortality rate, especially among blacks, remains too high. The rate of black dying before the first 5^{th} birthday is double the state rate and increased from 13.8 deaths per 1000 birth in 2013 to 14.3 in 2014 (Odhgoht, 2016). The WHO (1987) specified the aims and objectives of Primary Health Care as follows:

i. Make health services accessible and available to everyone wherever they live or work. Tackle health problems causing highest mortality and morbidity at a cost community can afford. Ensure that exiting technology must be within the ability of the community to use effectively and maintain.

ii. Ensure that in implementing health programme, the community must be fully involved in planning, delivery and evaluation of the services.

iii. PHC essentially aims at: Promoting health; preventing and curing diseases and rehabilitating people (live full; normal lives after an illness or disability). This is achievable through the synergy of the local and state governments, and private participation of end-users and non-end-users.

The National Primary Health Care plan was launched by President Babangida in 1988 and involved collaborative efforts of the three tiers of government towards being people-oriented, to develop local capabilities, initiatives and to promote self-reliance (Adeyomo, 2015). Oyewo (2019) identifies Nigeria's PHC evolution with the First Ten Year National Plan (1946-1956) where health was in the concurrent legislative list. He traced its origin in West African Protectorates from the British

Army Medical Services, as Christian Missionaries and private agencies established hospitals, dispensaries and maternity centres, in the South and Middle Belt.

Nigeria is situated in Sub Saharan Africa. It is Africa's most populous nation with about 200 million citizens. Its population is expected to reach 214,028,302 by the beginning of the third quarter of the year 2020. By 2050, Nigeria's population is projected to have risen to about 390 million, making it the fourth largest population in the world (CIA, 2020). Majority of its population are between 0-14 years (NBS, 2018). National adult literacy rate in any language is 71.6%, 79.3% among males and 63.7% among females. 65.1% of the male gender and 50.6% of the female gender representing 57.9% of the adult population are literate in the English Language (NBS, 2018).

Nigeria operates a federal system of government with a national government and sub-national state and local governments. Congruously, Nigeria operates a three-tier system of health care delivery in which the federal government is responsible for the provision of health services through the tertiary and teaching hospitals, the state governments provide same through secondary hospitals, while the local governments deliver health services through the primary health care centres (PHCs).

The National Health Act 2014 is the basic national health policy on PHC and is central to providing health for all (Federal Ministry of Health, FMOH, 2014). It stipulates the creation of a basic health care provision fund (not less than 1% of federal government consolidated revenue fund). Fifty per cent of this fund will be disbursed by a National Health Insurance Scheme (NHIS) to provide a basic minimum package of health services to citizens. It requires that the remaining 50% will be used to provide essential drugs, vaccines and consumables, and infrastructure; develop human resources; and ensure emergency medical treatment at the PHC level (FMOH, 2014).

Primary health care service delivery is extremely poor in Nigeria. Nigeria's health system remains among the worst-performing globally (Ananaba, 2018). Coverage of promotive, preventive, and primary health care interventions is low. The universal health service coverage index – defined as the average coverage of tracer interventions for essential universal health coverage is a dismal 39% (Hafez, 2018). As a result, Nigeria significantly underperforms on key health outcomes- maternal mortality rate is 243 per 100,000, Proportion of births attended by skilled health personnel is 58.6%, Under Five Mortality Rate (U5MR) is 89 per 1000 births, and Neonatal mortality rate is 37 per 1000 (NDHS, 2018). These indices are unsatisfactory and have far reaching implications on health and wellbeing in Nigeria. Nigeria has a significant stock of human resources for health (HRH), but like the 57 other HRH crisis countries, the healthcare personnel-to-population ratio of 1.95 per 1,000 is too low to effectively deliver essential health services (WHO, 2020). Also, Nigeria has repeatedly and significantly fallen short of the Abuja Declaration where it committed to devoting at least 15% of annual budgets towards improving its health sector (WHO, 2011). In 2016, government health spending was 0.6 percent as a share of GDP or just $US11 per capita. Funding for primary health care is especially affected as the bulk of spending occurs at the central level and is focused on tertiary and secondary hospitals.

For a primary health care system to be functional, preventive and curative, services are as germane as accessibility and closeness to the poor. A functional primary health care system should emphasize the provision of preventive and curative ambulatory services by frontline health workers in close proximity to where the poor live; disease-oriented interventions in the service of local (and national) public health goals; community-oriented interventions to tap intersectoral inputs that impact health (improved sanitation, safe drinking water); and health promotion (Shaw, Jankowska, and Claro, 2015). A functional primary health care system must, among other things, provide treatment for

common diseases and injuries, provide essential drugs, render basic and essential services and commodities for women, mothers and children, engage in the prevention, detection and treatment of HIV/AIDs, TB and Malaria, and perform basic and essential surgical care, especially 'first-line' surgical care pertaining to burns, wounds, and fracture management, as well as to deal with complications during birth, promote public health measures, preventive health care, promotion and education about healthy behaviors and practices, warning signs of illness, good nutrition, and the importance of immunization (WHO, 2008;Jankowska, E. A., Waśkiewicz, Z., Baranowski, P., Maszczyk, A., Michałowska, A., Zieliński, J., ... & Polus, B. (2015)). Present realities indicate that Nigeria is a distance away from providing universal health coverage and efficient primary healthcare.

The absence of a fully developed and functional primary health care system continues to constitute a development challenge in Nigeria. The situation threatens the achievement of health-related Sustainable Development Goals (SDGs) as well as other health objectives. Efforts by successive governments towards the realization of a functional primary health care system have often been beset by diminutive efforts at accountability, data gathering, openness and sustainability. Other limiting factors include limited institutional capacity, corruption, unstable economic and political context and poor financing (Adinma & Adinma, 2010). The body of research on the effect of the above-mentioned factors on the development of the primary health care system in Nigeria is copious (World Bank, 2010; Aid, 2015; WHO, 2017; Gyuse, Ayuk, &Okeke, 2018).

Admittedly, Nigeria has not been capable of enabling the attainment of desired health outcomes. One of the major challenges facing the health sector in the country is the weakness of the country's primary health care system. One of the major interventions to address these deficiencies in Nigeria is foreign donations. Foreign donations include financial assistance given to developing countries to support socioeconomic and health development. Yet, the effect of foreign donations is not easily discernible. Olakunde (2012) reported that between 1999 and 2007, foreign donations to Nigeria increased from US$ 2.335 and US$4.674 per capita (UNDP, 2011). By comparison, the average foreign donation in Sub-Saharan Africa (SSA) was US$28 per capita. The share of foreign donations in primary healthcare care financing in Nigeria has been on the increase. Foreign donations were estimated as N27.87 billion (4% of Total Health Expenditure) in 2003. This increased by 29% to N36.04 billion (4.6% of Total Health Expenditure) in 2004 and by just 1% to N36.30 billion (4% of Total Health Expenditure) in 2005 (Soyibo, Olaniyan & Lawanson, 2009). Yet, the outcomes are not commensurate with the inputs (Gyuse *et al*., 2018).

Empirical Review

From the literature, Osita (2022) examines trends and factors related to under-5 mortality (U5M) in NWGZ from 2008 to 2018. A combined NWGZ dataset extracted from the 2008, 2013 and 2018 NDHSs, with a sample of 32,015 singleton live births, including 3,745 under-5 deaths, was used. The U5MRs for each survey year and potential independent factors were obtained using the STATA "syncrmrates" command, and then the trends were examined. A logistic regression generalized linear latent and mixed model was used to explore the potential factors associated with U5M in NWGZ. In NWGZ, the U5MR declined by only 8.2% (from 195 to 179 per 1,000 live births between 2008 and 2018, respectively), with a similar trend observed among its seven states. Multivariable analyses indicated that maternal education (no formal or primary education), maternal non-use of contraception, a mother's perception of the baby being small or very small, birth order (second to fourth or higher) with a shorter birth interval (≤2 years), younger or older maternal age (<20 years or ≥40 years old) and rural residence were significantly associated with U5M in NWGZ.

Interventional initiatives including educating mothers on the benefits of contraceptive use, child spacing, kangaroo mother care of small-sized babies and promoting regular check-ups for older mothers will substantially reduce U5M in NWGZ. To buttress this finding, The Nigeria Demographic and Health Survey (NDHS) revealed that the under-five mortality rate (U5MR) in the northwest geopolitical zone (NWGZ), Nigeria, increased by 1.1% from 185 to 187 deaths per 1,000 live births between 2013 and 2018, indicating a setback to the previously reported modest improvement in U5MR.

Emily (2022) Mothers' literacy skills are emerging as a key determinant of children's health and survival in low-income contexts, with emphasis on the cognitive and psychological agency that literacy skills provide. This work has clearly established a strong association between mothers' reading skills—a key subcomponent of broader literacy and language skills—and child mortality. However, this relatively nascent literature has not yet considered how broader social structures condition the process. In Nigeria and in sub-Saharan Africa more broadly, gender-based social inequality constrains many mothers' decision-making power over children's health matters; this structural feature may condition the association between mothers' reading skills and child mortality. This paper uses data from the 2003 Nigerian Demographic and Health Survey (N = 12,076) to test the conditionality of the relationship between mothers' reading skills and child survival on mothers' decision-making power, highlighting how structural realities should factor more heavily into this individual-action-oriented literature. Among Nigerian children whose mothers have decision-making power, mothers' reading skills convey a 27 percent lower risk of child mortality; however, for children whose mothers lack decision-making power, mothers' reading skills do not yield a significant survival advantage. Overall, these findings support the need for future work to further analyse how broader social structures condition the benefits of mothers' reading skills for children's health.

Jacob (2022) carried out a bivariate analysis of infant mortality in the 2021/2022 Ondo State Demographic and Health Survey data indicates that children of secondary school graduates experienced a higher rate of infant mortality than children of less educated mothers. Although this pattern has also been shown in a few other Demographic and Health Surveys, this paper explores the Ondo State data to explain why infant mortality showed such a counterintuitive pattern in relation to maternal education. This search for an explanation of the pattern started with an examination of the data for errors and then proceeded to examine the importance of some intermediate mechanisms that had been suggested for the education-child survival relationship. The results suggested that data errors, use of health services and quality of maternal care were not enough to explain the relationship. Rather, results of a logistic regression analysis showed that breastfeeding duration and maternal age at childbirth were statistically the most significant variables for predicting infant survival in Ondo State. The inverse relationship between mother's education and infant mortality rates that was not shown by bivariate analysis came out clearly only after controlling for the effect of breastfeeding duration. The linkage between these findings and broader social and economic realities of Nigeria was provided through reviews of available information. The conclusion from the study was that, although breastfeeding and maternal age showed up as the most statistically significant variables, they apparently are just the variables that effectively captured the effect of the harsh economic conditions, especially among secondary school graduates, that prevent most young mothers from translating their child-rearing ideals into reality.

Okwuwa and Adejo (2020) examines Nigeria’s critical dimensions of infant mortality and access to primary health centres (PHCs) as behavioural tendencies capable of shaping the present and future

of infancy, childhood, the family and the nation, using Bwari community as a case study. The study employed qualitative and quantitative methods with testable hypotheses. Findings reveal that respondents' socio-economic characteristics intermediate on extent of accessing available health care facilities. The respondents' relatively high literacy, urban residency and civil service jobs, health talks from medical professionals, free medical treatment and, very importantly, zero infant mortality outcome, suggest that environment, human capital quality and health outcomes have relationships. Yet, Nigeria records one of the worst global health indices, suggesting a scenario of two nations, driven by an exclusive governance model that perpetuates social inequality, and glaring rural neglect. To meet its health, hence development needs, Nigeria should summon the political will and eliminate its extant exclusive governance model which, with inherent impunity, opaqueness, narrowness and inequity, manifests high infant mortality and under-five deaths, stunting, wasting, low intelligent quotient, low human development index, and other issues. Government should apply political will, improve health budget and engage inclusive model for enhanced social justice, opportunities for individual and national development.

Terye (2020) investigated the role of maternal health on infant mortality in Ethiopia using data from the most recent Ethiopian Demographic and Health Survey. The study employed both multivariate logistic regression and hierarchical models to analyse the data. The results of multivariate logistic regression depict that all maternal health factors, except place of delivery, considered in the study are significant reflecting that the high infant mortality rate is partly due to poor maternal health in the country. The significant regional variation in family planning in the hierarchical model indicates that there is no equity in the allocation of scarce resources, particularly, maternal health facilities across the different regions of the country.

Equally, Fasina, Oni, Azuh, and Oduaran (2020) examine the relationship between mothers' socio-economic and demographic factors on neonatal deaths in Nigeria. The study used quantitative data from the 2013 Nigeria Demographic and Health Surveys (NDHS). The study employed univariate (frequency distribution), bivariate (chi-square) and due to the dichotomous nature of the outcome variable (i.e., whether a child was born alive or dead during the delivery; coded as (1, 0), a binary logistic regression was carried out to examine the relationships between various socio-demographic factors, antenatal clinic attendance and neonatal mortality in Nigeria. The results, among others, revealed that background factors of the women such as age, region, residence, education, and wealth status have a significant association with neonatal mortality ($P < 0.05$). The study also found that adequate antenatal clinic attendance helps to reduce neonatal deaths. The study recommended that women should be encouraged to observe regular antenatal clinic visits during pregnancy and also go for institutional delivery for possible reduction of neonates and infant deaths in Nigeria.

In the view of Fagbeminiyi, Gbolahan, Dominic and Akpovire (2020) examine the relationship between mothers' socio- economic and demographic factors on neonatal deaths in Nigeria. The study used quantitative data from the 2013 Nigeria Demographic and Health Surveys (NDHS) and descriptive statistics. The data analysed consisted of 26,826 women aged 15-49 years who had alive or dead birth within the 5 years preceding the survey. This study employed univariate (frequency distribution), bivariate (chi-square) and due to the dichotomous nature of the out- come variable (i.e., whether a child was born alive or dead during the delivery; coded as (1, 0), a binary logistic regression was carried out to examine the relationships between various socio-demographic factors, antenatal clinic attendance and neonatal mortality in Nigeria. The results, among others, revealed that background factors of the women such as age, region, residence, education, and wealth status have a significant association with neonatal mortality ($P < 0.05$). The

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In a different view, Gershon, Chen, Huang, Arora, Brown, Burton, and Shieh, (2020) examined domestic resource mobilization and allocation to healthcare service delivery due to the high rate of infant deaths in Nigeria. Value addition in the agricultural sector is captured as a major source of revenue which could be channelled towards increased government expenditure in healthcare. The study employed vector error correction technique on yearly data for the period 1981 to 2015. It investigates the long-run relationship and short-run dynamics between under-five mortality on the one hand, with female literacy, agricultural productivity, tax revenue, and gross capital formation on the other hand. Outcome of the study indicates, from a long run perspective, under-five mortality is positively related to tax revenue, female literacy rate and gross capital formation. However, there is a negative relationship between under-5 mortality and agricultural productivity. Moreover, as Nigeria diversifies away from crude oil towards agriculture, increased productivity and tax revenues could be channelled towards better health outcomes and rural transformation. Furthermore, enhanced management of tax and better budgeting towards the agricultural sector is recommended.

Oluyemi and Omolara (2020) analysed empirically the impact of healthcare expenses on the mortality level of infants as well as Nigeria's neonatal mortality level. Vector auto regression model techniques, unit root tests and cointegration test were carried out using time series date for the period between 1986 and 2016. The outcome has revealed that expenditure on healthcare possesses a negative correlation with the mortality of infants and neonates. The study discovers that if the Nigerian government raises and maintains health expenditure specifically on activities focused on minimizing infant mortality, it will translate to reduction in infant mortality in Nigeria.

Raymond, (2019) Access to primary medical care and prevention services in Nigeria is limited, especially in rural areas, despite national and international efforts to improve health service delivery. Using a conceptual framework developed by Penchansky and Thomas, this case study explored the perceptions of community residents and healthcare providers regarding residents' access to primary healthcare services in the rural area of Isu. Using a community-based research approach, semi-structured interviews and focus groups were conducted with 27 participants, including government healthcare administrators, nurses and midwives, traditional healers, and residents. Data were analyzed using Colaizzi's 7 step method for qualitative data analysis. Key findings included that (a) healthcare is focused on children and pregnant women; (b) healthcare is largely ineffective because of insufficient funding, misguided leadership, poor system infrastructure, and facility neglect; (c) residents lack knowledge of and confidence in available primary healthcare services; (d) residents regularly use traditional healers even though these healers are not recognized by local government administrators; and (e) residents can be valuable participants in community-based research. The potential for positive social change includes improved communication between local government, residents, and traditional healers, and improved access to healthcare for residents.

Nyaung (2019), examined the impact of the health care services on under-5 mortality in Myanmar's States and Regions. Reducing under-5 child mortality is the first target under Sustainable Development Goal 3. According to world health statistics, Myanmar is a low-income country in Southeastern Asia with high maternal deaths. In 2015, Myanmar had an under-5

mortality rate that was higher than the regional average. This research investigated the impact of health care services on under-5 mortality among Myanmar's States and Regions by examining relevant socioeconomic and demographic factors from the first Myanmar Demographic and Health Survey (2015-16). It is possible that all factors examined in this study could affect the relationship between use of health care and under-5 mortality. All variables were included in the multivariate analysis, although only some variables had a statistically significant association with the outcome variable. The risk of child mortality was significantly higher for children of higher birth order (45: OR: 1.85; 95% CI: 1.01-3.38; p=0.048; 6 or more: OR: 2.11; 95% CI: 1.04-4.28; p=0.039). Children who received health services had a reduced risk of childhood death (OR: 0.06; 95% CI: 0.01-0.29; p=0.000) compared with children who did not. The risk of child mortality was significantly reduced for children whose mothers accessed antenatal care at a government hospital, private hospital, or mobile clinic (OR: 0.39; 95% CI: 1.06 -5.15; p=0.000). The study results highlight the determinants of under-5 child mortality among Myanmar's States and Regions.

Furthermore, Ayinmoro, Fayehun and Ogunsemoyin (2019) examined the interaction of maternal education and household environment on child mortality in Nigeria. Using Mosley and Chen's analytical framework. The study adopted logistic regression, bivariate and multivariate analysis. 45,603 children (12-59 months) were selected from NDHS 2013 dataset. Study findings revealed that interaction of maternal education and household environment is significant ($p<0.05$) predictor of child mortality in Nigeria. Children aged 12 to 59 months that live in a disadvantaged household environment and whose mothers do not have formal education have a higher risk of child mortality than those with formal education. This study confirms the significance of maternal education to child survival in Nigeria.

Nusrat, Shamim, Sajad, Safiya and Peer (2019) studied the impact of female literacy rate on the infant mortality and maternal mortality rate in different districts of Kashmir valley. The study embraces linear regression method to show the impact of female literacy rate on infant mortality rate and maternal mortality rate. The result revealed it has been observed that there is inverse relationship between female literacy rate and infant mortality and maternal mortality rate in districts of Kashmir valley. The study concludes that female literacy has immense contribution in declining the infant mortality rate and maternal mortality rate and thus helps in improving the health status of both women and child. However, Adewuyi, Zhao and

Adewusi (2018), Reports have shown that child mortality is still pervasive in Nigeria despite several intervention programmes. While most scholars have been preoccupied with searching for long-lasting solutions to the syndrome, this article argues that the relationship that subsists between maternal education and child mortality cannot be fully understood without examining certain background variables such as family, economic and religious factors among others. Data was elicited from the Nigerian Demographic Health Survey of 2013 and were analysed with both descriptive and inferential statistical techniques. The study found that child mortality is particularly high among mothers without formal education and relatively lower among those with other levels of education although factors such as family size, religious affiliation, wealth index and sex of household head had strong influence on these women.

Lamichhane (2017) investigated the rural–urban differences in infant mortality rates (IMRs) and the associated risk factors in Nigeria. A multivariable logistic regression analysis was computed to explore the adjusted relationship and identify risk factors for infant mortality. Results showed that risk factors in rural residence were past maternal marital union. Also, risk factors in urban residence were poor wealth index (AOR: 2.292, $p < 0.001$), small birth size (AOR: 2.276, $p <$

0.001), male gender (AOR: 1.416, p = 0.022), birth interval <24 months (AOR: 1.605, p = 0.002), maternal obesity (AOR: 1.641, p = 0.008), and cesarean delivery (AOR: 1.947, p = 0.032). The study concluded that Infants in rural residence had higher rates of mortality than their urban counterparts and disparities in risk factors exist between the residences.

Balogun *et al* (2017) examine whether maternal literacy and socioeconomic status mediates the relationship between maternal education and complete immunization coverage in children. Nationally representative data from the first wave of the Nigeria General Household Survey-Panel were used, which includes 661 children aged one year and below. Regression analyses were used to model the association between maternal education and child's immunization uptake; we then examined whether maternal literacy and household economic status mediates this association. Findings showed that out of the 661 children, 40% had complete immunization. The prevalence ratio (PR) of complete immunization in children whose mothers were educated versus those whose mothers were not educated was 1.44 (95% CI: 1.16-1.77). Maternal literacy substantially reduced the estimated association between maternal education and complete immunization by 90%, whereas household economic status reduced the estimates by 27%.

Sufiyan, Bashir and Umar (2016) studied the effect of maternal literacy on the nutritional status of children under 5 years of age in Babban-dodo, Zaria, and Northwestern Nigeria. A cross-sectional descriptive study of 300 children aged less than 5 years and their mothers and caregivers was conducted, using a multistage sampling technique. The study involved collecting information on the socio demographic characteristics of the respondents and the anthropometric measurements (weight, height, mid-upper arm circumference) of the eligible children. The data were analysed using statistical software SPSS 19.0 and Epi-Info version 6.0. The study result revealed that out of the 300 children studied, 87 (29%) were found to have underweight, 21 (7%) were wasted, and 93 (31%) were stunted. The majority (65%) of the mothers/caregivers have no form of formal education. There was a significant statistical association between maternal literacy status and occurrence of malnutrition (specifically stunting) among the children studied. ($X2 = 26.2$, $df = 1$, $P < 0.05$). The study concluded that there is the need to promote and encourage female/girl child education in the communities in order to empower them to know the right type of food and the right way to give it in the right quantity. This will help to prevent the occurrence of malnutrition among children, especially those under the age of 5 years.

Adewuyi, Zhao and Lamichhane (2016) studied the association of socioeconomic, bio-demographic and health/behavioural factors with neonatal mortality in Nigeria using the most current available evidence. The 2013 Nigeria demographic and health survey (NDHS) dataset was analysed. Multiple logistic regression analysis was applied to identify determinants associated with neonatal mortality. The role of breastfeeding was examined by conducting analyses with and without adjustment for 'breastfeeding statuses. Complex sample analysis was used to control for the complex sampling design used in NDHS. Results showed that Neonatal mortality rate (NMR) stood at 33 deaths per 1000 live births. With or without adjustment for 'breastfeeding status', bio-demographic factors – maternal marital status, rural-urban residence, birth size, gender of child, birth interval and maternal body mass index (BMI) were predictive of neonatal mortality. Maternal age and ethnicity became additional bio-demographic predictors after adjusting for 'breastfeeding statuses. Maternal literacy (socioeconomic factor) and mode of delivery (health/behavioural factor) were significant predictors only when breastfeeding status was not adjusted for. Their study concluded that Bio-demographic factors formed the bulk of predictors of neonatal mortality in Nigeria. The effect of socioeconomic and health/behavioural factors disappeared when

breastfeeding status was adjusted for. Intervention programs would need to prioritize the identified predictors for an accelerated reduction of neonatal mortality in Nigeria.

Omodero and Azubuike (2016) investigates the impact of United Nations assistance through the World Health organization on general mortality rate in sub- Saharan Africa region from 1994 and 2014. Secondary method of data collection was used, multiple regression of ordinary least square estimation was the tool used to analyse the data. The study revealed that there exist significant of the UN health assistance on death control within the sub-Saharan Africa. The study however, found a significant negative relationship existing between external debts and the general mortality rate in the sub-Sahara Africa.

Comfort and Hannah (2016) assessed the individual and state determinants of child immunization in Nigeria and used multilevel logistic regression to estimate the odds of full immunization among 5,561 children aged 12–23 months, with their mothers clustered in the 36 states and the Federal Capital Territory (level 2). Findings indicate low immunization coverage rates overall; diphtheria, pertussis, and tetanus vaccine first dose (DPT1) 49.8%, DPT3 38.2%, measles 41.8%, and full immunization 24.9%. There was also significant clustering of full immunization among states. The study found that having a health card and receiving postnatal care within the first 2 months of life were positively associated with full immunization, as were maternal education, wealth, age, and ethnicity. At the state level, the proportion of employed mothers and those who received tetanus immunization before birth was positively associated with full immunization. The following barriers were negatively associated with full immunization: needing to obtain permission, poor financial situation, and far distance to clinic. These findings call for state-specific targeting to address inequitable access to routine immunization in Nigeria.

Adedeji, Adewusi and Ezebunwa (2015) examined maternal education and child mortality in Nigeria. Data were sourced from the Nigerian Demographic Health Survey of 2013 and were analysed with both descriptive and inferential statistics. The study found that child mortality is particularly high among mothers without formal education and relatively lower among those with other levels of education although factors such as family size, religious affiliation, wealth index and sex of household head had strong influence on these women.

Luret (2015) conducted a study on the challenges of integrated disease surveillance response reporting among healthcare personnel in Mangu, Plateau State, Nigeria. Integrated disease surveillance and response comprises data collection, analysis, interpretation and feedback on communicable and non-communicable diseases like cholera and hypertension. It assists health workers detect and respond to these diseases. The regional office for Africa of the World Health Organization implemented it in 1998. Nigeria has embraced this strategy, but there are challenges regarding implementation. This interventional study determined challenges faced by healthcare workers on reporting these priority diseases. One hundred and eight respondents were recruited using multi-stage sampling. Pre-tested, interviewer-administered questionnaires and baseline data were collected on respondents' knowledge, practices and factors affecting the reporting. Training was given and post-intervention data collected. Data was analysed using Epi info and a p-value of ≤ 0.05 was statistically significant. Mean knowledge scores improved from 2.92 ± 1.72 to 4.61 ± 1.03, postintervention; those of practice increased from 1.90 ± 2.8 to 2.86 ± 3.4. The availability of the forms for reporting was the most challenging factor among 30 (27.8%) respondents, pre-intervention. There were statistically significant associations with the availability of reporting forms ($p < 0.0001$), the receipt of commendation ($p < 0.0001$) and feedback ($p = 0.0007$), post-

intervention. Though this strategy is not challenge free, training healthcare personnel can minimize challenges.

Susuman, Chialepeh, Bado and Lailulo (2015) examined the impact of high infant mortality rate and high total fertility rate on female literacy rate; adopting descriptive analyses, study findings show that Sierra Leone (107.2), Angola (102) and Central Africa Republic (96.1) reported the highest infant mortality rate per 1000 live births. Also, total fertility rates in Niger (7.6), Mali (6.8) and Somalia (6.6) were higher than other comparable countries. The study concludes that health care service providers need to pay more attention during pregnancy periods, improve number of field visits, identify pregnant women and promote 100% antenatal care. If this is done practically, these countries will reduce and ultimately eliminate infant mortality.

Ezeh *et al* (2014) investigate whether children under 5 years old without access to improved water and sanitation facilities are at higher risk of death in Nigeria. Pooled 2003, 2008 and 2013 Nigeria Demographic and Health Survey data were used to examine the impact of water and sanitation on deaths of children aged 0–28 days, 1–11 months, and 12–59 months using Cox regression analysis. Survival information of 63,844 children was obtained, which included 6285 deaths of children under 5 years old; there were 2254 cases of neonatal mortality (0–28 days), 1859 cases of post-neonatal mortality (1–11 months) and 2,172 cases of child mortality (1–4 years old). Over a 10-year period, the odds of neonatal, post-neonatal and child deaths significantly reduced by 31%, 41% and 47% respectively. The risk of mortality from both unimproved water and sanitation was significantly higher by 38% (Adjusted hazard ratios (HR) = 1.38, 95% confidence interval (CI): 1.14–1.66) for post-neonatal mortality and 24% (HR = 1.24, 95% CI: 1.04–1.48) for child mortality. The risk of neonatal mortality increased by 6% (HR = 1.06, 95% CI: 0.85–1.23) but showed no significant effect. The Nigerian government needs to invest more in water and sanitation to reduce preventable child deaths.

Adeyele and Ofoegbu (2013) studied the influencing factors on infant and child mortality in Nigeria. Survey data from the National Health Demographic Survey have been used to examine the patterns of infant and child of mortality. The simple regression estimation technique was employed to investigate the effects of some selected socio-economic variables on infant and child mortality. The selected variables include: the educational attainment of mothers, place of delivery, women's status respecting decision making in the house which are; final Say on Mother's Health Care, final Say on Making Large Household Purchases, final Say on Making Household Purchases for Daily Needs, final Say on Visits to Family or Relatives, final Say on Deciding What to do With Money Husbands Earns. The study reveals that there exist positive linear association between infant and child mortality and each of the variables serving as indicators for women's status. This study was able to find out that place of delivery plays a crucial role, as better places of deliveries significantly reduce infant and child mortality in Nigeria. Also, that higher level of educational attainment has negative impact on infant and child mortality.

Mojekwu and Ibekwe (2012) studied maternal mortality in Nigeria: examining the intervention and methods. Adopting simultaneous multiple regression on fourteen variables for maternal mortality modelling in Nigeria. Stepwise regression was then applied to identify, from among the fourteen variables, the major determinant factors that appear to affect maternal mortality ratio more than the others. The study revealed that delivery by a skilled health professional and educational attainment of women had more effect on maternal mortality ratio than the other factors. The implication of this finding is that advocates of maternal mortality reduction in Nigeria will need to

focus more attention on developments in the educational sector and not just on making direct improvements to the healthcare system.

Relatively, Mu'awiyyah, Sufiyan and Bashir, (2012) assessed the effect of maternal literacy on the nutritional status of children under 5 years of age in Babban-dodo, Zaria, Northwestern Nigeria using the A cross-sectional descriptive study of 300 children aged less than 5 years and their mothers/ caregivers was conducted, using a multistage sampling technique. The study involved collecting information on the socio demographic characteristics of the respondents and the anthropometric measurements (weight, height, mid-upper arm circumference) of the eligible children. The data were analysed using statistical software SPSS 19.0 and Epi-Info version 6.0. Result: Out of the 300 children studied, 87 (29%) were found to have underweight, 21 (7%) were wasted, and 93 (31%) were stunted. The majority (65%) of the mothers/caregivers have no form of formal education. There was a significant statistical association between maternal literacy status and occurrence of malnutrition (specifically stunting) among the children studied. ($X2 = 26.2$, $df = 1$, $P < 0.05$). Maternal literacy has a significant relationship with the nutritional status of children. Therefore, there is the need to promote and encourage female/girl child education in the communities in order to empower them to know the right type of food and the right way to give it in the right quantity. This will help to prevent the occurrence of malnutrition among children, especially those under the age of 5 years.

Adhikari and Sawangdee (2011) analysed the impact of female literacy rate on the infant mortality and maternal mortality rate in different districts of Kashmir valley. For this linear regression method was used which shows the impact of female literacy rate on infant mortality rate and maternal mortality rate. From the result it has been observed that there is inverse relationship between female literacy rate and infant mortality and maternal mortality rate in districts of Kashmir valley. This study conclude that female literacy has immense contribution in declining the infant mortality rate and maternal mortality rate and thus help in improving the health status of both women and child.

Also, Mojoyinola (2011) investigated the influence of maternal health literacy on healthy pregnancy and pregnancy outcomes. The study was carried out among 231 pregnant women and nursing mothers using the descriptive survey research design of the ex-post-facto type. Three hypotheses were tested by using Pearson product moment correlation. The study established that there were significant relationships between maternal health literacy and antenatal care ($r = .445$, $df = 229$, $p<.05$) and healthy pregnancy ($r = .367$, $df = 229$, $P<.65$). However, the study established that there was no significant relationship between maternal health literacy and pregnancy outcomes ($r = .006$, $df = 229$, $P> .05$). Based on the above findings it was recommended that, the health care-givers should encourage the pregnant women and nursing mothers to enroll in adult education programmes to improve their level of literacy, and become better educated on what to do when they perceive danger signs during pregnancy.

Materials and Methods

The study utilized annual time series data obtained from various editions of the United Nation International Children Emergency Fund (UNICEF), World Health Organization (WHO) and National Bureau of Statistics (NBS) Bulletins. The secondary data was collected through internet research on the database sites of the relevant bodies.

The study employed statistical and econometrics tools for data analysis to achieve its objectives. The statistical tools include; the mean, median, standard deviation, skewedness measures, Kurtosis, Jarque-Bera, graphs to ascertain the normality properties of the data set. The econometrics tool includes the Autoregressive Distributed Lag Model (ARDL) technique to examine the impact and long-run relationship health care investment on child mortality.

In view of this, the study adopted a model by Siyuan, James, Dahai and Qingyue (2019) with modification to examine causal-effect relationship between primary health care services and child mortality in Nigeria in accordance to ARDL model developed by Pesaran and Shin (1999) and further developed by Pesaran, Shin and Smith (2001) to allow for causality and dynamics as well as testing for both short run relationship among the variables. The model is considered more appropriate compared to other approaches. The approach can be implemented if the variables are integrated of the same order (1) or (0) and can be applied to large finite samples. The basic form of the relationship between the variables drawn from theoretical framework can be expressed as; Child Mortality rate (CMT) as function of health care per-capita income, children immunization enrolment, maternal literacy and antenatal enrolment. The relationship can be expressed in a functional form as;

CMT= F(DSU, HED, IMN, ANT,) (1)

The estimable model for the study can be expressed as;

$CMT = \beta 0 + \beta_1 logDSU_t + \beta_2 logHED_t + \beta_3 logIMN_t\ \beta_4 logANE_t + U_t$ (2)

The general equation is transformed into autoregressive distributed lag (ARDL) model as follows;

$$\Delta lnCMT_t) = \beta_0 + \sum_{i=1}^{m} \beta_1 \Delta\, lnDSU_{t-i} + \sum_{i=1}^{m} \beta_2 \Delta\, InHED_{t-i} + \sum_{i=1}^{m} \beta_3 \Delta\, lnIMN_{t-i} + \sum_{i=1}^{m} \beta_4 \Delta\, lnANT_{t-i} + \alpha_1 lnDSU_{t-1} + \alpha_2 InHED_{t-1} + \alpha_3 lnIMN_{t-1} + \alpha_3 lnANT_{t-1} + \varepsilon_t \quad (3)$$

While the long-run equation is presented as:

$$\Delta lnCMT_t) = \beta_0 + \sum_{i=1}^{m} \beta_1 \Delta\, lnDSU_{t-i} + \sum_{i=1}^{m} \beta_2 \Delta\, LnHED_{t-i} + \sum_{i=1}^{m} \beta_3 \Delta\, LnIMN_{t-i} + \sum_{i=1}^{m} \beta_4 \Delta\, LnANT_{t-i} + \varepsilon_t \quad (4)$$

From eq. (4), the short run dynamics are generated and depicted as follow:

$$\Delta lnCMT_t = \beta_0 + \sum_{i=1}^{m} \beta_1 \Delta\, lnDSU_{t-i} + \sum_{i=1}^{m} \beta_2 \Delta\, LnHED_{t-i} + \sum_{i=1}^{m} \beta_3 \Delta\, LnIMN_{t-i} + \sum_{i=1}^{m} \beta_4 \Delta LnANT + \sum_{i=1}^{m} \beta_5 \Delta\, lnECM_{t-i} + \varepsilon_t \quad (5)$$

Where:

lnCMT	=	Child mortality Rate
InDSU	=	Domestic Surveillance
LnHED	=	Natural Logarithm of Health Education
lLMN	=	Children Immunization Enrolment
lnANT	=	Natural Logarithm of Antenatal Enrolment
β_o	=	Intercept/constant
β_1, $\beta_2$and β_3,	=	Short-run Parameters
α_1, α_2 andα_3,	=	Long-run Parameters
t	=	time or year

ε_{it} = idiosyncratic error term

Result of the Findings

Table 1: Descriptive Statistical Data

	CMR	DSU	HED	IMN	ANT
Mean	836101.3	5672987.	6702716.	6992142.	6572537.
Median	846842.0	6052697.	6582808.	7014004.	6592086.
Maximum	942539.0	8345186.	8718876.	8002758.	7570882.
Minimum	714188.0	2372809.	5300735.	6053810.	5656206.
Std. Dev.	87848.09	1743569.	1038516.	553215.8	541241.7
Skewness	-0.143432	-0.385138	0.270339	-0.041280	-0.026403
Kurtosis	1.367499	2.057816	1.915290	2.088404	2.104138
Jarque-Bera	3.548663	1.913003	1.897364	1.082190	1.040253
Probability	0.169597	0.384235	0.387251	0.582111	0.594445
Sum	25919140	1.76E+08	2.08E+08	2.17E+08	2.04E+08
Sum Sq. Dev.	2.32E+11	9.12E+13	3.24E+13	9.18E+12	8.79E+12
Observations	30	30	30	30	30

Result output (2024)

Table 1 indicates the total summary of descriptive statistics the major idea, it established the normality test of variables used. That is to check if the distributions of the variables used conform to the assumed normally distributed population or not. From above the yearly sum of observations of the variables are 30. The basic idea is checking the outliners which give signal for residual error especially those with high deviations. The mean values of variables are; 836101.3, 5672987, 6702716, 6992142, 6992142., 6572537, for CMT, DSU, HED, IMN, ANT respectively. Similarly, the standard deviation; 87848.09, 1743569, 1038516, 553215.8, 541241.7, (CMT, DSU, HED, IMN, ANT). Furthermore, the skewness of the variables is all negative except for HED which is positively skewed, implying that the mean of the observation drawn towards the left and for the positive the right. Examining the kurtosis, all have their entire kurtosis coefficient >0 which shows they are leptokurtic. The Jarque-Bera test is used as a test from the probability values the rule is that the p-value should be less than the 0.05% from the results Nevertheless, the Jaque-Bera (JB) test which reveals that the residuals for all the variables are normally distributed. The JB statistic reveals that, the null hypothesis that the series residuals are normally distribution is accepted because the respective p values are greater than 0.05.

Autoregressive Distributed Lag Bounds Test

The autoregressive distributed lag (ARDL) Bounds test approach to cointegration was employed to investigate if the variables used for the study which sought to investigate the effect of primary health care services on under-five mortality rate in Nigeria converge in the long-run. The ARDL Bound test result is presented in Table 2.

Table 2: ARDL Bound Test to Cointegration

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	5.502486	4
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.15	3.62
5%	2.76	3.01
2.5%	3.15	4.49
1%	3.74	4.06

Source: E-Views 9.0 (2024)

Table 2 presents the result of ARDL Bound test of Cointegration to examine the existence of a long-run relationship between the dependent and explanatory variables. The rule of ARDL Bounds test of cointegration states that; the null hypothesis of no long-run relationships existing among the variables be rejected, if the value of the computed F-statistic is greater than the upper bounds Pesaran critical value, and accepted if the F-statistic is less than the lower bounds Pesaran critical value. The ARDL cointegration test will be said to be inconclusive should the computed F-statistic falls between the lower and upper bound. The estimated result indicated the rejection of the null hypothesis since computed F-statistic (5.502486) was consistently greater than the upper bound critical value at 10%, 5%, 2.5% and 1% level of significance. This implies that, there is a long-run relationship among the endogenous and the exogenous variables. Hence, a long run relationship exists between health care investments on child mortality in Nigeria.

Table 3: Error Correction Mechanism

Dependent Variable: log(IMR)

Variable	Coefficient	P-Value
D(CMT(-1))	-0.119026	0.0000
D(CMT(-2))	0.198751	0.5504
D(CMT(-3))	-0.688393	0.2257
D(DSU)	3.520958	0.0000
D(DSU(-1))	23.158041	0.3023
D(DSU(-2))	41.065085	0.0427
D(DSU(-3))	40.678262	0.2650
D(HED)	10.614407	0.0355
D(HED(-1))	2.210811	0.8962
D(HED(-2))	14.003188	0.3947
D(HED(-3))	30.899143	0.4775
D(IMN)	3.426728	0.0031
D(IMN(-1))	20.691957	0.4656
D(IMN(-2))	39.049723	0.1035
D(IMN(-3))	21.09416	0.4283
D(ANT)	6.521621	0.4315
D(ANT(-1))	11.272127	0.1111
D(ANT(-2))	14.258830	0.7677
D(ANT(-3))	21.244386	0.1064
CointEq(-1)	-0.670909	0.0029

Result output (2024)

Since the variables were found to be cointegrated implying that they have long-run equilibrium relationship, it is necessary to test for short-run relationship. From table 4.3, the lag length isdeterminedautomaticallyusingAkaikeinfocriterion.ECMparameterisnegative(-) and significant which is -0.670909. This shows that 67 percent disequilibrium in the previous period is being corrected to restore equilibrium in the current period. Therefore, it has been established that the variables are cointegrated and also have short run relationship as established from the ECM.

Table 4: Long-run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(DSU)	-0.579718	0.141279	-4.124312	0.0084
LOG(HED)	-0.652684	1.230998	-6.637948	0.0011
LOG(IMN)	-0.478911	0.968745	-4.577049	0.0037
LOG(ANT)	-0.1723627	2.311365	-0.074571	0.00336
C	35.949076	10.430379	3.521496	0.0068

R^2= 0.913842

AdjR^2= 0.903841Fstat=95.94482Prob=0.00000

DW = 1.82921

Result Output (2024)

From Table 4, a percentage increase in the level of disease surveillance will lead to 58%percentagedecreaseinunder-five mortality. In addition to this the impact is statistically insignificant at 1% level of significance since the probability of DSU is <5%. This result fulfils a priori expectation and is consistent with other results on health and under -5 child mortality rate e.g Chaabouni (2010) and Garba (2012).

Also, a percentage increase in HED will leads to 65% percent decrease in under-five mortality rate. The increase is statistically significant at 1% level. This result implies that increase in HED on health will lead to decrease in under-five mortality. This shows that Health expenditure on education has a negative impact on under-five mortality. This result fulfils a priori expectation and is consistent with empirical findings by Imoughele and Ismaila (2013). In addition, a percentage increase in IMN will lead to 47% decrease in under-five mortality rate. The result is statistically significantat1%level. This conforms to a priori expectation the same apply to. The R-Squared and the adjusted R-Squared shows that 91% and 90% change in infant mortality rate is accounted for by changes in the independent variables. The Durbin-Watson (D-W) Statistics is 1.82921 approximately 2 indicating the absence of autocorrelation in the model. In addition, the F-statistic reveals that the model is significant and well specified. From the F-distribution table with 5 percent and degree of freedom (v1=k-1 =4-1=3 and n-k=36-4=32) at 5 percent level of significance, the critical F value 2.92 was obtained. This value is less than the calculated value of 95.94482, leading us to rejection of the null hypothesis of insignificant model implying that the independent variables are significant explanatory factors of the under-five mortality rate in the long run.

Conclusion

The study used econometric tools to analyse the effect of primary health care services on under-five mortality rate in Nigeria. The evidence established that primary health care services in terms of Disease Surveillance, Health education, Children Immunization Enrolment and Antenatal enrolment which led to a significant reduction in under-5 mortality rates in Nigeria during the period under review. Therefore, strengthening primary healthcare services in Nigeria through enhanced disease surveillance, targeted health education, increased children immunization enrolment, and improved antenatal enrolment will undoubtedly contribute to achieving sustainable reductions in under-five mortality rates. These efforts must be complemented by broader systemic changes aimed at addressing social determinants of health, expanding access to affordable healthcare, and building resilient health systems capable of delivering high-quality care to all Nigerian citizens.

Recommendations

Based on the findings, the following recommendations are made:

a. Nigerian Centre for Disease Control (NCDC), World Health Organization (WHO), United Nations Children's Fund (UNICEF), and state ministries of health, should: Strengthen existing disease surveillance systems to detect outbreaks earlier and respond more quickly to prevent further transmission and minimize fatalities among children under five.

b. National Orientation Agency (NOA), State Primary Healthcare Development Agencies (SPHCDAs), non-governmental organizations (NGOs), and faith-based organizations (FBOs), should design and implement contextually relevant health education programs focusing on key drivers of under-five mortality, such as hygiene promotion, exclusive breastfeeding, complementary feeding, and recognition of danger signs during pregnancy and childbirth.

c. National Primary Health Care Development Agency (NPHCDA), Global Alliance for Vaccines and Immunization (GAVI), Bill & Melinda Gates Foundation, UNICEF, WHO, and state ministries of health, should intensify efforts to expand immunization coverage nationwide, with particular attention to vulnerable and marginalized populations living in remote areas.

d. SPHCDAs, National Population Commission (NPC), Association of Local Governments of Nigeria (ALGON), professional midwifery associations, and NGOs, should: Strengthen health systems to deliver high-quality antenatal care services, including skilled birth attendance and emergency obstetric care.

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