Socio-Economic Determinants of Infant Mortality in Nigeria

By

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Abstract

Given, the high incidence of preventable infant mortality and its attendant consequences in Nigeria, this study examined the socio-economic determinants of infant mortality in Nigeria. The study used quarterly series data sourced from the Central Bank statistical Bulletin, National Bureau of Statistics and World Bank data bank. The dependent variable is infant mortality (IMR) while the independent variables are literacy rate (LTR), real per capita income (RPI), government health expenditure (GHE) and employment (EMP). The autoregressive distributed lag technique was used in estimating the socio-economic model. The result established that an inverse relations exists between employment and infant mortality, and also between literacy rate and infant mortality while a direct relationship exists between government health expenditure and infant mortality. Thus, the study concludes that employment and literacy rate are major determinants of variation in infant mortality. The study recommends that government should allocate 25% of the Gross Domestic Product to the education sector, and government should create conducive environment for private businesses to strive as to generate employment.

Key Words: Infant Mortality, Socio-economic determinants, Gross Domestic Product, Education, Employment

Introduction

Disparities in child health between and within countries have persisted and widened considerably during the last few decades (Bryce et al. 2006; Moser et al. 2005). The reduction of these disparities is a key goal of most developing countries' public health policies, as outlined in the Millennium Development Goals 2015 (Lawn et al. 2007). It is well recognized that disparities in child health outcomes may arise not only from differences in the characteristics of the families that children are born into but also from differences in the socio-economic attributes of the communities where they live (Fotso & Kuate-Defo 2005; Kravdal 2004; Ladusingh & Singh 2006; Montgomery & Hewett 2005;).

Indeed, the incorporation of community-level factors in the analysis of child mortality provides an opportunity to identify the health risks associated with particular social structures and community ecologies, which is a key policy tool for the development of public health interventions (Pickett & Pearl 2001; Stephenson et al. 2006).

The fourth goal and one of the most cardinal issues in the Millennium Development Goals (MDGs) is the reduction in infant and child mortality by two-thirds from 1990-2015, (UNICEF, 2006). Infant mortality rate (IMR) is one of the basic indicators of the economic and health status of a country. This is because more than any other age-group of a population, infants' survival depends on the economic conditions of their environment (Madise, 2003). It is one of the major components of United Nations human development index (UN, 2007). Hence its description is very vital for evaluation and planning of public health strategies (Park, 2005).

Infant and Child mortality rates still remain inadmissibly high in sub-Saharan African countries as approximately half of childhood deaths take place in sub-Saharan Africa despite the region having only one fifth of the world's children population (Smith, 2019). For instance, in sub- Saharan Africa, 1 child in 8 die before age five- nearly 20 times the average of 1 in 167 in developed parts of the world (Ojikutu, 2018).

Likewise, at the dawn of the twenty-first century, it is heart-rending that one in seven Nigerian children die before his or her fifth birthday (UNICEF, 2010). A baby born in Nigeria is 30 times more likely to die before age five than one born in in the North/Developed country (UNICEF, 2001). Infant and child mortality rates are remarkably high, and Nigeria ranks 15th highest in the world among countries with high under-five mortality (UNICEF, 2018).

With more than one million children dying annually from preventable diseases, Nigeria is one of the least successful of African countries in achieving improvements in child survival in the past four decades, in spite of advance in universal immunization and oral re-hydration therapy (ORT) for diarrhoea disease, and the wealth of Nigeria's human and natural resources, (Kayode et al., 2012).

Current indicators from UNICEF (2020) in the state of the world's children report stated that 5.2 million children across the world who died in 2019 before their fifth birthday lived in developing countries and died from a disease or a combination of diseases that could easily have been prevented or treated. It also noted that, half of these deaths occurred in just five countries namely, India, Nigeria, the Democratic Republic of Congo, Pakistan and China with India and Nigeria both accounting for one third of the total number of

under five deaths worldwide. The report describes the declining rate as distressing and grossly insufficient to achieve the MDGs by 2015 as only 9 out of the 64 countries with high child mortality rate are on track to meet the MDGs target.

Despite Nigeria's annual GDP growth of the past decades it has not translated drastically to reduction in infant and child mortality in Nigeria. As one of the economic determinants of infant mortality, one would expect that when an economy is growing, the growth should be reflected in other social indicators like infant mortality. Therefore, for the case of Nigeria, infant mortality should have been reducing at corresponding rate with economic growth but it has not been the case. This paper therefore; examine the effect of socio-economic factors on infant mortality in Nigeria. The rest of the paper is divided into six sections. Immediately after the introduction is the conceptual clarification in section two, which is followed by theoretical literature in section three and empirical literature in section four. Section five is the method of study, followed by data analysis and discussion of result in section six. Section seven is conclusion and recommendations.

2. Conceptual Clarifications

2.1.1 Infant Mortality

The most widely used definition of Infant Mortality Rate (IMR) is the number of deaths of babies under one year of age per 1,000 live births. The rate in a given region, therefore, is the total number of newborns dying under one year of age divided by the total number of live births during the year, then all multiplied by 1,000. The infant mortality rate is also called the infant death rate per 1,000 live births. The above definitions are according to the UNICEF report of 2000.

2.1.2 Socioeconomic Determinants

This refers to how economic and social factors that interact to affect infant mortality. For example, your employment will dictate your income. Your income level most a times correlates with your level of education and your level of education helps to dictate your employment, and all these affect infant mortality in one way the other. Thus, socioeconomic determinants refer to economic and social factors that influence infant mortality, which in this paper are real gross domestic product, employment and literacy rate.

3. Theoretical Literature

3.1 The Mosley and Chen Framework:

Mosley and Chen (1984) categorized the socio-economic determinants of infant and child mortality into individual, household and community level variables. On the individual level fathers' and mothers' skills, health and time are the three main

determinants of child survival. Parental skills have an important implication for child survivals that usually measured by fathers' and mothers' educational attainments. Mother's education may improve her productivity in child survival through influencing care seeking, morbidity and nutrition status while father's education particularly in urban areas strongly associated with the occupation and household income, household decision taking and for father's personal illness. However, the mothers' education level is the primary important determinant for child survivals. Due to strong biological association between the mothers and child during pregnancy and lactation, mother's educational levels influence her health, nutritional status, reproductive behaviours and knowledge of child care practices associated to contraception, nutrition, hygiene, preventative care and disease treatment that affect the health and survival of the child (Mosley & Chen, 1984).

Finally mother's time also has an impact on child survival such that time for health care, food preparation, washing clothes, bathing the child and house cleaning etc. A mother's time is also linked to economic activities, particularly income generating activities that increases child survival. In traditional society, the labour division by sex enable mother's to allocate much time for child care. However, in the majority of developing countries mother's time for children also depend on the economic situation of the household. For richer families it may be easier to allocate the needed time for child care, even if the mothers are outside for work, their income enables them to hire skilled or attentive nursemaid for the child while the poor household neglect the child at the mercy of less skilled or non-skilled sibling. As a result mother's time highly depends on the economic situation of the household, which influence infant and child mortality through the proximate determinants (Mosley & Chen, 1984).

Household levels factors consider income and wealth effect on child survival that a variety of goods, services and assets influence child survival through operating the intermediate factors of child survival (Mosley & Chen, 1984). Similarly, community level factors also includes ecological setting (climate, soil, rainfall, temperature, altitude, and seasonality):- these variables particularly in rural societies influence child and infant mortality and these variables can influence on the income generating work, use of medical facilities and the time of mothers for child care), political economy (infrastructure, political institution and health system variables) and availability of health service are crucial determinates for child survival (Mosley & Chen,
1984).

Other proponents for the framework of proximate determinants such as Preston (1975, 1980); Agha (2000) and Bawah (2001) are of the opinion that these factors which include

maternal fertility, lack of nutrition, environmental pollution, also personal injury and sickness are the course through which socio-economic factors shape the process of infant health and thus the level of infant mortality in a society. Following the same line of argument, Schultz, (1984) is of the opinion that socioeconomic factors affect indirectly infant and child mortality through the proximate factors while proximate determinates affect infant and child mortality directly.

4. Empirical Literature Review

4.1 Socio-economic Determinants and Infant Mortality

Rehman (2019) examined health care expenditure and health outcomes nexus: new evidence from SAARC-ASEAN region. Using the World Bank data set for 20 years (1995-2014) in 15 countries of the region, a panel data analysis is conducted where relevant fixed and random effect models are estimated to determine the effects of healthcare expenditures on health outcomes. The separate effects of private and public health expenditures were also explored. Total health expenditure, public health expenditure and private health expenditure have a significant effect in reducing infant mortality rate and the extent of the effect of private health expenditure is greater than that of public health expenditure. Private health expenditure also has a significant role in reducing the crude death rate. However, the study has not found any significant effect of health expenditure on life expectancy at birth. Per capita income growth and improved sanitation facilities have also significant positive roles in improving population health in the region.

Boachie, et al. (2018) study re-examined in Ghana the link between government health expenditures and health outcomes to establish whether government intervention in the health sector improves outcomes. The study uses annual data for the period 1980–2014 on Ghana. The ordinary least squares (OLS) and the two-stage least squares (2SLS) estimators are employed for analyses; the regression estimates are then used to conduct cost-effectiveness analysis. The results show that, aside from income, public health expenditure contributed to the improvements in health outcomes in Ghana for the period. We find that, overall, increasing public health expenditure by 10% averts 0.102–4.4 infant and under-five deaths in every 1000 live births while increasing life expectancy at birth by 0.77–47 days in a year. For each health outcome indicator, the effect of income dominates that of public spending. The cost per childhood mortality averted ranged from US$0.20 to US$16, whereas the cost per extra life year gained ranged from US$7 to US$593.33 (2005 US$) during the period. Although the health effect of income outweighs that of public health spending, high (and rising) income inequality makes government intervention necessary. In this respect, development policy should consider raising health sector investment inter alia to improve health conditions.

Meroyi (2018) examined the determinants of health investment in Nigeria: A case of infant mortality, with the aim of determining the impact of government expenditure, maternal education, and poverty on infant mortality in Nigeria. The study employs descriptive statistics and the Ordinary Least Square econometrics regression method of data analysis, using time series data in Nigeria. Secondary data from WHO, retrieved from indexmundi.com were used for our analysis. The results show that per capita income and maternal education have significant impact on infant mortality in Nigeria. These variables are significant policy variables in achieving lower infant mortality in Nigeria.

Novignon and Lawanson (2017) study sought to understand the relationship between child health outcomes and health spending while investigating lagged effects. The study employed panel data from 45 Sub-Saharan African countries between 1995 and 2011 obtained from the World Bank's World Development Indicators. Fixed and Random effect models were estimated. Under-five, infant and neonatal mortality were used as child health outcomes while total health spending was disaggregated into public and private spending. The effects of one and two period lags of expenditure were estimated. The results show a positive and significant relationship between health expenditure and child health outcomes with elasticities of -0.11 for infant mortality, -0.15 (under-five mortality) and -0.08 (neonatal mortality). Public health expenditure was found to be relatively more significant than private expenditure. Positive and significant lagged effects were also estimated between health expenditure and child health. The findings suggest that, while health expenditure is crucial for the improvement of child health, it is equally important for this expenditure to be sustainable as it also has delayed effects.

Bashir (2016) conducted a study to assess the impact of government expenditure on social service in Nigeria with emphasis on health sector performance. Secondary data were sourced from CBN bulletins, World Bank publications as well as the Nigerian Budget Office Portal. Life expectancy and infant mortality rates were measured against government expenditure from 2000-2013. The study employs Pearson's moment correlation and found that government expenditure is inversely and significantly related to infant mortality implying that an increase in the government budget to the health sector can cause a decrease in the rate of infant mortality. On the other hand, a weak positive and statistically insignificant relationship exists between government expenditure and life expectancy. It is therefore recommended that the government should allocate more funds to the health sector and encourage private sector financing of the health sector as part of their corporate social responsibility.

Faye, et al. (2014) examined the effect of government health expenditures, income and health outcomes from 1981 to 2010. The study used Vector Autoregressive Analysis and

Granger Causality test to determine the direction of relationship of the variables. Results revealed that health expenditure per capita followed an overall increasing trend with an average growth rate of 6.49% and GDP per capita with an average growth rate of 11% from 1981 to 2010. These correspond to the reduction of infant mortality rate 1.64% on average, under five mortality by 1.76% and the increase in life expectancy with an average growth of 0.17% from 1981 to 2010. However, VAR results revealed that the past values of public health expenditure has no effect on under-five mortality rates but affects infant mortality rate. This may suggest that the past and present level of health expenditure is not sufficient enough to affect under five mortality rate but is effective enough on alleviating infant mortality rate. Conversely, past and present values of GDP per capita is not sufficient enough to affect infant mortality rate but affects under five mortality rate in the Philippines. VAR estimation also revealed that both health expenditure and GDP per capita has a positive and significant effect on life expectancy. Thus, to improve life expectancy and to reduce child mortality rates in line with the Millennium Development Goals, it requires effective and sufficient health expenditure and a sustainable economic growth.

5. Method of Study

5.1 Socio-Economic Determinants Model Specification

Equation 5.1 is the socio-economic determinant equation that capture the socio-economic determinants model it helps to capture the objective of this paper.

INT = f(RPI, GHE, LTR, EMP)

$$(IMR)_t = \beta_0 + \beta_1(RPI)t + \beta_2(GHE)t + \beta_3(LTR)_t + \beta_4 EMP + U_t \quad (5.1)$$

Where:

IMR = Infant mortality per 1000 live birth
RPI = Real per capita income
GHE = Government Health Expenditure
LTR = Literacy Rate
EMP = Employment
U = Error term
$B_1 - B_7$ = Parameters to be estimated

5.2 Unit Root for Economic Determinants Model

The result of the unit root test for socio-economic determinant of infant mortality is present in table 5.1.

Table 5.1: Unit root result for socio-economic determinant model

Variables	Level	1st Difference	Order of Integration
IMR	-0.108297	-12.64302	1(1)
EMP	-1.143515	-4.502556	1(1)
RPI	-4.479432	-	1(0)
LTR	-2.294683	-4.357206	1(1)
LNGHE	-1.601217	-7.564941	1(1)

Source: Author's computation using E-views10

The result of the unit root test using the Augmented Dickey Fuller test (ADF) shows that all the variables are integrated of order one 1(1), except real per capital income (RPI). Employment (EMP), infant mortality (INF), literacy (LTR) and government health expenditure (GHE) are stationary at first difference 1(1). This result of the unit root test justifies the adoption of the autoregressive distributed (ARDL) as technique of data analysis in socio-economic determinants model.

Autoregressive Distributed Lag (ARDL) Bounds Test

The result of the autoregressive distributed lag test is shown in table 5.2.

Table 5.2: ARDL Bounds Test Result

Null Hypothesis	Value	K
F-statistic	4.668201	4
Critical value bounds		
Significance	1(0)	1(1)
10%	3.03	4.06
5%	3.47	4.57
2.5%	3.89	5.07
1%	4.4	5.72

Source: Author's computation using e-views 10.

The above table displays the computed F-statistic (F-statistic = 4.668201), depicting that the null hypothesis of no long-run relationship can be rejected at 5 percent critical level. The justification for such inference is that the calculated or estimated bounds test (F-computed) is greater than the upper bound critical value of 4.57 at 5 percent critical value or 5 percent level of significance. This, therefore depicts that there exists a long-run relationship or cointegration between socio-economic determinants and infant mortality in Nigeria. Given, the above result that long-run relationship exists among the socio-economic

determinants and infant mortality, we take a step further to estimate the long-run coefficients by estimating an autoregressive distributed lag model (ARDL) of the (2, 0, 2, 1, 0).

5.3 Estimation of Long-Run Coefficients of ARDL (2, 0, 2, 1, 0)

Table 5.3: Presented the result of the long-run coefficients of the socio-economic determinants model.

Table 5.3 : Result of the long-run coefficient.

Levels Equation
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRPI	-1.786806	1.623105	-1.100852	0.3556
EMP	-0.873739	0.383388	-2.278994	0.0272
LNGHE	0.001562	0.001037	1.505856	0.1351
LTR	-0.137029	0.067265	-2.037151	0.0114

EC = MMR - (-0.0000*LNRPI -1.786806*EMP + 0.0016*LNGHE + 0.3703*LTR), R^2 = 0.79667 and F- Statistic = 8542.9

The long-run estimated result in table 5.3 shows that the overall socio- economic determinants model is well fitted given the F-statistic value of 8542.9. The adjusted R-square (R^2) value is 0.79667, which implies that the explanatory variables explain about 80 percent of the variation in infant mortality in Nigeria. The remaining 20 percent of the variation in infant mortality may be explained by variables outside the socio- economic determinants stated in the model specification.

Real per capita income (RPI) a proxy for income has a negative coefficient -1.78, but it is not statistically significant. However, it confirms to economic theory. This shows that an inverse relationship exists between real per capita income and infant mortality, although the relationship is not significant.

Employment (EMP) has a negative coefficient -0.87 and it is statistically significant. The above result is in line with economic theory and also confirms to the findings of Marwa (2020). An inverse relationship exists between infant mortality and socio-economic

determinants. An increase in employment by one percent will lead to 0.87 percent decline in infant mortality in Nigeria all things being equal.

Government health expenditure (LNGHE) a control variable has a positive coefficient 0.0015 but, it is not statistically significant. This result does not conform to economic theory. This result negates the finding of Kevin (2020) who asserted that an inverse relationship exists between government health expenditure and infant mortality in Nigeria. Thus, a unit increase in government health expenditure will lead to increase in infant mortality but it is not significance. The reason for this may be as result of the poor allocation to the health sector in Nigeria.

Literacy (LTR) has a negative coefficient 0.137 and it is significant. This is in line with economic theory. An increase in the rate of literacy will lead to a decline in infant mortality all things being equal.

Short-Run Result of Socio-Economic Determinants Model

The short-run result for socio- economic determinants model is presented in table 5.4 below:

Table 5.4: Short-Run Result of Socio-Economic Determinants Model

ECM Regression
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	155.3656	32.34132	4.803936	0.0000
@TREND	-0.744477	0.155250	-4.795356	0.0000
D(LTR)	-0.755418	0.058559	-12.90006	0.0000
D(EMP)	-19.74100	4.079791	-4.838729	0.0000
D(EMP(-1))	15.00077	4.027616	3.724480	0.0003
D(LNGHE)	-0.000274	0.000234	-1.171939	0.2439
CointEq(-1)*	-0.088283	0.018127	-4.870267	0.0000

R-squared	0.643208	Mean dependent var	-6.521739
Adjusted R-squared	0.623387	S.D. dependent var	14.17983
S.E. of regression	8.701996	Akaike info criterion	7.223920
Sum squared resid	8178.271	Schwarz criterion	7.391003
Log likelihood	-408.3754	Hannan-Quinn criter.	7.291738
F-statistic	32.44960	Durbin-Watson stat	2.011534
Prob(F-statistic)	0.000000		

* p-value incompatible with t-Bounds distribution.

The error correction term (ECM) has the right sign which is negative. The error correction term coefficient is -0.088, this shows a very slow speed of adjustment from the long-run. The speed of adjustment is about 9 percent, this implies that if the equilibrium is disturbed. It will take a longer time for it to be restored.

The adjusted R-Squared (R^2) value is 0.623 which implies that socio-economic determinants explained about 62 percent of the variation in infant mortality in Nigeria in the short run. The remaining 38 percent is explained by other variable not included in the model but captured by the error term.

Literacy rate (LTR) in the short-run has a negative coefficient 0.755 and it is statistically significant. This is in line with economic theory, thus, implying that an inverse relationship exists between literacy rate and infant mortality in Nigeria. This finding is in line with that of the long-run result and in conformity with the finding of Felix (2019). An increase in the rate of literacy will lead to 0.755 unit decline in infant mortality in Nigeria all things being equal. This is because education develop the skill of the individual and liberate the mind, it reduces superstitious believe and bring about sound mind and high level of awareness in modern medicine which help to reduce the rate of infant mortality. This level of awareness causes the pregnant women to seek help from medical practitioners both at prenatal and postnatal stage thereby help in reducing the incidence of infant mortality.

Employment (EMP) both at current period and lag one period have negative coefficients -19.74 and -15.0 respectively and are statistically significant. This is also in line with economic theory or postulation. An inverse relationship exists between employment at current period and infant mortality. So also an inverse relationship exist between employment (EMP(-1) at lag one period and infant mortality in Nigeria.

The above result is consistent with that of the long-run result. Employment offers one an opportunity to earn income and with the income earn via employment medical bill of the pregnant woman can be taken care of and her nutritional status will increase this will reduce the rate of infant mortality in Nigeria all things being equal. An increase in employment at current period will reduce infant mortality by 19.74 units all things being equal. A unit increase in employment at lag one period will reduce infant mortality by 15 units all things being equal.

Government health expenditure (LNGHE) at current period has a negative coefficient -.0.000274 but it is not significant. This may be as a result of poor funding of the health sector or the endemic corruption that characterized Nigeria. This has turned our general

hospitals to mere dispensaries with no drugs and the incessant strike by doctors as a result of poor working condition.

Post Diagnostic Test

The diagnostic test result is presented in table.

Table 5.5: Post Diagnostic Result

Serial correlation LM Test	F(2,21)	1.355322	0.2795
Hetroskedasticty	F(5, 23)	0.592330	0.7059
Normality test	34.462		0.000

Source: Author's computation using E-views

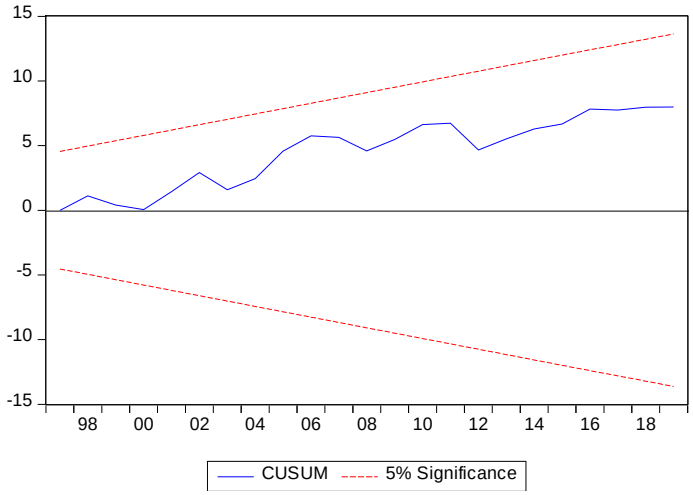
The empirical estimations in table 5.5 are used for autocorrelation, heteroskedasticity and normally are used to test the below stated hypotheses:

There is no serial or autocorrelation

There is no heteroskedasticity

There is no non-normal error

The result of the short-run model shows that it passed the post-diagnostic tests. The result in table 5.5 indicated that there is no serial correlation, given that the probability value is higher than the threshold value of 0.05. There is no heteroskedasticity in the model this is because the probability value is greater than the threshold of 0.05. The error term is normally distributed, given the result of the Jarque-Bera test and the probability value that is greater than the threshold of 0.05.



Stability Test

Figure 5.1: CUSUM Graph

In testing the stability of the long-run coefficients with the short-run dynamics cumulative sum of squares is used. The graphic illustration of the cumulative sum of squares is shown in figure 10. As shown by the graph, the cumulative sum of squares (CUSUM) line lies within the 5 percent critical bound. This shows that the stability of the long-run coefficients of the regressors have an effect on maternal mortality in Nigeria.

6. Conclusion and Recommendation

This paper investigated the socio-economic determinants of infant mortality in Nigeria. The requisite data were collected and analyzed and based on the results from the data analyzed the paper concluded that employment and literacy rate (socio-economic determinants) are major determinants of variation in infant mortality in Nigeria.

6.1 Recommendations

Based on the findings from the paper and the conclusion deduced the following recommendations were put forward.

5.3.1 For Policy

To reduce the level of infant mortality in Nigeria the following recommendations were made for policy implementation:

- Fertility rate should be reduced through sex education and campaign at both rural and urban centres.
- Government should create a conducive environment for private businesses to strive as to generate employment.
- Healthcare expenditure should be increase to 30 percent of the gross domestic product
- Female education should be encouraged through award of scholarship.

References

Bashir, O. K. (2016). Government spending and inclusive-growth relationship in nigeria: An empirical investigation. *Zagreb International Review of Economics and Business, 1*(2), 33-56.

Bhuiyat, E. (1991). Modeling determinants of under-five mortality in rural and urban Ghana. *Research on Humanities and Social Sciences, 6*(5), 60-71.

Bryce, J ., Morris, S. S., & Black, R. E (2003). Where and why are 10 million children dying every year? *Lancet*, *361,* 2226- 2234.

Boachie, M. K., Ramu, K. & Polajeva, T. (2018). Public health outcomes: New Evidence from Ghana. *Economics, MDPI, Open Access Journal, 6*(4), 1-25. https://doi.org/06-00058.2018.608002.

Fatusi, A. O., Sule, S. S., Onayade, A. A., Soetan, R. O., & Connell, F. A. (2008). Utilization of primary health care facilities: Lessons from a rural community in Southwest Nigeria. *Journal of the National Association of Resident Doctors of Nigeria*, *17*(1), 98–106. https://doi.org/10.4314/njm.v17i1.37366.

Faye, T., Peralta, S. & Roperto, S.D. (2014). Public health expenditures, income and health outcomes in the Philippines, *MUMCH Personal RePEc Archive (MPRA) Paper No.* 60115. https://mpra.ub.ub.uni-muenchen.de/60116/

Felix, J. M. (2019). Fertility rate literacy and maternal mortality in Nigeria. *International Journal of Demographic Studies, 8*(2), 280-293.

Felix, J. M. (2020). Population dynamics on maternal mortality in Nigeria. *Journal of Demography, 11*(3), 173-198.

Fotso, J. C., Ezeh, A. C. & Essendi, H. (2009). Maternal health in resource-poor urban settings: How does women's autonomy influence the utilization of obstetric care services? *Reprod. Health, 6*(9), 156-169. https://doi.org/10.1186/1742-4755-6-9

Frey, S. R. & Carolyn, F. (2000). The determinants of infant mortality in the less developed countries: A cross-national test of five theories. *Social Indicators Research, 52,* 215-234. Kluwer Academic Publishers.

Griffith, R, Stephen, R, &Reenen, J. V (2004). Mapping the two faces of R&D productivity growth in a panel of OECD industries. *The Review of Economics and Statistics 86*(4) 883-895.

Kevin, M.T (2020). Effect of literacy on infant mortality in Nigeria. *Journal of Economic Development 13*(3) 143-157.

Lamani, V. (2013). Demographic and socio-economic shifts partly explain the Martinican nutrition transition: An analysis of 10-year health and dietary changes using decomposition models. *Public Health Nutrition, 24*(18), 6323-6334.

Lawn, J. E, Cousens, S, Zupan, J. (2007). Four million neonatal deaths: When? Where? Why? *Lancet, 365,* 891-900.

Madise, N. J. (2003). Infant mortality in Zambia: Socioeconomic and demographic correlates. *Social Biology*. www.findarticles.com/p/articles/mi_qa3998.

Mckeown, T., Brown, R. G., & Record, R. G. (1972). An interpretation of the modern rise of population in Europe. *Population Studies, 26*(3), 345-382.

Mengiste M., & James, F. (2017). Determinants of antenatal care utilization in Arsi Zone, Central Ethiopia. *The Ethiopian Journal of Health Development*, *10*(3), 78-88. https://ejhd.org/index.php/ejhd/article/view/1055

Mesfin, N., Haile, M. D., Kassie, G. (2005). Assessment of safe delivery service utilization among women of childbearing age in North Gondar Zone, North West Ethiopia. *Ethiopian Journal of Health Development, 18*(8), 80-91. https://doi.org/ https://doi.org/10.4314/ejhd.v18i3.9952.

Mogford, L. (2004). Structural determinants of child mortality in sub-Saharan Africa: A cross- national study of economic and social influences from 1970 to 1997. *Social Biology, 51*(3-4), 94-120.

Mojekwu, J. N. & Ajijola, L. A. (2011). Developing a model for estimating infant mortality rate of Nigeria. *Journal of Research in International Business and Management*, *1*(2) 164-170.

Mosley, W. H. & Chen, L. C. (1984). An analytical framework for the study of child survival in developing countries. *Population and Development Review, 10*, 25-41.

Mukosolu, N. & Onwughalu, C. (2007). *Infant mortality rate in Nigeria. University of California Los Angeles School of Public Health-MPH Community Health Sciences,* 100 Winter Quarter 2007.

Mulenga, P. B. (2010). *An analysis of economic growth, energy consumption and carbon emissions: The case of Zambia.* MSc dissertation submitted to the department of Economics, University of Zambia.

Novignon, J. & Lawanson, A. O. (2017). Health expenditure and child health outcomes in sub-Saharan Africa. *African Review of Economics and Finance, 9*(1), 90-121.

Preston, S. H (1975). The changing relation between mortality and level of economic development. Population Studies 29(2), 231-248

Rabiu, M. (2008). Under-five child mortality and morbidity associated with consanguineous child marriage in Pakistan: Retrospective analysis using Pakistan demographic and health surveys. *Maternal and Child Health Journal, 21*(5), 1095-1104.

Rehman, D. U. (2019). Does social infrastructure expedite economic development? The case of Pakistan. *International Journal of Trade and Economic Development, 13*(12), 131-143.

Schultz, T. P (1984). The impact of household economic and community variables on child mortality. *Population and Development Review 10*(1), 215-235.

United Nations Children's Fund (2001). *The state of the world's children*. Oxford University Press.

WHO (2006). Bulletin World Health Organization, *81*(3) Genebra 2003.

WHO (2006). Neonatal and perinatal mortality country, regional and global estimates. Oxford University Press.

World Health Organization (2000). Reproductive and family health in the western pacific region. Part one & part two. *World Health Organization, Reproductive Health.* Oxford University Press.

World Health Organization (2005). *World Health Report: Make every mother and child counts. Geneva: The World Health Organization,* UNICEF.