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Correlates of Infant Mortality

Empirical Evidence from Ile-Ife, Nigeria

**Alfred A. Adewuyi and
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D E D I C A T I O N

DR. (Mrs.) Modupe Odumosu
    You conceived of the idea of
    a study on Infant Mortality
    But you died before its execution
    You died at the time your struggles
    Had begun to yield fruits
    You departed the sinful world suddenly
    Your death has further confirmed our
    Faith in God

We dedicate this report to you.

Preface

The idea of a study on correlates of infant mortality in Nigeria was that of late Dr. (Mrs.) Modupe Odumosu of the Department of Community Medicine and Nutrition, University of Ife, Ile-Ife. She was conscious of the interdisciplinary nature of the study when she approached Dr. Alfred A. Adewuyi of the Department of Demography and Social Statistics of the same University for the collaborative research.

The intention was to select mothers who registered for antenatal care and delivered either at clinic or at home in 1980. As a control group, we included mothers who did not register to receive antenatal care and delivered at home. The addresses of mothers who registered for antenatal care were collected from three centres in Ile-Ife (1) Enuwa Maternity Centre (2) Modakeke Maternity Centre and (3) Ife State Hospital. In theory, the two maternity centres are generally used by mothers classified as low risk whereas Ife State Hospital for high risk cases.

At that stage, we sought for and obtained financial support for our proposal from International Development Research Centre, Ottawa, Canada. We then finalized the questionnaire, trained the interviewers and the beginning of fieldwork was slated for June 1, 1982, when in the early hour of May 30, Dr. (Mrs.) Odumosu was reported dead. Her death was sudden and a shock to the University Community and particularly to her co-researcher. Further action was temporarily suspended on the project.

However, Dr. Feyisetan of the Department of Demography and Social Statistics later joined in the execution of the project. Therefore, at the completion of writing this research report, we feel greatly indebted to Dr. (Mrs.) Odumosu for stimulating our interest on a subject matter which is of great concern not only to Nigeria, but to other less developed countries of the world. We respect Dr. (Mrs.) Modupe Odumosu for her imagination, conscientiousness and devotion to scholarship. May her soul rest in perfect peace.

We seize this time to record our acknowledgement to the sponsor of the project - The International Development Research Centre of Canada- whose financial support helped to actualize our dreams on this project. Apart from its financial support, the IDRC demonstrated high level of organization in monitoring its funded projects around the world. We personally appreciated the brotherly love of Dr. Francois Belisle at the beginning of this project; Dr. Eva, who visited us two times; Dr. Mark Farren whose only visit to us in Nigeria was very cordial and Dr. Alan Simmons whose keen sense for details and readiness to help at short notice are hereby amply appreciated.

In Nigeria, we express our sincere appreciation to those Community Nurses who diligently carried out the field work, Misses Veronica Merotiwon, Toyin Awodehin, Deola Adewolu, and Mr. Tunde Olugbodi among others for editing and coding of the data. One major constraint in the

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Research Problem and Literature Review

Introduction:

The concern with infant mortality is, in some respects, a result of its acceptance as a widely used index of socioeconomic development and standard of health care programmes in a society. However, consequent upon the paucity as well as unreliability of relevant demographic data, not much is known about the mortality rates and correlates among infants in Nigeria. What we know about infant mortality in Nigeria is gathered from a few ad hoc surveys (Gardner and Gardner, 1959, Houck, 1963; Nicol, 1959; Morley, 1962; Ekanem and Farooq, 1976; Ekanem and Ebigbola, 1979).

Evidence from pre-1970 surveys shows no consistent pattern in time and space. For instance, it was claimed that in mid 1930s, infant mortality rate in rural areas was about 300 deaths per 1000 live births and that the figure did not fall below 290 in the 1950s (Uche, 1981). Nicol (1952) estimated infant mortality rates to lie between 327 and 525 deaths per 1000 births in a fishing and farming villages respectively and the same author in the late 1950s (Nicol, 1959) estimated infant and child mortality rates to be between 292 and 289 deaths per 1000 births. Gardner and Gardner (1959) estimated mean child morality rate of 490.5 per 1000 live births in Plateau State in 1955 and data assembled from six mission hospitals in Northern Nigeria showed that infant mortality rates varied between 202 and 825 deaths per 1000 births in 1955-1957. However, estimates of infant mortality rates for Lagos during the same period are clearly lower than the rates reported above. Indeed, the Ministry of Health estimates were 88, 82, 63, and 68 for 1950, 1955, 1960 and 1963 respectively (Demographic Year-book, 1965).

The high but fluctuating infant mortality rates should be accepted with caution and the figures reported may, strictly speaking, not be comparable with each other. It is difficult to know whether the deaths referred to are indeed infant deaths. There is the high probability that some of the deaths may include deaths of children above one year old. There estimate might be affected as well by method of data collection, variations in the period of time represented; diverging cultural practices affecting child survival; wide variations in the size of sample used as well as respondents' ability and willingness to supply the needed information (Gardner and Gardner, 1957).

While it is hazardous to assume trends of infant mortality rates before 1960 in Nigeria from the available fragmentary evidence, it might be save to claim a declining trends from results of studies carried out in the late 1960s as well as by the turn of 1970 decade. The evidence from rural demographic sample survey carried out in 1965/66 (FOS, 1968) showed that infant mortality rate was 178 deaths per 1000 births while the results from the 1971-75 national survey at Ife showed that infant mortality rate was 97 in South-Western Nigeria and 118 deaths per 1000 live births in South-Eastern Nigeria (Ekanem and Farooq; 1976; Ekanem and

live births in South-Eastern Nigeria (Ekanem and Farooq; 1976; Ekanem and Ebigbola, 1979).

Nonetheless, knowledge about the trends of infant mortality is inadequate if we remain ignorant of factors affecting it. Attempts at rigorous research into these factors have been hampered by lack of a comprehensive conceptual framework. However, recent efforts have been directed towards building such an analytical framework. (Mosley, 1983, 1985; Mosley and Chen, 1984, Davanzo, 1984, Shultz, 1984, 1985).

Conceptual Framework

The disproportionate concern with fertility studies in the last three decades in developing areas was justified partly because it was assumed that the precipitous fall experienced in mortality levels since the end of World War II would be irreversible and the fall would continue until developing countries attain the same expectation of life at birth as in the more developed areas (Adewuyi, 1975). However, the assumption was vitiated early in this decade when it was realised that mortality levels have remained static at low level of expectation of life in less developed countries (Gwatkin, 1980; United Nations, 1983). The well documented initial evidence of rapid mortality decline in the LDCs was largely attributable to the availability of medicine imported from Europe and countries of European origin while mortality decline in the MDCs were due to improvements of indicators of socioeconomic development and only later to medical improvement.

More specifically, the mortality decline in the MDCS was attributable to (1) increased level of living emanating from increased production, (2) improvement in personal hygiene and environmental sanitation as well as (3) peace and stable government (Adewuyi, 1975). Such factors led to drastic reduction in the incidence of environmental contamination, food deficiency and improvement in socioeconomic attributes of individuals, households and the community. Since developing countries might have to repeat the experiences of the MDCS in this respect, the search for correlates of infant mortality should be multi-disciplinary in approach. Unfortunately, arising from disciplinary boundaries, individual researchers have concentrated on the application of their respective research tools to explain infant mortality differentials in the population of the third World Countries. For instance, Social Science research has focused on the relationship of socioeconomic variables in the study of levels and patterns of mortality; medical research concentrates on biological processes of diseases and less often on mortality per se. Such studies attribute specific diseases to mortality using data obtained from death reports while ignoring socioeconomic factors as explanatory variables. Epidemiological studies focus on mechanisms of disease transmission in the environment; intervention studies alter environment to reduce disease transmission while nutrition research focuses on breast-feeding, dietary practices and food availability as they relate to nutritional status. Thus while different research disciplines have contributed to the understanding of infant and child mortality in developing countries, the differing research stra-

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tegies have constrained the growth of potentially useful approaches in the understanding of correlates of infant and child survival (Mosley and Chen, 1984, p. 27; Mosley, 1985; p. 1980).

In the absence of intellectual dialogue, the varying research methodologies could be reconciled incorporating both social and medical sciences (epidemiological, interventional or nutritional) techniques into a coherent analytical framework for the study of differential in infant and child survival. For Social Science research, Mosely and Chen argued that physical and biological assaults on individuals do not occur randomly but are the consequences of physical environment and socio-economic setting of the child; while from medical science, it is accepted that infant and child deaths in poor countries are not due to a single cause but rather the end results of repeated episodes of infections compounded by malnutrition (Puffer and Serrano, 1973). The point of concern for policy prescription is to explain the risk factors that reduce chances of infant survival (Mosley, 1985). On this basis, the risk factors could be divided into two broad categories as follows:

(1) Proximate determinants-biosocial mechanisms that **directly** influence the risks of morbidity and mortality

(2) Underlying determinants - all other social and environmental determinants which operate indirectly through proximate determinants to influence infant and child survival (For details of the analytical framework, see Mosley, 1985, Mosley and Chen, 1984).

The framework succeeds in demonstrating the interdisciplinary requirements for the study of correlates of infant and child survival in less developed countries.

In the present study, we shall not attempt to integrate the measure of mortality and morbidity (1) because the data for such integration are not available (2) such integration will reduce the level of comparability of research with earlier studies (3) the measure would not represent adequate index of health status. Scaling for malnutrition may not be straight forward. Relating weight with age may be incomparable among cultures.

For want of data, we shall also exclude injury from the proximate determinants as well as institutional and environmental factors from the underlying determinants. Place of delivery represents the index for cultural factors. However, in most of developing countries, place of delivery transcends individual preferences particularly in countries with inadequate mass transit transportation system as well as other physical and environmental constraints. Thus as a matter of realities of the circumstances in most developing countries, we often have three categories of mothers with respect to place of delivery. These are (1) those who register and deliver in the clinic (2) those who register in the clinic but deliver at home and those who did not register in the clinic

and also deliver at home. In the present study we exclude mothers who did not register in the clinic but deliver there.

The indices of proximate and underlying determinants included in the present study reflect the environment from which the study is carried out.

Review of Literature

The correlates of infant mortality may be divided into exogenous and endogenous factors which are subsumed in the analytical framework

Fig 1. Reduced General Model of the Interrelationships of
       Underlying and Proximate Determinants to Child Survival

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            ┌─────────────────────────────────────┐
            │   Socioeconomic Determinants          │
            │  (Individual and Household Factors)    │
            └─────────────────────────────────────┘
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Maternal/Infant   Environmental and   Nutritional   Personal illness
   Factors   Health Factors   Factors   Control
  (Biological   (Maternal/   (Antenatal Care
   Factors)   Infant   Factors

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                        ┌──────────┐
                        │ Place of │
                        │ Delivery │
                        └──────────┘
                             │
                        ┌──────────┐
                        │Mortality │
                        └──────────┘
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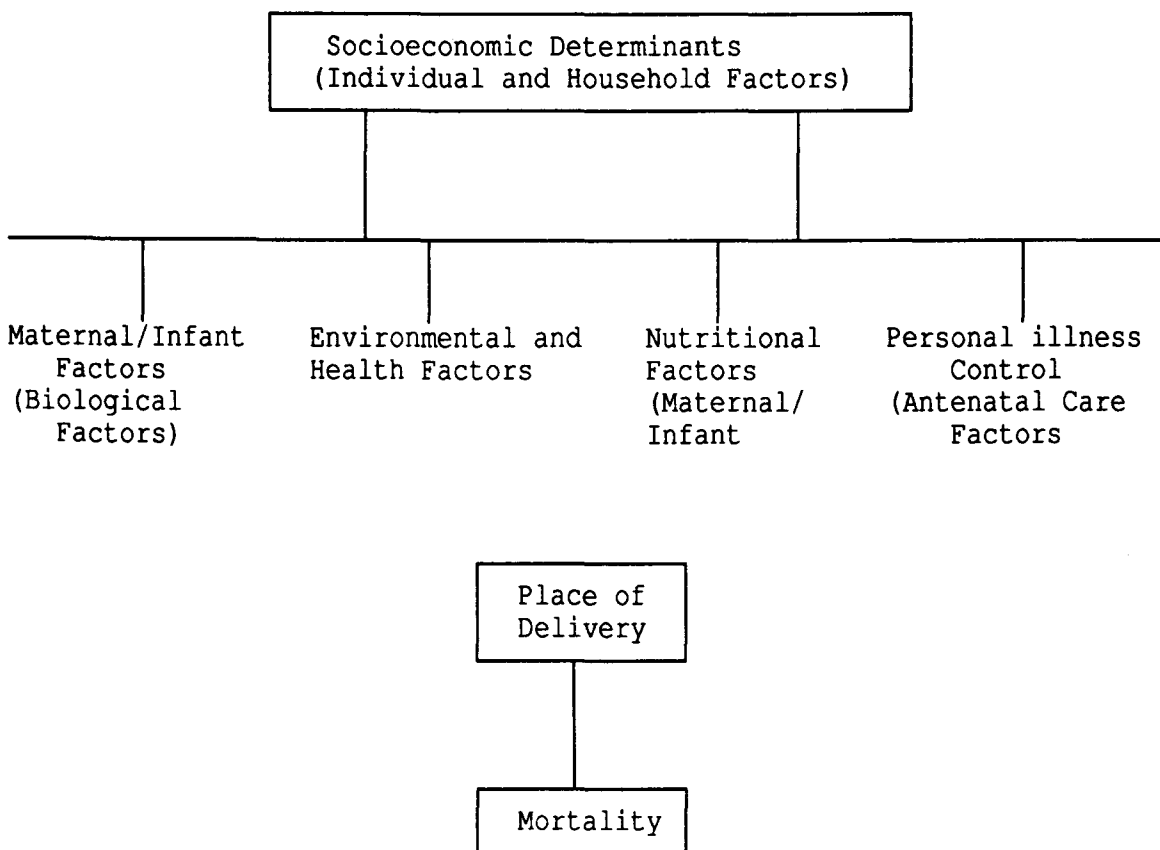
present above. The exogenous factors include social, economic nutritional and environmental factors; the endogenous variables are concerned with antenatal care as well as factors relating to delivery (biological factors) (U.N. 1982). The present study is designed to examine both the exogenous and endogenous variables affecting infant mortality. On a

general note, the nearer one comes to birth itself, the more the effect of endogenous variables and less the socioeconomic and environmental influence. Thus, still-births, later neonatal as well as postneonatal deaths are explicable largely in terms of exogenous variables, whereas perinatal deaths particularly neonatal deaths during the first week are, to a large extent, results of endogenous factors.

Antenatal Care Factors

The contention has been that mothers who deliver in hospitals experience better chances of children's survival than any other group of mothers. Such other group may include mothers that originally registered in the clinic for antenatal care but finally deliver outside the clinic; mothers that do not register in any clinic and deliver at home; others may include those who did not have prenatal care in any clinic but ended up delivering in the clinic. Such clinics referred to here exclude private physicians or prenatal clinic (Plank and Milanesi, 1973). Such proposition hangs on the rationality that mothers that go through antenatal care in an organised clinic benefit from medical treatment that could eliminate the effects of diseases and complications that accompany pregnancy. Thus mothers without exposure to organised medical care during pregnancy are prone to diseases and complications that favour infant deaths.

Research evidence in support of the above contention is not consistently unidirectional. For instance, infant mortality or its variant-perinatal mortality - might be related to other variables. In Zackler (1969) and Clark (1970) studies, perinatal mortality was related to prematurity rate which was found to be associated with young age and low income. Hence, low income teenagers experience inadequate antenatal care and therefore high perinatal mortality. Clark (1970) further claimed that for mothers with antenatal care there was a drop in the incidence of toxemia, breed presentations and cesarian sections as well as infant mortality rate.

Kessner and his associates (1973) developed a three factor maternal health care index which is composed of (1) trimester of first antenatal visit (2) number of prenatal visits controlled for length of gestation and (3) whether the patient was a ward or private patient as an assessment of continuity in antenatal care. They found that (a) in the first year of life, adequacy of care is positively related to infant birth weight and therefore, children's survival (b) there are consistent trends found between adequacy of care as measured by the health care index and infant birth weight and survival in each of four maternal risk groups (c) health care services are misallocated among ethnic groups when medical and social risks of mothers are taken into account. Terris and Glassner (1974), Drillen (1957) and Terris and Gold (1969) at different times and places found that neither the month of initiation of prenatal care nor the number of prenatal visits influenced the probability of prematurity in their respective study groups. In the Louisiana infant mortality study, Dott and Fort (1975) found that infant mortality rate of children who were delivered in a hospital was about a half the rate for children

born outside the hospital and they claimed that infant mortality rate was eight times greater for infants of mothers who received no prenatal care than for those who received nine or more visits and that distance to hospital had no effect.

In the results of an international collaborative study of social and biological effects on perinatal mortality (WHO, 1978), place of delivery was considered an important correlate of perinatal mortality even though the clear policy of most of the countries included in the study was that mothers should be delivered in hospital. It was found that less than 8% of mothers still delivered outside hospital and they could be classified under the following three groups.

(a) There might be a small carefully selected group of low risk mothers for whom delivery at home was planned.

(b) Where some form of domiciliary midwifery service was known to exist, there was the group of mothers who were determined to have their babies at home rather than in the hospital, regardless of medical advice.

(c) Unplanned and sometimes dangerous circumstances.

When examined aggregatively, the proportion of deliveries that occurred outside hospital was inversely related to the perinatal mortality rate in the group. Thus, where the proportion of deliveries at home was high, like in England and Wales in the study, the mothers selected might have low risks and in the age group 20 to 29. If the selection process was working effectively, perinatal mortality rates among home deliveries were considerably lower than for hospital deliveries. However, in countries where non-hospital deliveries were not planned, the perinatal mortality rates exceeded those of hospital deliveries at almost every parity. This pattern was the same for all the countries for non-hospital deliveries of teenage mothers.

In short, the contention that mothers who deliver at home experience high infant mortality rate than those who deliver in the hospital is not a straight forward proposition. As it is, it depends further on the condition of the mother as well as that of the child. Young mothers who deliver at home risk the chances of child loss; so also mothers with premature babies; babies with low birth weight and high parity and of course, the result of findings may depend on whether home delivery was planned on the basis of knowledge that those involved are low risk mothers in the age group of 20 to 29.

Maternal Nutrition in Pregnancy

The belief that adequate foetal growth and development owe much to maternal nutrition in pregnancy is widely documented (Moghissi, 1978). The rationale is that pregnant mothers experience basic metabolic and physiologic changes involving all organs of the body. Thus, for a mother to maintain good health and that of the baby parasitic on her feeding,

adequate nutrition must be assured. If the mother is sufficiently denied adequate nutrition, the fetus may suffer from a number of pathologic conditions (Krause 1969). For example, under-nourished mothers tend to produce babies of low birth weight even at term but frequently, most of their babies are preterm (WHO: 1969). Low birth weight babies are also prone to variety of chronic conditions and infections. The evidence is that mothers deficient in vitamins during pregnancy often give birth to babies that may lose eye sight later in their life and for those that experience protein-<u>caloric</u> malnutrition, the babies' developments are retarded with restricted intellectual level.

Further research evidence on maternal nutritional status showed that the problems babies have began towards the latter part of gestation. The claim is that foetal growth slows down during this later period and the baby might be delivered prematurely. Such babies suffer higher perinatal morbidity and mortality rates (Welman, 1972). Thus good liberal diet in pregnancy prevents sluggishness in foetal growth and its later complications.

However, it has equally been submitted that except where maternal deprivations are extreme, it is difficult to ascribe specific clinical advantages to dietary improvement during gestation (Hillman and Goodhart, 1973). Indeed, most authorities contend that nutritional status of the mother, result of her life-time dietary habits, exert greater influence on the outcome of pregnancy (Baird, 1965).

Therefore, the unsatisfactory maternal nutrition generally held as a correlate of low infant birth weight is found to be associated more with maternal social class and stature rather than the diet in pregnancy (Thomson, 1959). At any rate, the issue still remains that big babies are not always the "best" babies (Naeye, 1966). Again, associating adequate maternal nutrition to infant maturation requires better standardized criteria that will control for ethnic, familial and sex differences. So far, differences noted in infant maturation reflects normal biological variations as against the effect of maternal nutritional status (Moiyama, 1959).

Furthermore, available factual knowledge does not support the contention that malnutrition in utero and/or during infancy is a factor explaining mental retardation and unsuccessful attempts have been made to explain congenital malformation in terms of nutritional deficiencies (Hillman and Goodhart, 1973). An influence of maternal nutrition in pregnancy on the occurrence of toxemia is widely posited but there has been no convincing evidence to support the proposition (Block et.al., 1952; Smith, 1947).

<u>Infant Nutrition</u>

On the aggregate, there is the dominant view that human milk show clear important advantages over cow milk. Provided the mothers' diet is adequate, the breast fed babies suffer less from scurvy, rickets and iron deficiency anaemia. Even then, the claim depends on the period of life

of the infant. Perhaps the claim is true for a particular type of infant
at certain age. By way of illustration, premature babies fed on cow milk
in suitable dilution gain in body weight more rapidly than those fed on
breast milk (Gordon, Levine and MacNamara, 1947).

The issue is that suitable infant feeding prevents malnutrition with
its concomitant pathologies like infection, disability, low birth weight,
stunted growth, morbidity and mortality. In the Narangwal study (Kielman
et.al.; 1978) morbidity and mortality rates were found to vary inversely
with level of medical care and nutrition of infants. It was also clear
that irrespective of medical care and nutrition, socioeconomic status of
the parents play significant role in the morbidity and mortality dif-
ferentials among infants. The contention that inadequate feeding can
adversely affect body weight and height of the baby becomes attenuated
with control for caste and sex differences.

Among people in poverty ridden community, with poor home hygiene and
low level of parental education, two things happen to infants in the
first three months of life (1) there is inadequate production of breast
milk among mothers and ill-effects of declining breast-feeding can lead
to marasmus and in-effective diarrhea (2) diluting cow milk is invariably
performed under unhygienic conditions which lead to bacteriological
contamination of the bottle. These two conditions largely explain the
cause of diseases and death among infants (Jellifee and Jellifee, 1978;
Plank and Milanesi, 1973). Thus, it appears that the level of breast-
feeding as well as condition for bottle feeding is affected by social
class of the family (Taylor, et.al., 1978; Dannel, et.al., 1978).

Even then, there are clinical problems associated with different
levels of child development and these might dictate the type of feeding
that may be prescribed for babies at each of these levels (Brooke, 1978).
Clinical problems of early feeding of first week are physiological
jaundice which is common among the breast fed and hypocalaemia, common
among bottle fed babies. The increased jaundice is not a problem and
with improved mix of cow milk, the latter problem has also reduced.

There are also difficulties with breast-feeding later in life.
There is the usual anxiety over the amount of milk to give to babies.
Some under-fed babies may be fretful and hard to settle after feeds,
others starve uncomplainingly (Evans and Davis, 1977). When baby's
weight falls short of the standard expected, it means the baby needs
extra food. Again, we possess inadequate knowledge about the suitable
variations in rates of weight gain of normal infants. However, we know
that low weight means the baby needs additional food. Babies that are
bottle-fed exclusively also may be unable to pass urine adequately. This
latter problem may lead to further complications that can result in death
or permanent brain damage (Brooke, 1978). Other anxieties about cow milk
include infection of diarrhea, constipation, abdominal distention,
vomiting and/or sudden death (Brooke, 1978).

Since suitable infant nutrition is not widely known among mothers,
and because mothers are conscious of the pathologies that may accompany

underfed babies, the tendency is for some mothers to overfeed their infants. Overfed babies may suffer from recurrent respiratory infections and some delay in motor landmarks. The view that overfed babies may become obese has not been wholly supported by evidence from laboratory research (Snyderman and Holt, 1966).

Apart from the fact that widespread use of bottle-feeding has reduced child health nutrition, there are other social effects. The contention has been that the shift from breast-feeding to bottle feeding interfere with biological child spacing. Mothers used to breast-feed between two to three years during which period they avoid coitus and therefore risk of pregnancy. With the introduction of bottle feeding, child spacing has become remarkably reduced, thereby increasing the rate of population growth. Developing countries, again, have to depend on the importation of baby foods with its consequent effects on local food production and foreign exchange earnings (Jellifee and Jellifee, 1978).

Breast milk which also claims the virtue of providing an unrivalled opportunity for close emotional and physical contact (Brooke, 1978) is now known to be on the decline for a number of reasons. Working women, particularly those engaged in non-domestic activities have little time to breast-feed their babies. Since by modern convention particularly for mothers in high social status, breast-feeding is carried out in private, it is now regarded as a social inconvenience. Emancipated women take more interests in alternative pursuits and amusements and lactation failure tends to be more common.

Thus infants' food requirements are complicated. Through the provision of breast milk, we realise that nature is able to take care of the initial infants food demands. It is cheap, lack of bacterial contamination steady composition and temperature and easily available (Jellifee, 1968). However, there are differences in the quantity of breast milk available among mothers. Some mothers produce adequate breast milk in the first few days/months of delivery, others find it difficult to do so. The unequal distribution of breast milk as well as unequal access to cow milk due to budget constraint reduces the potency of the argument of length of time to breast-feed or bottle feed and makes it a little diversionary and out of place. For instance, the argument that bottle feeding in the first three months of life lead to significantly high postneonatal deaths whereas children exclusively breast-fed for nine months suffer from under nutrition needs to be qualified. Suitable infant feeding is the most important factor to prevent first year deaths and not necessarily whether it has to be breast or cow milk and for specified length of time (Plank and Milanesi, 1973).

Health and Environmental Factors

That environment which does not provide adequate clothing, housing and preventive health services for proper physiological development would, ipso facto, be inimical to human survival is incontestible. Therefore, it goes without saying that poor environmental sanitation and personal hygiene could contribute immensely to high rate of infant

deaths. Evidence from Nigerian study revealed that provision of public health services in small traditional villages reduces mortality (Orub-uloye and Caldwell, 1975). Presence of pipe water or toilet sanitation in a clean environs are significant in reducing infant mortality for women who do not breast-feed adequately or even not at all (Butz et.al.; 1982).

Unfortunately, a baby cannot sufficiently live on breast milk for a long time without alternative food supplement which must as of necessity be prepared with water. Without modern water and sanitation facilities as well as clean surroundings, water used in mixing alternative foods would invariably be contaminated. It is not surprising, therefore, that poor water and toilet sanitation are found to correlate positively with infant deaths (Barrel and Rowland, 1979). Even for most of the urban areas of less developed countries in which there are piped borne water and toilet sanitation, the volume of dirts in the environment as a result of poor sewage disposal and housing, robbed them of the advantages to be derived from such facilities.

Environments in less developed areas are characterised by open gutter, dung hills, indiscriminate animal and human defecation as well as unorganized fecal disposal. During rain, water collected for use or those in wells are replete with fecal and dirty sediments. Such fecal and other contaminants of water are associated with widespread incidence of diseases including cholera, diarrhea, typhoid, dysentery and hepati-tis. They constitute sources of infant deaths in developing countries. Again, lack of water also produce the same effect since it encourages development of poor sanitary habits (Stein, 1977).

Although the claim has always been that provision of modern sanitary facilities enhance hygienic conditions of the home and therefore tends to reduce the incidence of morbidity and death, it is contended that sanitary facilities can produce desired effects if only they are put into proper use (Gordon et.al., 1964) and if the total environments are themselves clean. Perhaps, incorrect use of sanitary facilities might explain the findings of Levine et.al., (1976), Curlin et.al., (1977) and Scrimshaw et.al., (1968) which show that availability of better waste disposal facilities as well as improved water quality do not automatical-ly ensure reduced child morbidity and mortality. Therefore, sanitary facilities only aid in the maintenance of sanitary conditions but do not serve as a perfect index of the true level of household sanitation (Stephens, 1984).

Biological and Related Factors

Biological factors and those characteristics of biological nature to be reviewed in this section in relation to infant mortality include birth weight, gestational age, parity, interval between births, sex of child and age of mother.

One index of measuring new born infants by developmental maturity is birth weight. Generally, birth weight is dichotomized into high and low.

The low birth weight babies are those whose weight are below 2,500 grammes and those with high birth weights are of 2,500 grammes or more. The general proposition is that infant deaths are higher among low birth weight babies than among babies with birth weight of order 2,500 grammes or more (United Nations: 1973).

Research evidence indicates that deaths of infants with low birth weights accounted for more than two-thirds of neonatal deaths (Sharpiro, Schelesinger and Nesbitt, 1968). That birth weight is inversely related to infant mortality rate was amply demonstrated in WHO's study (1978). The study showed that there were decreasing perinatal mortality with increase in the weight of babies. For instance, there were almost 1000 perinatal mortality per 1000 births for babies of under 1000 grammes, for those in the weight group 1000-1499 grammes perinatal mortality fell between 400 and 656; at between 1500 and less than 2000 grammes, the perinatal mortality rate is between 159 and 300 per 1000 births. The findings thus show that with higher birth weights, perinatal mortality rate lies between 72 and 244 per 1000 births of babies in the weight group below 2500 grammes and it is between 12 and 40 per 1000 births for babies in the weight group 25000 grammes and above (WHO, 1978).

Gestational age has close bearing on infant mortality rate. In sum, the longer the gestation period (tending towards 36 and 42 weeks), the more mature the baby and the greater the chances of the baby's survival. (National Centre for Health Statistics, 1968; Sharpiro, 1952). In the WHO report referred to above, it was demonstrated that for duration of gestation less than 28 weeks the perinatal mortality rate is close to 1000 per 1000 births; for birth at 28-36 weeks, the rates were between 75 and 189 per 1000 births in the United States and New Zealand respectively; and for duration of gestation at 37-41 weeks, the perinatal mortality rates were low ranging between 5 and 16 per 1000 births in the U.S.A. and Cuba respectively. The risk of death among infants increases when duration of gestation is 42 weeks and over. At all gestational ages, however, the position of the countries in terms of total perinatal mortality rates is contingent more on the proportion of births rather than on the rates at specific durations of gestation. Gandotra and Das (No date) in India found that mature babies experience only one fifth of deaths of premature babies but they further argued that prematurity was contributory cause rather than the primary cause of death.

The number of previous births affects infant deaths. Infant mortality rate particularly neonatal infant mortality rates generally increases with increase in the number of previous births (Butler and Bonham, 1963; Gandotra and Das, (No date) Edmonston, Greene and Smith, 1981; Ayeni and Oduntan, 1978). However, with the use of probit, parity also has expected positive relationship with infant mortality rate but the relationship is not statistically significant while with the use of loglinear regression equation, the confirmation of the role of parity was not clear (Edmonston, Green and Smith, 1981). Martin et.al., (1982) found no strong a priori expectations about the effects of birth order on survival probabilities. Although, a first born child has less competition for the family resources, yet a mother's first delivery may involve

more complications. They found that in a univariate model, first order birth is subject to a greater mortality risk and that in a multivariate model, the reverse is the case. Aroral (1981) using hospital records confirmed this latter findings.

The frequency of childbearing also exacts serious effects on infant mortality. In general, women who give birth at short intervals experience high risks of infant deaths that those with longer birth intervals. Empirical evidence in this regard is not unanimous (Edmonston, Green and Smith, 1981; Rahman, 1968). With the use of logistic model, Edmonston et.al.; (1981) found that there is unexpected higher infant mortality risk for the 12-23 month birth interval than for the less than 12 months interval. However, with the use of probit, prior birth intervals display the higher risk to children born shortly after a previous birth. In the WHO study already cited in this section, the general tendency is that infant deaths are more among mothers with short birth intervals than those with longer intervals. The risk was high for births with an interval less than one year; indeed, about double the average for all birth intervals. For interval group of 12-17 months, there is an appreciable reduction of risk up to interval of 35 months. Based on the experiences of four countries with data on birth interval in the study, the optimal birth interval was considered to be from eighteen months to three years and that it was disadvantageous to have longer or shorter intervals (WHO, 1978).

The general claim is that infant deaths are higher among males than females particularly more so for early neonatal death rate (Arora, 1981). However, for a number of developing countries, female infant mortality rates are in excess of those of males (United Nations, 1973). In their multivariate analysis, Edmonston et.al. (1981) showed that males initially have higher mortality and this declines towards the end of first year of life and beyond Gassie (1975) also found that the probability of failure to survive the first year of life is higher among boys than girls. However, in his study, Dorjahn (1970) found that female infant mortality rate was higher than that of males except for children of mothers aged 50 years and above and those in age group 30-39 in urban areas. He made the same claim for rural areas except for mothers in age group 20-29 and 40-49. Ayeni and Oduntan (1978) found also that infant mortality rate among females is higher than of males even though the difference is not statistically significant.

The effect of age of mother on infant mortality rate has been widely documented and the general finding is that there is a rise in infant mortality with increasing age of mother (Benjamin, 1965; Heady and Heasman, 1959; Gandotra and Das; (No date).

Edmonston, Greene and Smith (1981) found that young mothers experience high infant mortality risk as well as shorter birth intervals. They claimed that mothers' age generally shows a J-shaped pattern, with higher infant mortality risk for younger mothers and fairly constant levels for older ones.

However, it has been demonstrated that relatively high neonatal mortality rates are found for births to mothers under twenty and over thirty years of age (National Center for Health Statistics, 1968; Ayeni, and Oduntan, 1978; WHO; 1978). Rusicka and Kanitkan (1973) also found that the youngest and oldest mothers experienced the highest infant mortality in both its components: that is neonatal and post-neonatal.

Socioeconomic Variables

There is enough evidence that large proportion of late neonatal and post-neonatal deaths are ascribed to exogenous factors such as the socioeconomic conditions of a family's existence (United Nations, 1982). Indeed, it has once been asserted that no fact is better established than that the death rate and especially the death rate among children is high in inverse proportion to the social status of the population (Newsholme, 1910). The inverse relationship is inspite of the advances in medicine and surgery, sanitation and housing conditions and the over all rise in living standards which were only special benefits to the lower class (Antonovsky and Bernstein, 1977).

If these conditions are incontestable, one would then agree with Anderson (1958) who claimed that any further research revealing relationships between infant mortality and income level, occupation etc. would be a waste of time, money and effort because the gross relationships have been established conclusively enough. However, the interaction effects among various correlates of infant mortality amidst different levels of over all development have cast doubt on the conclusiveness of findings of socioeconomic correlates of infant mortality; in fact, increasing empirical evidence continue to show that findings of such studies are rather complicated and therefore not unidirectional.

The factors are interdependent. For instance, occupation is related to level of education; income is related to occupation and both income and education may influence prenatal and maternal cares, nutrition, housing conditions, living habits and consequently biological factors as discussed above (United Nations, 1973). As stated by Antonovsky and Bernstein, "Very young women and very old women, unmarried women and high parity women have the highest infant mortality risks. All available evidence indicates that these women are more frequently found in the lowest socioeconomic categories; namely, low education, low income and blue collar workers".

Therefore, because of the problem of isolating individual effects of these variables on mortality, the tendency is for scholars to adopt one factor as an index of others. There are methodological and conceptual problems with this approach within and across cultures (United Nations, 1973). In the present study, we shall be concerned with type of clinic, occupation, age at marriage, education, marital status, income and employment status as well as religion of husband and wife, and type of marriage as they relate to infant mortality rate. The sample is taken in a Nigerian, urban place, so there will be no discussion of rural-urban or regional differentials.

For occupational groups, infant mortality rate is generally lowest among the professional, technical managerial and administrative workers and highest among farmers and production workers (Humphreys, 1887). In England and Wales, statistics showed that since 1911, there is inverse relationship between social class represented by father's occupation and foetal and infant mortality rate (U.S. National Center for Health Statistics, 1968). However, because of general improvement in health care, the range of the rate between the highest and lowest social classes have narrowed more for neonatal than for post neonatal deaths. In the WHO's study on perinatal mortality, it was found that perinatal mortality rates by father's occupation rise more or less continuously from professional and administrative groups to the agricultural and production groups; that is, from sophisticated occupations to meaner ones (WHO; 1978). Higgs and Booth (1979) also confirmed the findings. When occupation is used as an index of social status, the general finding is that mothers in high social status experience low infant deaths and vice versa (Anthonovsky and Bernstein, 1977; Rusicka and Kanitkan, 1973; U.S. National Center for Health Statistics, 1968).

Parental education particularly that of mothers have also been found to be inversely related to infant mortality (Rusicka and Kanitkan; 1973 Carvajal and Burgess, 1978; Caldwell, 1979). Szabady (1963) found inverse relationship to be true between parents' educational attainment and infant mortality; however, maternal education exerts great influence than that of the father. Caldwell (1979) claimed that maternal education in Nigeria appeared to be the single most powerful determinant of the level of child mortality. Since other variables are also highly correlated with infant mortality, it was found that when other covariates are controlled, the effect of education is weakened (Martin et.al., 1982). Indeed, Rahman (1968) found that there was no association between education and infant mortality. If anything, the distribution of infant mortality were found to be about the same among different educational groups.

The inverse relationship between income and infant mortality has been a subject of critical examination (Titmus, 1943). In a study from Latin America, the hypothesis of inverse relationship between income and infant mortality was supported (Carvajal and Burgess, 1978). The contention is that low income earners could not seek for adequate medical assistance when they are pregnant; they lack sanitation facilities and of course there is clear evidence of poor maternal as well as infant nutrition, and all these combine to explain high infant mortality among them.

In the current study, we shall also examine the effects of religion on infant mortality. Few studies that have included the variable demonstrated that infant mortality rate is lower among Christians than any other religious groups (Ruzicka and Kanitkan, 1973; Rahman, 1968).

Objectives of the Study

Nigeria has remained largely a country without reliable demographic statistics. Apart from inadequate information on population size, the knowledge about population composition and basic parameters have remained fragmentary for the country as a whole and virtually unknown for cities, towns and villages. Although we have some knowledge of the level of fertility and mortality of some urban areas in Nigeria, we have very poor information on infant mortality. Specifically the general objective of the project is to assess the impact of antenatal care and maternity centres on infant mortality and to identify infant mortality correlates in Ile-Ife, Nigeria.

The specific objectives are to:

(a)   Compare mortality rates among the following groups of infants:

   (i)   infants whose mothers registered in the clinic and delivered there;

   (ii)   infants whose mothers registered in the clinic but delivered at home; and

   (iii)   infants whose mothers did not register in the clinic and delivered at home.

(b)   Identify the correlates of infant mortality.

(c)   Determine why some mothers who registered in the clinic for antenatal care do not deliver there.

(d)   Suggest policies and programmes aimed at reducing infant mortality levels.

Organization of the Study

This report has been organised into eleven sections. First section deals with the statement of the problem and review of literature as well as the objectives of the study. Section two deals with survey methodology. In section three, we examined the characteristics of the respondents and that of their households. Section four gives a first description of factors affecting infant mortality, Section five to nine examines each correlate in relation to probability of dying. These are antenatal, maternal and infant nutrition, health and environmental sanitation, biological and socioeconomic factors. Section ten examines variables selected through their relative significance to infant death in the present study. Section eleven is conclusion and implications of the study for research and policy.

II

Date Source

The Areal Unit: Ile-Ife

Ile-Ife, located about 80 kilometers North-east of the Oyo State
capital, Ibadan, and about 230 kilometers North-east of Lagos, the
capital of Nigeria, is one of the oldest towns in the South West of
Nigeria; Ile-Ife with a 1963 population of about 130,000 is famous not
only for its historical reputation as the cradle of the Yoruba race but
also as the centre of an ancient civilization and the home of the Museum
which contains the renowned Ife heads. Its historical eminence as well
as its cultural significance has no doubt influenced its choice as the
permanent site of the University of Ife established in 1962 by the then
government of Western Nigeria. The two is presently divided into six
wards: Iremo, More, Ilode, Ilare, Okerewe and Modakeke. The continuing
demand for autonomy by Modakeke has however, generated a series of
strifes that have not only led to the loss of several lives but have also
affected the stability of the population. In addition to few feeder
roads, Ile-Ife is linked with surrounding towns by three major highways:
Ibadan - Ife, Ilesa - Ife and Ondo - Ife.

Ife is primarily a commercial and an educational centre. It is by
no means an industrial centre. Commercially, there exist few medium-size
departmental stores and several small-scale retail stores. Small-scale
retail and wholesale trading is mostly concentrated along Iremo, Aderemi,
Fajuyi and Lagere Streets. Textiles, electrical appliances, vehicle
spare parts, photographic equipments, drugs and several brands of
manufactured foods are some of the wares traded along these streets. In
addition to the small retail stores, traders from within and outside of
Ife congregate in five different centres to sell their goods daily.
These centres are: Enuwa, Ogunsua, Akogun, Sabo and Odo-Ogbe. In these
centres, raw foods are traded in addition to the wares that are traded
along the streets.

In addition to trading, farming, production and service occupations
are undertaken by a large proportion of the inhabitants. The production
sector is mostly comprised of vehicle mechanics, tailors, dressmakers,
shoemakers, gold and blacksmiths and a host of other semi-skilled
workers. The service sector is principally consisted of barbers,
hairdressers, cooks, waiters and related workers. Farming is practiced
on the outskirts of the town where pieces of land are owned by in-
dividuals or by families. Cash crops such as cocoa, rubber, palm-oil and
kola-nut are produced in addition to the production of food crops. A
high proportion of the farmers commute to their farms daily.

Educationally, Ife consists of many primary and secondary schools, a
technical school, a teacher training college, a college of Arts and
Sciences and a University, the University of Ife. These institutions of
learning, especially the University of Ife, attract students from all
parts of the country. In addition to attracting students, these institu-

tions of learning provide employment for various categories of workers-administrative, clerical, secretarial and academic - who are also drawn from different parts of Nigeria. Because of the inflow of students and workers from different parts of the country, migrants constitute a significant proportion of Ife population.

Apart from the University of Ife health centre that is designed mainly to attend to the medical needs of the students, the member of staff and their dependents, two hospitals under the University of Ife Teaching Hospitals Complex - The Seventh Day Adventist Hospital and the Ife State Hospital - provide health care services to the inhabitants of Ife. The services of these hospitals and those of the University Health Centre are supplemented by those of a few private hospitals and clinics and maternity centres. While the private hospitals and clinics provide all kinds of services to their patients, the maternity centres specialize in providing ante - and post natal care services to the mothers. Like the public hospitals, emergency services are also rendered in the private hospitals throughout the day. While the payment of higher fees tend to limit the number of patients that go to the private clinics, faster services tend to encourage their patronage.

B.   Sources of Data - Sample Selection

The records of two maternity centres (Enuwa and Modakeke) and of the Ife State Hospital were used to determine the names and addresses of women in Ile-Ife who received antenatal care and either did or did not deliver in these establishments. The names and addresses of women who did not receive antenatal care and delivered at home were obtained through a brief household interview in selected neighborhoods.

From the records of the hospital and the two maternity centres, 1000 mothers who received antenatal care and delivered in these centres in 1980 and 1000 mothers who did not deliver in the centres but who by their antenatal care records would have delivered at home in the same year were selected. Having randomly selected these mothers from all the mothers in each category, the services of the community health nurses were employed to trace them. Unfortunately the internal rifts between Modakeke section of the town and the rest of Ife resulted in considerable out-migration of the population; hence it was impossible to obtain more than half of the desired sample size for each of the two groups of women, using the 1980 records only. In order to achieve a larger sample size, a decision was taken to also make use of 1981 records. The use of the 1981 records led to a considerable improvement in the sample size but target of 1000 each of the two groups of mothers was still unattainable. Of the over 1000 selected mothers who delivered in the hospital and maternity centres, 634 were traceable and of the over 1000 mothers who delivered at home 839 were located.

Women who neither received antenatal care nor delivered in any of the establishments were located through a two - stage sampling procedure. First community nurses who lived in different parts of Ife were asked to conduct household interviews in selected neighborhoods similar in

socioeconomic characteristics to those from which the maternity centres and hospital client came to determine who has recently given birth. (In 1980) a list of such mothers were compiled. A sample of about 1000 mothers that would be paid follow-up visit was selected from the list through a random selection procedure. Also, as a result of internal disturbances, some of the mothers left Ife before they could be reached. It then became desirable, in order to achieve a fair sample size, to extend the survey to mothers who had their deliveries in 1981. Even then, only 638 of such mothers were successfully interviewed.

Data on births and infant deaths were collected through a two-stage questionnaire administered in follow-up home visits. The first part of the questionnaire deals with the socioeconomic and cultural characteristics of the mothers and of their households. In particular, information was sought on the reproductive history of mothers (maternal age at birth and birth order, the socioeconomic characteristics of the household (income, type of economic activity among others), socio-cultural factors (such as the education of the mother), environmental factors (such as water supply, sewage disposal facilities, household sanitation practices, endemic diseases) and the nutritional habits of mothers before and after weaning. The second part of the questionnaire concentrates on the infant. An attempt is made in this part to ascertain the infant's sex, date of birth, delivery condition, immunization, health history, feeding habits, weight and size at birth and cause of death (if dead at the time of the survey).

Merits and Demerits in the Technique of Sample Selection

The sample selection procedure adopted has some merits with respect to the quality of data and the types of analysis feasible. The hospital records provide a means of identifying mothers who actually received antenatal care and either did or did not deliver in the centres. The quality of data is enhanced since response errors that could have cropped into the data through the use of information gathered from surveys alone tend to be minimized. Since the records have delineated women who actually received antenatal care, it is therefore possible to examine with a high level of confidence, the impact of antenatal care on infant deaths. Hospital records also provide a means of cross checking responses of mothers, especially of those who delivered in the establishments, with respect to the characteristics of the infants at birth.

The merits not withstanding, the sample selection procedure could introduce some bias into the analysis. It is possible that those who received antenatal care and either did or did not deliver in the establishments are very much different from those who did not receive antenatal care with respect to their socioeconomic and cultural characteristics. Thus observed differences in infant deaths on the basis of whether the mother received or did not receive antenatal care may merely reflect differences induced by differences in the socioeconomic and cultural characteristics of mothers. The quality of data may also be affected by responses from mothers who neither received antenatal care nor delivered in the establishments. For instance, data on date of

birth, weight at birth and age at death may be prone to errors. It is possible that some of the reported births and deaths occurred before and after the reference periods. It is also possible that many infant deaths were not reported thus leading to an under estimation of infant mortality rates. As mentioned above, tracing of mothers was a problem.

(1) because the mothers were highly mobile and particularly

(2) the sample area was engulfed with civil disorder which resulted into dissolution of many marriages. Arising from civil disorder and general distrust it generated, some respondents even hesitated to own up that they were indeed the mothers that were being sought.

III

Household and Socioeconomic Characteristics of the Respondents

The pertinence of describing socioeconomic as well as household characteristics is to examine the composition of the population whose infant deaths is under study. From the discussion in the earlier chapter, it is clear that individual characteristics as well as household attributes contribute immensely to chances of infant survival. The household conditions may dictate the probability of a mother receiving antenatal and maternal care during pregnancy; such household conditions may also explain, along with individual characteristics, the quality of nutrition, hygiene and environmental sanitation a mother enjoys.

Although the study area in terms of classification of communities by population size, is an urban area, a description of the basis characteristics of the respondents may throw light on the extent of urbanism in the environment. Therefore, a description of these characteristics may contribute usefully to later analysis in this study.

Household Characteristics

For our purpose, a household is defined as a group of persons living together under the same roof - and eating from the same pot. This definition implies that a household includes the immediate family members, other relatives and non-relatives as well as domestic servants who may sleep under the same roof or quarters specially provided for them as long as their activities are controlled by the person designated as the head of household.

Using this definition, the average number of persons per household in Ife is 5.4. The figure is higher than the national average for urban Nigeria (FOS, 1980, 1983) but lower than that of Lagos metropolis (Olusanya, 1981). The study area is a University town with a teaching hospital and a college of Arts and Science. It also has five banking institutions and many secondary schools. Thus, the employment prospects are higher than those found in most urban areas in Nigeria but less than those for Lagos. The higher number of persons in the household than that of national average for urban Nigeria might be explicable in terms of the presence of other relatives who have migrated to the city for employment.

The household sizes vary from as small as 2 persons per household to 15 or more persons. The variations might be due to differences in the types of household structures. Two types of household structures are identified in the survey area: these are monogamous (nuclear) and polygynous structures. A monogamous household structure is made up of a couple with their unmarried children. But as explained earlier, the presence of other relatives and non-relatives as well as domestic servants may argument the composition of the household. Polygynous structure is the second type of household and is made up apart from the husband, children and others, of at least two wives living under the same roof. Monogamous household is more dominant in Ife than the polygynous

type. In the polygynous households, the maximum number of wives is 5.
However, a greater proportion of men in polygynous household have only
two wives. Indeed, more than one in every ten husbands have two wives.
Spouses with five wives are small in the sample. The mean age for heads
of households is 32.9 years. More than 70% of them are between the age
group 25 and 39 years. Insignificant proportion of men become heads of
households before age 20.

Educational distribution of heads of households shows, that more
than one third are illiterates. When those with uncompleted primary
school are added to this group, more than two in every five persons in
the sample area cannot effectively read and write. The distribution also
shows that large proportion of the heads of households do not complete
secondary schools or possess only primary school certificate. That is,
about three quarters of the heads of household do not attain adequate
functional level of education.

The two most common occupations among the heads of households are
sales and crafts, production process and laborers. These two groups are
followed by transportation and communication workers. When the propor-
tion of farmers are added, the occupations requiring low level of
education made up almost three quarters of the economic activities of the
heads of households. For urban environment with no major manufacturing
industries, the pattern is expected. The proportion of heads of house-
holds who are farmers is low in relation to the national average even for
urban Nigeria. That the proportion of workers in the professional
technical, administrative and related workers is almost 13% of the heads
of household is again a reflection of the types of establishments in Ile-
Ife: educational and commercial institutions.

Socio-Demographic Characteristics

Part of the general objective of this study is to assess the impact
of antenatal care and maternity centers in reducing levels of infant
mortality. Towards this goal, we had three subgroups. In describing the
socio-demographic and socioeconomic characteristics of the respondents,
we distinguish between the groups, namely, mothers who registered and
delivered in the clinic (hereafter referred to as "at clinic"), those who
registered at clinic but delivered at home) and those who did not
register at the clinic and delivered at home (unregistered).

In the questionnaire, the first question after the household's is do
you receive antenatal care for your last pregnancy? As expected,
virtually all the respondents at clinic and at home received antenatal
care. An insignificant proportion registered but received no antenatal
care. That such mothers at clinic and at home did not receive antenatal
care might be due to some personal reasons such as living on the farm,
long distance between their homes and the clinic, or mothers having no
chance because they travel often. However, more than one mother in every
ten of those who did not register for antenatal care claimed that they
received antenatal care. There may be two reasons for this apparent
anomaly. First is the fact that the interviewers for this study are

community nurses. Their appearance in the home asking the unregistered mothers questions on antenatal care might cause suspicion and any negative answer could be regarded on their part as a show of ignorance. To pretend not to be ignorant, some mothers might claim that they received antenatal care when in fact they did not. Alternative explanation might lie in our reluctance to regard those who registered in the private clinics as duly registered for actual organized antenatal care. Thus, those who claim to receive antenatal care among the unregistered might be those mothers who registered in the private clinics.

Reasons were demanded from mothers for their failure to receive antenatal care in an environment where there were organized clinics at maternity centres and teaching hospitals. More than one third of the unregistered mothers deliberately refused to attend clinics. They claimed that there were no special reasons and in fact there was no need to do so. One other major reason is religion. It is true that in our society we have various sects of pentecostal churches that preach the significance of faith in the provision of children and in their delivery. This extends also to the belief in faith healing for the sick. However, another significant proportion of mothers expressed difficulties in getting to the clinic since their usual place of residence was on the farm and therefore no hospital around at the time they were pregnant and gave birth to the baby whose survival is examined in this study. As noticed earlier, other groups of mothers did not receive antenatal care but they were registered in a private clinic. Such other reasons as no chance because the mother travelled often or because of unexpected labour indicate the readiness on the part of the mothers to receive antenatal care if they could. Mothers who claimed that they avoided antenatal care clinics for fear that they might be delivered through cesarian section and the subsequent request for blood donation from relatives demonstrated the relics of superstition or myth that surround child delivery in our society. That mothers did not receive antenatal care because they were unmarried or because they were students also reflect the extent of ridicule such mothers might be exposed if they showed up in the clinic.

The three clinics selected for the present study are part of many controlled by Ife University Teaching Hospital Complex in Ilesha and Ife Divisions of Oyo State. However, the clinic at Ife State Hospital (ISH) is reserved for high risk mothers. The distribution of the respondents by registration centre and place of delivery shows that a large proportion of mothers who registered at ISH delivered there, whereas a considerable proportion of those who registered at Enuwa and Modakeke finally delivered at home. Thus on the basis of this distribution, it is tempting to claim that, large proportion of mothers at clinics are high risk mothers and those who are slow risk could risk delivery outside the clinic. However, it might be incorrect to assume that all mothers that delivered at ISH are high risk mothers. The wives of University teachers and administrators who have personal relationships with the medical doctors working at ISH might use their personal connection to get themselves delivered at ISH though they might not be high risk mothers.

The proportion of unregistered mothers that shows up as registered in Enuwa and Modakeke might be mothers who attended those clinics for reasons primarily different from their pregnancy condition at the time.

More older mothers registered and delivered at clinics than those at home or unregistered. For those at clinic, almost 12% aged 35 years and above were involved; their mean age is about 30 years which means they were older than the mothers in either of the other two groups by two or more years.

With respect to age at marriage, mothers at clinic marry a little later than the other two groups. Indeed, about 94% of mothers at home and unregistered married by age group 20-24, whereas, the proportion was less than 90% for mothers at clinic. However, little difference in the registration status of women by their marital status since at different places of delivery, the proportion married with husband present is about 98% in each group.

As stated in the earlier section, monogamous type of household structure is dominant in Ife even though we found that for the polygynous household structures there are between two to five wives to a spouse. However, the unregistered mothers live more in polygynous associations than those at clinic and at home.

Religion is one of the important reasons advanced in this study by the unregistered mothers for failure to receive antenatal care. For most committed Christians, Faith is a crucial factor for formal antenatal and maternal care. It is on this note that we include religion as a variable to be examined in the present study. There is a striking similarity between husband's and wives' religion and we are able to identify five religious groups. For each sub-group, Protestants are most common followed by the Muslims. The "others" category which include most of the Pente-costal Churches are more for others at clinic than for those at home and unregistered. However, there are more followers of traditional religion among the unregistered than for those in the other two groups.

Education and Economic Characteristics

In terms of formal education, evidence from our study shows a higher proportion of illiterates and semi-illiterates among mothers at home and unregistered than for those at clinic. Almost two-thirds of mothers in the former two groups are, strictly speaking, illiterates. Conversely, about one-thirds of mothers at clinic have secondary education and above, whereas it is only one in every two mothers that attain this level of education among mothers at home and unregistered.

The superior educational qualification which mothers at clinic enjoys over their counterpart is also enjoyed by their husbands over the husbands of wives who delivered at home or unregistered. However, the proportion of illiteracy is reduced considerably among the husbands of mothers at home and unregistered; husbands of unregistered mothers are more illiterate than those of the former groups as can be inferred from

the proportional distribution of mothers by the education of their
husbands. Nonetheless, the proportion of mothers whose husbands'
education is secondary and above increased proportionately in the three
sub-groups.

The response to the question are you working now shows that most
mothers in the three registration groups are working. However, mothers
at clinic have higher proportion of workers than those at home and
unregistered. Mothers who are not working are full-time housewives.

Those who are working engaged in a particular occupation. For the
three groups, the modal occupation is sales. Whereas the persons engaged
in sales among mothers who delivered at clinic is less than half of the
total work force for the group, sales workers are well above two-thirds
in the other two groups. About one-third of mothers at clinic are in
professional, technical, administrative and related occupations, and only
about one in every ten workers in the other two groups are in that
category. Also, there are more clerical workers among mothers at clinic
than are found in the other two groups; mothers at home have the least
number of workers in clerical occupations. The proportion of farmers is
insignificant as expected for mothers; so also those in transportation
and communication are small in number.

In terms of employment status, the proportion of persons in self-
employment is highest in each of the three groups. The proportion of
workers in employee status for mothers at home and unregistered put
together is still far less than that for mothers at clinic. Mothers who
were not working were simply housewives. The proportion of employers
among mothers is not significant for any of the group.

The dominance of mothers in self-employed status is also true for
their husbands. However, more husbands of mothers at home and unregis-
tered are in employee status than that observed for their wives. More of
the husbands of mothers at clinic have slightly higher proportion of
workers as employers. The proportion is at any rate equally small.

Reliable income data are difficult to obtain in all cultures, but it
is more difficult in a culture where a high proportion of workers are
engaged in unorganized economic activities. In the present study, data
on income suffer the highest rate of non-response and the distribution
obtained in this study may not reflect the true income distribution among
both the respondents as well as their husbands. The data obtained show
that mothers at home are the poorest. Almost 94% of them are in the
income bracket below ₦2,000.00 and only 0.2% have income above ₦3,000.00.
For mothers at clinic, the proportion of mothers having the income below
₦2,000.00 is slightly higher than two thirds and mothers with income of
₦3,000.00 and above constitute almost one fifth. For unregistered
mothers, less than 90% and almost 8% fall within the income group of less
than ₦2,000.00 and more than ₦3,000.00 respectively.

The pattern observed for the distribution of income of husbands is also similar to that of the respondents. In this case husbands of mothers at home are the poorest, followed by husbands of the unregistered mothers; the most affluent are still the husbands of mothers at clinic.

IV

Factors Affecting Infant Mortality: First Description

This chapter is divided into two sections. In section one, an examination of the general level of infant mortality and levels of its components (the neonatal mortality and post-neonatal mortality) is undertaken. In the second section, we examine the probabilities of infant death according to some parental attributes, environmental and nutritional factors while holding constant the variable of antenatal registration status and place of delivery.

Basic Measure of Infant Deaths

The general level of infant mortality and the levels of its components (neonatal mortality and post-neonatal mortality) are indicated in table 4.1. Infant mortality rate, as reported in the table, is the number of infant deaths per 1000 live births in the survey area. The infant mortality rate of 97.1 therefore implies that about 97 out of 1000 live births in Ife died before reaching their first birthday. This rate is composed of neonatal mortality rate (26.1) and post-neonatal mortality rate (71.1). While neonatal mortality rate is computed as the number of deaths, per 1000 live-births, before the first month of life, post neonatal mortality rate is measured as the number of infant deaths per 1000 live-births, after the first month of life. The comparatively higher rate of post-neonatal mortality could be attributed to two factors: first, it is possible that infant deaths are attributable more to exogenous or environmental factors than to endogenous factors in the survey area. Second, infants' age at death could have been grossly misstated by mothers who had to report events that occurred one or two years before the survey period. We, however, believe the second factor is not as important as the first.

Variations in levels of infant mortality and of its components (neonatal mortality and post-neonatal mortality) exist according to place of delivery and mother's antenatal registration status. Infants delivered in the state hospital had the least probability of dying (58 deaths per 1000 live births); for this category of infants, endogenous factors are more important causes of death. While infants born in Modakeke clinic had the second least probability of dying (93 deaths per 1000 live births) infants born in Enuwa maternity centre had the highest probability of dying before attaining the age of one year (148 deaths per 1000 live births). For these other groups of infants, environmental or exogenous factors are greater determinant of deaths than endogenous factors. The dominance of endogenous factors as a determinant of death among infant born in Ife State Hospital is a reflection of the fact that high risk cases are being taken care of in that hospital. The ability of mothers, who delivered in the hospital, to give more accurate information on the age at death of their infants might have been also reflected by the result. A clinic and non-clinic delivery comparison indicates that infants born in either a maternity centre or hospital (referred to as

clinic delivery) had a higher chance of survival than infants born outside the clinic (referred to as non-clinic delivery).

<u>Basis Measures of Infant Deaths</u>

Panels	Variables	Infant Mortality Rates	Neonatal Mortality Rates	Post Neonatal Mortality Rates
I	General Level	97.1	26.0	71.1
II	Maternity Centre/ Hospital Delivered			
	Enuwa	147.6)	44.6)	100.0)
	Modakeke	93.4)94.0	25.6)32.0	67.8)62.0
	Ife State Hospital	58.4)	31.0)	28.3)
	Outside Clinic	103.7)	13.3	90.4
II	Registration Status			
	Clinic[1]	61.5	28.4	33.1
	At Home[2]	110.8	29.8	81.0
	Unregistered[3]	114.4	18.8	95.6

1. "At clinic" refers to women who registered for antenatal care and delivered in the clinic.

2. 'At Home' refers to women who registered for antenatal care and delivered at home.

3. "Unregistered" refers to women who did not register for antenatal care and delivered at home.

With respect to antenatal care registration status, infants of mothers who registered for antenatal care and delivered in any of the maternity centres or hospital had the highest probability of survival (938 infant survivors per 1000 live births) infants of mothers who neither registered for antenatal care nor delivered in any of the clinics had the highest probability of dying before reaching their first birthday (114 deaths per 1000 live births). The differentials, as will be highlighted in the main text, might be due to a host of socio-cultural, environmental, biological and nutritional related factors.

Probabilities of Infant Deaths According to Some Characteristics

The probabilities of infant death according to age of mother and registration status indicate that between ages 15 and 34, a negative association exists between the probabilities of infant death and age. However, the trend was reversed for women in the age group 35 years and above. The finding depicts that infant mothers in the age group 30-34 are least likely to die, and that mothers who delivered in a clinic were least likely to die, and that mothers who delivered in a clinic were least likely to suffer the death of their infants while those who delivered at home had the highest probability of infant death.

The probabilities of infant death according to mothers age at marriage and registration status, depict an erratic pattern. However, except for women who married at age 23, infants of mothers who delivered in the clinic are least likely to die for all ages at marriage. The study also shows that the probabilities of infant death appear to be lowest for women who married after age 25.

The probabilities of infant death according to maternal education and registration status show two clear features: first it is observed that for all registration status, mothers with post-secondary education had the least probability of losing their live births before the age of one year; however, a clear pattern does not emerge among the three lower educated groups. Second, mothers who delivered in the clinic are less likely to experience infant death than their unregistered counterparts at each level of education. At the primary and higher levels of education, mothers who delivered at home experience lower rate of infant mortality than their counterparts who delivered in the clinic.

Employment - registration statuses specific probabilities of infant death are also examined. Within the two groups of registered mothers, those who were employees were least likely to have their infants dead. Among, the unregistered mothers, those who were self-employed were least likely to experience infant death.

Although, data on income is the least reliable, in this study we find a negative association between the probabilities of infant death and paternal income for incomes below ₦4,000 and for infants born either in the clinic or at home; at higher incomes, a positive association tends to be discernible. For infants of unregistered mothers, a clear pattern of

relationship does not emerge; however, infants of fathers earning between ₦3,000 and ₦4,000 are least likely to die.

The probabilities of infant death according to mother's condition of labour and registration status show that mothers who delivered in the clinic are least likely to experience infant death. Also for all registration statuses, mothers who had "normal" labour condition experience comparatively lower rate of infant death. The results tend to suggest that the maternity centres are best placed to handle all conditions of labour while babies born without much complication are more likely to survive than those born under complicated conditions.

An attempt was made to see the impact of the source of water supply on infant mortality on controlling the effects of registration status. The result indicate that the use of pipe born water is associated with relatively lower probability of infant death while the use of well water tends to be associated with comparatively higher probability of infant death irrespective of mother's registration status.

For the two groups of mothers that registered for antenatal care, a U-curve association exists between probabilities of infant death and the number of rooms occupied by the family; the most ideal number of rooms seems to be three. For mothers that did not register for antenatal care, a clear pattern of relationship does not exist between the probabilities of experiencing infant death and number of rooms occupied. Discernible from the data presented is the fact the mothers that delivered in the clinic had the least probability of experiencing infant death for every category of the number of rooms occupied by the family.

In order to assess the effects of air pollution that emanate from the smoke some cooking facilities produce, the effects of the use of some cooking facilities on the probability of infant deaths are examined having taken into account mothers' registration statuses. Again, mothers who delivered in the clinic had lower probabilities of experiencing infant death for all cooking facilities. For all registration status groups, the use of firewood is associated with the highest probability of experiencing infant death, probably because of the possible air pollution arising from the smoke it produces. The use of gas stove is associated with the least probability of infant mortality for the two groups of mothers that registered for antenatal care while for the unregistered mothers, kerosene stove tends to be associated with the least probability of infant mortality.

The chances of infant death according to the type of toilet facilities available and mother's registration status were also examined. In consonance with earlier findings (see for example Stephens, 1984) households with flush toilet appear to have the least chance of experiencing infant death while those using the bush for human waste disposal tend, with a minor exception, to have the highest probability of losing an infant. In addition, the data show that for all toilet facilities, women who delivered in the clinic are least likely to experience infant mortality.

With respect to refuse disposal systems, our data show that mothers using incinerators and dustbins for refuse collection experience lower rates of infant death than mothers burning or dumping refuse in open gutter. The comparatively high infant mortality associated with the dumping of refuse in open gutter is worthy of note. Dumping of refuse in troughs generally inhibits a free flow of water thus leading to the formation of stagnant waters that are usually breeding places for mosquitoes.

In this study also multiple births are associated with higher infant deaths than single births for all registration statuses of mothers, while infants weighing over 3 kilograms are least prone to death except for mothers who delivered in the clinic. Even though the effects of types of birth and birth weight are examined separately, it has been ascertained that multiple births generally weigh less than single births, hence the higher probability of infant death usually associated with multiple births could be a reflection of, among other things, the impact of birth weight.

There is no clear pattern of relationship between probabilities of infant death and birth order for mothers of all registration statuses. The only discernible feature of the data is the higher probability of infant death associated with first order babies irrespective of the registration status of mothers.

The effects of maternal nutrition on infant mortality are examined through an investigation of the probabilities of infant death according to the number of times in a week mothers of all registration statuses consume certain food items. A general feature of the data is the non-emergence of a clear pattern of association between the number of times each of the food items is consumed by mothers in a week and the probability of infant death.

The data on the number of times in a week that mothers of all registration status consume chicken, fish, vegetables, oranges and milk (some food items that produce considerable amount of protein) are also examined mothers who either delivered in the clinic or did not register for antenatal care are least likely to experience infant mortality when chicken is consumed twice a week. An inter-registration status comparison of probabilities of infant mortality at each number of times chicken is consumed a week does not produce a clear pattern of association; however, women who delivered in the clinic tend to experience lower infant mortality than their counterparts who delivered at home for every number of times chicken is consumed.

We also find in this study that mothers who delivered in the clinic tend to have lower probabilities of experiencing infant death than any other group of mothers at every level of consumption of fish and vegetables. This pattern does not hold where the effects of the intensity of mothers' consumption of oranges and milk on infant mortality are respectively examined. At low level of consumption of oranges, women who delivered in the clinic had an advantage over other groups with respect

to infant survival while at higher levels of consumption of oranges, women who delivered at home had a comparative advantage with respect to infant survival. The data examined in respect of milk also do not give a clear indication of the advantages or disadvantages of increased consumption of milk; however among mothers who delivered in the clinic, those who consume milk seven times a week tend to experience lowest infant mortality. Among unregistered mothers, those who consume milk six times a week are least likely to experience infant mortality.

The data on the probabilities of infant mortality according to duration of breast-feeding are examined for mothers of all registration statuses. Except for a minor deviation, the two groups of mothers who registered for antenatal care experienced a decline in the probabilities of infant death and duration of breast-feeding is not discernible among unregistered mothers until duration of breast-feeding exceeds five months. For the three groups of mothers, the lowest probability of infant death is attained when duration of breast-feeding exceeds 11 months. It is also pertinent to note that except where no breast-feeding was undertaken, mothers who delivered in the clinic had lower probabilities of losing their infants than any other group at each duration of breast-feeding.

The impact on the probability of infant death of the age at which artificial food was introduced to the babies was also examined. Except for the situation where the two groups of registered mothers who introduced artificial food to their babies in the first week are found to have lower probabilities of infant death than their counterparts who introduced artificial food to their babies in the second week, an increase in age at which artificial food was introduced was associated with a decline in the probabilities of infant death. The results generally imply an increase in the probability of infant survival as duration of feeding increases. Again, mothers that delivered in the clinic have a comparative advantage over others with respect to infant survival especially if artificial food is introduced after the first week of life.

For almost all brands of artificial food introduced, mother who delivered in the clinic have lower probabilities of losing their infants than any other group of mother. Infants of mothers who either delivered in the clinic or are not registered for antenatal care are least likely to die when fed with similac milk; however infants of mothers who delivered at home are least likely to die when fed with NAN milk.

The data on the intensity of bottle feeding and the probabilities of infant deaths show that except for minor fluctuations, infants of mothers who registered for antenatal care survive more when they are fed up to six times a day. Among infants of mothers who did not register for antenatal care, those who are fed up to three times a day are least likely to die. The data on the probabilities of infant death according to the number of feeding bottles possessed do not present a clear pattern of association between the two.

So far we have examined the relationship between some health-environmental, biological, socioeconomic and nutritional factors and the probabilities of infant death. Our findings have tended to show that mothers who delivered in the clinic have comparative advantage over others with respect to infant survival at most of the levels of the variables examined. The "pure" effects of each of the variables on infant mortality are not obtainable until the effects of several other variables that are not only related to infant mortality are not obtainable until the effects of several other variables that are not only related to infant mortality but also to each of the independent variables have been controlled. The multivariate analysis adopted in later chapters is a step towards achieving the pure effects.

V

Antenatal Care Factors

This chapter and the next five examine the correlates of infant mortality through a multivariate analysis. The details of the technique used are contained in the appendix. Earlier works have shown complex nature of the inter-relationships of these variables with infant deaths. However, attempts are made in these chapters to examine, the effect of each of the factors in the broad categories on infant mortality. In the present chapter, the general hypothesis is that mothers who receive antenatal care from clinics and delivered in the clinics experience lower rates of infant deaths than their counterparts who either receive antenatal care but delivered at home or did not receive antenatal care.

The assumption here is that in organised maternity clinics, modern medicine and facilities are usually available to care for would-be mothers and their subsequent newborns. Such modern facilities are supposed to aid in ensuring greater survival of children than when babies are exposed to crude or rather primitive techniques and facilities at the time of delivery.

There is positive relationship between stage of gestation at registration of mothers in the clinics for antenatal care and infant mortality. This finding implies that mothers that registered early in pregnancy for antenatal care experience lower infant mortality rate. This is expected as those who registered early are expected to go through more adequate medical care that could enhance healthier pregnancy maturity. Apart from reducing the rate of infant mortality, early registration might also reduce the rate of pregnancy wastage as well as foetal deaths. There are, however, outside the focus of the present study. The chance to receive adequate medical care by registering early in pregnancy is based on the rationale that such mothers are likely to pay more visit to the clinics before delivery. The higher the number of visits paid to the clinics, the more adequate the medical care to be received and the greater the chances of survival of the infants. In the present study, such inverse relationship between the number of antenatal visits to the clinics and the rate of infant mortality is demonstrated. It is possible for mothers who frequent clinics to go through proper medical monitoring of the foetus and receive prompt treatment against any deterioration of its development at any stage of gestation.

Tetanus infection is deadly. Its appearance at any stage of gestation in pregnant women endangers both the life of the mother, and that of the baby. Maternal immunization provides six months of passive immunity for the foetus against neo-natal tenaus. In the study area, there is no information on the extent of its prevalence. Information of the cause of death in the present study shows that fever is most dominant and other causes of death including tetanus represent 0.8%. This proportion is considered insignificant. There is also a large number of non-response to the question whether or not pregnant women receive tetanus vaccine. On the whole about 200 respondents claimed to have

received tetanus vaccine during the pregnancy of the baby whose survival is being examined. Even then, we included in the equation immunization status of the women and the number of doses received. The result showed a slightly positive association. We hesitate to attache any importance to this result. In the first case the mean number of tetanus doses received is one; actually most immunizations are not given solely because the women are pregnant and most women could not associate their own immunization with antenatal care. Hence for the present study, immunization against tetanus and the number of doses received are not considered significant.

Among mothers in the sample, a number of them delivered outside Ife. Such areas are divided into two namely town outside Ife and village. The town outside Ife are mainly around Ife. It is striking to note that babies delivered in villages survive more than those delivered in Ife town or town outside Ife. More adequate medical facilities available in towns as well as other social infrastructures particularly pipe born water and electricity, may make infant mortality rate in urban areas to be lower than that which obtains in rural areas. AT ife, the demand for the available social and medical services is considerably higher than the supply; in addition most of the services are themselves very poor. The villages are, contrarily, having a low demand on their existing services and are capable of maintaining better social services. Food is also more abundant and cheaper in the rural areas than in towns. All these factors might be responsible for the low pattern of infant mortality rate observed in the rural areas in relation to urban places. A more detailed discussion of the effects of the effects of environmental sanitation on infant mortality is presented in a later section. That infant mortality is lower at Ife than other towns outside Ife might be explicable in terms of relatively easier accessibility to medical care than in other towns around Ife as well as to relatively better social services.

Place of delivery has been regarded as important correlate of infant mortality. Generally, infant mortality rate is expected to be lower for mothers who delivered in the maternity centre/hospital than those who delivered elsewhere. The revelations from the data do not support his hypothesis. Indeed, mothers who deliver in private clinic/hospitals, home and with the herbalists respectively experience lower infant mortality rate than those who deliver at local government maternity centres/hospitals. At first, one might claim that antenatal care services in our maternity centres/hospitals are poor as could be inferred from mortality rate among infants delivered in them when compared with what obtains among infants delivered in other places. It is a common knowledge in recent times that medical services wee politicised and declared ostensibly free. However, the period of free medical care was characterized by lack of medical infrastructures including drugs in the government maternity centres/hospitals. Individual patients were responsible for the purchase of the materials needed for their own treatment in all these centres. Hence, the services rendered were haphazard and poor in quality.

It is also a fact that there is usually an unconscious pre-selection of mothers who deliver in different places. The common impression is that more complicated deliveries usually take place in government maternity centres/hospitals. Mothers who are expected to deliver at home, private clinics/hospitals and with herbalists often got rushed almost at late hours to government maternity centres/hospitals whenever complications arise. Such births are deemed to have taken place not in the centres from where the mothers have been transferred but where they finally delivered. Perhaps because government maternity centres/hospitals deal more with complicated cases, the high probability of dying observed in these centres when compared with deaths among infants delivered in other places might be a reflection of the type of delivery taking place in them. The lower mortality among infants delivered at government hospitals when compared with those in maternity centres is in consonance with the differential levels of medical expertise and facilities available which are always in favour of government hospitals.

During labour, mothers are usually attended to by one form of delivery attendants or the other. The handling of babies at the time of delivery may also be an important determinant of infant deaths. Generally, we expect that deliveries handled by midwife/medical doctor in organized hospitals would be better managed and therefore involve lower infant deaths than that handled by other categories of birth attendants. From the present study, mortality was highest among infants delivered by a male neighbour. A situation in which a male neighbor delivers of a baby must be a case of unusual emergency after the women might have failed to deliver herself. A male neighbor is likely to be least prepared for the exercise, and he is not likely to be capable of managing the delivery properly considering likely embarrassing situation he might find himself at the time. That the probability of death among babies delivered through the help of husband is the second highest point to one fact, namely, that males generally are most unsuitable to deliver babies more so when they are not trained to do so.

Traditional birth attendants are known to help mothers deliver at home. They are not trained formally but gained experience through practice. The evidence here is that the probability of deaths among infants delivered by them and by female neighbor are high when compared with that of infants delivered by midwife. Midwives are highly trained and are therefore better prepared for deliveries than the untrained ones. However, infant mortality arising from births delivered by herbalists is only slightly higher than that of trained midwives. That this is the case might be as a result of pre-selection of mothers who delivered there as explained earlier. One other interesting observation is that infant mortality rate is least among births delivered by mothers themselves. Births delivered by mothers themselves are most likely to involve least complications and in most cases, through unexpected labour. These are therefore low risk cases which in turn are associated with low infant mortality. The apparently high probability of dying found among babies delivered by medical doctors is most unexpected. Doctors are regarded and recognized as experts in child delivery. Because they are fully equipped with medical facilities required for deliveries, babies deli-

vered by them should experience the least probability of death. The unexpected pattern found in this study could be explained by the fact that in the study area, doctors do not ordinarily deliver babies except when condition of labour become complicated. It is therefore the co-application in the cases they generally handle that might explain the unexpected high rate of mortality among infants delivered by them and not because they are incompetent.

During pregnancy anxiety fluctuates as mothers go through one form of complaints or the other. Depending on the place and time such complaints arise, mothers invariably take care of themselves in other places other than their usual place of antenatal care. Therefore, a question was asked about other places where mothers receive treatment during pregnancy. Such other places may make the difference in the survival of children. It is clear that mothers who do not have any other place other than their usual place of care have infants with the highest probability of dying. This tends to show that mothers usually find themselves in situations when it was necessary to receive care if only on ad hoc basis to relieve them of their pains when they could not find their ways to their usual place of care. Failure to receive care in such other places when they should could lead to high infant mortality probabilities.

Mothers that patronize private doctors in addition to their usual place of antenatal care have infants with lowest infant mortality rate. This group is followed by those who sought help from herbalist. As indicated above, it is suspected that mothers that patronize herbalist are low risk mothers since mothers with complications are rushed to maternity centre/hospitals. We found that infants of mothers who attend other hospitals for such ad hoc treatment experience second highest infant deaths. This finding could be due to the fact that such intimacy and love as well as understanding needed in handling cases of pregnant mothers was absent in such "foreign" hospitals. Also the high infant mortality may also reflect the degree of complicated cases that are referred to other hospitals if mothers were not around their usual place of care when labour unexpectedly begin.

Part of antenatal care is the preparation of the materials on which to deliver. The result si consistent with the earlier observation, namely that less modern facilities were associated with low infant mortality rate than the modern ones. We argued that such possibility could arise in a situation where modern facilities are associated with organized government maternity centres/hospitals. These are places where complicated and high risk cases are treated. It is also our contention that high risk cases in the less modern environment are often rushed to government clinics/hospitals once complications arise. Thus, the large number of complicated cases being handled in government health centres with modern facilities account for the apparent high infant mortality rate in these centres rather than the failure of the system per se.

Children delivered in bed with rubber experience higher infant mortality than infants delivered either on old clothes on the floor or

those delivered on the floor or on bare floor signifies emergency situation - a call for a prompt action being taken to receive the baby. Emergency cases in which mothers could not prepare properly for the delivery of the babies are most common among low risk cases. To spread mat on the floor or rubber on a bed reflect some degree of preparation for the arrival of the baby. In a situation in which the baby is awaited, there might be more prolonged and complicated cases and consequently higher rate of infant mortality.

Mothers' delivery position are known to correlate with probability of child's survival. In this study, squatting is related to the highest rate of infant mortality. This is to be expected since this delivery position exposes the baby more to injury at birth than any other positions. Dorsal or sitting on special delivery chair, which are the practices in modern settings, lead to lower infant deaths than either squatting of lateral.

One of the reasons advanced for the observed relatively higher infant mortality rate in government maternity centres/hospitals is the supposition that births involving prolonged or complicated labour are more common in them than cases generally handled outside hospital environment. The prevalence of prolonged or complicated cases has been adduced as a cause of the relatively higher probability of dying at government maternity centre/hospitals. It is obvious that normal labour involves considerably lower infant deaths than either the complicated or prolonged cases of labour. That prolonged labour account for the highest infant mortality rate is consistent with the fact that such labour also leads to complications through weakening of the state of health of both the mother and the baby.

We also sought to know the effects of the instruments by which umbilical cord was cut as well as the methods for sterilizing them on probability of infants' survival. The degree of the cleanliness of the instruments aids in determining the changes of survival of the infants. We find that knives and scissors account for higher infant mortality rate than either the bamboo stick or razor blade. The former instruments are likely to be unclean. While bamboo stick may be regarded as crude, it is often neatly prepared. The stick is prepared fresh and has not suffered from bacteriological contamination before it is used for the cutting of the umbilical cord. The razor blade is also usually used having being taken out of its perfectly sterilized environment.

The method of sterilizing the instruments before use determines the extent to which the instrument could be judged as safe for cutting the umbilical cord. We find that the infants probability of dying is enhanced when nothing is done to sterilize the instruments used to cut the umbilical cord. The technique of flaming account for relatively high infant mortality. Boiling of the instruments reduces the level of contamination and thereby ensures greater survival of the baby. The most effective way of sterilizing instruments used for the cutting of umbilical cord is to soak them in disinfectant since babies whose umbilical cord are cut by such instruments experience the least infant deaths.

One other way delivery attendants prepare for the arrival of babies in addition to getting ready for instruments used to cut the umbilical cord is to ensure that babies are delivered with clean hands. The greatest probability of survival is found among infants delivered when delivery attendants wore gloves and masks in addition to washing their hands. Babies whose delivery attendants wore gloves only have the second highest probability of survival. We do not expect infant mortality rate to be higher among babies whose delivery attendants wore masks, gloves and washed hands than any of the groups mentioned above except perhaps under the condition of pre-selection of high risk vis-a-vis low risk mothers. If this were true, it could be said that situations where delivery attendants have access to masks, gloves and were able to wash their hands, are likely to be maternity centres/hospitals which handles prolonged and complicated cases. It is therefore the type of cases being handled rather than the nature of preparation that could account for low probability of infants survival. By the same logic, the comparatively low infants deaths observed for babies whose delivery attendants did nothing in terms of preparation for the arrival of the babies could be associated with emergency condition of delivery which possibly involves low risk mothers. Thus the pattern observed here seems to place emphasis on the cleanliness of the hands rather than any other phenomenon. It may not be unexpected that infant mortality rate is highest among babies whose delivery attendants only wore mask.

One of the specific objectives of this study is to compare mortality rates among the following groups:

(i)   infants whose mothers received antenatal care and delivered at maternity centres,

(ii)   infants whose mothers received antenatal care but delivered at home and

(iii)   infants whose mothers received no antenatal care and delivered at home.

The pattern obtained is derived after controlling for other factors of antenatal care. It is clear here that infant deaths among mothers who received antenatal care and delivered in the clinics/hospitals are considerably lower than that experienced by mothers who either received antenatal care but delivered at home or did not receive antenatal care at all. This pattern is consistent since the pregnancies of mothers who either received antenatal care but delivered at home or did not receive antenatal care at all. This pattern is consistent since the pregnancies of mothers who registered for antenatal care and delivered at clinic are monitored from time to time. They have the privilege of receiving proper medical attention for any complications or complaints that may arise during the period. However, we could not guarantee that mothers who registered for antenatal care and finally delivered at home did in fact receive proper antenatal care. Therefore, the high mortality rate among their infants may be the result of haphazard way in which they have received antenatal care. The high infant deaths tend to imply that it is

better not to register for antenatal care at all than to register and be inconsistent in carrying out the clinical instructions. Those that never registered for antenatal care are more likely to prepare for their delivery at home than mothers who apparently could not make up their minds.

A number of mothers who registered at centre/hospital to receive antenatal care were found to deliver away from the original centres. In fact, many of them later delivered at home. We asked for reasons which accounted for the change in their initial plan to deliver where they registered for antenatal care. Two most important reasons stood out clearly (1) unexpected labour (2) travelled outside Ife town at the time. We are not sure whether mothers who travelled outside Ife did so deliberately or they fell into sudden labour at the time they travelled.

VI

Maternal And Infant Nutrition

Maternal Nutrition

Suitable maternal nutrition partially explains adequate growth of foetus and later life chances of survival as well as proper physiological and mental development. For developing countries and particularly in Africa, people, specifically mothers, are ignorant on reliable measure of what constitutes suitable maternal nutrition during pregnancy. Indeed, dietary aversions common among pregnant mothers are not based on any scientific evidence. Mothers in Ile-Ife recognised the need for adequate intake of energy giving food items but were averse to such food items that are protective and for body building on cultural, religious and health bases (Ojofeitimi and Tanimowo 1980). For instance, milk, cowpea seeds and Bournvita were avoided for fear of being heavy or to prevent having such babies that could cause difficult labour, perineal tears or cesarean section (Ojofeitimi et.al., 1982).

The concern of the present section is not with food aversions per se but with the consequences of aversions and the impact of the frequency of intake of certain food items on infant mortality. Being retrospective, one could not regard the findings of this pioneering study in Ile-Ife area as absolute. We are aware of other allied factors that could be responsible for infants' death. For the present set of factors, there is the need for much closer examination of their effects on infant mortality.

Towards this goal, it could be necessary to monitor the effects of dietary aversions and consumption of certain food items among an experimental group vis-a-vis a control group before more credence could be placed on our results. In the first place, the responses to the question on the number of times mothers consume each of the food items per week could be exaggerated in the presence of the community nurses who carried out the field work. Again we do not control for characteristics of the mothers who eat what. In short, there is need for further research in this area.

Findings

Dietary aversions are known to be common among pregnant mothers in Ile-Ife on grounds of cultural, religious and health reasons. A question was asked from mothers about food that were forbidden or that could not be eaten during pregnancy. The division of the different types of food is generally broad (see Appendix B) as it is clear from this study that avoidance of protein and carbohydrate which are in the group of body building and energy giving food items respectively account for high infant mortality rate; avoidance of carbohydrate being the most serious. The fact that avoidance of protein could lead to high infant mortality rate is expected because lack of it has been widely claimed to be responsible for poor development of foetus, stunted growth of the child

in later life or even its deaths. For Africans, the contention has been that there is too much carbohydrate in our diets; but as our findings show the avoidance of carbohydrate by pregnant mothers lowers infants' chance of survival.

Avoidance of consumption of food items that contain fat by pregnant mothers is also found to be more injurious to infants' survival than when mothers are averse to vegetables and fruits. Indeed, it is least dangerous for pregnant mothers to avoid the consumption of vegetables/-fruits which belong to the group of protective food items. This might imply that the tendency for mothers to avoid consumption of such food items during pregnancy might not produce serious adverse effects on infants' survival. However, as stated earlier, a more definitive statement should await a closer study of the avoidance of these food items in relation to infant deaths. We need also to know, even when the infants finally survive, the differences in later growth physiologically and mentally. These are areas outside the objectives of this study.

Response to questions relating to the number of times mothers eat certain food items per week during pregnancy might be highly subjective; however, it is worth examining the responses in relation to infant mortality. Two categories "not stated" and "unknown" are made up of mothers of different levels of consumption of the food items. Therefore, their significance could not be reasonably evaluated and as such, we de-emphasise their discussion in the present study.

It is surprising to find that consumption of beef several times a week could be injurious to infants' survival. The patterns in this study tends to be U-shaped and it does show that eating beef three or four times a week produces the most favorable effects on infants' survival after which infant mortality rate increases with increase in the number of times beef is consumed. These results conflict, to some extent, the pattern observed for the consumption of bush meat. The effects of consumption of bush meat on infants' survival is favorable if consumed even two times a week, but much more favorable if consumed five times a week since for that number of times, its consumption leads to even lower infant mortality. Comparing the effects of the consumption of beef with those of the consumption of bush meat might not be appropriate in this context, however, it is to be noted that bush meat is generally more "fresh" than beef whose unhygienic display in butchers' stores might lead to its being contaminated with the resultant effect of facilitating higher infant deaths than bush meat.

The consequences of liver intake on infants' survival is favorable. Except for some slight increase in infant mortality rate when it is consumed four times a week, there is generally positive association between the number of times liver is consumed by pregnant mothers and the chances of survival of their infants. This picture is different from the pattern of infant mortality rate among mothers who consume chicken during pregnancy. Indeed our findings tend to imply that chicken consumption could not be recommended for more than three times a week for pregnant mothers. The increase in mortality rate among infants of mothers with

higher frequency of chicken consumption during pregnancy becomes exceedingly high when it is consumed six or more times a week.

Seafoods like other kinds of meat already discussed are presumably nutritious. However, the effects of its consumption by pregnant women on infant mortality are generally adverse. A U-shaped pattern of association, implying in this a favorable effect if fish is eaten four or five times a week by pregnant mothers and an adverse effect there after is discernible between the probability of infants deaths and fish consumption. This pattern is unexpected. An increase in the rate of infants' survival is expected with an increase in the number of times fish is consumed per week. It is a common experience that only few mothers could afford to buy ideal fresh fish in Ile-Ife. Most mothers buy those that are almost decomposed: these are cheaper but less hygienic and nutritious. Consumption of dried fish seems to produce more deleterious effects on infants' survival than that associated with the consumption of fresh fish. In all cases, there is positive relationships between the consumption of dried fish, and infant mortality rate at every level of consumption the initially irregular pattern not withstanding. The manner by which dried fish are prepared and preserved is not wholly hygienic and therefore makes them susceptible to possible bacteriological contamination. In sum, the state of hygiene of both fresh and dried fish are at present poor in Ile-Ife and this might explain one observed pattern in this study. However, it appears that consumption of fresh fish during pregnancy exhibits superior effect on probability of survival of infants over that of dried fish.

Bone consumption by pregnant mothers exerts favorable impact on infants' survival particularly when its consumption is restricted to four times a week. If consumed more than four times the level of infant mortality rises. The consequence of egg consumption during pregnancy is also favorable specifically when it is consumed for more than three times a week. Its consumption four times a week appears most ideal in terms of its effects on infants' survival thereafter, there is the tendency for the probability of infants' deaths to rise; the rise is however slight and even irregular.

One component of plant protein included in this equation are beans. The ideal number of times for pregnant mothers to consume beans per week if five times after which infant mortality rate increases slightly.

Carbohydrate is the major food item of our diets. Although it is energy giving, it is necessary to know how much of the quantities of each type of carbohydrate supplying food item consumed would produce less adverse effects on infants' survival.

Although the effects of consumption of bread on infant mortality is highly irregular it suggests that bread consumption could produce favorable effects on infants' survival if consumed between two and five times a week; after that the level of infant mortality tends to rise. The decline in the rate of infant mortality when bread is consumed seven times a week is hard to explain.

Consumption of rice is favorable to infants' survival. There is an initial increase in the rate of infant mortality with increase in the number of times rice is consumed per week. A slight decline in the probability of infant death if consumed five times is later observed. This irregular pattern does not fluctuate widely and the change in the rates is generally slight. Therefore, infant mortality rate remains consistently low with any number of times rice is consumed per week. Perhaps the highly favorable effects of rice consumption on infants' survival is attributable to the fact that rice is not a wholly car- bohydrate food item; its consumption of other food nutrients might explain its highly favorable effects.

Yam is one of the commonest carbohydrate food items in Ile-Ife environment. The findings tend to suggest that pregnant mothers should restrict the consumption of yams to three or fewer times a week if an increase in the infant's probability of dying is to be avoided.

Cocoyam is another common food item in Ile-Ife area but it is not consumed as widely as yam. There are a number of traditional beliefs negating its consumption. One of such beliefs is that it causes a lot of itching and therefore discomfort. However, the effect of its consumption on infant mortality are overwhelmingly favorable when consumed for at least five times a week.

That consumption of gari reduces the probability of infants survival is in line with expectation. The general belief is that the consumption of gari leads to stomach upset because it is not easily digestible. The evidence from this study suggests that its consumption is positively associated with infant deaths in the sense that the higher the number of times it is consumed per week the higher the rate of infant mortality.

Plantain consumption used to be common around Ile-Ife; the acute shortage of every food item in Nigeria has made its consumption a preserve of the affluent. However, the effects of its consumption on infant survival is generally positive.

Butter, Milk, Palm Oil, Groundnut Oil, Vegetables, Oranges, Banana and Pawpaw belong to a group of items often avoided during pregnancy. They are avoided because mothers feel very strongly that they help to produce big babies which could be difficult to deliver thus leading to perineal tears or cesarean section. However, our study shows that mothers would have to consume butter between five and seven times a week before the probability of infants' survival could be enhanced. Milk is recognised world wide as an adequate nutrition not only for pregnant mothers but for the population in general because of its richness in vitamins and associated food nutrients. However, in our study, we find that mothers who consumed milk three times a week experience the lowest probability of dying. The highest rate of infant mortality is observed among infants of mothers who consumed milk five times a week, the decline in the probability of infants' survival afterwards notwithstanding. This pattern is unexpected; however the result is significant in the sense that it reflects the poor, unhygienic condition under which milk is

consumed. Mothers rely on the consumption of tin milk which are largely imported into the country. Many of the consignments arrived in Nigeria in poor condition while the good ones, on arrival are not well preserved, mothers that consume milk several times a week often use small quantities in bits from a tin. The remaining part is invariably kept in the open place accessible to flies and ants. It is therefore the problem of probable contamination of milk for mothers who take it several times a week that might explain the apparent positive association of milk consumption with probability of dying.

The pattern observed for palm oil is different and indeed irregular. There appears to be a decline as the consumption of palm oil increase. There is however, a slight increase in the probability of dying with increase in the number of times palm oil is consumed per week, such increase is not enough to rob it of its generally favorable effects on infants' survival. The consumption of ground-nut oil also exerts favorable effects on the probability of infant survival. The pattern of association with infants' death is irregular. The inverted U-shaped curve implies that ground-nut oil, when consumed either a few times or six or more times a week tends to be associated with high probability of infants survival.

That consumption of vegetables would be positively associated with infant deaths is unexpected. It is to be noted that vegetable as an item of food in this study is rather aggregative. There are different types of vegetables in our environment; and diversity in them might equally be responsible for the results obtained in this study. Future studies should be more specific on the type of vegetables whose effects on infant mortality are being investigated. In the present study the pattern of probability of dying in infancy by the number of times vegetables are consumed by pregnant mothers is irregular. After the initial high rate if infant mortality the rate declines and then rises again before it finally begins to decline with increase in the number of times vegetables are consumed per week.

Consumption of oranges by mothers during pregnancy exhibits favorable effects on infants survival irrespective of the number of times consumed. After the initial irregularity, there is a generally positive association between the number of times oranges are consumed per week, and the rate of infant mortality, the consumption of banana seems to produce favorable effects on probability of infants survival. There appears to be an inverted U-shaped curve except with some slight increase when it is consumed seven times a week. Consumption of pawpaw during pregnancy shows a generally favorable effects on the probability of survival.

Infant Nutrition

As with maternal nutrition, results from a retrospective survey on infant nutrition should be accepted with caution as responses might not represent the true situation. We also do not control for other characteristic of parents that provide the foods whose effects on infants mortality are being examined.

Findings

Response to the question relating type of food with which baby was fed to infant mortality shows that some mothers fed their babies exclusively on breast milk for the first year of life while others supplement infant feeding as early as one week of life. Babies that are bottle fed on artificial milk tends to experience higher chances of survival than babies that were spoon fed on artificial milk or those exclusively breast fed. This pattern tends to reflect the inadequacy of breast milk for feeding of infants throughout the first year of life. The common experience is that the quantity of breast milk might not be adequate for satisfactory infant feeding. Unfortunately for some babies that starve uncomplainingly, mothers might even be unaware of the inadequacy of their breast milk to satisfy the babies.

We also explore the relationship of length of breast-feeding with infant mortality. The general pattern here is that breast-feeding along tends to be inimical to infants survival. The decline in the rate of infant mortality with increase in the number of months babies are breast fed might be due to the increasing immunity gained by such babies from their mothers and their adaptation to the kind of food given to them overtime.

Babies that were not bottle fed experience the highest rate of infant mortality. An introduction of artificial milk as early as one week of life is better than feeding babies exclusively on breast milk. However, babies that were introduced to artificial milk after three months have higher chances of survival than those who were introduced to artificial milk much earlier in life.

In Nigeria, there are different kinds of artificial milk and their costs vary as well. We examine the effects of a number of artificial milk for which data were available in this study on infant survival. Mothers were asked to indicate the type of artificial milk with which their babies were fed generally. We find that the effect of artificial milk is favorable generally. But lactogen, the cheapest artificial milk in the market is least effective as its consumption by infants is associated with the highest infant mortality rate; Cow and Gate follow lactogen. SM26 and SMA which are the most expensive in our markets are associated with the least infant mortality rate.

Babies are usually fed several times a day. The question was asked about how many times per day babies were bottled fed. Feeding babies once or twice a day tends to be best in terms of their effects on

infants' survival. Thereafter, there is a general increase in the rate of infant death. No doubt, babies could not be adequately fed only two times per day: babies that are bottle fed two times a day are therefore likely to be those that are also on breast milk as well. One implication of the present finding is that babies bottle fed more than two times are likely to be exposed to contamination through the constant use of the bottles in an environment with inadequate water supply. Perhaps the rise in infant mortality rate for babies bottle fed for more than two times might be a reflection of the level of hygiene and sanitation prevailing in Ile-Ife community.

In order to further examine the implication of the finding in relation to sanitary conditions of the feeding bottles, we asked for the number of feeding bottles possessed by the mothers. Mothers who possessed the largest number of feeding bottles tend to experience lowest rate of infant mortality. Possession of a large number of feeding bottles implies that mothers could adequately clean the used ones, get them sterilized before they could be used again. Controlling for infant nutrition shows that mother at clinic experience greater chance of infant survival than those at home or unregistered.

VII

Health And Environmental Sanitation

The point has been well made earlier that availability of health and sanitary facilities are only necessary but not sufficient condition of the level of household sanitation. The use to which the facilities are put is much more significant than their prevalence in an environment. An attempt is made in this section to examine the effects of health and sanitary facilities available to mothers and their infants on the survival of the newborns.

Findings

Unexpectedly, water supply from either stream or bore holes has a more favorable impact on infants than that from either pipe borne water or wells. Indeed, pipe borne water is found to have negative effects on infant mortality, a result that is contrary to expectation. It is to be noted that there is no effective water supply system in Ile-Ife particularly in recent times. (The University of Ife Community which has a dam from which water is being supplied is excluded). The supply of pipe borne water is very irregular in the town. There might be days without water supply and when eventually there is water supply, it is not uncommon to find the water contaminated. The locational advantage of source of water supply is also examined: we find that water source located inside the dwelling house exhibits a more favorable effects on infants' survival than that located outside. Apart from pipe borne water, water from wells and bore holes could also be within the dwelling house.

Mothers live in different types of dwelling units. In the study area, there are the rented, personal and family houses. In the family houses other members of the extended family system cohabit. Living in a personal house tends to ensure greater infants' survival than living in rented houses. However, this variable is aggregative and hence may not depict the real situation. For instance, no distinction is made between different types of rented and personal houses. There is no information on whether these houses (rented or personal) are in low density or high density areas or whether the families occupy a whole house, a room or a number of rooms? Hence the aggregative nature of the variable might conceal the real effects of the variable on infant mortality. However, the evidence from the current study suggests that personal house ensures more comfort than rented houses. The fact that mortality is lower among infants of mothers living in the extended family house tends to suggest that more care is available to infants in those houses than for infants found in personal or rented houses. The personal and rented houses might be more isolated in terms of intensity of interaction or quantum of unsolicited or solicited care when babies are sick or when the parents are out of the house. It is also discernible that the number of rooms occupied by a family is inversely related to the probability of infant mortality.

Electric power supply is available in Ile-Ife but because of the irregularity in its supply, a number of homes had to acquire electric generators to supply power to their homes; in some parts of Ife, there is no electricity supply at all. By Authority (NEPA) is always criticized for poor distribution of electric power. Mothers from homes that depend solely on the supply of electricity from NEPA experience the highest infant mortality rate. Indeed, homes without electric power supply fair better than those places supposedly being supplied with power from NEPA.

We also examine the effect of cooking methods and kitchen facilities on infant mortality. The fact that mothers who make use of firewoods for cooking experience the highest probability of infant deaths is attributable to the unhygienic condition arising from the use of firewood in the house. The higher probability of infant deaths among mothers who use gas stove when compared with that of infants of mothers using kerosine stove might be unexpected the use of gas stove makes for cleaner environment than the use of kerosine stove. It should be noted that cooking gas is always in short supply, hence, mothers who rely on it exclusively are likely to resort to the use of firewood or any other cooking facilities when gas is out of supply. We have no information on other cooking facilities used when gas supply runs out. The supply of kerosine is much steadier and its use does not necessarily reduce the level of hygiene in the house, hence it could facilitate better survival chances.

It appears from our study that the type of kitchen per se does not exert much influence on infant survival. It is the use to which a kitchen is put that might explain differences in the effects of the kitchens on infant mortality. Nonetheless kitchen along the passage in the house is less desirable as it is associated with higher infant mortality rate than that associated with the use of kitchen in the backyard or separate kitchen. There is a general belief that the possession of a refrigerator in the home is an asset since it facilitates the storage of food items for a long time without being spoilt or contaminated. That mothers who possess them experience lower infant mortality rate than those without them is therefore not unexpected. Earlier in our discussion, it is noted that the relatively high probability of infant deaths among mothers who rely on pipe borne water as source of water supply is associated with the highly irregular nature of water supply in the study area. Further confirmation of the above contention is found in households that make use of water system of toilet these households experience higher infant mortality than other households with any of the three supposedly less hygienic toilet; in effect their presence in the home is thus counter productive. Contrary to expectation pail carrying system is associated with the least probability of infant deaths. This finding tends to support the claim that availability of health and sanitary facilities are only necessary but not sufficient condition as a perfect index of true level of household sanitation.

The use of dustbin for refuse collection is expected to be associated with the lowest probability of infant deaths, however this is not the case. The use of incinerator is associated with the lowest rate

of infant mortality while the dumping of refuse in open gutter account for the least infant survival.

Personal hygiene is represented by the number of times as well as period of the day mothers take their baths since delivery. Bathing in the evening every day tends to appear most healthy for mothers and hence is associated with a high probability of survival of infants. That bathing in the mornings and evenings every day is not associated with the lowest infant death is unexpected.

Human teeth are usually cleaned daily. There are however differences with respect to number of times and period when cleaning is done. The responses relating to the number of times teeth are cleaned showed that mothers who clean their teeth once a day experience higher infant mortality rate than mothers who clean teeth after each meal. Mothers who clean their teeth after each meal experience the lowest infant mortality rate. Mouths are generally cleaned by either chewing stick or by tooth paste and brush. The evidence in the present study suggests that the use of the latter instrument is better than the former in terms of their effects on infants' survival. There is no further advantage in using the combination of the two at the same time for cleaning teeth.

On delivery, the babies are exposed to some hygiene. Babies whose heads are washed with native medicine experience higher infant mortality rate than those whose heads are dipped in water downwards or those whose babies experience other forms of cleaning like sucking of the nose or mouths with certain instruments. Dipping heads downward in water helps to clear the chest of babies of any impediment.

At birth, babies are wrapped with clothes. The evidence here suggest that babies are wrapped in towel or new cloth experience higher infant mortality than those wrapped with old cloths. As mentioned earlier, babies delivered in hospital/clinics are more likely to be wrapped in towels or new cloths; but most of the mothers that deliver in hospitals/clinic are high risk mothers and are therefore more likely to experience higher infant mortality than the low risk mothers who usually deliver at home and whose babies are likely to be wrapped with old cloths. That babies wrapped with towel or new cloth experience higher mortality than those who were wrapped with old cloths might therefore be a reflection of the differences in the level of risk under which they were delivered.

Babies are usually subjected to series of immunizations from birth till late in their childhood. In this study, we are concerned with infant immunization. Mothers were initially asked whether they had knowledge of immunization for their babies; babies of mothers who answered in the affirmative were found to experience lower mortality than infants of mother without such knowledge. However, babies who have had any immunization experience higher infant deaths than those who did not. This finding is unexpected.

Immunization included in the study are BCG, first and second DPT, first and second oral polio, small pox and measles vaccines. Although we asked for the number of times mothers received each of the vaccines, we hesitate to include the responses in the regression equation because of the inconsistency in the response pattern observed. It is found that babies who had taken BCG have higher survival chances than those who had not. However, the picture was different for those who had taken the first DPT: babies without the first DPT experience just about half of the infant mortality probability experience of those who took it. But infants who took the second DPT experience lower death rate than those who did not. Taking of the first and second oral polio vaccines tends to be inimical to infant survival. Indeed, for the first oral polio vaccines babies that did not take it survive more than those that took it. This finding might be explained by the fact that most vaccines used have expired. At any rate babies who obtained small pox and measles vaccines survive more than those without them. One final variable about the health of babies relates to the number of times babies were ill. The inverse relationship between the number of times babies were ill and infant mortality rate was unexpected. We expect a positive relationship. However, there was no control for the nature of illness.

The direction of the finding is unexpected; infants of mothers who received antenatal care and delivered at clinic are found to experience higher infant mortality rate than infants of mothers who never received antenatal care having controlled for health and environmental factors. However, the probability of infant deaths among mothers who received antenatal care and finally delivered at home is, as usual, higher than those of infants of mothers who received antenatal care and delivered at clinic. The evidence here indicates that once the health and environmental factors have been held constant, mothers who did not register for antenatal care fair better in terms of survival of infants than mothers in the other two categories.

VIII

Biological And Related Factors

Some biological and related variables are included in the present analysis. These variables include sex, type of birth, birth weight, parity and age of mother. We do not have information on birth intervals and gestational age. That biological and related factors are important determinants of infant mortality had been amply demonstrated in earlier works.

Findings

The direction of the effects of sex on infant mortality is not consistent with earlier studies. Males infants tend to experience higher survival probability than their female counterparts. This finding is contrary to the usual pattern in which the reverse is the case. One could say the sample is not representative enough of the Nigeria's experience. Again the difference is slight and could be assumed equal. Even equality of mortality among sexes is unusual and there is need for further study.

The general contention that babies of multiple births survive less than those of single births is supported by this study. Multiple birth babies usually have lower birth weights than the single birth babies; low birth weight is an indication that the babies are not physiologically mature and thus have less chances of survival than mature babies that are probably having higher birth weights. Birth weights are low when babies weigh less than 2,500 grammes (i.e. 2.5 kilogrammes) and high when they weigh 2,500 grammes or more. In the present study, babies that weigh less than 2,500 grammes are coded as weighing two kilogrammes; those weighing between 2,500 grammes and less than 3,500 grammes are coded as weighing three kilogrammes and those weighing 3,500 grammes or more are coded as weighing four kilogrammes. The expected pattern is confirmed. Babies with low birth weight experience higher rates of mortality than babies with high birth weight.

There is also the contention that higher order babies tend to experience higher rates of mortality than low order ones, except for the first order baby. Usually, primigravida has higher probability of death than the second order babies. In the present study, primigravida tend to experience considerably higher rates of infant deaths than those in the subsequent order except for parity 8 and 9. However, after the first birth, the rate of infant mortality tends to increase with increasing parity except for the unexpected decline for parity 5, 6 and 7. It is difficult to explain this fall except that mothers in these parities might give less accurate information about their experiences as they relate to infant deaths.

Age of mother is a variable which might be social but biological in nature when it is related to infant mortality. It is clear in our study that infants of mothers who are less than 20 years of age experience the

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highest rate of mortality. Infants of older women experience lower rates of mortality except after age 34 where the rate tends to rise again. This finding is in line with earlier findings and points to the incompetence of young mothers to effectively care for infants.   Young mothers are also likely to be in low socioeconomic status because of their age; hence they may not be able to cope adequately with the economic demands of their sick babies. The rise in infant mortality rate as mother attain age 35 years and above might be due to increasing congenital malformation associated with the infants of older mothers.

Finally, infants of mothers categorized as at clinic experience the lowest infant mortality rate having controlled for biological and related factors. Infants of mothers categorized as at home also experience lower infant mortality rate than the infants of unregistered mothers.   In this section therefore, receipt of antenatal care shows up to be advantageous for infants' survival.

IX

Socioeconomic Correlates

The unequal level of development has led to the dissimilarity in the socioeconomic patterns of societies. "Societies differ in their expectations and explanations of socioeconomic conditions and thus have different socioeconomic ends, meanings and values. Consequently, they manifest differences in patterns of socioeconomic interpersonal relationship, especially within the family unit..." (Caldwell, 1982). Hence, one may not expect the pattern of association between the independent variables and infants deaths to be similar to those of earlier studies. In fact a review of earlier works has demonstrated that no unidirectional pattern exists across cultures.

As indicated earlier, the socioeconomic variables included in the present study are maternity centre or clinic in which mothers obtained antenatal care, age at marriage, marital status, occupation and type of marriage. Others are education, employment status, income and religion of parents.

Findings

One of the primary objectives of the current study is to examine the impact of antenatal care on infant mortality. Mothers who receive antenatal care whether they delivered at clinic or finally at home are captured from three health centres in Ile-Ife. Mothers who received antenatal care at Enuwa have babies with the highest probability of death. This group is followed by infants of mothers who received antenatal care from the State Hospital. It is to be noted that Enuwa and Modakeke Maternity centres, located in the "traditional" part of Ife are supposed to cater for low risk mothers, while the State Hospital which is located in the more modern section of Ife caters for high risk mothers. Ife State Hospital has the highest concentration of experience mid-wives, nurses and doctors; however, the relatively higher rate of mortality found among infants born there could be attributed to the fact that the centre handles greater proportion of high risk cases than each of the other two centres.

Women who married at very young ages are likely to be inexperienced in caring not only for themselves but for others; their babies are also likely to be of low birth weight and hence physiologically immature. These attributes might therefore be responsible for the high rate of mortality found among infants of mothers who married before age 20 years. Generally, there is a decrease in infant deaths as higher ages at marriage are attained; the only exception is the rise in infant deaths when age at marriage is 23. Apart from greater physiological and social readiness for marital responsibilities, women who married after age 20 years are likely to have lower fertility rate and therefore higher chances of having surviving infants than women who married earlier.

The expectation that married women who are still living with their husbands might have greater proportions "of surviving" infants than women in other marital statuses is not met in this study. Our finding might be attributed to the fact that mothers of other marital statuses are more likely in our own culture, to live within the extended family system which guarantees better care than when the couples live in conjugal association in personal or rented houses.

Earlier works have demonstrated the relatively high impact of maternal education on the probability of infant death. Usually, mothers' education is inversely related to infant mortality rate. However, the present finding shows a contrary pattern. Indeed, infants of mothers with primary school education experience lower probability of death than infants of mothers with post-secondary education; the highest infant mortality rate is found among infants of mothers with secondary school education. Similar pattern is observed at different levels of fathers' education. Again infants whose fathers are holding primary school certificate experience lower mortality possibilities than their counter parts whose fathers have post-secondary education. However, in relative terms, fathers' education tends to be more favorable to infants' survival than that of the mothers'.

The pattern of association between infant deaths and parental occupations is in line with earlier findings: Infants of mothers in professional technical, managerial, administrative and executive occupation experience lower mortality than infants of mothers in other occupational categories. Additionally, mortality among infants of mothers in clerical jobs are lower than that found among infants of mothers who are blue collar workers. That infants of mothers who are farmers experience the highest rate of morality is attributable to the hazards associated with the occupation. Farmers generally live on the farm which are usually removed from hospital or clinic facilities; hence they do not normally receive medical attention for their children when those children are sick. Apart from that, environmental sanitation of many farmers is poor. The rates of death among infants mothers engaged in sales, service, sports and recreational occupations are almost equal and only slightly different from those experience by infants of mothers who are not in the labour force or unemployed.

The findings suggest that infants of mothers in employee status experience lower rate of mortality than infants whose mothers are in any other employment status. However, the results in the present study fail to support this intuition. Infants of mothers who are employers experience the lowest rate of mortality. The rates of mortality among infants of housewives and infants of self employed mothers are about equal. If the association between employment status of the mother and infant mortality is unexpected, the association between the fathers' and infant mortality is close to the expected. Rate of mortality among infants whose fathers are either employers or self-employed are about equal.

Surprisingly, infant mortality rate is higher in monogamous marriages than in the polygamous ones. In monogamous marriages, fertility is likely to be high; the higher infant mortality rate might therefore reflect the exposure of more children to infant death. Another reason for the relatively lower infant mortality in polygynous houses might be that polygynously married women live in the extended family system where the children are exposed to greater care and hence more likely to survive in the first year of life.

Generally speaking infants of women with high income are likely to experience lower rate of mortality than infants of low income mothers. Data on income as a variable is generally unreliable. In our present study, there are a large number of non-responses and for mothers that respond, such responses hardly reflect the true situation with respect to their income. Therefore, the finding here should be accepted with caution. As it is, the finding in the present study shows that infants of mothers who earn between ₦2,000 and ₦3,000 experience the lowest rate of mortality while infants of mothers in higher income brackets experience higher rates. This finding is difficult to explain. However, the expected inverse relationship between infant deaths and fathers' income is supported at different levels. This finding probably suggest, as earlier noted, that fathers characteristics have greater impact on infant mortality, a reflection of the fact that male characteristics determine household status in our society.

Infants of mothers who are muslims experience the lowest rate of mortality. This group is followed by infants of mothers in traditional religion and others in that order. There is no way to explain the relatively higher mortality rate among infants of mothers who are Protestants and Catholics. It is most probable that mothers who are Catholics and Protestants gave more accurate information on infant deaths than the others. Catholics and Protestants are more exposed to ideas and more aware of the need to supply accurate data on such phenomena like infant deaths among their children than that reported in this study. an expected lower mortality rate among infants whose fathers are Catholics or Protestants is found in the study. The difference in the mortality rate of infants of men who are either Protestants or Catholics and that of infants whose fathers are either Muslims or traditional believers is wide.

Again, infants of mothers categorized as at clinic experienced the least rate of mortality, followed by those at home while controlling for socioeconomic variables.

X

The Relative Significance Of The Correlates Of
Infant Mortality

Thus, far, we have discussed the basic correlates of infant mortality as exhaustively as data could permit in this study. In all, there are five broad categories of the correlates involving almost ninety conceptual (not dummy) variables. These are factors of antenatal care, maternal and infant nutrition, health and environmental Sanitation, biological and socioeconomic. Although, the significant dummies are identifiable, through the statistic, the significance of each conceptual factor represented by a block of dummies, is not identifiable. The need to examine significant explanatory factors arises because of the desire to analyze the effects of significant variables across the broad categories on the probability of infant survival. Such an exercise is aimed at throwing further light on our earlier findings.

In selecting significant variables, the contribution of each factor to explanation of infant mortality was examined. Conceptual factors within each broad categories of correlates having the greatest net association with the probability of infant deaths were selected.

A measure of the importance of individual regressors by their individual contribution to the estimated value of the independent variable is a common, but not a well-defined problems. In this study coefficients of partial determination are used to rank variables according to their degree of importance. This is a measure based on explained variance criterion; its square root is the partial correlation coefficient (for details of the technique used see Feyisetan B.J., 1982).

The pattern of the probability of the infant deaths observed for the variables under each broad category of the correlates of infant mortality are generally confirmed.

The number of visits of pregnant mothers to the antenatal clinic is inversely related to probability of dying. Thus, the number of visits to antenatal clinic before delivery is rewarding in terms of its effect in reducing the probability of dying among infants. This finding implies that pregnant mothers exposed to the facilities of antenatal clinic through out most of the period of gestation stand the chance of experiencing low rate of infant mortality than their counter parts who either paid occasional visit to antenatal clinic or never paid any visit. To be able to pay many visits to the clinic during pregnancy, mothers have to register early.

During labour, delivery attendants are often present. In a society like ours where women are not bound by law to deliver in the clinic, there are as many types of delivery attendants as there are places of delivery. Unlike the grouping in Section IV, we regrouped delivery attendants by type of skill; the category of self, female and male neighbors and husband belong to the least skilled while midwife/doctors

the most skilled. However, the probability of dying observed is at variance with the level of skill of delivery attendants. Infant deaths associated with the least skilled groups are lower than that associated with the most skilled delivery attendants. Infants delivered by herbalists with their relatively poor skill display the lowest probability of dying. The midwives/doctors are highly trained personnel entrusted with delivery of infants and traditional birth attendants are also associated with child delivery even though they possess lower skill than the former group. As it is, infants delivered by these two groups experience highest probabilities of dying. As mentioned earlier, the high probability of dying might be associated with the high risk cases often handled by these categories of experts. At any rate, that infant deaths of high risk mother are still high signifies the relatively poor level of medical facilities in our hospitals. Complaints abound on the short supply of medical facilities including drugs. Even if there were qualified midwives/doctors, there could be no efficient performance of functions in the absence of the needed facilities. Hence, health care delivery system demands substantial financial facilities with which the available trained medical personnel could perform their duties efficiently. Traditional birth attendants could also, through practice, be regarded as trained. However, the high rate of mortality associated an instrument of cutting umbilical cord was found to be associated with lower infant mortality than hospitals or clinic specific tools of razor blade/scissors or knife. However, it is not all the hospital equipments that were found to exhibit deleterious effects on infant mortality rate. For instance, the use of boiling as a means of sterilizing instruments used for cutting umbilical cord or soaking in disinfectant are hospital based methods whose effects on probability of dying is low. On the other hand less modern methods like flaming is associated with highest rate of infant deaths. When nothing is done to sterilize instruments for cutting umbilical cord the probability of infant deaths is also high but slightly less than that associated with flaming. Additionally, wearing of gloves, masks and/or washing of hands are practices common among hospital personnel and in this study their use is associated with lower infant mortality than when only masks are worn. Wearing of only mask or nothing by delivery attendants are practices known with herbalist or delivery attendants for women who deliver at home. Deliveries which involved no preparation could occur as a result of spontaneous labour common among los risk mothers; therefore, the high probability of surviving associated with it might be consistent.

The patterns observed in Section VII when the effects of health and environmental factors were examined are generally confirmed. Again, we found that pipe borne water and well in that order exert deleterious effects on infant survival. This finding lend support to the grossly inadequate and unhygienic condition of water from pipes in Ile-Ife area. That water from wells are associated with higher probability of dying than water from stream or bore hole could be explained in terms of contaminants that often flow into them after each surface run off.

The effect of cooking facilities on infant deaths is slightly different in this session from that observed in an earlier chapter. The

use of fire wood for cooking still account for the highest infant mortality rate. Although the low probability of dying earlier associated with the use of kerosene, still persists, the difference is only slightly over that associated with the use of gas, electricity or a combination of other facilities. Thus, with the control of other variables, the advantage the use of kerosene enjoys over the use of gas, and electricity with respect to infant survival becomes attenuated. Thus if the supply of gas and electricity could be constant as that of kerosene, their effects on probability of infants' survival might be enhanced.

The inverse relationship earlier observed between number of rooms occupied and infant mortality is also confirmed. In effect, living in crowded household as it is the case in Ile-Ife lower the probability of surviving among infants. That the use of dustbin for the collection of refuse is not associated with low occurrence of infant death might be associated with its poor management; refuse in dustbin are irregularly collected. The common experience is that locations of dustbins are centres of dirts and viruses in the environment, a situation that differs from that which obtains in places where incinerators are located. The high rate of infant mortality associated with refuse either being thrown into open gutter or dumped in open spaces for burning calls for expansion in the use of incinerator and improvement in the use of dustbin for the collection of refuse.

It is healthy for infants to cry at birth – the cry might be immediate or delayed. Newborn babies that failed to cry at birth stand higher probability of dying. The association between the number of times baby was ill and infant death is negative. The result tends to imply that the greater the number of times baby was ill, the greater the number of times such babies would be exposed to more aggressive therapy and less would be the probability of their dying.

As with health and environmental factors, the patterns observed for maternal nutrition in the earlier section are generally confirmed. Maternal consumption of chicken during pregnancy is again found to exert most favorable effects on infants' survival when consumed between two and three times per week; after that the probability of survival decreases. However, the greater the number of times rice is eaten per week (under the assumption that it is consumed once a day) the lower the rate of probability of dying; this pattern is the same with the consumption of Cocoyam. However, consumption of gari exerts deleterious effects on infants survival; the greater the number of times pregnant mothers consume it per week, the lower the probability of their infants' survival. Although it is a relatively cheap food item, its consumption could be minimized during pregnancy.

Three types of protective food items are included in the equation. The effects of their consumption on infants' survival vary. For the consumption of butter to enhance infants' survival, it has got to be consumed between five and seven times a week. The consumption of oranges generally exhibits favorable effects implying that, the higher the number of times it is consumed, the better in terms of decreased probability of

dying. However, milk consumption could be restricted to between two and four times to ensure high probability of infants survival. As remarked earlier the relatively unfavorable pattern observed with the consumption of milk could be attributable to poor hygienic condition under which tin milk are stored at home rather than the effect of milk consumption per se.

As before, babies that were bottle fed on artificial milk experience the lowest infant mortality rate than those fed on breast milk or spoon fed with artificial milk. However, the evidence from our study suggests that the greater the length of breast-feeding up to eleven months, the lower the probability of dying of infants. Among nursing mothers, the time artificial milk is introduced varies. As it is, the pattern is an inverted U-shaped curve which implies that when artificial milk could not be introduced to infants in less than two weeks of birth, then it becomes more ideal to introduce it when baby is three or more months old. For further classification, there is need for further research in this area. Artificial milk in terms of cost and quality. It appears that the most expensive ones such as similac, SM26 and SMA are associated with low probability of infants' death. Cow and gate as well as lactogen, generally cheaper than NAN and others, are associated with lower infant mortality rate than the former group. This finding might reflect the regrouping of NAN with others as could be detected from the earlier results.

The effects of number of times babies are bottle fed per day exhibits an inverted U-shaped curve.

The finding implies that babies that are bottle fed one or two times or six times or six times and above experience high probability of infants' survival. Those bottle fed between three and five times experience the highest rate of mortality. Perhaps the evidence might reflect the level of hygiene with respect to the use of bottles: mothers who bottle feed a few times might be able to keep clean the bottles used much more than those bottle feeding between three and five times. Those who bottle feed six or more times might also maintain a high level of hygiene since they are likely to possess many such bottles that could be used interchangeable at a relatively more hygienic condition. There may be need for further research on this. The greater the number of feeding bottles possessed, the lower the probability of dying of infants. This is consistent with the reasoning that better hygiene could be maintained with larger number of feeding bottles.

There variables among the biological group of correlates were included in the present analysis, namely, birth weight, birth order and maternal age. The latter two variables were drastically regrouped. The pattern observed for birth weight in an earlier chapter is maintained. This is that low birth weight babies experience relatively high probability of dying. The pattern observed for birth order, however, is not consistent with most findings in earlier literature. That there would be inverse relation between birth order and probability of dying among infants is most unexpected. There is need for further investigation.

Maternal age is broadly grouped particularly for mothers in age group 15-24. Lower mortality rate is associated with infants of mothers in age groups 15-24 and 30-34 than for those in the reference category. This is an irregular pattern; but the difference is not very high. However, mothers aged 35 years and above experience the highest rate of infant mortality as expected.

Infants delivered at Ife State Hospital experience the least probability of dying. This contradicts the earlier finding. However, the present pattern is consistent with the expected since the hospital has the highest concentration of trained mid-wives and doctors and of course better medical facilities than maternity centres either at Enuwa or Modakeke.

The pattern of infant mortality rate with age at marriage is inversely associated with the probability of infants survival shows a U-shaped curve: mothers with secondary education experience the least infant mortality rate. That mothers with post secondary education would experience a relatively higher probability of dying of their infants than mothers with secondary education might be due to the fact that mothers with post-secondary education spend less time with their children because of the nature of their occupation. Such mothers often employ the services of mother substitutes, who are virtually illiterates, to care for their infants. That mothers with primary education experience higher infant mortality rate than those with secondary education might be due to income effect. However, the effect of paternal education on infant mortality rate is at variance with that of maternal education. Women whose husbands have secondary level of education experience the highest infant mortality rate. This might be consistent since fathers with secondary education might be married to women of slightly lower educational status. Women whose husbands have post secondary level of education experience the least probability of dying. The pattern of relationship observed for type of marriage in an earlier chapter is confirmed. At any rate, the gap between the two narrows in this section. The registration status of mothers clearly shows the superior effect of receipt of antenatal care on infant survival over non-receipt or ever those who received but delivered at home.

XI

Conclusion And Policy Implications

This is, to the best of our knowledge, the first comprehensive study on correlates of infant mortality in an urban area in Nigeria. The urban centre (i.e. the areal unit) does not represent the diverse urban environments in the country. In terms of industry, commerce, expectation of life at birth and perhaps urban mentality, Ile-Ife is not in the forefront of urban milieu in Nigeria. It is an ancient city with large proportion of the population in traditional economy. However, the establishment of the University of Ife has given rise to the growth of a number of urban services in recent times. These services include banking and education. The city enjoys most of the urban social facilities such as pipe borne water, electricity, tarred roads and hotels. Because of the Faculty of Health Sciences of the University of Ife there is the Ife University Teaching Hospitals Complex controlling two major hospitals-Seventh Day Adventist Hospital and Ife State hospitals - and a number of maternity centres.

The current study is built upon records of mothers who received antenatal care during pregnancy from Ife State Hospital, Enuwa and Modakeke Maternity Centres. Mothers who received antenatal care were divided into two groups: those who received antenatal care and delivered into the clinic and those who received antenatal care but delivered at home. Mothers who did not receive antenatal care were also included in the sample. At the end of the survey, responses of two thousand one hundred and eleven mothers were processed for analysis. These correlates are grouped into five broad categories. These are: the antenatal care factors, factors of maternal and infant nutrition; health and environmental sanitation variables, biological and related factors and socioeconomic correlates, arising from our conceptual framework.

With respect to antenatal care factors, it was demonstrated that infants of mothers who received antenatal care and delivered at clinic experienced lower mortality rate than infants of mothers who either received antenatal care but delivered at home or did not register for antenatal care at all. In addition, we found that mothers who pay many visits to hospitals during pregnancy as a result of early registration and mothers with normal labour have infants that experience relatively lower rate of probability of dying. Our findings also suggest that although trained mid-wives and medical doctors are available in maternity centers and hospitals, they work with poor facilities which impede the effective performance of their functions especially as those functions relate to giving medical attention to high risk cases that they are supposed to handle. The hospital - based facilities and equipments designed to help in child delivery of infants' survival.

Maternal nutrition in pregnancy requires more intensive study before general statements could be made. However, in the present study, four different patterns emerge (1) Certain food items have to be consumed for specific number of times per week before they exert favorable effects on

infants' survival. These are beef, chicken, fish, yam, butter and milk; (2) Some food items could be consumed as many times as financially possible since greater number of times of their consumption leads to lower rate of the probability of dying among infants. These are liver, beans, rice, cocoyam, oranges and paw-paw; (3) Some others appear generally suitable but the number of times they should be consumed is indeterminate considering the irregular manner in which they affect infant mortality; such food items include bush meat, bones, eggs, bread, palm-oil, ground nut oil and banana (4) Some are found to be relatively unsuitable during pregnancy, these are dried fish, gari, plantain and vegetables.

Although there is inverse relationship between length of breast-feeding and probability of dying during the first year of life, the findings in this study tend to suggest that the use of artificial milk exerts more favorable effects on infants' survival, artificial milk administered through clean bottles constitutes a more suitable infant nutrition than the breast milk.

The effects of health and environmental factors on the probability of dying shows that although modern social infra-structure are available in Ile-Ife, they have not been able to play significant roles in enhancing infant survival. It is unexpected to find that infants from houses that have pipe born water, modern cooking facilities, refuse disposal system, electricity supply from NEPA, and toilets with water carrying system have lower probability of survival. However, a positive association is observed between the number of rooms a family occupies and the probability of infant survival. Also infants of mothers who bath daily in the evening and clean their teeth after each meal experience low rate of mortality. Crying of babies immediately after birth or a little exercise for the baby after birth enhances the probability of their survival in the first year of life.

Our findings also show that, female infants, multiple births and low birth weight babies experience relatively high probability of dying. Low and high maternal ages are associated with low probability of infants survival.

Babies born in Ife State Hospital experience the least probability of dying when we control for variables cutting across the broad categories. There is a general tendency for infant mortality rate to be positively associated with age at marriage. However, parental education shows an inverted U-shaped relationship with probability of dying. The relationship of occupation with infants' survival is consistent with earlier findings and unexpected relationship between each of mothers' employment status and income. At any rate, father's income is generally inversely related to probability of infant's death, the pattern of religion on infant mortality is haphazard.

In the antenatal care equation, receipt of antenatal care was advantageous for mothers who deliver in the clinic, but not for those who received antenatal care but delivered at home; indeed, the experience of

unregistered mothers with infant mortality rate was better. In biological and socioeconomic equations there was a clear advantage of receipt of antenatal care during pregnancy even when such mothers finally deliver at home. When maternal and infant nutrition factors were controlled there was a clear advantage only for mothers who received antenatal care and delivered at the clinic; there is no difference in the level of infant mortality rate among the infants of mothers of the other two categories. A control for health and environmental factors shows that receipt of antenatal care is redundant if not counter productive.

Implication for Further Research

We have obtained data for the present study through a retrospective survey. That not withstanding, the finding is revealing particularly as they relate to availability of modern facilities in the health care delivery system. The study has dealt extensively also with unusual correlates of infant mortality. In Nigeria, there has not been such a study and therefore calls for further research in the following areas.

(a) The unexpected relationship between the availability of modern facilities and equipment and the probability of infant deaths needs critical examination. There is the need to find out if the results are due to the qualities of these facilities or their management.

(b) The assumption that high risk cases lead to high infant mortality rate again needs deeper examination. Apart from general impression gained from hospital policy, we have no clear cut records on the cases that are handled in the hospital. What is the proportion of high risks to low risks? This is one of many questions posed by the present study.

(c) Mothers in Nigeria are least informed about the suitability of certain food items in pregnancy. There is the need to know the number of times certain food items could be consumed in order to effect reduction in the probability of infant deaths.

(d) Breast-feeding and artificial milk are not sufficiently disaggregated. They should be examined by the degree to which each is supplemented by the other. Again, what is the level of hygiene maintained by breast-feeding mothers and in the preparation of artificial milk?

(e) Some of the findings relating to socioeconomic variables need to be reinvestigated particularly effect of material education as well as parental income and religion on the probability of infants' survival.

(f) There is the need for a repeat of this study in other areas in Nigeria that would make use of some if not all of the variables included in the present exercise.

(g) However, the available data have not been fully exploited with respect to the interaction effects of these variables. For instance, that there is more female deaths than that of males contradicts the existing biomedical theory. An analysis of birth weight with sex or type of births might reveal a more consistent pattern.

Implications for Policy

(a) The hospital facilities and equipment need to be carefully examined with a view to guaranteeing high level of hygiene with respect to the storage and use. Available medical personnel without suitable facilities and equipment may not lead to low probability of dying. Again, time of registration of pregnant mothers for antenatal care should be stream lined and place of delivery controlled. The present practice of delivering anywhere tends to undermine the impact of health care delivery system.

(b) Food aversions are currently not based on any scientific evidence. Government could make public the implications of food aversions in pregnancy on infants' survival particularly aversions to body-building and energy giving food items. Maternal nutrition in pregnancy also requires more public enlightenment. There is need to know the number of times certain specific food items are to be consumed to minimize level of infant deaths. What are generally the most suitable food items in pregnancy and those that should be avoided completely in pregnancy or that which might not be duplicated?

(c) The inverse relationship between length of breast-feeding and infant mortality is supported in this study but the use of artificial milk is found to be more suitable in relation to infants' survival. There is the need to know the circumstances under which mothers should be encouraged to introduce artificial milk to infants. Which are the types to introduce and what quantities? In maintaining a high level of hygiene, there is the need to be acquainted with the least number of feeding bottles needed for feeding babies? In supplementing breast milk, it is also of policy relevance to guide parents on the ideal time to supplement and in what quantities as babies grow older. However, the evidence from Research is that breast milk should be expected to have equally favorable effects on the probability of infants' survival; that this is not from mothers in Ile-Ife. Ways to improve the quantities of breast milk should be a policy of the national government.

(d) Pipe borne water is universally preferred to any other source of water supply; however when water supply is as irregular as it is in Ile-Ife or when water from such a source is likely to be contaminated, the advantages to be derived are lost. There is the need to make supply of pipe borne water effective,

constant and clean, it is disadvantageous to just have the pipes. An expansion of the water reservoir from where Ile-Ife receives its present water supply will be a step in the right direction. With respect to housing programmes, there is need for specific policy guidelines stating the ideal number of persons to occupy a room. The currently congested way of living is found to correlate positively with the probability of infants' deaths. Collection of refuse from dustbin is a task that could be performed effectively if roasters are drawn up specifying how many times such refuse should be collected per week. The use of incinerator could be improved and made more common around town than they are found at present. With respect to cooking facilities like gas and electricity, there is need for health education programme to bring to the consciousness of the populace the import of a healthy environment. Baby's health at birth should be closely monitored by qualified pediatricians. They are at present in short supply even at Ile-Ife. The condition of vaccines currently in use is poor particularly DPT and Oral Polio. Efforts should be geared to making available only the best.

(e)   Birth weight correlates highly with infant mortality. Thus birth weight could be closely followed from the foetal stage and efforts should be made to correct abnormalities as soon as they are detected. Reduction in foetal abnormalities could be achieved if prospective mothers are educated that the ideal child bearing ages are the age bracket 20-34.

(f)   One of the socioeconomic variables relevant to policy implications is age at marriage. Increase in age at marriage could be achieved through education and premarital employment in non-domestic occupations. Policy guidelines that are formulated in that direction could lead to a reduction in infant mortality rate.

(g)   Evidence from this study also shows that infants of mothers in poor socioeconomic status stand the chance of experiencing high mortality rate. For instance, certain food items need to be consumed several times a week before a reduction in infant mortality could be achieved e.g. eggs, butter, and vegetables. Expensive artificial milk are also associated with low infant mortality rate; also the greater the number of rooms occupied, the lower the rate of probability of dying. The implication is that mothers that are in low socioeconomic status might not be able to afford the consumption of some suitable food items in pregnancy; they may also find it difficult to give highly nutritious artificial milk to their babies and of course would live in crowded rooms, use common kitchen with other poor families and live without refrigerator. There is the need to devise methods by which poor families could be helped so as not to deny them of these essentials.

(h)   Poor families are also likely to have greater family size than
        those in middle class and above. Increasing number of children
        might lead to rise in infant mortality rate. Mothers that
        experience high rate of mortality among their infants are
        likely to be unwilling to take to family planning. Therefore
        family planning programme should be geared towards birth
        control which would lead to a reduction in number of parity and
        consequently probability of dying.   Such family planning
        programme would also make mothers conscious of the advantages
        in planned parenthood.

<u>Appendix</u>
<u>Statistical Note</u>

<u>Variable Definition and Measurement</u>

<u>The Dependent Variable</u>

At the aggregate level, the dependent variable is defined as the ratio of the deaths of children under one year of age reported to have occurred in 1980 or 1981 to the total number of live births registered or reported to have occurred in 1980 or 1981 respectively. That is,

if Doi is the number of infant deaths in year i, 1980 or 1981; Doi is the number of live births in year i, 1980 or 1981, the Di the proportion dead before the first birthday is equal to Doi/Boi

At the individual level, the dependent variable is definable as the probability that a child borne by a woman in 1980 or 1981 will die before attaining the age of 1.

If, $P(i) = e^{-s' u(t) \sigma t}$ is the probability of surviving the first year of life

Then $I - e^{-s' u(t) \sigma t}$ is the probability of dying before the first year of life - (the dependent variable) No attempt was made in the study to decompose infant deaths into neonatal and post neonatal deaths.

<u>The Independent Variables</u>

The independent variables are grouped into six categories corresponding to the classifications of the correlates of infant mortality; antenatal care and related factors; maternal nutrition variables; variables that measure the quantity and quality of infant nutrition; health and environmental sanitation and associated variables; biological factors and socioeconomic variables. The antenatal care related variables include stage of gestation at the time a woman registered for antenatal care in a clinic, number of visits to the clinic before delivery administration of tetanus injection during pregnancy (including the number of doses given), condition of labour, place of delivery position of women while delivery, the types of instruments used to cut umbilical cord and methods of sterilizing those instruments.

The maternal nutrition variables include the consumption and the frequency of consuming such food items as beef, liver, chicken, rice, yam, dried fish, plantain, bananas, oranges, pawpaw, vegetables (fruits and oils) and eggs among others. Among the variables used to measure the quality and quantity of infant nutrition are the duration of breast-feeding, the type of supplementary food offered and the age at which it was introduced, the number of times in a day the baby was fed. With respect to health and environmental sanitation, variables of interest relate to the source of water supply (whether inside the dwelling house or outside of the dwelling house), the type and size of accommodation,

availability of electricity, the nature of cooking facilities and the availability of sewage disposal facilities refrigerators or freezer for storing foods in addition to the sanitation practices of the parents.

The sex of the baby, the type of birth (single or multiple); the birth weight, the birth order and the age of mother at birth are the biological variables whose effects on infant mortality are examined in this analysis. The socioeconomic variables include the mother's education, marital status (currently married or formerly married) present labour force and employment statuses, income, religion; her husband's educational attainment, income, labour force and employment statuses and religion.

It is pertinent to note that most of the independent variables are dichotomous and are therefore represented by a set of dummies in the regression analysis. Also it should be noted that the inclusion of each of the independent variables in our analysis is based on findings of earlier works and on our notion of their relevance to infant mortality in this part of Nigeria.

D.   Method of Analysis

The principal methodological procedure adopted in this study is the dummy variable regression. This statistical procedure, generally believed to be fairly adequate for the multivariate analysis of categorical data has been adopted because of the dichotomous nature of most of the variables whose impact on infant mortality variables take the values one or zero depending on whether the respondent does or does not belong to the group to which it refers. It is hoped that on inclusion of several sets of dummies in one regression equation will facilitate an easy comparison of the differential effects of various level of each qualitative factor controlling for other factors in the equation.

As an exposition of the approach, let us assume that a child's probability of dying before attaining the age of one year is influenced by maternal education where maternal education is measured as none, primary, secondary and post-secondary.

A simple way of regressing the probability of infant mortality on maternal education is to represent education by a set of dummy variable regressors. If the regressors are defined as

X_1 = (1 if maternal education is none
      (
      (0 otherwise

X_2 = (1 if maternal education is primary
      (
      (0 otherwise

X_3 = (1 if maternal education is secondary
(
(0 otherwise

X_4 = (1 if maternal education is post-secondary
(
(0 otherwise

Then a simple dummy variable regression equation could be written as

$$D_i = a_0 + a_1 X1_i + a_2 X2_i + a_3 X3_i + a_4 X4_i + U_i \qquad (1)$$

where D_i = the probability that a child will die before attaining the age of 1 (this is represented as $1 - e^{-su(t)\sigma t}$ as in the above section.

a = constant term

a_i, a2, a3, a4 = coefficients of X's and

U_i = error term

In the estimation of equation (1) it should be noted that dummies corresponding to every level of the explanatory variable cannot all be included in the equation since this would cause the moment matrix to be singular and the normal equation would accordingly have no unique solution. In order to avoid this problem, one category of the binary variable groupings has to be omitted in the estimation of the parameters of the equation. An omission of the last category of the binary variable grouping reduces equation.

(1) to

$$D_i = a_i + a_i Xi_i + a_2 X2_i + a_3 X3_i + U_i$$

where $D_i, X1_i, X2_i, X3_i$ are as defined for equation (1);

a_o is the new regression constant

a_i, a_2, a_3 are the new coefficients of X's.

Equation (2) becomes a reparamentrised version of equation 1 and each coefficient now measures the difference between the probability of infant deaths when the mothers possess one of the first three educational qualification and the probability of infant deaths when mothers have post-secondary education (the omitted category).

With two or more qualitative variables, equation (1) becomes expanded to incorporate dummies that correspond to every level of each of the qualitative conceptual variable. a category of each of the binary variable groupings is then omitted to make for an easy estimation of the parameters. It is to be noted that qualitative and quantitative ex-

planatory variables are included in our regression equations where the data permit.

A significant shortcoming of the dummy variable approach is that with a dichotomous dependent variable, ordinary least squares estimates can be obtained which are outside the theoretical bounds of the variable. However, considering the ease of use, the cost - effectiveness and the possibility that there may be only few instances in which the conditional probabilities go outside this range, it has been chosen over more sophisticated models, in particular, the logic model which would have overcome the problems inherent in dummy variable regression approach.

Note

The tables for the report could be obtained from the authors on request.

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