

DEMOGRAPHIC FACTORS INFLUENCING DIFFERENTIALS IN INFANT MORTALITY IN NASARAWA STATE, NIGERIA

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Abstract

Infant mortality is one of the most expressive indicators of development in all countries of the world. In Nigeria, the current rate of infant mortality indicates that the country is far from ending the problem of infant mortality. It has not only reflected on the health of an infant, but also, the societal wellbeing as a whole. Hitherto, available studies on infant mortality have not clearly indicated its level as to whether it is increasing or decreasing in Nasarawa State, let alone its differentials. The paper examines the demographic factors influencing differentials in infant mortality in Nasarawa State-Nigeria. A multistage sampling technique was adopted to select respondents. Initially, for the study which involved six (6) namely Local Government Areas, electoral wards, main street, houses, household and individual/respondent. The methods of data collection utilized for the study was questionnaire. The questionnaires were analyzed quantitatively using tables, frequency, percentage, cross tabulation and Chi-square to establish and statistically test the level of significance in the relationship between two variables. Findings of the study established the differentials in infant mortality in urban and rural communities in Nasarawa State, Nigeria, but overall, it is still high. There were marked differentials found in the prevalence of infant mortality among socio-economic and demographic factors, such as maternal education, maternal occupation, sex of infant birth interval and gender. On the basis of these findings, the study recommends a renewed policy on maternal health education in Nasarawa State including free counselling on birth spacing, family planning, immunization, ante-natal and post-natal care for all women.

Keywords: Demographic, Influencing, Differential, Infant Mortality, Nasarawa State

Introduction

Infant mortality can be classified as one of the components of population fluctuation and demographers have long been captivated in its study. Infant mortality which is a broad term that has been used to define mortality for the whole first year of life is a crucial public health concern globally and one of the key signs of the quality of primary health care delivery systems and the overall health status of a country. An infant is powerless of him or herself, highly exposed to many spheres of life and completely dependent on other people for care, development and survival. Millions of infants have died and continued to die from various causes, many of which are avoidable and avertable (Mazharul, 2010). Many components account for infant mortality in all countries, but these components vary between the developed and developing countries, and also between rural and urban areas within each country.

In 2023, 3.3 million infant deaths occur globally, and the rate of infant mortality, which is the number of deaths of infant under age 1 per 1000 live births in that given year was 26 deaths per 1000 live births (World Population Data Sheet, 2023). Infant mortality rate is high in Sub-Saharan Africa. Despite the region having only one fifth of the world's infant's population, it harbors half of childhood deaths globally. The risk of infant mortality is highest in Asia and Africa with rate of more than 55 deaths per 1000 live births (World Health Organization, 2023).

Infant mortality rate is none of the components of the United Nations Human Development Index, and is very essential for the assessment and planning of public health strategies. Furthermore, one of the targets of the Sustainable Development Goals (SDGs 3.1) is to achieve good health and wellbeing and to reduce under five mortalities, including infant mortality to no more than 25 deaths per 1000 live births by 2023 (World Mortality Report, 2015). In developed countries, infant mortality has significantly reduced mainly due to advancement in basic healthcare and technological progress in the medical field. However, in developing countries, especially in Sub-Saharan Africa, infant mortality remains a major cause of concern as it is the most difficult place for a child to survive until the age of five (Ahmed & Hussein, 2010).

Infant mortality rate in the developed nation is on the average of 5 deaths per 100 live birth as compared to the developing nation of 26 deaths per 1000 live birth (World Population Data Sheet, 2023). The World Health (WHO) stated that rural infants, infants born to uneducated mothers, and infants living in poorer households continue to have higher mortality (WHO, 2018). The course of infant mortality in Nigeria and Nasarawa State is such that the greater portion of infant deaths occurs in the rural areas. For instance, in 2013, the infant mortality rate was 60 deaths per 1,000 live births in the urban area compared to 86 deaths per 1,000 live births in the rural area (Nigeria Demographic Health Survey, NDHS 2018). The exposure of infant mortality is said to be highest in developing countries like Africa which have a rate of 55 deaths per 1000 live births (NPC & ICF International, 2023). This figure has attracted the nationwide attention and is a major contributor of reduction of life expectancy of the population.

According to the National Population Commission (NPC) and ICF International (2023), there are differences in the rates of infant mortality in each geo-political zones of the country. These differences range from 89 deaths per 1000 live birth in Northwest, to 82 deaths per 1000 live birth in Southeast, 77 deaths per 1000 live birth in Northeast, 66 deaths per 1000 live birth in South-South. In Nasarawa State, infant mortality has been unstably declining at gradual rates over the years at a high prevalence rate of 115 deaths per 1,000 live births in 2008 to 60 deaths per 1000 live births in 2018 (NPC & ICF International, 2023). This present situation notwithstanding, still remains too slow to realizing the Sustainable Development Goals (SDGs) of reducing infant mortality by 2030 in Nasarawa State.

Infant mortality is studied in two age segments: mortality between birth and exact age of one month (the neonatal period) and mortality between one month and eleven months (the post neonatal period). The first month of life of an infant represents the most vulnerable time for its survival. Nigeria ranks second globally, as the country with the second highest number of neonatal mortality (United Nations International Children's Emergency Fund, UNICEF 2015). Globally, one million neonates die during the first day of birth and roughly two million within the first seven days of life (WHO, 2020). The rate of neonatal mortality declined from 36 deaths per 1000 live birth to 19 deaths per 1000 live birth between the period of 1990 and 2015 (UNICEF, 2015). Available interference so far has failed to yield beneficial results; thus, it was concluded in a recent study that there was no much improvement in neonatal survival in Nigeria since 1990 (Akinyemi, Bamgboye & Ayeni 2015). Nigeria would need about two to three times increased reduction in neonatal mortality rates to be on track to meeting the targets of SDG for infant survival at 12 deaths per 1000 live births for neonatal mortality rate by 2030 (Emmanuel, Yun & Reeta, 2016).

In Nigeria and Nasarawa State in particular, due to issues such as trends in rapid population growth, downturn of the economy, malnutrition, ignorance, unsafe drinking water, environmental population, poor hygiene and nutrition, lack of accessibility to health services, relatively high level of poverty, apathy inadequate sanitation and diseases, infant mortality is still at an alarming figure, therefore, the study examines the demographic factors influencing differentials in infant mortality in Nasarawa State-Nigeria.

Statement of the Problem

Though a common problem relating to the studies of infant mortality in developing countries can be attributed to the scarcity of data, it has also been argued that scientific research on infant mortality is also hampered by the insufficient use of the information available, however imperfect or indirect they may be. Cases involving infant mortality in developing country have largely been under-reported (Emmanuel, Yun & Reeta, 2016). Although substantial improvement in survival has occurred, the encumbrance of mortality within the first month of life has remained basically unchanged. Each year, four million infants die, three quarter of this death occur during the first week of life of which at least 1 million die in their first 24 hours of birth globally. Most infant deaths occur at home where there is an absence of contact with any skilled health care provider (Lawn, Knippenberg, & Darmstadt, 2005).

Monitoring the differences in infant mortality is challenging because country specific differentials tend to change overtime. Adequate data in comprehending on the levels and differentials of infant mortality at the State level is insufficient, given the variation of each State in Nigeria. Nasarawa State is an agrarian state with high percent of rural dwellers. The state has a population of over 3 million people including 1.6 million women of childbearing age (National Bureau of Statistics, 2022). Nasarawa State has dis-satisfactory high mortality rate and disease burden profile. In 2018, infant mortality rate was 115 per 1000 live birth (African Population and Health Research Centre, 2019). This figure represents a worsening trend in the level of infant mortality have approached the study based in trend analysis.

Women in rural areas contributed more to this number as they were less advantage compared with women in urban areas in terms of access to maternal healthcare services. Infant mortality in the State is a serious health problem. Most rural women are challenged with the predicament of accessing and utilizing of maternal health care services. This is because they are faced with the problems of low income and education, unavailability of health care services and poor road network. Often times, women living in rural areas have little or no source of income, education to

cater for their health needs. They are at the disadvantaged part of the society. Besides, women from disadvantaged segments of society are in double jeopardy since they find themselves even more disadvantaged within a disadvantaged population—they are the poorest among the poor and the least educated among the inadequately educated.

Several studies in Nigeria (Bongaarts, 2014; Wilopo, 2009; Ahmed & Hussein, 2010) have been undertaken on differentials in infant mortality, but none has explored differential in infant mortality in Nasarawa State-Nigeria where infant mortality rates remain increasingly higher. Consequently, little is known about differential in infant mortality in this part of the country. This has given rise to not just context-specific gaps in literature on differential in infant mortality in Nasarawa State-Nigeria, but also in knowledge. Therefore, it has become imperative to examine the differential in infant mortality in Nasarawa State-Nigeria.

Research Questions

- i. What is the level of infant mortality in Nasarawa State, Nigeria?
- ii. What are the demographic differential of infant mortality in Nasarawa State, Nigeria?
- iii. What are factors that determine infant mortality in Nasarawa State, Nigeria?

Objectives of the Study

The main objective of the study was to examine the demographic factors influencing differentials in infant mortality in Nasarawa State-Nigeria. However, the specific objectives included:

- i. To examine the level of infant mortality in Nasarawa State, Nigeria
- ii. To ascertain the demographic differential of infant mortality in Nasarawa State, Nigeria
- iii. To examine the factors that determine infant mortality in Nasarawa State, Nigeria

Statement of Hypotheses

The following hypotheses were formulated for this study:

- i. H_0 : There is no significant relationship between infant mortality and maternal level of education in Nasarawa State, Nigeria
- ii. H_0 : There is no significant relationship between infant mortality and maternal occupational status in Nasarawa State, Nigeria
- iii. H_0 : There is no significant relationship between sex of infant and age at birth in Nasarawa State, Nigeria
- iv. H_0 : There is no significant relationship between infant mortality and birth interval in Nasarawa State, Nigeria

Conceptual and Theoretical Clarification

Mortality

Like other societal issues, scholars or intellectuals have variegated views on mortality. In other words, there is no consensus or generally accepted definition of the concept. But this study will dwell on those definitions that are widely accepted. Mortality is the pattern of death in a population. It is the occurrence of deaths within a population at a given point in time. Mortality refers to deaths that occur within a population. The incidence of death can reveal much about a population's standard of living and health care delivery services in a country (NBS, 2016).

For Graunt (1662), morality refers to the relative frequency of death in a population. Demographer use two different concepts when referring to mortality, namely, the life span, which is numerical age limit of human life and life expectancy or expectation, which is the average

expected number of years of life to be lived by a particular population at a given time. In the context of the study, mortality means deaths that occur among women in Nasarawa State.

Infant mortality

It is rather difficult to point out a single holistic definition of infant mortality despite its significance and wide usage in the field of demographic and population studies. This has left scholars, researchers, intellectuals and authors to defining infant mortality from different perspectives and perceptions. Infant mortality is the death of a live born infant between the day of birth and span of 12 months (UNICEF, 2018). The rate of infant mortality is the measure of probability of infants dying before reaching the age of one year.

Theoretical Framework

The study is positioned within the Mosley-Chen Model. This model was formulated in 1984 and was believed to have combined social sciences and medical perspectives in restrained way. This model was first designed by Henry Mosley and Lincoln Chen, purposely to develop a new analytical framework to study the factors of infant survival in developing countries. The strength of the Mosley-Chen model lies in combining elements from both social science research and medical research, which gives a stable base for studying the determinants of infant mortality. The approach includes both social and biological variables and integrates research methods used by social and medical scientists. Morbidity and mortality were both measured as a single variable. This was considered as the outcome variable, that is, depending on the interaction of the factors in the model, an infant might end up being sick (morbidity) and eventually gets better and regains his/her health or the state of health might get worse which then leads to death (mortality).

Some specific medical causes of deaths are not being addressed by social scientists, and the processes by which socio-economic determinants operate to bring about mortality differentials are often not disentangled. The Epidemiological studies focus on mechanisms of disease transmission in the environment and studies on nutrition centers on breastfeeding, dietary practices and food availability as they relate to nutritional status. The assumption of this model is that underlying socio-economic status manifests itself in proximate determinants. The value of this variable influences the risk of disease, which is linked to the probability of death. Mosley and Chen set the framework of infant survival based on the assumption that all socio-economic factors of infant mortality necessarily operate through a determinant of infant mortality and they categorized fourteen (14) proximate determinants of infant into five (5) general groups. These groups are:

- i. Maternal factors such as age at birth, and birth interval.
- ii. Environmental contamination such as air, food, water, skin, soil, and insect vectors.
- iii. Nutrient deficiency such as calories; protein; micronutrients (vitamins and minerals).
- iv. Injury either accidental or intentional.
- v. Personal illness control: personal preventive measures, medical treatment.

Underlying factors on the other hand are categorized into three (3) levels and are stated as:

- a. Individual-level variables (i.e. individual productivity at household's level as well as traditions/norms/attitudes).
- b. Household-level variables (e.g. income and wealth)
- c. Community-level variables (i.e. ecological setting; political economy and health system).

Sullivan et al. (1994) classified the sex of a child, birth order, birth intervals from previous birth, and age of mother at birth as biological factors that are related to the inherent risk of infant

mortality. Bicego and Ahmad (1996), further classified the factors as bio-demographic differentials. Bio-demographic determinants are classified into two groups. First factors are genetic endowment which represents biological factors that are genetically endowed by the child. For example, birth interval, being singleton or twin, birth weight, and size at birth. The second factors are biological and demographic factors that affect infant mortality through the health and fertility status of the mother, for example mother age when the baby was delivered, complications during pregnancy, and problems that occur during labour and delivery.

The second proximate determinants of infant mortality are categorized into behaviour factors. This factor is divided into two categories. The first category focuses on nutrient intake factors that consist of breast-feeding practice and the other category addresses issues on health control that is related to the household effort in order to prevent the child illness and the medical treatment taken to cure the disease. In addition, health control also includes other activities of health seeking behaviors' (place of delivery) such as using contraception to control birth spacing. Due to current medical intervention, a child may remain healthy, the sick could recover and become healthy or treatment may fail and the child dies.

The third proximate determinants are the household hygiene and infrastructure. These determinants comprise of environmental contaminations that are affected by the hygiene condition inside the household. This contamination can occur at any point in time. It can occur in the household's source of drinking water, in the practice of waste disposal, and contacts to parasitic agents from unimproved type of flooring materials and untidy environmental surroundings.

Mosley and Chen (1984) conceptual framework was adopted for this study because of its appropriateness and relevance to the study and this model believes that death is the final biological expression of a process that is determined basically by the economic and social structure of a country or region. These conditions influence the occurrence of the disease and how it develops. One of the possible outcomes of such occurrence is death. Structural determinants are mediated at the family level, since the infant growth and development are heavily dependent on the living environment of the family. These determinants of infant mortality are grouped into four (4) categories. They are:

- i. The socio-economic characteristics such as mother's education, occupation, place and region of residence, resources of the household, income of the parents and medical care.
- ii. The intervening/housing conditions/ environmental variables such as source of water, access to toilet facilities and distance from home to the nearest health facility.
- iii. The demographic variables such as age of mother at child birth, birth order, previous birth interval, breastfeeding and sex of the child.
- iv. Access in terms of accessibility to geographical location, affordability in terms of financial capability, adequacy in term of quality services, acceptability in terms of cultural practices and availability in terms of facilities provision.

These variables operate through the proximate determinants (i.e. the intermediate of intervening variables) to influence infant mortality.

Methodology

The study was conducted in Nasarawa State, Nigeria. Survey research design was adopted for the paper. This design is one in which a group of people or items is studied by collecting and analyzing data from few people considered to be a representative sample of the entire population. The survey design is suitable for this study because, the target population is large and it is obviously not possible to reach out to all of them. The study population consist of women of

childbearing between the age of 15 and 49 years in Nasarawa State, Nigeria estimated at 1,621,381 populations as at 2022 (NBS, 2022). Smith (1984) sample technique was used to estimate a sample size for the study population. The Smith (1984) formula is given as:

$$n = \frac{N}{3 + Ne^2}$$

Where:

N = Population size

3 = Constant

e = Margin of error (5%)

$$n = \frac{N}{3 + Ne^2}$$

Substituting into the formula we have

$$n = \frac{1,621,381}{3 + 1,621,381 (0.05)^2}$$

$$n = \frac{1,621,381}{3 + 1,621,381 (0.0025)}$$

$$n = \frac{1,621,381}{4056.4525}$$

$$n = 399.70$$

$$n = 400$$

This formula gives the degree of accuracy of the sampling technique. It gives an idea as to how many samples have to be studied taking into consideration the error. From the population of 1,621,381 respondents the formula yielded a sample size of 400 respondents from the study population. 400 questionnaires were distributed and 397 were retrieved as valid. The study employs multistage sampling technique. A multistage sampling technique involves selecting sample from another sample. In this sampling procedure, the primary groups and sub-groups are selected on the basis of geographical distribution rather than other characteristics. Multistage sampling technique was employed in the selection of local government, electoral wards; streets; houses/compounds, household and respondent/individual. The questionnaires were analyzed quantitatively using tables, frequency, percentage, cross tabulation and Chi-square to establish and statistically test the level of significance in the relationship between two variables.

Results and Discussions

Table 1: Differentials in Infant by Maternal Level of Education and Infant Mortality in Nasarawa State, Nigeria

Infant Mortality	Maternal Level of Education					X ² Value	df	p-value	Remark
	NoFormal education	Primary	Secondary	Tertiary	Total				
Yes	52 (32.9%)	47 (29.7%)	59 (37.3%)	0 (0.0%)	158 (100%)	26.25	3	<0.05	Significant
No	0 (0.%)	0 (0.0%)	71 (29.7%)	168 (70.3%)	239 (100%)				
Total	52	47	130	168	397				

Pearson Chi-Square value =26.25; Alpha Level= 0.05; df=3; Critical value=7.815; Missing value=0

Table 1 shows the relationship between maternal level of education and infant mortality. About 33 percent of respondents who has ever lost an infant had no formal education, 30 percent of respondents attended secondary education and 70 percent of the respondents with tertiary education have not lost infant. From the table, it can be deduced that majority of respondents had tertiary education and never lost infant. The analysis of variance on the maternal level of education and infant mortality is demonstrated as the factors varied significantly across the study area. Consequently, the hypotheses that there is no significant relationship between maternal level of education and infant mortality in the study area is hereby rejected as the calculated chi-square of 26.25 at df.3 is greater than the table chi-square of 7.815.

Table 2: Differentials in Infant by Maternal Occupational Status and Infant Mortality in Nasarawa State, Nigeria

Infant Mortality	Maternal Occupational Status					Total	X ² Value	df	p-value	Remark
	Petty trading	Artisan	Civil servant	Farmer	None					
Yes	158 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0.)	158 (100%)	31.039	4	<0.05	significant
No	24 (10%)	26 (10.9%)	149 (62.3%)	21 (8.8%)	19 (7.9%)	239 (100%)				
Total	182	26	149	21	19	397				

Pearson Chi-Square value = 31.03; Alpha Level= 0.05; df=4; Critical value=9.488; Missing value=0

Maternal occupation determines the amount of care rendered to an infant. In table 2, data generated from the study established that artisans, farmers, and the unemployed have a low percentage in terms of infant mortality. The higher percentage of petty trader have lost an infant, while those whose occupation is in the civil service have a percentage of 62 percent and were seen to have not lost an infant. The hypotheses that there is no significant difference between occupational status and infant mortality ever lost is hereby rejected as the calculated chi-square of 31.03 at degree of freedom 4 is more than the table chi-square of 9.488. This implies that the occupational status of the mother influences the incidence of infant mortality in the household.

Table 3. Differentials in Infant Mortality by Sex of Infant and Age at Death in Nasarawa State, Nigeria

Sex of infant	Age at death				X ² Value	df	p-value	Remark
	Early neonatal stage	Late neonatal stage	Post neonantal stage	Total				
Male	69 (85.2%)	12 (14.8%)	0 (0.0%)	81 (100%)	12.064	2	<0.05	Significant
Female	0 (0.0%)	42 (54.5%)	35 (45.5%)	77 (100%)				
Total	69	54	35	158				

Pearson Chi-Square value= 12.064, Alpha Level= 0.05; df=2; Critical value=5.992, Missing value=0

Table 3 indicate the differentials in infant mortality by sex of infant and age at death in Nasarawa State, Nigeria. About 85.2 percent of respondents who lost a male infant died during the early neonatal stage, 15 percent died during both the late neonatal stage and post neonatal stag. Likewise, about 54.5 percent of respondents who has ever lost a female infant died during the late neonatal stage, 45.5 percent died during the post neonatal stage. This implies that majority of infants who died were male and that they died during the early neonatal stage. The hypothesis that there is no significant difference between sex of infant and age at death is hereby rejected as the calculated chi-square of 12.06 at degree of freedom of 2 is higher than the tabulated chi-square of 5.992.

Table 4: Differentials by Birth Intervals and Infant Mortality in Nasarawa State, Nigeria

Infant Mortality	Birth Intervals between respondent's current child and the previous one				Total	X ² value	Df	p-value	Remark
	>1year	1-2 years	2-3 years	4years					
Yes	32 (20.3%)	126 (79.7%)	0 (0.0%)	0 (0.0%)	158 (100%)	135.102	3	<0.05	Significant
No	0 (0.0%)	125 (52.3%)	98 (41.0%)	16 (6.7%)	239 (100%)				
Total	32	251	98	16	397				

Pearson Chi-Square value = 135.102; Alpha Level= 0.05; df=3; Critical value=7.815, Missing value=0

The length of the preceding birth interval is a factor that compounds to the parity of infant. In table 4, it can be acknowledged that respondents who have a birth interval of less than one year make up 20.3 percent of infant mortality and 1-2 years of birth interval make up 79.7 percent of infant mortality. It was also shown in the table that 52.3 percent of respondents who have not lost their infants have a birth interval of between 1-2 years, 41 percent have a birth interval of 2-3 years and 7 percent have a birth interval of 4 years and above. Approximately 93.3 percent of respondents who have a birth interval of 1-3 years between their current child and previous one has not experience infant mortality. Therefore, the result of the analysis on birth interval and infant mortality shows that the variable varies significant. The null hypothesis (H_0) that there is no significant difference between birth interval and cases of infant mortality is hereby rejected and the alternate hypothesis (H_1) that there is a significant difference between birth interval and cases of infant mortality is accepted as the calculated chi-square of 135.102 at the degree of freedom 3 is bigger than the critical chi-square of 7.815.

Discussions of Findings

Findings on the maternal level of education and infant mortality indicates that respondents with tertiary education experience lower incidence of infant mortality than those without educational qualification. This was supported by Danjuma (2015) that maternal education has been identified as one of the most important socio-economic determinants of infant mortality. Education increase the woman ability to utilize government and private healthcare facility and it may increase the independence necessary to advocate for infant in the household and outside world.

Regarding findings on maternal occupation and infant mortality, result shows that there is significant variation between the two variables. Occupation has been seen as a factor that has both

positive and negative impact on the infant. To an extent, it determines the amount of care rendered to an infant. Some previous studies believed that working class women have lesser time to render in taking care of an infant thereby leading to infant death, other studies believed that women who are not engaged in any form of occupation find difficult to take care of an infant especially when it relates to finance and health (Mahfouz, et al, 2009).

On the sex of infant and age at death, the study findings established a significant difference between the two variables. Similar pattern was found in a previous study conducted by Negara (2013) that male infant mortality usually surpasses female infant mortality in the first 6 days of birth, but this differential is often reversed in the remaining 11 months. This is in line with NPC and ICF (2013) that infant deaths among births that occurs been attributed to the first month of life. Findings on infant ever lost and birth interval shows there is a significant difference between the two variables as short birth interval can lead to infant death.

Conclusion

The study found out that the incidence of infant mortality in Nasarawa State, Nigeria is reducing, but the level is still fairly high especially in relation to the Sustainable Development Goals. Marked differentials were found between the incident of infant mortality in socio-economic as well as demographic factors particularly maternal education, maternal occupation, sex of infant and birth interval.

Recommendations

The following recommendations are put forward to drive policy towards the mitigation of the identified challenges;

- (a) There is need for a renewed policy on maternal health education in Nasarawa State including free counselling on birth spacing, family planning, immunization, ante-natal and post-natal care for all women.
- (b) All policies on infant mortality developed should be integrated with women empowerment programmes especially through education. Women with low status usually do not fully utilize the facilities provided to them. This could hamper progress even if government improves the health care system.
- (c) To increase the survival rates of infants in Nasarawa State, policies and programmes to urgently address poverty alleviation and increase the level of maternal education and literacy should be implemented

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