

## THE PATTERN AND DETERMINANTS OF INFANT MORTALITY IN RURAL NIGERIA

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### ABSTRACT

This research examined the pattern and determinants of infant mortality in Abia rural community, Nigeria. The data for this study were obtained from household questionnaire surveys administered to 140 randomly selected households who have experienced infant mortality in the five years preceding this study. From the data generated descriptive statistics was used to analyze the pattern of infant death in the study area. In addition, Principal Component Analysis (PCA) was used to analyze the socioeconomic and demographic determinants of infant mortality in the study area. The results show that almost half (49%) of the respondents have experienced infant mortality in the past five years, while 35% of all infant mortality in occurs in the first month of birth. The PCA also extracted six underlying components of that together explained 73.42% of the cumulative variance in the determinants of infant mortality. The components are mother's economic status, nature of care for the infant, quality of household infrastructure, maternal age, quality of life of the infant, and quality of attention given to the infant. Based on the results, recommendations such as improvement of health facilities and education of the girl child are made to help reduce the incidence of infant mortality in the rural areas.

**Keywords:** Abia community; Infant Mortality; Determinants; Pattern; Rural Nigeria

### INTRODUCTION

Infant mortality rate (IMR) is one of the important indicators of the socio-economic and health status of a community. Infant mortality rate is one of the components of United Nations human development index [1] and is very vital for the evaluation and planning of public health strategies [2]. Furthermore, one of the most important targets of the Millennium Development Goals (MDG) is to reduce infant and child mortality by two-thirds between 1990 and 2015 [3]. Many researches have carried out on infant mortality and its determinants globally. According to [4,5], infant mortality is studied under two age segments namely, mortality between birth and exact age of one month (neonatal period) and mortality between one month and eleven months (post neonatal period). Early childhood mortality varies among World regions even as the differences are large and increasing. For instance, in 2006, Sub Saharan Africa had average mortality rate of 186 per 1000 children while the industrialized countries had average mortality rate of 6 per 1000 children [6,7]. Despite advances in medical sciences and acknowledgement of the role of hygiene and sanitation, survival of infants continues to be a challenge worldwide [7].

It has been estimated that five million children under one month of age die each year, and nearly all (98%) of these deaths occur in developing countries [8]. Most of these deaths are from preventable and treatable conditions, and almost all deaths are in poor countries. Of these 10 million deaths, eight million are infants, half of who are newborns in their first month of life. A high proportion (40%) of deaths in children less than 5 years occurs in the first month of life, and 30% during their first week [9]. For instance, in 2005, Nigeria infant mortality rate was 98.8 deaths per 1000 live births [10]. Also, while the 2012 estimates of world infant mortality rate were 39.48 deaths/1,000 live births, Nigeria's infant mortality rate is 74.36 deaths/1,000 live births [11]. Consequently, Nigeria is currently ranked as the country with the lowest child survival rates in the world, with only 1.2% reduction in childhood mortality per year since 1990. Thus Nigeria needs to achieve 10% in annual reduction rate from now until 2015 to meet MDG 4 for child survival.

Nigeria's failure to meet this MDG target will influence Sub-Saharan Africa's achievement of these goals as a whole and will contribute significantly to global childhood mortality [12,13,14].

In Nigeria, different studies have been carried out on the determinants of infant mortality [12,15,16,17]. For instance [16,17]

examined the role of religious affiliation on the survival probability of the child. They observed that that polio vaccination refusal in Nigeria related to mother's affiliation to traditional indigenous religion ultimately affected child morbidity and it is significantly associated with increased early childhood mortality. Research has also shown that perception, attitudes and behavioral practices toward childhood morbidity and mortality would be better understood by examining the mother's ethnic membership as the customs, and the learned behavioral pattern surrounding the care of infants vary by ethnicity [15]. Even though the Nigerian Health Policy recognizes the need to reduce the current high childhood morbidity and mortality rates, but people's behavioral practices have not been adequately integrated into the health intervention programs. Studies have identified several factors affecting the health and survivorship of the child and that of the mother to include; societal belief, values, norms, orientation and expected gender roles, diminished access to livelihood, abandonment of total family caring responsibilities to women by men, lack of prioritization of the special health needs of women and children at all levels [18]. Other works on infant mortality in Nigeria was associated with its environmental determinants such as rural and urban influence on infant mortality, demographic factors such vaccination and immunization determinants [19,20,21].

The above studies on infant mortality differentials in Nigeria have been at large scale levels of regions while neglecting the critical influence of community-level variables and small area variations especially as it concerns rural areas. The study of patterns of infant mortality and their determinant factors, particularly at the rural community levels, will help improve our understanding of the mortality situation in the different rural areas of the country and in the design and implementation of policies and interventions to lower infant mortality and achieve its uniform decline nationwide [22]. In addition these mortality studies has been reported on in other parts of Nigeria by even Non-governmental Organizations such Policy Project/Nigeria, Save the Newborn, UNICEF but no research work on the patterns and determinants of infant mortality has been carried out in Abia rural community of Enugu State, Nigeria. Furthermore, studies on community-levels determinants of under-5 mortality are needed to enhance the understanding of the spatial variation of infant death. Therefore, this dearth of research in the pattern and determinants of infant mortality at the rural and micro level necessitated this study. This study is also germane since public

health advocates have recommended multi-sectoral interventions to address the challenges of infant mortality. Rather than generating causality conclusions, this study aims to arrive at a better understanding of the association between the determinant factors of infant mortality that could be plausible and consistent with the available information.

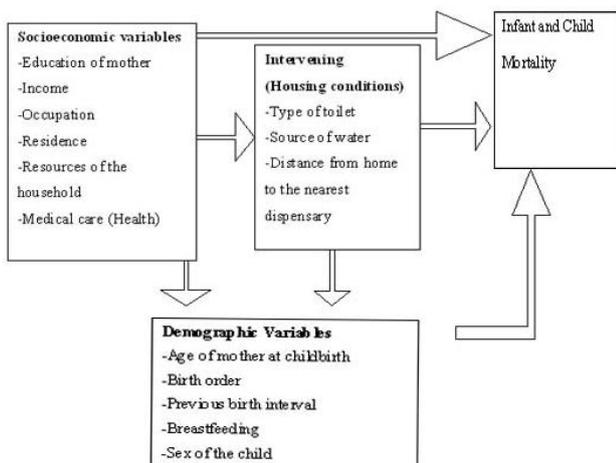
**MATERIALS AND METHODS.**

Abia rural community which is the study area comprises of seven villages; Ofeke I, Ofeke II, Agbani, Ameti, Igbochi, Enugwu Abia and Ogwugwu. The study area is in Udi Local Government Area of Enugu State, Nigeria and is located between latitude 6°15'N and 6°30'N, and longitude 7°15'E 7°26'E with an altitude of 400-550metres. In each of the villages, a random sample size of 20 households who have given birth to at least an infant in the past five years preceding 2103 (the time of the fieldwork) were used for this study, totaling 140 households for the seven villages used for this research. The data was for this study was collected through household questionnaire administered on the heads of the randomly selected households. The questionnaire comprises questions on the patterns, and the determinants of infant mortality. On the other hand, the secondary sources of data for this study include text books, journals, unpublished and internet/online materials on infant mortality. Descriptive statistics were used to analyze the pattern and determinants of infant death in the study area. Furthermore the data on the determinants of infant mortality were subjected to the principal component analysis in order to identify the underlying components of infant mortality in the study area.

**CONCEPTUAL FRAMEWORK**

This research is based on the model of the determinants of infant and child mortality as shown in Figure 1 below [23]. This model which is a modified form of the [24] model assumes 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 its development, one of the possible outcomes of which is death.
- Structural determinants are mediated at the family level, since the child's growth and development are heavily dependent on the living environment of his /her family. These conditions generate the biological risk factors that act directly on the child's health.



**Figure 1: The Conceptual Framework of the Determinants of Infant Mortality [23].**

These determinants of mortality are grouped into three categories, namely

- The socio economic characteristics such as mother's education, occupation, residence, resources of the household, income of the mother and medical care,
- The intervening/housing conditions/ environmental variables such as source of water, toilet facilities and distance from home to the nearest health facility.
- The demographic variables such as age of mother at child birth, Birth order, previous birth interval, breastfeeding and sex of the child

From the conceptual framework shown in Figure 1, it is clear that socio-economic characteristics of mothers play a key role in determining child mortality. They both directly and indirectly influence childhood mortality. Indirectly, they operate through demographic/housing conditions/environmental factors to influence infant and child mortality. But for the purpose of this study, we considered the determinants of infant mortality by merging housing conditions into socioeconomic variables and thus having two determinants factors; socioeconomic and demographic.

**RESULTS AND DISCUSSION**

**Pattern of Infant Mortality in Abia Community.**

The analysis of the pattern of infant mortality is based on the variables of incidence of infant deaths, sex differentials of infant death with regards to order of pregnancy, and age differentials of infant death. These will be discussed on the level of the entire community/study area.

**Incidence of Infant Deaths**

Infant mortality has been identified as an indicator of population health and a measure of global health inequalities [25]. The incidence of infant death is the occurrence of child dying before reaching one year of life. Incidence of infant mortality in the study area was determined using the percentage of women that have experienced any of their children dying at infancy. Results in Figure 2 shows that 49% of the respondents have experienced infant mortality in the study area in the past five years. This shows that infant mortality is high in the study area as almost half of all the fertile women have experienced infant death in the study area.



**Figure 2: Incidence of Infant Mortality in the Study Area in the Past Five Years. (Source: Fieldwork, 2013).**

### Age Differentials of Infant Mortality in the Study Area

Deaths of infants may occur at the neonatal (during one month) and post neonatal (between two to twelve months) periods. However, studies have shown that the greater proportion of infant mortality occur during one month of birth. In 2011, it was estimated that nearly 3million deaths (43% of under-five deaths) occurred during the first month of life and almost 5 million (72% of all under-five deaths) within the first year of life [26].



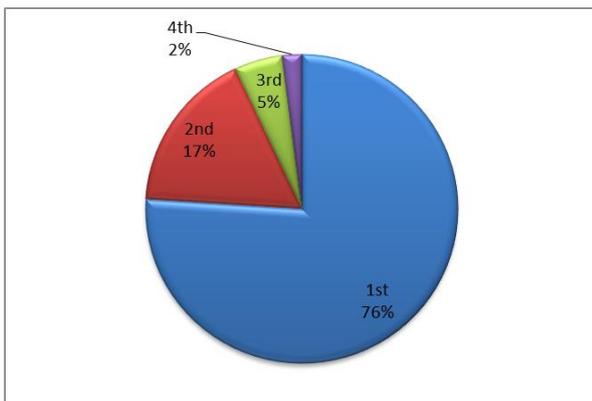
**Figure 3: Age Differentials of Infant Mortality in the Study area (In Months). (Source: Fieldwork 2013)**

From Figure 3 above, the highest proportion of infant death was experienced in the first month of life accounting for 35% of all the infant deaths. This result is in tandem with the results of other studies on infant mortality from other parts of the world as noted above by [26]. On the other hand, mortality within the second and third months of birth in the study area accounts for 22% and 21% of all infant mortality respectively.

### Sex Differentials in Infant Deaths with Regards to Order of Pregnancy

In the majority of world regions, studies have shown that the female child enjoys better survival chances than their male counterpart. High rate of male mortality has been documented by many researchers and has been attributed to biological weakness of male children at birth.

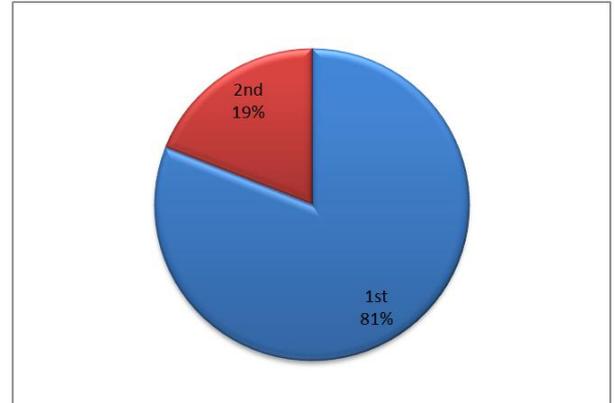
According to [11], Nigeria was ranked the 16<sup>th</sup> highest in the rate of male infant mortality worldwide at 79.44 per 1000 birth. Figure 4 below shows the incidence of male infant death in the study area that agrees with the 2011 estimates.



**Figure 4: Male Infant Mortality With Regards to Order of Pregnancy. (Source: Fieldwork, 2013)**

The results shown in Figure 4 indicates that first order pregnancies accounts for more one-third of all male infant mortality in the study area while fourth order pregnancies accounts for only 2% of all male infant mortality in the study area. The reduction in male infant

deaths may be due to the mothers getting more matured and experienced in caring for their infants. On the other hand, the rate of female infant mortality in the study area as shown in Figure 5 shows that all female infant mortality among the respondents occurred between the first and second pregnancies. However, almost all the female infant deaths (89%) occurred within the first pregnancies while the second pregnancies account for the remaining 19% of female infant deaths.



**Figure 5: Female Infant Mortality With Regards to Order of Pregna (Source: Fieldwork, 2013)**

### Principal Component Analysis (PCA) of the Determinants of Infant Mortality

The determinants of infant death in the study area were considered from two perspectives; socioeconomic determinants which were merged together with Intervening (Housing conditions) and demographics determinants. Due to the myriad of responses received and considering the fact that the response may be difficult to present and explain one after the other, the principal component analysis (PCA) was used to collapse the determinants of infant mortality in the study area into major underlining components for easy interpretation. Table 1 shows the results of the rotated principal component analysis.

It can be seen from table 1 that the principal component analysis produced six components out of the 15 variables that together explain 73.42% of the total variance in the determinants of infant mortality, thus leaving 26.58% of infant mortality unexplained due to other factors.

- Component I has significant loadings on three variables; X1(Mother's education) which exposes her to information about better nutrition, use of contraceptives to space births and knowledge about childhood illness and treatment, X7 (Mother's occupation) which impacts either positively if the job pays well and do not take much of the mother's due attention for the child and negatively if the job pays very little to add a meaningful increase in the general household income and at the same time consumes much of the mother attention in caring for the infant, and X9 (Mother's monthly income) which influences the income accruing to the household and the standard of living of the household. All other things being equal, these variables impact on the health and growth of the infant and therefore the underlining dimension for this component becomes "mother's economic status". This component has an eigen value of 3.007 and explains 20.05% of the total variance of the PCA.
- Component II has an eigen value of 2.425, explains 16.17% of the total variance of the PCA and loads significantly on two variables. The variables are X8 (number of months of exclusive breastfeeding) which affects the infant's nutritional value and susceptibility to illness and infection, and X10 (Husband's Occupation). The type of father's occupation determines the amount of income that accrues to the household which in turn affects the well-being of the infant. Here the underlining dimension is "nature of care for

the infant”.

- Component III has significant loadings on two variables namely X6 (Type of Toilet System) which determines the level of hygiene of the household. For instance pit latrine is less hygienic than the water system toilet. The other variable is X11(Type of house) reflection of the household level of economic empowerment. It also determines the level of ventilation for the infant well being, because stuffy house can pose health challenges such as breathing problem to the infant. The underlining dimension becomes “quality of household infrastructure”. This component has an eigen value of 1.909 and accounts for 12.72% of the total variance of the PCA.
- Component IV has significant loadings on two variables; X3 (Mother’s age), which a factor of the woman’s maturity or otherwise child’s bearing, and X5 (Mother’s age at infant birth) which is one of the factors most frequently associated with infant mortality differentials based on the level of care given to infant. For instance, teenage mothers are generally inexperienced and

**Table 1: Varimax Rotated Component Matrix of the Determinants of Infant Mortality**

Variables	Components					
	I	II	III	IV	V	VI
X1 – Mother’s education	*.831	-.086	.088	-.168	-.114	.091
X2 –Marital status	-.198	.009	-.166	.073	.021	*.801
X3 –Mother’s age	-.127	.005	-.200	*.796	.174	.035
X4 –Infant’s Weight at Birth	.271	-.486	.088	.348	.372	-.080
X5 –Mother’s age at infant Birth	-.179	-.122	.369	*.770	-.154	.071
X6 –Type of Toilet System	-.473	-.221	*.709	.084	-.017	.063
X7 –Mother’s occupation	*.850	-.079	.146	-.021	.169	-.093
X8–Month of exclusive Breastfeeding	.008	*.856	.174	.158	.025	-.017
X9 –Mother’s Monthly income	*.610	.501	-.122	.008	.082	-.364
X10 –Husband’s Occupation	.037	*.714	.180	.144	.162	-.054
X11 –Type of House	-.010	-.142	*.862	.140	.206	-.030
X12 –Waste Disposal Method	.034	-.022	.132	.054	*.805	.330
X13 –Hours of Work Per Day	.261	.277	.219	.451	-.130	*.523
X14 –Days of Work per week	-.020	.134	-.075	.027	*.810	.240
X15 –Month to stop Postnatal Care	-.385	.208	-.402	.266	-.149	-.476
<b>Eigen Value</b>	<b>3.007</b>	<b>2.425</b>	<b>1.909</b>	<b>1.407</b>	<b>1.193</b>	<b>1.073</b>
<b>% of Explained Variance</b>	<b>20.05</b>	<b>16.17</b>	<b>12.72</b>	<b>9.38</b>	<b>7.96</b>	<b>7.16</b>
<b>Cumulative Variance (%)</b>	<b>20.05</b>	<b>36.21</b>	<b>48.93</b>	<b>58.31</b>	<b>66.26</b>	<b>73.42</b>

\*significant loadings exceeding 0. 60.

unexposed to what is best for their baby and even themselves. Thus the underlining dimension is “maternal age”. This component has an eigen value of 1.407 and accounts for 9.38% of the total variance of the PCA.

- Component V has an eigen value of 1.193, explains 7.96% of the total variance of the PCA has significant loadings on two variables, X12 (Waste Disposal Method) which could determine the hygienic condition of the environment on to which the infant is exposed, and X14 (Days of work per week) which influences the quality of attention given to the child during the working days when the mother has to leave her baby under the care of another person. The underlining dimension then becomes “the quality of life of the infant”.
- Finally component VI has significant loadings on three variables; X2 (Marital status) which influences the psychological and emotional stability of the nursing mother, X13 (Hours of work per day), which determines the level of mutual interaction between the mother and the infant, for instance the eye to eye contact and mumblings between the mother and infant when breastfeeding makes the infant feel secured, and X15 (Period of postnatal care) which easily affects the survival probability of the infant. This component has an eigen value of 1.073 and explains 7.16% of the total variance of the PCA while the underlying dimension is “the quality of attention given to infant”.

## SUMMARY OF FINDINGS AND RECOMMENDATIONS

This study examined the pattern and determinants of infant mortality in Abia community, a rural area in Udi Local Government Area of Nigeria. Descriptive statistics were used to examine the pattern of infant mortality for the study area. The results showed that infant mortality is high, and most of the infants die between the first and second months of birth. In addition, the most of the female infant mortality (89%) occur during the first pregnancies of the mothers. The socioeconomic and demographic variables that determine infant death were also analyzed using the Principal Component Analysis (PCA), which was carried out using Statistical Packages for Social Sciences (SPSS). The PCA which accounts for a cumulative variance of 73.42% collapsed the 15 variables/indices that are determinants of infant mortality into six components namely: mother’s economic status, nature of care for the infant, quality of household infrastructure, maternal age, quality of life of the infant, and quality of attention given to the infant.

Based on these findings, the following recommendations are proffered

### Promotion of girl education

An improvement in the enrolment of the girls in schools will increase the age of marriage and subsequently increase the age at child birth and reduce adolescent pregnancies, by the would-be-mothers. The girl child education can be encouraged through such incentives such as education without fees, free books etc. This would address the problem of teenage pregnancies and the susceptibility of infant death.

### Provision and improvement of health facility

Good health constitutes one of the basic needs, and contributes significantly towards enhancing and maintaining the productive potential of people. Improving the health system in the study area will have positive impacts on making provision for family planning to control the number of children ever born. From fieldwork observation, the only primary healthcare in the study area (which is a replica of other most other rural areas in Nigeria) leaves much to be desired in terms of availability of equipment, drugs, bedding and more importantly medical personnel. It is hoped that if these recommendations are effectively implemented, it will help reduce the rate of infant mortality in the study area, and by extension, other rural communities of Nigeria.

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