# FACTORS INFLUENCING MORTALITY PATTERN AMONG UNDER-FIVE CHILDREN ADMITTED IN SELECTED STATE AND MISSION HOSPITALS IN IBADAN, NIGERIA

**BY**

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## CERTIFICATION

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## DEDICATION

This dissertation is dedicated to the Almighty God.

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## ABSTRACT

Overall Under-Five Mortality Rate (U5MR) is reportedly high in Nigeria. Statistics on U5MR in Nigeria are mainly derived from data obtained from community-based surveys and teaching hospital records. There are few reports on childhood mortality from secondary health institutions where many deaths are known to occur. This study was therefore designed to determine the mortality pattern and factors influencing mortality among under-five children admitted in selected hospitals in Ibadan.

A review of records of deaths and admissions occurring in under-five children between January 2005 and December 2009 was conducted in three purposively selected mission and state hospitals in Ibadan. A total of 19,203 under-five children were admitted within the period under review. Records of all the 2146 under-five children that died and an equal number of children admitted but recovered which were matched for age and sex were reviewed using a structured chart review form. Information collected included age, place of residence, parents' occupation and causes of death. Data were analyzed using descriptive statistics, Chi-square test and logistic regression at $P<0.05$. Results were compared with the World Health Organisation mortality rate standard of < 40/1000 admission.

The mean ages for neonates, post-neonates and children aged 12-59 months were 8.5 ± 5.5 days, 6.1 ± 3.1 months and 26.4 ± 13.1 months respectively. Many of the deaths (47.4%) occurred within 24 hours of hospitalisation. Overall U5MR was 111.8/1000 admissions. Annual trend in mortality rate was 107.6/1000 in year 2005, 95.7/1000 in 2006, 96.5/1000 in 2007, 127.1/1000 in 2008 and 128.7/1000 in 2009. Mortality rate per 1000 admissions was highest (132.3/1000) among post-neonates, followed by neonates (88.2/1000) and children aged 12-59 months (52.5/1000). Neonatal deaths were mainly due to sepsis (32.2%), perinatal asphyxia (26.5%), prematurity (14.4%), and meconium aspiration syndrome (4.5%). Malaria (25.7%) was the predominant cause of death among post-neonates followed by bronchopneumonia (16.3%), gastroenteritis (12.4%), sepsis (10.1%) and anaemia (5.9%). Malaria (35.2%), anaemia (11.2%), measles and post measles complications (10.8%), gastroenteritis (7.8%) and bronchopneumonia (6.6%) were the main causes of deaths among 12-59 months. Immunisation history was

significantly associated with mortality ($p<0.05$). Children from highly congested areas (81.9%) were 2 times more likely to die compared with children from the suburban areas (OR = 2.0, 95% CI = 1.5, 2.7). U5MR was significantly more among children whose father were engaged in unskilled works (OR=2.0, 95% CI=0.3, 0.7). Children were at higher risk of dying during rainy season than in the dry season (OR=2.3, 95% CI=0.5, 0.8).

Under-five mortality rate was higher than the World Health Organisation standard over the five year review period and the deaths were mostly caused by infections and preventable conditions. Advocacy and public enlightenment for the adoption of immunisation services and timely presentation to hospitals are needed to reduce the prevalence of under-five mortality.

**Keywords:** Under-five children, Mortality rate, Childhood diseases, Mission and state hospitals.
**Word count:** 452

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| | |
|---|---|
| AIDS: | Acquired Immune Deficiency Syndrome |
| ARI | Acute Respiratory Infection |
| BA | Birth Asphyxia |
| BCG: | Bacille Calmet Guerrin |
| CEE | Central and Eastern Europe |
| CIS | Commonwealth of Independent States |
| CSM | Cerebrospinal Meningitis |
| DHS | Demographic and Health Survey |
| DPT: | Diphtheria Pertussis Tetanus |
| DR | Death Rate |
| EOS | Early Onset Sepsis |
| END: | Early Neonatal Death |
| GBD | Global Burden of Disease |
| GET | Gastroenteritis |
| HIV: | Human Immunodeficiency Virus |
| IGME | Inter-agency Group for Child Mortality Estimation |
| IPD: | Immunisation Plus Day |
| LMIC: | Low and Middle-Income Countries |
| LND | Late Neoanatal Death |
| LOS | Late Onset Sepsis |
| MDG: | Millennium Development Goal |
| MICS | Multiple Indicator Cluster Survey |
| MR | Mortality Rate |
| NAS | National Academic of Science |
| NDHS: | National Demographic Health Survey |
| NGO: | Non Governmental Organisation |
| NPI: | National Program on Immunisation |
| OPV: | Oral Polio Vaccine |
| ORT | Oral Rehydration Therapy |

| | |
|---|---|
| PEM | Protein Energy Malnutrition |
| PHC: | Primary Health Care |
| PMC | Post Measles Complications |
| PMI: | President's Malaria Initiative |
| RBM: | Roll Back Malaria |
| SPSS | Statistical Package for Social Sciences Software |
| U5MR | Under-five Mortality Rate |
| UNDP: | United Nations Development Programme |
| NICEF: | United Nations International Children Emergency Funds |
| VAD: | Vitamin A deficiency |
| VPD: | Vaccine Preventable Diseases |
| WHO: | World Health Organisation |
| WHOSIS | World Health Organisation Statistical Information System |

# CHAPTER ONE

## 1.0 INTRODUCTION

The United Nations Children's Emergency Fund (UNICEF) defined the under-five mortality rate (U5MR) for every country in the world as the number of children dying before their fifth birthday per 1000 live births if subjected to current age-specific mortality rates. Worldwide, 9.7 million children under the age of five years die each year (UNICEF, 2009). There is continuing high rates of infant and childhood mortality in the poor populations of the developing world. The rates are still in the order of 50–100 per 1,000 person-years in a number of countries, which is still up to 50 times higher than in the industrialized parts of the world. This may even be higher as there is inadequate data in many developing countries (Rajaratnam, *et al.*, 2010).

Generating accurate estimates of under-5 mortality poses a significant challenge because of the limited data available for many developing countries. The data on causes of death are generally unreliable and more often incomplete (You *et al.*, 2009). This is related to the general pathetic nature of the research environment in Africa. In Africa, deaths are sad events particularly those of children. Such events are often not wanted to be remembered let alone documented. To many Africans, the causes of death are immaterial since the result may probably not give back the life that has been moaned by death. More often, researchers have relied on 'verbal autopsy' technique to determine the probable causes of death particularly those that were not attended to by trained medical personnel. (Adeyemi *et al.*, 2008).

Under-five mortality and infant mortality rates are leading indicators of the level of child health and overall development of a nation. They are also Millennium Development Goal indicators (WHO, 2011). Millennium Development Goal 4 (MDG 4) aims, to reduce by two-thirds the mortality rate among children under-five by 2015. According to the new estimates generated by the Inter-agency Group for Child Mortality Estimation (IGME), overall, substantial progress has been made towards the achievement of MDG 4. In 2008, 10,000 fewer children under age five died every day than in 1990, the baseline year for the MDGs (Brunner, 2009). Moreover, the rate of decline in under-five mortality increased for the period 2000 to 2008 compared with the 1990s (the average annual rate of decline for 2000-2008 was 2.3% compared with 1.4% for 1990-

2000). However, the rate of decline in under-five mortality is still grossly insufficient to achieve the MDG goal by 2015, particularly in sub-Saharan Africa and South Asia; although childhood mortality rates have been slightly decreasing in many developing countries over the last decades. It is alarming that among the 67 countries with high mortality rates (40 per 1,000 livebirths or more) only ten are on track to meet MDG4 of which Nigeria is not included (UNICEF, 2009).

High-risk births, such as among women who have too many births (five or more) or births too closely spaced (less than 24 months apart), are associated with increased infant and childhood mortality. Malnutrition is another major factor influencing child mortality. Good nutrition is necessary to achieve a healthy and active life, optimize education performance and enhance productivity. It has been reported that early childhood malnutrition can be fundamentally attributed to poverty and lack of economic resources (Ajao *et al*., 2010).

According to the NDHS (2008), almost one-quarter of all Nigerian children are underweight. Inadequate feeding and repeated illness are the immediate causes of the problem, which can be exacerbated by some combination of large family size, household food insecurity and the consequent inability of families to take care of their young adequately. Matthias *et al*. (2012) highlighted other factors that affect under-five mortality to include delay presentation, educational status of parents, immunization status and mother's age among others.

The World Health Organization (WHO) has also established that over half of all child deaths annually are caused by five preventable conditions: diarrhoea, acute respiratory infections, measles, malaria, and perinatal conditions. Malnutrition can severely aggravate these conditions; however it is not a leading cause of child mortality itself. These deaths occur mainly in the developing world. About 29,000 children under the age of five die worldwide on daily basis, that means 21 children die each minute of the day on average mainly from preventable causes (UNESCAP, 2006).

Asia and Africa bear a disproportionate burden of mortality in under-fives: some 40 per cent of the world's under-five deaths occur collectively in India, Nigeria and the Democratic Republic of Congo. In South Africa, the child mortality rate has gone up, mostly because of the high number of mothers living with HIV. (Chris, 2009). Two-thirds of all under-fives deaths occur in just 10

countries. Some of the deaths occur from illnesses like measles, malaria or tetanus and others result indirectly from marginalization, conflict and HIV/AIDS. Malnutrition and lack of safe water and sanitation contribute to half of all these children's deaths (Niles, 2009).

It has been shown that most of these lives lost at the early stage of life can be saved by expanding low-cost prevention and treatment measures. These include exclusive breastfeeding of infants, use of antibiotics for acute respiratory infection, oral rehydration for diarrhea, the use of insecticide-treated mosquito nets and appropriate and effective drugs for malaria as well as immunization. In addition, proper nutrition which prevents malnutrition – a contributory factor for increase mortality is important. Also, better care for mothers and babies before and after birth which stand to address the challenge of one-third of these deaths that occur in the first five years of life cannot be overemphasized (UNICEF, 2009).

With special reference to Nigeria, most studies suggest that child mortality levels continue to be high and exhibit wide geographic disparities (UNICEF, 2009). The 2008 Nigeria Demographic and Health Survey (NDHS, 2008) data also showed that there are regional variations in infant and child mortality in Nigeria. According to NDHS 2008, under-five mortality ranges from 89 deaths per 1000 births in South West to 222 deaths per 1000 births in North East. The South West zone which Ibadan is part of has the lowest rates for all under-five childhood mortality estimates compared with the other zones. Infant mortality is lowest in South West (59 deaths per 1000 births) and highest in North East (109 deaths per 1000 births) (NDHS, 2008).

The disparity in availability of health services in Nigeria has been linked to the historical difference between the north and the south in access to Western missionaries – the pioneers of modern health services provision in Nigeria. Although various actions have been taken to ameliorate the historical disparity in access to modern health services, it seems the gap has not been completely eliminated. The 2009 Multiple Indicator Cluster Survey in Nigeria found that about 48.5% of children aged 12-23 months had received no immunisation in Northwest and 33.3% in the Northeast. The proportion of such children was about 12.9% in the Southwest and 10% in the South-eastern regions. According to the 2008 NDHS, 67.1% of the children born in the Northwest and 51.2% of the children born in the Northeast were to mothers who received no antenatal care, compared to 7.4% in the Southeast and 5.7% in the Southwest (NDHS, 2008).

Under-five children mortality rate varies by age categories. These are rates which vary in different countries and in different parts of the same country, but the leading cause of the various categories of under-five children mortality remain largely unchanged in many parts of the developing world. These rates are high in developing countries including Nigeria (NDHS, 2008). However, data obtained from the NDHS were community survey which may have problem of recall and inaccurate diagnosis of causes of death. Deaths occurring in the health facilities which are expected to be accurate were not included in the calculation of death rates among under-five children in the survey.

This study is aimed at providing information on death rates, factors influencing mortality and trend in causes of death among under-5 children admitted in paediatric wards of three selected secondary health facilities in Ibadan, Nigeria, a major city in sub-Saharan African. How these compare to the mortality patterns of other parts of Nigeria and other countries is also discussed.

## 1.1 STATEMENT OF PROBLEM

In 2008, 8.8 million children born alive across the world died before their fifth birthday. Most of these children lived in developing countries and died from a disease or a combination of diseases that could easily have been prevented or treated. Undernutrition contributes to over a third of these deaths (UNICEF, 2009).

Global under-five deaths over the last four decades have fallen from 20.4 million to 10.9 million annually. During this time deaths in sub-Saharan Africa almost doubled from 2.3 million to 4.5 million annually. The region's perilous situation is aggravated by the increasing number of under-five deaths due to HIV/AIDS and low immunization coverage as a result of weak health care systems. Despite a steady decline during this century, Nigeria still has one of the highest infant mortality rates among developing nations. (Uthman, 2008).

According to the report of the NDHS, 2008, an examination of mortality levels across three successive five-year periods shows that under-five mortality decreased from 199 deaths per 1,000 births during the middle to late 1990s (1993-1998) to 157 deaths per 1,000 births in the middle part of this decade (2003-2008). This translates to about one in every six children born in Nigeria dying before their fifth birthday.

According to the 2009 State of the World's Children report by the UNICEF, Nigeria ranked 9th out of 193 countries in under- five mortality rate (U5MR) with a record of about 1,077,000 under-5 children dying every year. Figures from the Federal Ministry of Health (FMOH) in 2008 showed that about 2,300 under-five children die every day in Nigeria (Ahamba, 2011).

## 1.2 JUSTIFICATION FOR THE STUDY

Due to enormous health problems in under-five children, periodic review of mortality could show new trends and may provide information for the planning and evaluation of country's health care delivery services. Ideally, national registration of deaths should provide this data, but such are not readily available in Nigeria, this hospital review of death is thus a viable option.

Child mortality reflects a country's level of socio-economic development and quality of life. In developing countries, mortality rates are not only influenced by socio-economic, demographic and health variables but they also vary considerably across regions and districts. Survey of this nature will provide local information on mortality among under-five children in Ibadan.

Hospital admission data can be a valuable proxy source of information to assessing the epidemiology of diseases within populations. Substantial insight can be obtained into the types of diseases, the age at which conditions present and their burden on in-patient service unlike the NDHS data which is based on recall and inadequate or incorrect diagnosis of causes of death.

There are few reports on childhood mortality from secondary health institutions as majority of the health statistics on pattern of childhood morbidity and mortality in Nigeria are derived from data obtained from the nation's teaching hospitals. Data from tertiary health institutions only may not depict the true childhood mortality patterns for the nation. Secondary health facilities also contribute significantly to the provision of health care of the populace. Therefore, data from secondary health institutions are required to give a balanced picture of childhood mortality pattern in Nigeria. (Onyiriuka, 2005).

## 1.3 OBJECTIVES OF THE STUDY

### 1.3.1 Broad Objective

To determine the mortality pattern and its influencing factors among under-five children admitted in selected state and mission hospitals in Ibadan, between January 2005 and December 2009.

### 1.3.2 Specific Objectives

To determine the trend and pattern of mortality among under-5 children between January 2005 and December 2009 in selected secondary health facilities.

- To determine the factors influencing mortality in under-five children admitted in these selected health facilities.
- To identify causes of mortality among under-five children admitted into the selected health facilities.
- To determine the mortality rate among under-five children admitted in selected health facilities.
- To describe the trend of mortality among under-five children between January 2005 and December 2009 in the selected hospitals.

## 1.4 OPERATIONAL DEFINITION

### 1.4.1 Under-five Mortality Rate

The under-five mortality rate (U5MR) is considered as the probability (expressed as a rate per 1000 admissions) of a child born in a specified year dying before reaching the age of five years. Under-five children were grouped into the following:

- Neonates: These are children below the age of 1 month, precisely within 1 – 28 days.
- Post neonates: These are children within the age of 29 days and 11 months, 29days.
- Child: These are children between the age of 12 months and 59 months, 29days.

The mortality rates of under-five children were grouped in this study to neonatal, post neonatal and child mortality rates and they were expressed per 1000 hospital admissions.

### 1.4.2 Neonatal Mortality

This is defined as the probability of dying within the first 28days of life

### 1.4.3 Post neonatal Mortality

This is the mortality occurring between the 28th day of life and 11th month.

### 1.4.4 Child Mortality

This includes death occurring between the 12th month and 59th month of life.

### 1.4.5 Co-morbidity

Co-morbidity refers to the presence of one or more significant diseases in addition to a major disease e.g. malaria parasitemia and gastroenteritis or measles and bronchopneumonia.

### 1.4.6 Area of town

The area of town (Ibadan) where children who were presented in the selected came from was categorized into highly congested and less congested areas.

Highly congested area: This area is overcrowded with several houses lacking toilet facilities and proper drainage system. It is also characterized by limited amenities and many public health problems.

Less congested area: This area is characterized by modern low-density residential estates and mostly occupied by professionals and other high to middle-income groups.

### 1.4.7 Parent's occupation

Parent's occupation was categorized into unskilled, semi-skilled, skilled and professionals (Ginsberg, 2008).

- **Skilled**: Someone who knows how to make things skillfully by hand. For example tailor, mechanic and electrician.
- **Unskilled**: This is an individual who require no special training for a job. Unskilled occupations are the least complex types of work. Jobs are unskilled when persons can usually learn to do them in 30 days or less e.g. hospital cleaner, restaurant dish washer and clerk.
- **Semi skilled**: A profession or activity that requires skill and training, or experience or specialized knowledge. For example driving
- **Professional**: A worker in a paid occupation that requires extensive education or specialized training**.** For example, doctor, engineer, nurse, teachers and architects.

### 1.4.8 Global Burden of Diseases (GBD) Categories

This shows different categories of causes of morbidity and mortality in children. It is largely classified into communicable (infectious and parasitic diseases, respiratory infections, condition arising during perinatal period and nutritional deficiency) and non-communicable diseases (congenital anomalies and other) (Nte *et al*., 2006)

# CHAPTER 2

## 2.0 LITERATURE REVIEW

### 2.1 Under-Five Mortality

There has been increasing interest in measuring under-five mortality as a health indicator and as a critical measure of human development. Neonatal and infant mortality are part of under-five mortality. Neonatal mortality rate is a major determinant of infant and by extension, childhood mortality. It is an index of the quality of the antenatal, obstetric and neonatal care available in a community (Ogunlesi *et al.*, 2006) and achievement in reducing the infant mortality rate can be regarded as the key factor that has contributed to the reduction in the child mortality rate (UNESCAP, 2006).

### 2.2 Global State of Under-Five Mortality Rate

Since 1990, the average global under-5 mortality rate has declined by 28% from 90 deaths per 1000 livebirths to 65 in 2008. The total number of under-five deaths in the world has declined from 12.5 million in 1990 to 8.8 million in 2008. The highest rates of mortality in children under five years continue to occur in sub-Saharan Africa (You *et al.*, 2009). In 2008, one in seven children (144 per 1000 livebirths) died before their fifth birthday; the highest levels were in Western and Central Africa where one out of six children die before age five years (169 per 1000 livebirths). Among the 34 countries with under-5 mortality rates exceeding 100 per 1000 livebirths in 2008, all are in sub-Saharan Africa, except for Afghanistan. Although under-five mortality has declined by 22% since 1990, the rate of improvement in child survival in sub-Saharan Africa is insufficient to achieve MDG 4. Furthermore, high levels of fertility in sub-Saharan Africa, combined with the high levels of under-five mortality, have resulted in an increase in the absolute number of under-five deaths (from 4.0 million in 1990 to 4.4 million in 2008). Sub-Saharan Africa now accounts for half of the 8.8 million under-5 deaths worldwide in 2008 (You *et al.*, 2009).

Over 60 countries have achieved the targeted one-third reduction, but the sub-Saharan region's situation is aggravated by the increasing number of under-five deaths resulting from preventable diseases such as malaria and measles, unfavourable cultural beliefs and weak health care

systems. Although the global average U5MR has declined, a significant challenge remains in sub-Saharan Africa, where U5MR is 129 per 1000 livebirths. Malnutrition is associated with half of all under-five deaths and a reduction of this is central to decreasing under-five mortality (UNICEF, 2010). Under-5 mortality is increasingly concentrated: 75% of the world's under-five deaths in 2008 occurred in only 18 countries. Half of the deaths occurred in only five countries: India, Nigeria, Democratic Republic of Congo, Pakistan, and China (Brunner, 2009). Report had it that India and Nigeria together account for nearly one-third of the total number of under-five deaths worldwide (21% and 12%, respectively). Africa and Asia combined represent 93% of all under-five deaths (51% and 42%, respectively) (Brunner, 2009).

Progress has actually been made as each year the number of children under-five dying is slowly reducing. However as UNICEF cautioned in their State of the World's Children 2008 report that progress has been unevenly distributed. Good progress was made by a few nations with large populations, but many countries made 'no progress or insufficient progress' Moreover, UNICEF noted in 2010 report that the risk to child rights from the current economic crises and other external challenges cannot be underestimated (Anup, 2010).

The greatest progress has been made in the Latin America/Caribbean and Central and Eastern Europe and Commonwealth of Independent States regions, which have achieved greater than 50% reduction in under-5 mortality between 1990 and 2008 (56% and 55%, respectively. Additionally, Niger, Malawi, Mozambique, and Ethiopia achieved absolute reductions of more than a 100 per 1000 livebirths since 1990. These countries are providing proof of concept that MDG 4 is achievable, even in the poorest environments (You *et al.*, 2009).

Recent studies have suggested that the burden of childhood death has only changed minimally in the last two decades in most parts of the developing world, especially as a result of persistently high neonatal mortality rates (Fatuga *et al.*, 2007). Of all world continents, infant mortality is highest in Africa particularly in its sub-Saharan region. This may be declining, but the rate remains unacceptably high when on shoulders with other regions of the world (Adeyemi *et al.*, 2008). However, in some developing countries such as Cuba, Sri Lanka, Syria, remarkable decline in infant mortality rate has been reported due to improved neonatal care (Ogunlesi *et al.*, 2006).

## 2.3 Uses of under-five mortality rates

The under-five mortality rate often known by its acronym U5MR or as the simply child mortality rate has several advantages as a barometer of child well-being in general and child health in particular. First, it measures an 'outcome' of the development process rather than an 'input' such as per capital calories availability or the number of doctors per 1000 population - all of which are means to an end. Secondly, the U5MR is known to be the result of a wide variety of inputs: the nutritional status and the health knowledge of mothers; the level of immunisation and oral rehydration therapy; the availability of maternal and child health services; income and food availability in the family; the availability of safe drinking water and basic sanitation and the overall safety of the child's environment among other factors (Anup, 2010).

Frequent determination of the factors associated with neonatal mortality is desirable for effective planning of interventions aimed at reducing neonatal mortality rates (Ogunlesi *et al.*, 2006). Infant and child mortality rates are basic indicators of a country's socio-economic situation and quality of life. The rates are important for identifying population groups at risk; planning, monitoring, and evaluating population and health programmes and policies; and monitoring progress towards the Millennium Development Goal to reduce child mortality by two-thirds by the year 2015 (UNDP, 2007). As mortality in general declines, it concentrates at the two extremes of life; the first year of life is a time of great vulnerability, with infancy remaining the most perilous period of childhood in terms of mortality risk. Factors such as ethnicity, socio-economic circumstances, the environment, parental behaviour and sub-standard health care are potential risk factors for infant death (Fitzpatrick, 2001).

Mortality rates provide a common measure that facilitates comparison of programs. For example, under-five mortality rates allow us to compare the effect of a measles vaccination program with the effect of a program for treating diarrhea. Secondly, reductions in mortality often reflect reductions in the duration or severity of illnesses. For example, a program that treats or prevents malaria may lower mortality by reducing the incidence, prevalence, or severity of malaria. It is difficult to produce a simple measure of morbidity that incorporates both prevalence and severity. However, if mortality due to infectious diseases can be reduced through a program, it is likely that morbidity also declines. (WHO Press Release, 2000). Furthermore, Schultink, (2002) in his study titled "Use of Under-Five Mortality Rate As an Indicator for Vitamin A Deficiency (VAD) in a Population" explains that a country with a U5MR >50 likely has VAD problem that

requires immediate or continuing action, in other words the U5MR, when using a cut off point of 50, relates well to the existence of a VAD problem in regions of the world where problems of malnutrition are most prominent (Schultink, 2002).

### 2.4 Implications of under-five mortality rates to achievement of MDGs

Africa already had very high child mortality levels when the MDGs were established, rendering a two-thirds reduction less likely. In 1990, on average, the under-five mortality rate of Africa was around 154 per 1000. That would mean reducing it to 51 per 1000 by 2015 in order to reach the goal. By 2005, the under-five mortality rate on the continent had reached 137 per 1000, a decrease of only 9.3 per cent instead of the 40 per cent required to be on track. Nigeria's population was 18.4 percent of the total of sub-Saharan Africa, but the country contributed 21.5 percent to the region's under-five deaths, thereby making her an important determinant of the status of the MDG4 (Nte *et al.*, 2006). The United Nations Report on MDGs in 2005 noted that "just five diseases – pneumonia, diarrhea, malaria, measles and HIV/AIDS – account for half of all deaths in children under age five years. Lack of basic health services and continuing conflict are the main reasons for the shortfall and the very slow average progress in reduction of under-five mortality rate (Andrey, 2008).

Furthermore, progress within countries does not always mean progress for everyone. In many cases, the better-off are making progress towards the goals while the poor are being left behind. This disparity is most notable for under-five mortality (UN 2007). In other words, it is much more difficult for a wealthy minority to affect nation's U5MR and it therefore presents a more accurate picture of the health status of the majority of children and the society as a whole (Anup, 2010). In Nigeria for example, there is a big disparity between rich and poor people in access to healthcare as with all area of live, with higher and increasing mortality rate amongst the poor people. It is therefore necessary for the governments to focus on the barriers that stop the poorest children, i.e. children from low economic class from getting access to the health care and nutrition that will improve their chances of survival (Save-the-Children, 2011).

In every country however, it is important to measure the mortality effect of various types of interventions. When we know that a specific type of program can reduce mortality, we can reasonably assume that any similar program that reaches a substantial proportion of the population with quality services probably reduces mortality. (WHO Press Release, 2000). In a

study carried out by Tanja and Kunst (2009) in Erasmus MC University Medical Center Rotterdam, Netherlands, childhood mortality was systematically and considerably higher among lower socio-economic groups within countries. Also most proximate mortality determinants, including malnutrition, exposure to infections, maternal characteristics and health care use show worse levels among more deprived groups. The magnitude of inequality varies between countries and over time, suggesting its amenability to intervention. Reducing inequalities in childhood mortality would substantially contribute to improving population health and reaching the Millennium Development Goals (Tanja *et al*., 2009).

### 2.5 Causes of under-five mortality

Estimates of under-five deaths by cause are important for targeting interventions to reduce child mortality and to monitor progress. In Africa, the total of under-five deaths is relatively well known, but the proportion related to each cause is much more uncertain. There are several reasons for this. Firstly, vital registration systems that provide cause-of-death data in industrialized countries do not exist in most developing countries. Secondly, children often die from multiple causes, and deciding which of them the primary cause is can be difficult. In addition, malnutrition is associated with half of all deaths. Thirdly, small-scale studies must be used to estimate the cause for the majority of under-five deaths (WHO Press Release, 2000).

Patterns of under-five mortality are heterogeneous among different regions in the world and within countries. Data on global causes of child death have been published. They show that 90% of deaths occur in 42 countries; diarrhoea, pneumonia and neonatal disorders explain about 74% of these deaths. This information has been built mostly on the basis of study data or National Demographic and Health Survey (NDHS) information, particularly for low-income countries, where vital registration systems are incomplete and/or unreliable (Huicho *et al.*, 2006).

Infant and child mortality are caused by different factors. In less developed nations, the causes include diarrhea, acute respiratory infections, infectious diseases and malnutrition. In contrast, the leading causes of under-five deaths in industrialized nations are birth defects, Sudden Infant Death Syndrome (SIDS), preterm birth/low birth weight and complications during pregnancy. HIV/AIDS is also a contributory factor (WHOSIS, 2008).

According to the World Health Organization (WHO), poor neonatal conditions are the most prominent causes of young deaths. Each year approximately four million newborns die, most from preventable causes. Deaths in the neonatal period (the first 28 days of life) account for 41 percent of all deaths in children under the age of five years. Most neonatal deaths happen during the first seven days after birth, known as the early neonatal period. (A & T Technical Brief, 2010). Neonatal mortality rates have been alarmingly high in most parts of the developing world where the leading causes include prematurity, perinatal asphyxia, severe neonatal jaundice and neonatal infection especially septiceamia and tetanus. Interestingly, the role of these disorders in neonatal mortality has hardly changed over several decades in Nigeria. In some other parts of the developing world, improved neonatal mortality has reportedly resulted in remarkable decline in under-five mortality rates (Ogunlesi *et al*., 2006).

In a study carried out by Morris *et al.* (2003), a systematic review was undertaken of all studies published since 1980 reporting under-5 mortality by cause. Causes of death were standardized across studies, and information was collected on the characteristics of each study and its population. Proportional mortality outcomes were significantly associated with region, mortality level, and exposure to malaria; coverage of measles vaccination, safe delivery care, and safe water; study year, age of children under surveillance, and method used to establish definitive cause of death. In sub-Saharan Africa and in South Asia, the predicted distribution of deaths by cause respectively was: pneumonia (23% and 23%), malaria (24% and <1%), diarrhoea (22% and 23%), measles (2% and 1%), 'neonatal and others' (29% and 52%) (Morris *et al*, 2003).

### 2.5.1 Malaria

Globally, millions of deaths attributable to malaria are still being recorded. Malaria remains a major public health problem in most countries of the tropics with high morbidity and mortality. The toll of the disease is highest on the under-fives (Ibe *et al.*, 2005). In endemic areas, severe *Plasmodium falciparum* malaria is primarily a disease of young children. Children under five years of age are the focus of most strategies for control of the disease in endemic areas of Africa (Abdullah *et al.*, 2007). New data reveal a continued drop in the rate of deaths of children below age five, attributed to greater access to mosquitos' bednets and vaccinations. Yet three countries

– India, Nigeria and the Democratic Republic of Congo continue to be responsible for 40% of all deaths (Niles, 2009).

Malaria constitutes a huge epidemiological burden in Africa and continues to cripple the economic development in the region. In a study carried out by Abdullah *et al.*, (2007) in some African countries, he found that in all sites a substantial proportion of deaths (ranging from 20.1% in a Mozambican site to 46.2% in a site in Burkina Faso) were attributed to malaria. The overall age patterns of malaria mortality were similar in the different sites. He also emphasized that age- and season- dependence of malaria mortality is an important prerequisite for epidemiologic models of malaria immunity. Malaria is one of the most common causes of illness and death among children in sub-Saharan Africa. The Roll Back Malaria (RBM) partnership proposes to reduce by 75% the 2005 malaria burden by 2015. However, establishing the role of malaria in causing disease or death is not straightforward. Many of the effects of malaria on childhood health and survival are indirect. Severe malaria can be clinically indistinguishable from other common illnesses including pneumonia, meningitis, and sepsis (Gwer *et al.*, 2007).

In Nigeria, malaria is believed to be responsible for 60% outpatient visit to health facilities, 30% childhood death, 25% in children under-one year. The money loss due to malaria annually is estimated to be about 132 billion naira of treatment cost, prevention, loss of man hour etc; yet, it is a treatable and completely evitable disease (Ibe *et al*., 2005). A study carried out in a hospital by Kazembe *et al.* (2006) in Malawi confirms that the rate of malaria hospitalization and in-hospital mortality decrease with age. Case fatality rate was associated with distance to the health facility, age, wet season and increase if the patient was referred to the hospital. In sub-Saharan Africa including Nigeria, where the disease remains a major public health problem, children's caregivers and community drug providers (patent medicine sellers, market stall drug sellers, drug hawkers, village health workers and retail pharmacists) are actively involved in treating childhood malaria at home and take affected children to health-care facilities only if they fail to improve or have severe disease from the onset (Ajayi *et al.*, 2009).

According to the World Health Organization (WHO) 2010 World Malaria Report, the estimated number of global malaria deaths has fallen from about 985,000 in 2000 to about 781,000 in 2009. In the last five years in Africa, substantial reductions in mortality among children under five have been recorded together with improvements in coverage with malaria interventions. From the seven President's Malaria Initiative (PMI) focus countries where baseline and follow

up health surveys have been conducted, mortality due to malaria among children under five has dropped by thirty six percent. In Senegal alone, malaria cases have declined by 41 percent - from about 300,000 to around 175,000 in one year. Child mortality decreased by 30 percent between 2005 and 2009, which malaria experts believe is largely because of the drop in malaria deaths (Quam, 2011). Studies have shown that the prompt and appropriate treatment of suspected cases of childhood malaria close to the home can remarkably reduce malaria morbidity and mortality moreover, proper health education needs to be set up to enlighten the populace on mode of home treatment for malaria in order to reduce the disease burden on families (Ajayi *et al.*, 2009).

### 2.5.2 Diarrhoea

Diarrheal diseases continue to be an important cause of morbidity and mortality worldwide, and despite all advances in health technology, improved management, and increased use of oral rehydration therapy (ORT) in the past decades, they remain among the five major killers of children under five years of age (Boschi-Pinto *et al.*, 2006). In Nigeria, diarrhea is the cause of 194,000 deaths of children under five every year, which is the second highest in the world, after India (Ahmed, 2011).

Omokhodion *et al.*, (1998) in their study carried out in Ibadan titled: Diarrhoea in children of Nigerian market women: prevalence, knowledge of causes, and management, disclosed that a large proportion of lower socioeconomic status women in Nigeria are petty traders, with many selling their products in markets with poor environmental conditions. Therefore, the children who often accompany their mothers to the market are constantly exposed to health hazards, especially contaminated food and water. Child diarrhea is an important cause of morbidity and mortality in the south western region of Nigeria. Studies have also found dirty feeding bottles and utensils, inadequate disposal of household refuse and poor storage of drinking water to be significantly related to the high incidence of diarrhea (Omokhodion *et al.*, 1998).

A statement made available to newsmen in Bauchi by the UNICEF indicated that hand washing, especially among children, would help reduce the incidence of diarrhea. It stressed the need to

always wash hands with soap or ash and water at critical moments particularly after using the toilet and before handling food (Ahmed, 2011).

### 2.5.3 Measles

Measles is one of the most contagious diseases known. Almost all non-immune children contract this respiratory disease if exposed to the virus. It is an acute illness caused by a virus in the paramyxovirus family. Measles virus normally grows in the cells that line the back of the throat and in the cells that line the lungs. It is a human disease not known to occur in animals.

The clinical patterns of measles in the developing country including Nigeria are contrasted with those in the economically developed countries of Europe and North America. The areas of difference lie in the epidemiology, the age incidence, and particularly in the severity of the disease as manifested by the phenomenal morbidity and mortality rates in Nigeria. Malnutrition, aided and abetted by a number of "iatrogenic" complications, is the most important single factor which determines the outcome of the disease (Adesipe, 2011).

According to the World Health Organisation, measles remains a leading cause of death among young children, despite the availability of a safe and effective vaccine for the past 40 years. While measles is now rare in many industrialized countries, it remains a common illness in many developing countries like Nigeria. More than 20 million people are affected each year by measles. In 2006, it was estimated that there were 242 000 measles deaths globally: this translates to about 663 deaths every day or 27 deaths every hour. The overwhelming majority more than 95% of measles deaths occur in countries with per capita Gross National Income of less than US$ 1000 and weak health infrastructure. The primary reason for continuing high childhood measles morbidity and mortality is the failure to deliver at least one dose of measles vaccine to all infants. In countries where measles has been largely eliminated, cases imported from other countries remain (Akoh, 2011).

Measles is often an unpleasant mild or moderately severe illness. Severe measles is particularly likely in poorly nourished young children, especially those who do not receive sufficient vitamin A, or whose immune systems have been weakened by HIV/AIDS or other diseases. The most serious complications include blindness, encephalitis - a dangerous infection of the brain causing inflammation, severe diarrhoea possibly leading to dehydration, ear infections and severe

respiratory infections such as pneumonia, which is the most common cause of death associated with measles (Akoh, 2011).

### 2.5.4 Anaemia

This is usually a symptom of several disorder of disease, but may also be a major cause of death. Anaemia is a pathologic deficiency in oxygen-carrying haemoglobin in red blood cells. It is one of the micronutrient deficiencies that affect both developed and developing nations under-five children. Anaemia results when the haemoglobin level is significantly depressed to result in a haemoglobin or haematocrit below the 90% or 95% of the range of a healthy reference sample of the same age and sex. Anaemia is the best known manifestation of iron deficiency. It retards physical and cognitive development, and affects about two billion people worldwide. Iron deficiency affects children under five years of age more than any other group. This is because iron stores are exhausted between 4 months and 6 months after which the child needs iron supplementation in the diet. During the period from birth to two years, the growth rate is high, and so is the need for nutrients (Brabin *et al.*, 2001).

In a hospital based study carried out by Brabin *et al*. (2001) in Malawi to review the contribution of iron-deficiency anemia to child mortality and to estimate the magnitude of that effect. They found that for children aged 0–5 years, the percentage of deaths due to anemia was comparable to reports from highly malarious areas in Africa (Sierra Leone 11.2%, Zaire 12.2%, Kenya 14.3%). Anaemia has been recognised as being associated with protein-energy malnutrition since the earliest classified descriptions, but the pathogenesis of anaemia is complex and involves several variables. Over half of the children in developing countries suffer from anemia, with malaria and iron deficiency being the major etiological factors. In some parts of Africa where malaria infection is sustained throughout the year, severe anemia is responsible for more deaths than cerebral malaria. Evidence from a number of studies suggests that mortality due to malarial severe anemia is greater than that due to iron-deficiency anemia (Brabin *et al*., 2001).

Although the detailed aetiologies of anaemia were not examined in this study, the dominance of severe anaemia as a cause of death in children under five is difficult to explain.

### 2.5.5 Pneumonia

Pneumonia is a deadly disease, especially for children in developing countries. It is a severe infection that affects lungs and makes it difficult for the lungs to absorb oxygen. Worldwide, nearly 1.6 million children under the age of five years die of pneumonia annually; 98% of these children live in developing countries. According to 2008 estimates, about 177,000 children under the age of five died of pneumonia in Nigeria. This number is highest in Africa and second highest overall in the world. There are an estimated 56 million episodes of lung infections among Nigerian children every year. Although, not all episodes will lead to death, these infections nevertheless cause suffering and require treatment. Pneumonia is an economic burden for families and communities, contributing to the cycle of poverty (Pneumonia Fact, 2010).

One in five of childhood deaths in developing countries have been ascribed to acute respiratory tract infections (ARI) and 90% of these deaths are due to pneumonia. The WHO-ARI control program has helped decrease this figure in the countries where implemented. The thrust of the program centers on efficient screening of children with high risk of death and referring them to hospital (Narayanan, 2006).

The incidence and severity of pneumonia increases in people with symptomatic HIV infection i.e. people who are already displaying the symptoms of HIV. The reason for this, as put by a health practitioner is that pneumonia may be caused by opportunistic or uncommon organisms. Speaking on the causes and symptoms that suggest pneumonia in children, the health practitioner said bacteria, viruses, fungal, non-fungal, non-bacteria, mycobacterium are culprits of pneumonia. According to him, if the pneumonia is caused by bacteria, it will be preceded by postular rashes on the child's body. This postular rashes, he said may be the forerunner of *Staphylococcus aureus* pneumonia. However, if the pneumonia is caused by virus, it is usually preceded by nasal discharge or non-postular body rashes e.g. measles. Generally, the symptoms of pneumonia include: fever, chills, chest pain, headache, irritability, vomiting, diarrhoea, poor appetite or refusal of food (Shiloh, 2008).

A pneumococcal conjugate vaccine has already been introduced in Rwanda, Gambia, and South Africa. The Nigerian government is striving to include HiB and pneumococcal vaccines into the national immunization program with GAVI's support. Other preventive strategies include: vaccination against measles and pertussis (i.e. whooping cough), zinc supplementation, HIV

prevention, and antibiotic prophylaxis for people with or exposed to HIV. In Nigeria, only an estimated 1 of every 5 children with pneumonia receives appropriate antibiotics (Shiloh, 2008).

### 2.5.6 Malnutrition

The provision of adequate nutrition during infancy and early childhood is a basic requirement for the development and promotion of optimum growth, health and behaviour of the child. Malnutrition is recognised as a global problem, which, beside weakening the immune system and worsening of illnesses, is the underlying cause of half of the deaths of children below five years of age (Adesipe, 2011). The reasons why children relapse or die are not well understood. Morbidity and inadequate feeding are likely causes, especially if parents and caregivers have not been given specific guidance or medical care is inaccessible (Khanum, Ashworth and Huttly, 1998).

The term malnutrition often implies one particular nutritional deficiency: protein-energy malnutrition (PEM), which results from inadequate consumption of calories or protein. However, deficiencies of numerous vitamins and other nutrients can be equally serious. It is often difficult to determine which the major cause of malnutrition is: inadequate consumption of specific nutrients (e.g., protein, vitamin A, or iron) or consumption of inadequate quantities of food (usually measured in calories) (NAS, 2010).

Protein-energy malnutrition is still highly prevalent in Nigeria due to faulty weaning practices, poverty, poor sanitary conditions, minimal medical attention, and endemic childhood infections. Insufficient food intake affects the child principally as a result of one of these causes: 1) the child is offered little food and is unable to get more by him/herself; (for example, restricted intake of protein during illness or prolonged exclusive breast feeding); 2) the child is offered ample foods but the quantity is of inadequate quality for his/her needs, resulting in low protein and/or energy density; 3) improper feeding practices such as non-hygienic preparation of over-diluted formula or starch gruels, which give rise to early-age severe protein-energy malnutrition. Studies in Nigeria found that protein-energy malnutrition was the second cause of death in children less than six years (Nnakwe, 1999). Moreover, Vitamin A deficiency (VAD) continues to be an important problem in many countries in the developing world. VAD influences the health, nutrition and survival of young children. The available data indicate that all countries with an under five mortality rate higher than 40 have VAD problem (Schultink, 2002).

The high levels of undernutrition in children and women in South Asia and sub-Saharan Africa pose a major challenge for child survival and development. Progress is made when provision of basic services is combined with support for initiatives that inform and empower communities and families (particularly women) to ensure adequate nutrient intake and prevent infectious disease. Malnutrition is associated with about half of all child deaths worldwide. Malnourished children have lowered resistance to infection; they are more likely to die from common childhood ailments like diarrhoeal diseases and respiratory infections; and for those who survive, frequent illness saps their nutritional status, locking them into a vicious cycle of recurring sickness, faltering growth and diminished learning ability (WHO, 2008).

### 2.5.7 Birth asphyxia

Birth asphyxia (BA) is estimated to account for 23% of the 4 million global neonatal deaths and an additional 1 million stillbirths annually. The burden of asphyxia-related morbidity and mortality is concentrated in low-middle–income countries, where 99% of neonatal deaths occur, and the majority of births occur without medical supervision. Birth asphyxia accounts for 2 million global neonatal deaths and stillbirths annually and occurs largely in developing countries without adequate vital registration systems. Verbal autopsy is a promising tool to determine cause of death in such settings (Shrestha and Darmstadt, 2008).

The lack of a standardized case definition for birth asphyxia, particularly in community-based settings, is a fundamental challenge to being able to understand its global public health impact and identify the risk factors. The World Health Organization (WHO) defines birth asphyxia as "the failure to initiate and sustain breathing at birth" whereas the American Academy of Pediatrics classifies an asphyxiated infant with (1) an umbilical cord arterial pH of <7.0, (2) an Apgar score of 0 to 3 at >5 minutes, (3) neurologic manifestations (seizure, coma, or hypotonia), and (4) multisystem organ dysfunction (cardiovascular, gastrointestinal, hematologic, pulmonary, or renal). Apgar scores and acidosis, however, have low sensitivity and low positive predictive value for neurologic injury and morbidity. Furthermore, laboratory data and monitoring are not feasible in resource-poor regions where the majority of births occur outside of health facilities, without skilled attendants, and many deaths occur before the infant survives long enough to develop neurologic signs and organ system dysfunction. Therefore, community-level definitions of birth asphyxia must use information about an infant's clinical condition surrounding the time of death that can be described by nonmedical caretakers. Establishing

accurate estimates of birth asphyxia in low-middle–income countries is a key priority to guide public health programming (Anne *et al.*, 2008). Estimates of birth asphyxia proportionate mortality vary substantially when using different verbal autopsy definitions and hierarchal approaches to assign cause of death. Neonatal deaths frequently have multi/overlapping causes (Shrestha and Darmstadt, 2008).

### 2.5.8 Neonatal sepsis

Sepsis is a major cause of neonatal mortality in developing countries globally. Early onset sepsis (EOS) is usually associated with peripartum factors, i.e. acquisition of the infectious agent from the mother before or during delivery, while late onset sepsis (LOS) is usually acquired in the newborn nursery, neonatal intensive care unit or the community. There has been a number of studies n the etiology of neonatal sepsis in developing countries review of culture positive for neonatal sepsis in India, Africa and Middle East show that *Klebsiella spp* was the most frequently isolated organism, although *S. aureus*, *E. coli* and *Pseudomonas spp* also occur (Motara *et al.*, 2005).

The incidence of neonatal bacterial sepsis depends on geographic area and may vary from country to country as well as within the same country. In developing countries, neonatal mortality resulting from all causes of neonatal sepsis is about 34 per 1000 live births, occurring mainly in the first week of life, whilst it is 5 per 1000 live births in developed countries. Bacterial organisms causing neonatal sepsis may differ among countries, however, in most developing countries. Gram-negative bacteria remain the major source of infection (Awoniyi *et al.*, 2009).

## 2.6 Co-morbidity

In co-morbidity, there exist more than one disease, for instance, malnutrition is thought to contribute to 53% of under-five mortality in the developing world. The global distribution of malnutrition overlaps with that of malaria. The relationship between malnutrition and malaria is unclear. Under-nutrition is widely believed to be protective for malaria, largely from hospital rather than community-based studies and no single study has convincingly refuted this view (Gwer *et al.*, 2007). In his study carried out in Kenya, Gwer *et al.* (2007) reaffirms that severe malaria is clinically similar to other severe febrile illnesses. However, in endemic areas,

parasitological confirmation of parasitemia is often unavailable or unreliable. False-positive malaria microscopy is common. The most important consequence of treating only for malaria when no parasitemia exists is failure to address other life-threatening conditions. Invasive bacterial infections were detected in up to one third of children with clinical features of severe malaria but with a test results negative for malaria (Gwer *et al*., 2007). Even among genuinely parasitized children, severe illness is not always due to malaria in endemic areas. Gwer *et al.* (2007) also confirmed that there have been several case series of bacteremia or meningitis among children with malaria.

## 2.7 Immunisation

Immunisation preventable childhood diseases are a major cause of the under five mortality in Nigeria (Adeyinka *et al.*, 2009). Immunisation is one of the most effective, safest and efficient public health interventions as it is estimated to save at least 3 million lives from vaccine preventable diseases. The global burden constituted by vaccine preventable diseases is immense.

While global immunisation rates have risen from less than 20 per cent in the 1970s to about 74 per cent in 2002, millions of children must still be reached (UNICEF, 2008). Globally speaking, 2.5 million children die every year from easily preventable infectious diseases. In fact, in the year 2000, measles resulted in 777,000 deaths and 2 million disabilities. It is worthy of note that Latin America/Caribbean as well as other industrialized countries have achieved the 90% coverage against measles and are likely to sustain these levels. However, Middle East and North Africa are improving also quickly but East pacific will need to make significant improvements (Adeyinka *et al*., 2009). Nigeria like many countries in Africa is making efforts to strengthen its health system especially the routine immunisation so as to reduce the burden from vaccine preventable diseases. This is against the backdrop of poor routine immunisation coverage of 13%, this low coverage level is affected by several factors. In Northern Nigeria for example, studies on perception, beliefs and practices towards measles and measles vaccination showed that one out of 500 mothers interviewed believed that measles is prevented by immunisation, 16% believed that it is contagious, 26% believed that it is caused by evil spirit and witchcraft, 25% has never heard of measles immunisation, 27% said that they did not believe immunisation was effective and 4% were not allowed to go for immunisation by their husbands (Adeyinka *et al.*, 2009).

Nigeria's routine immunisation schedule stipulates that infants should be vaccinated with the following vaccines: a dose of Bacillus Calmette-Guerin (BCG) vaccine at birth (or as soon as possible); three doses of Diphtheria, Pertussis and Tetanus (DPT) vaccine at six, 10 and 14 weeks of age; at least three doses of oral Polio vaccine (OPV) - at birth, and at six, 10 and 14 weeks of age; and one dose of Measles vaccine at nine months of age. The country's immunisation programmes have however been characterized by intermittent failures and successes since the initial introduction in 1956.

The proportion of deaths that can be averted by specific interventions such as vaccines was estimated by Boschi-Pinto *et al*. (2010). Rotavirus vaccine, for example, can only avert diarrhoea deaths that are due to Rotavirus; therefore, its estimated effectiveness can only be applied to this 'fraction' of diarrhoea deaths. Similarly, Hib and Pneumococcal vaccines can only avert those pneumonia deaths that are due to Haemophilus influenzae type b (Hib) and Streptococcus pneumoniae, respectively. It has been estimated that universal coverage of available interventions could prevent about two-thirds of childhood deaths. Some recent analyses provided further evidence that increase in coverage of key interventions is associated with reductions in under-five mortality. Consequently, specific effort for improving coverage of these key interventions is a possible means for health programmes to contribute to the achievement of the Millennium Development Goal 4 (Boschi-Pinto *et al.,* 2010).

Immunisation coverage in many parts of Nigeria is far from optimal, and far from equitable. Nigeria accounts for half of the deaths from Measles in Africa, the highest prevalence of circulating wild poliovirus in the world, and the country is among the ten countries in the world with vaccine coverage below 50 percent (Antai and Moradi, 2010). Although report has shown that access to immunization services has improved significantly in Nigeria over the years for instance, the coverage for Measles showed a rise from 25.30% in 2003 to 32.70% in 2006 and 63.55% in 2010. Looking at the zones shows 82.35% coverage in the South East, 74.40% in the South South and 47.15% in the North East as the Lowest (Mogashi, 2011). Widespread disparities in the coverage of immunisation programmes persist between and within rural and urban areas, regions and communities in Nigeria to the disadvantage of children of parents in the lowest socio-economic quintiles, with no education, and residing in rural areas (especially in the north). Therefore, a large number of children still remain unreached in the various districts and regions (Mogashi, 2011) Fully Immunized Child by 1year of age shows a National average of

9.83%.The rich geographical, cultural, ethnic, and socio-economic diversity of Nigeria implies that immunisation uptake varies between and within geographical regions (Antai *et al.*, 2010).

In their study, Sadoh and Eregie (2009) in Benin City Nigeria, reviewed the clinic records of 512 Nigerian children and evaluated them for timeliness in receiving vaccines and the completion rates of the schedule. It was discovered that about 30% of the children presented after four weeks of age for their first immunisation; 18.9-65% of the children were delayed in receiving various vaccines compared to the recommended ages for receiving the vaccines. Only 227 (44.3%) children were fully immunised. (Sadoh and Eregie, 2009) recommended health education and mass mobilisation of the community and health workers as means of encouraging timely receipt of vaccines. Moreover, to achieve maximal protection against vaccine-preventable diseases, a child should receive all immunisations within recommended intervals (Antai *et al.*, 2010).

### 2.8 Determinants of under-five mortality

Determinants of under-five mortality have been evaluated by several researchers. These included proximate factors (such as nonmedical factors and medical care during the antenatal period, care at birth, and preventive and curative care in the postnatal period); maternal factors (age, parity, and birth intervals); and household and community-level factors (water, sanitation and housing). Opinions differ as to the relative importance of socio-economic development and health services in reducing the child mortality rate. Some studies have also confirmed that a substantial decline in child mortality rate is possible without significant improvement in economic development (Claeson *et al.*, 2000). The following are some other determinants of mortality among under-five children:

#### 2.8.1 Treatment seeking behavior

A large proportion of Nigeria's health problems are general and preventable with only 10% of our health problems needing specialized tertiary care. The health seeking behaviour of majority of Nigerians is generally poor with many patients presenting at advanced stages of disease conditions. This Nigerian situation is made even worse by poor economic means and living conditions (Philip-Ephraim, 2010).

In most developing countries, children are often brought to hospitals in the late stages of their illness. Therefore conditions which normally should not be of emergency nature often assume

life threatening dimensions. For this reason, emergency facilities for treating such children who require prompt life-saving measures have become a necessity (Diakparomre and Obi, 1980). Taking malaria as an example, the person who makes treatment decision is also important to the management of an episode of malaria. Studies have shown that most times the caregiver is the mother. There is need to assess the decision made by other caregivers during the management of an episode of diseases such as malaria (Ajayi *et al.*, 2008).

### 2.8.2 Cultural beliefs and delay presentation

Cultural factors also affect infant and child mortality. Society's beliefs about diseases may result in taboos or ritualistic treatments whose therapeutic effects are not supported by modern medicine. According to UNICEF (1990), many child health-care problems are embedded in the cultural beliefs, values, practices and norms of the community. The organisation stated that many parents believe that the death of their infants is caused by external factors such as care givers, relatives, and anger of gods among other factors. Therefore, such beliefs have made the task of reducing under-five mortality very difficult especially in the developing countries like Nigeria. As a result of such beliefs, most parents sometimes find it difficult to accept modern medical care for their infants or they seek treatment late (Umoh *et al.*, 1996).

Knowledge of measles and diarrhea is quite pertinent in an understanding of the role of cultural beliefs in health seeking among the Yoruba. In the traditional Yoruba setting, measles attack is usually attributed to a variety of causes which have no link with the concept of virus. Measles attack is traditionally considered as a punishment for breaking family taboos or as an evil deed from witches or enemies. The belief that the measles attack is caused by enemies is common among family where co-wives are natural suspects. While measles is perceived as deadly disease among Yoruba people, diarrhea is perceived merely as a means of getting rid of body impurities or as a sign of 'teething', 'crawling', or 'stretching'. Also some mothers believe that diarrhea is caused by consumption of sweet things. Mothers with this view will not likely introduce oral rehydration solution to their children since it contains sugar and salt. Despite the fact that the major childhood diseases have been identified and modern technology to combat them developed, yet, children from African countries (Nigeria inclusive) die in large number from the attacks of these diseases. The adduced reason is deeply rooted in people's beliefs and attitudes concerning childcare and behavioural practices into health strategies (Ogunjuyigbe, 2004).

Food restrictions and taboos are yet another cultural practice that contributes to malnutrition in Nigerian children. Nigeria is the 3rd leading country (after India and China) globally in malnutrition. More than 60 per cent of infant deaths have been attributed to malnutrition; with 41% of under-five-year-old children classified as chronically malnourished and some of these are due to food restrictions. For example, young children are not given eggs and some certain meats in some parts of Nigeria due to the belief that such foods will predispose them to stealing. This contributes significantly to protein energy malnutrition in Nigeria (Ahamba, 2011). The Nigerian Health Policy recognizes the need to reduce the current high childhood mortality rates, but people's belief and behavioural practices have not been adequately integrated into the health intervention programmes (Ogunjuyigbe, 2004).

### 2.8.3 Socio-economic status of parents

Child mortality reflects a country's level of socio-economic development and quality of life. In developing countries, mortality rates are not only influenced by socio-economic, demographic and health variables but they also vary considerably across regions and districts (Adebayo and Fahrmeir, 2003).

Recent data (1995-2006) collected via household surveys, such as the UNICEF supported Multiple Indicator Cluster Surveys (MICS) and the USAID-supported Demographic and Health Surveys (DHS) also indicate that under-five mortality is considerably higher among children living in rural areas and for those living in the poorest households. The low nutrient density and high bulk of the weaning foods, early introduction of solid foods, and unhygienic practices predispose under-five children to malnutrition, growth retardation, infection, and high mortality (Uthman, 2008).

Mosley and Chen (1981) viewed morbidity and mortality of children as being influenced by underlying factors of both biological and socio-economic, operating through proximate determinants. These authors also concluded that as a result of the prevailing socio-economic situation in some countries where ignorance, poverty and diseases form a vicious web, many of our children die or suffer severely from diseases which are mainly preventable. In low- and middle-income countries (LMICs), the probability of dying in childhood is strongly related to the socio-economic position of the parents or household in which the child is born (Tanja *et al.*, 2009).

### 2.8.4 Health care system - quality of care and access

Globally, child mortality rates have been halved over the last few decades, a developmental success story. Nearly one-third of the 50 least developed countries, including the Maldives, East Timor, Nepal and Malawi, have reduced child mortality rates by at least 40 percent since 1990. One factor behind the progress in reducing child under-five mortality in the Asia and Pacific region is that many parts of it have improved general health conditions, especially those which are able to prevent the spread of communicable infectious diseases. Particular progress has been made in the prevention of diarrhoea and measles through increased use of oral rehydration therapy and improved coverage of routine vaccination. Estimating the effect of a health intervention becomes more difficult when the program does not reach all children at risk for the disease. For example, a program that reaches children only in the upper socioeconomic groups will probably have less effect on mortality than one that targets malnourished children in impoverished families. As a result of the unequal distribution of risks, there can be large differences in the effectiveness of programs that employ the same medical technologies (NAS, 2010).

Adetunji (1994), examined the effects of some determinants on infant mortality in Nigeria using data from the 1981/82 Nigeria Fertility Survey. He found out that children born in modern health facilities, irrespective of their mothers' place of residence, experienced significantly lower rates of infant mortality than those born elsewhere. Lack of access to quality obstetric and neonatal care as a result of intense economic depression and poor funding of the health sector constitute barriers to the reduction in under-five mortality in many parts of the developing world. Necessities such as essential drugs, stethoscopes, and sphygmomanometers are still scarce in some Nigerian hospitals (Ogunjuyigbe, 2004).

## 2.9 Measuring under-5 mortality rate

Information on profiles for under-five causes of death is important to guide choice of child-survival interventions. At country level, under-five mortality can be measured using a number of different methods, including registration of births and deaths via vital registration systems, national population censuses and/or data collected via household surveys. When vital registration systems are of good quality, the under-five mortality can be easily estimated (IGME, 2009).

In measuring progress towards MDG4, the best performing region is Latin America and the Caribbean. It has reduced under-5 mortality by 56 percent between 1990 and 2008, and is on-track to meet MDG4. The region including central and eastern Europe (CEE) and the Commonwealth of Independent States (CIS: formerly USSR) is also on the right track, with a 55 percent reduction from 1990 to 2008. Africa continues to be the region with the highest under-five mortality rates: 132 deaths per 1,000 live births across the whole continent. In sub-Saharan Africa, the rate is 144 deaths per 1,000 live births. This is 24 times the rate in industrialized countries. Africa has reduced its under-5 mortality rate by 21 percent between 1990 and 2008, but, this is not enough to achieve MDG4. Asia has had better improvements by reducing its own rate by 38 percent. But, this is still insufficient to reach MDG4 (Brunner, 2009).

Age-specific mortality rates usually are calculated from birth and death data derived from civil registration, census, and/or household surveys (WHO, 2011). Civil registration is calculated using the number of deaths by age and numbers of births and children in each age group. This system provides annual data. For census and surveys, an indirect method is used based on response to questions to each woman of reproductive age as to how many children she has ever born and how many are still alive. While for surveys, a direct method is used based on birth history - a series of detailed questions on each child a woman has given birth to during her lifetime (WHO, 2011). Both types of methods can suffer from errors in data. Both methods suffer, probably equally, from the omission of deceased children. For instance, estimation of infant mortality, using direct methods, depends on the correct reporting of age at death as under or over one year. The heaping of deaths at age 12 months is common, and to the extent that it causes a transfer of deaths across the one-year boundary, infant mortality rates may be somewhat underestimated (WHO, 2011). Estimates of indirect methods can suffer if women do not know their ages, as is common in many less-developed countries. The bias that results can be even greater if age is estimated on the basis of characteristics linked directly or indirectly to mortality levels; for example, number of children ever born. Censuses and surveys not specifically designed to gather data for mortality estimation have also been shown to be very prone to suffer from omission of dead children (WHO, 2011). NDHS has chosen to use direct estimation methods.

Using records from health facilities is another reliable way of measuring under-five mortality. Hospital based data on mortality pattern is a reflection of what is obtainable in a community at

large. Therefore, data obtained from such review is usually beneficial in re-evaluating existing services and in improving facilities and patient care (George, 2009). However, to better understand the determinants of health outcomes, it is essential to measure health outcomes as well as inequality in health using reliable data sources (Wang, 2002).

## 2.10 Roles of secondary health-care facilities in the care of under-five children

Health care provision in Nigeria is a concurrent responsibility of the three tiers of government in the country. However, because Nigeria operates a mixed economy, private providers of health care have a visible role to play in health care delivery. The federal government's role is mostly limited to coordinating the affairs of the university teaching hospitals, Federal Medical Centres (tertiary health care) while the state government manages the various general hospitals (secondary health care) and the local government focus on dispensaries (primary health care).

The secondary health care is the level of health care that provides specialized services to patients referred from the primary health care level through out-patient and in-patient services of hospitals for general medical, surgical, pediatric patients and community health services. Secondary health care is available at the district, divisional and zonal levels of the states. Adequate supportive services such as laboratory, diagnostic, blood bank, rehabilitation and physiotherapy are also provided (Wikipedia, 2010).

The data on vital statistics in Nigeria is poor and unreliable as most deaths and births occur outside the formal health system and so go unregistered. In-hospital mortality rates may not be a true reflection of the pattern in the general population; however, it gives insight into the disease burden in the community and may be valuable in evaluating health care system in the country. Mortality patterns are also valuable in routine clinical audit in any health institution. These audits are used for clinical quality assurance and the establishment of clinical practice standards in the health institution. The issue of clinical quality is also very paramount in the minds of health care financiers, policy makers, planners and administrators (Philip-Ephraim *et al.*, 2010).

## 2.11 Seasonal variations in under-five mortality

Several studies have examined seasonal pattern of death under age five for tropical countries of Africa and Asia and have documented that deaths usually peak during raining or post monsoon

(Muhuri, 1996). However most studies have concentrated more on seasonality of malaria infection, for example, Becher *et al*. (2008) present seasonal patterns of malaria and all-cause mortality from a longitudinal study with 60,000 individuals in rural northwestern Burkina Faso. Mortality was significantly higher in the rainy season. A study conducted by Muhuri (1996) to estimate the net effect of seasonality on child mortality in Matlab, Bangladesh, suggests that childhood mortality was well above the average monthly level in the hot, dry month of April and in November, the first harvest month of the aman crop. It was found to be remarkably low in the postharvest months of February and March, and also in August. During the hungry months of September and October, children were at a considerably increased risk of mortality, particularly from diarrheal diseases, if mothers had no schooling, but this was not the case if mothers had schooling.

Maurice *et al*., 2010 in their study to investigate the seasonal pattern of overall mortality among children aged below five years living in two informal settlements in Nairobi City, out of 17 878 children below 5 years in the study sites, 436 under-five deaths were recorded. The overall death rate for the under-five children was 19.95 per 1 000 person years. There was a significant seasonal variation of under-five mortality. The mortality risk was significantly higher in the second and third quarters of year than in the fourth quarter.

Moreover, understanding of the age- and season- dependence of some diseases such as malaria mortality is an important prerequisite for epidemiologic models of malaria immunity. However, most studies of malaria mortality have aggregated their results into broad age groups and across seasons, making it hard to predict the likely impact of interventions targeted at specific age groups of children (Abdullah *et al.*, 2007). In his study carried out in Ghana, Mozambique and Burkina Faso, Abdullah *et al*. (2007) recorded that all the sites showed seasonality in mortality, with most of them showing peak mortality during the rainy season.

### 2.12 Why decline in under-five mortality rate is slow

Africa as a whole recorded the most sluggish decline in child mortality among the six WHO regions - 42%, compared with 60-72% for other regions. And in Africa, about 15% of newborns are likely to die before reaching age five, compared to fewer than 2% in Europe. The reasons for the slump are unclear but in some countries, economic problems, civil strife and a poor choice of interventions used to try to reduce deaths among children are among the underlying factors

(WHO, 2008). Several studies have attempted to account for the slow pace of decline in the under-five mortality rate over the years. The global death toll in young children has fallen dramatically in the past half-century and has even dropped below the target set a decade ago by world leaders. But the pace of decline has been slowing in recent years, and in some countries the downward curve has leveled out or is even starting to rise (WHOSIS, 2008).

In Nigeria, while some progress has been made to reduce deaths after the first month of life (the post-neonatal period), there has been no measurable progress in reducing neonatal deaths over the past decade. About 5.9 million babies are born in Nigeria every year, and nearly one million children die before the age of five years. One quarter of all under-five deaths is newborns – 241,000 babies each year. Many deaths occur at home and are therefore unseen and uncounted in official statistics. Given that the country's population is the largest in Africa, Nigeria's failure to make inroads regarding the MDGs significantly influences Sub-Saharan Africa's achievement of these goals as a whole and contributes disproportionately to global childhood mortality (Save the Children, 2011).

The result of a study carried out by Adetunji, in 1994 shows that the rates of decline in infant and under-five mortality rates in Nigeria were very slow – an average of 1% per annum since 1960. The estimated levels of infant and under-five mortality were 4-7 times higher than the set targets for the year 2000. Wide regional disparities exist in infant and child mortality – after adjusting for the effects of socioeconomic and demographic factors, infant mortality rates were still 40-50% higher in the two northern regions while the rates of under-five mortality rates were about twice that observed in the southern and central regions. According to WHO (2001), "the world's biggest killer and the greatest cause of ill-health and suffering across the globe is – extreme poverty; poverty is the main reason why babies are not vaccinated, why clean water and sanitation are not provided, why curative drugs and other treatments are unavailable and why mothers die in childbirth" (Adeyemi, 2008).

Furthermore, in a study by Wang (2002) to investigate determinants of child mortality in low-income countries both at the national level, and for rural and urban areas separately using DHS of over 60 countries between 1990 and 1999 revealed a significant gap in child mortality between urban and rural areas, with rural population having a much slower reduction in mortality compared with their urban counterpart. Given that the poor are mainly concentrated in rural

areas, the above evidence suggests that health interventions implemented in the past decade may not have been as effective as intended in reaching the poor. The empirical findings in this study both consolidate results from earlier studies and add new evidence. He find that, at the national level, access to electricity, vaccination in the first year of life and public health expenditure can significantly reduce child mortality (Wang, 2002).

### 2.13 Other studies on under-5 mortality around the world

In a study carried out by Morris *et al.* (2003), a systematic review was undertaken of all studies published since 1980 reporting under-five mortality by cause. Causes of death were standardised across studies and information was collected on the characteristics of each study and its population. Proportional mortality outcomes were significantly associated with mortality level, and exposure to malaria, coverage of measles vaccination, safety delivery care and safe water, study year, age of children under surveillance, and method used to establish definitive cause of death. In sub-Saharan Africa and South Asia, the predicted distribution of deaths by cause was pneumonia (23% and 23%), malaria (24% and <1%), diarrhea (22% and 23%), neonatal and others (29% and 52%), measles (2% and 1%).

A study carried out by Huicho *et al.* (2006) shows that at country level in Peru, only 4 causes (pneumonia, diarrhoea, neonatal diseases and injuries) accounted for 68% of all under- 5 deaths in 1996, and for 62% in 2000. There was 32.7% of under-five death reduction from 1996 to 2000. Diarrhoea and pneumonia deaths decreased by 84.5% and 41.8%, respectively, mainly in the Andean region, whereas deaths due to neonatal causes and injuries decreased by 37.2% and 21.7% respectively. For 1996–2000 periods, the Andean, coast and jungle regions accounted for 52.4%, 33.1% and 14.4% of deaths, respectively. These regions represent 41.0%, 46.4% and 12.6% of under-five population in Peru. Both diarrhoea and pneumonia constitute 30.6% of under-five deaths in the Andean region. As a proportion, neonatal deaths remained stable in the country from 1996 to 2000, accounting for about 30% of under-five deaths, whereas injuries and "other" causes, including congenital anomalies, increased by about 5% (Huicho *et al*., 2006).

During one year of follow-up study in Ethiopia, Shamebo *et al*. (1993) recorded 306 deaths of children under the age of 5 years that were included in a concurrent case-referent study

that was based on a population estimated at 28,780. A total of 612 live referents, matched for age, sex and study area, were also selected from the study population through density sampling. Data were collected by lay reporters by verbal autopsy. For the study period the estimated cumulative under-five mortality rate was 293 and the infant (0-11 months old) mortality rate was 136 per 1000 live birth. Major probable causes of death were diarrhoeal disease or acute respiratory infections (ARI).

**2.14 Under-five mortality in Nigeria.**

Although there are not many studies on childhood mortality in Nigeria during the colonial period, available evidence suggests that infant and child mortality levels were very high. For example, Nicol (1949) reported an infant mortality rate of 326 per thousand live births for three villages in Niger province, northern Nigeria in 1949. Gardner and Gardner (1958, cited in Ekanem, 1972:110) also estimated an infant mortality rate of 358 and childhood mortality rate of 490 per thousand from 1955-57 among Birom women in northern Nigeria. By 1959, Nicol, cited in Ekanem, 1972) estimated an infant mortality rate of 269 per thousand live births for Awo-O mamma community in Eastern Nigeria. Nigeria had been the site of many studies in the field of child survival, an example of such studies is the Imesi-Ile longitudinal study site begun by Morley (1958) in the late 1950s. This was one of the earliest studies in developing countries that called attention to the importance of rural health clinics and growth monitoring in reducing mortality rates among children (WHOSIS, 2009).

In the post-colonial period, reliable nationally representative data on infant and child mortality have been scarce. There were some published mortality rates, especially from small-scale study sites such as that carried out by Morley *et al*. (1963). However, these are mostly localised and could not be generalised to the whole population of the region where they were conducted.

One of earliest national data on mortality levels in the post-colonial era came from the demographic health sample survey of rural Nigeria around 1966. The estimated infant mortality rate from that survey was 178 per thousand live births. The next major national survey was the 1981/82 Nigeria Fertility Survey. The survey data suggest a declining trend in infant mortality from about 110 per thousand live births in the period 1965-1969 to 85 per thousand in 1975-79 (National Population Bureau, 1984).

Out of a total 11,076 children whose admission records were complete, Bamgboye *et al.* (1990) reported in their study in Ibadan an overall decline from 238 death/1000 admissions in 1981 to 179 in 1986. Neonates accounted for 26.4% of the overall admission and children aged 1-11 months for 29.5%; 30.5% of admissions were 1-5 years old. The ratio of males to females for all age groups was 1.4:1; 20.6% of neonatal admissions, 24.7% of those 7-11 months old, and 27.2% of those 13-24 months old died. The mortality rate was considerably lower for children two years above and 2-6 months. Measles and tetanus ranked 4th and 11th among diagnoses and had the highest fatality rates of 32.6% each. Over sixty percent (61.6%) of tetanus cases were in neonates, who had a case fatality rate of 36.4%. Malnutrition cases had a fatality rate of 27.3%, and 7.2% of all deaths were due to malnutrition.

Akindele, Oyejide and Gbadegesin (1992) showed in their study that annual mortality amongst 3845 infants cared for on the Special Care Baby Unit of the University College Hospital, Ibadan, Nigeria, over a 10 year period ranged from 16.8% to 36.2%; there was a significant association between mortality and the male sex. An inverse relationship was observed between mortality and birth weight. Low birth weight (LBW) followed by respiratory distress were clearly the two important causes; these were closely followed by septicaemia and birth asphyxia. Amongst the LBW infants, mortality was highest when the former was associated with septicaemia and/or respiratory distress.

In Benin City, a study conducted by Onyiriuka (2005) to determine the morbidity and mortality pattern in children admitted into a mission hospital showed that out of the 8172 children seen at the paediatric outpatient clinic within the years under review, 1210 (14.8%) were admitted; comprising of 646 (53.4%) males and 564 (46.6%) females. Under-fives accounted for 84.0% of these admissions. Slightly more cases 632 (52.3%) were admitted during the wet season than the dry season 578 (47.7%). Overall, mortality rate was 4.1%, with under-fives accounting for 92.0% of these deaths. Mortality rate in under-fives was 18.0%, while mortality rate was 1.7 times higher in girls than boys. The common causes of death were malaria and its complications (52.0%), anaemia (18.0%), gastroenteritis (14.0%), measles (8.0%) and ALRTI (6.0%). High case fatality rates were found in cerebral malaria (27.8%), anaemia (20.0%), meningitis (20.0%) and measles (9.1%). The commonest cause of death among infants (excluding neonates) was

gastroenteritis, while malaria-induced anaemia was the commonest cause of death among children aged 1-4 years.

In a study carried out by Ayoola *et al.* (2005) at the University College Hospital Ibadan, 12,522 children were admitted during a five-year period. There were 1,185 deaths with an overall mortality rate of 9.5 per cent. There was no significant change in childhood mortality rate over the five years reviewed. Of the 1185 deaths, 48.8 % occurred within 24 hours and neonatal deaths accounted for 50.8 % of the total number of deaths. The leading causes of death were neonatal tetanus, Prematurity/low birth weight, neonatal septicaemia, severe birth asphyxia, meningitis, severe malaria, pneumonia, septicaemia, severe malnutrition, and measles.

Hendrickse (2005) reported that in Ibadan, measles occurs almost exclusively in the pre-school child, with a peak incidence between one and two years of age. The disease causes severe morbidity and appreciable mortality, which are maximal during the second week of illness. Children in the age group 3 to 4 years show the severest morbidity and females appear to be more severely affected than males. Morbidity and mortality are attributable mainly to multiple complications of which bronchopneumonia and gastro-enteritis are the commonest.

While studying the pattern of mortality and its causes among neonates at Olabisi Onabanjo University Teaching Hospital, Sagamu in 2006, Ogunlesi *et al*. reported that neonatal mortality was high (263.6/1000) admissions among children admitted over the ten year period studied. This accounted for 60.8 percent of the total paediatric deaths. They also confirmed the leading clinical condition associated with neonatal deaths to be preterm births (38.7%), followed by perinatal asphyxia (25.1%), septicaemia (10.5%), neonatal hyperbilirubinaemia (9.9%) and tetanus (7.9%). Mortality rate was significantly higher in females than that of the males. This is in contrast with the finding of Akindele *et al*. (1992) where mortality was significantly associated with male children. Moreover, the pattern of neonatal admissions and deaths between the years under review were strongly correlated. This means that there was a direct relationship between the changes in the magnitude of neonatal admissions and deaths over the period studied.

In a study conducted by Fatuga *et al*. (2007) in Sagamu, Nigeria, of 10,451 paediatric patients admitted, 1225 (12.2%) died. The male-to-female ratio was 1.4:1. The yearly mortality rate ranged from 10.7% to 14.9%. Most death (69.1%) occurred within 48 hours of hospitalization.

Of the 1225 patients who died, 57.3% were neonates and were commonly due to prematurity (34.6%), perinatal asphyxia (30.8%) and septiceamia (24.8%), while severe anaemia was the most common cause of death among infants (20.1%) and toddlers (25.1%).

Orimadegun and Akinbami (2008) reported in their study in a tertiary hospital in Ibadan that of the 541 admitted in the early neonatal period, 61.8% and 38.2% were delivered outside and inside the hospital setting, respectively. Among those outside hospital settings, 46.7% babies were delivered at religious or "mission" house, percentage of those who were delivered in their houses of residence was 38.0%, traditional birth attendants' homes (8.4%), and on the way to the hospital (6.9%). Births outside the hospital significantly increased as the birth order increased. Over half of the out-of-hospital deliveries took place under personnel whose primary responsibilities did not include labor care. Women who had less than secondary level of education and those from the lower social class were more likely to deliver outside the hospital. Out-of-hospital births were significantly associated with many complications, namely, hypothermia (53.6%), perinatal asphyxia (48.5%), hemorrhage (26.5%), cephalohematoma (12.9%), prematurity (9.9%), and neonatal tetanus (4.2%). Neonatal mortality rate of 12.6% in the out-of-hospital group was significantly higher than 6.3% obtained in the hospital birth group.

In 2009, George, Alex-Hart and Frank-Briggs reported in their study at a mission hospital in Port Harcourt that out of the 2174 paediatric admission over a two-year period, 61 deaths (2.8%) were reported (excluding neonatal and surgical cases). The youngest child was 2 months and the oldest 10 years. Fifty two (80.3%) were under five years. There was male preponderance. Most of the deaths occurred between April and September. The commonest causes of death were HIV/AIDS and bronchopneumonia in the under five age group.

# CHAPTER THREE

## 3.0 METHODOLOGY

### 3.1 Study area

Ibadan, the study area is an indigenous West African city and the capital of Oyo State, Nigeria. Population of Ibadan is 4,082,069 (O'Dywer, 2009). Politically and administratively, Ibadan municipality is divided in five local government areas (LGA) namely Ibadan Northwest, Ibadan Northeast, Ibadan North, Ibadan Southwest, and Ibadan Southeast. The city may also be divided into three socio-economic and cultural zones, which cut across the LGAs: a traditional inner core (highly congested area), a transitional (less congested), and a suburban periphery (non-congested area). The inner core areas are from the old part of the city, inhabited, for the most part, by people with low level of education; the transitional areas are inhabited also mostly by people with low economic status. The suburban periphery is described as the elite area, containing modern low-density residential estates, occupied by professionals and other high-income groups. The principal inhabitants of the city are the Yoruba people, other tribes are Hausa and Igbo.

This study was carried out in three major secondary paediatric health facilities in Ibadan. They are: Oni Memorial Children's Hospital Ring Road, Catholic Hospital Oluyoro, Oke-Ofa and St. Mary's Catholic Hospital Eleta. Two of the selected health facilities are situated in congested part of the city while one of them (Oni and Sons Memorial hospital) is located in a non congested part.

Oni Memorial Children Hospital was established in 1985. It is located in South-West LGA with ward bed capacity of 56. It is primarily a paediatric hospital comprising the children's emergency ward with eleven beds, special care baby unit (SCBU) with twenty beds (including five incubators) and children medical ward with 25 beds. This facility provides care primarily for children between the ages of 0 and 11 years of age, sometimes above 11 years when the weight is not above what is considered appropriate for the hospital. Averagely, about 200 children are attended to on daily basis.

Oluyoro Catholic hospital, Oke-Ofa is located in Ibadan North-East LGA. It a mission general hospital with under-five ward bed capacity of 88. The paediatric unit has been in operation since

1956 when the hospital was established. It has grown in terms of bed capacity, cliente and number and cadre of staff. The age for paediatric care in this hospital ranges from birth to 15 years.

St. Mary's Catholic Hospital, Eleta is located in Ibadan South-East LGA. It is also a mission general hospital with under-five ward bed capacity of 80. It was established in 1958. The hospital provides all level of care to children from birth to 15-16 years through their services in the special care baby unit, children's emergency ward and children's medical wards.

These health facilities serve as a referral centers for patients from within Ibadan and Oyo State in general. Clinical diagnoses made by doctors with or without ancillary tests are usually reviewed and verified by at least one consultant paediatrician in most cases and are critically discussed at the fortnightly morbidity and mortality review meetings that takes place from time to time in these hospitals. Although laboratory facilities are available to complement clinical diagnoses, post mortem are not usually done to confirm diagnoses for reasons of cultural disapproval. These hospitals have fairly equipped laboratories capable of performing routine laboratory investigations such as blood smears for malaria parasites, full blood count, urinalysis and urine culture.

### 3.2 Study design

This is a comparative analytical study that reviewed records of death and admission occurring in under-five children between January 2005 and December 2009 was carried out.

### 3.3 Study population

The study population included children under the age of five years. These are children who were presented in any of the selected hospital within the period under review.

### 3.4 Inclusion and exclusion criteria

One of the inclusion criteria for this study was that the participant must be less than five years. Another criterion adopted in this study was that a participant must have presented and admitted (in-patient) at a time or the other within the period under review. These inclusion criteria

automatically excluded children above the age of five years and children who were not admitted though they presented in any of the hospitals.

### 3.5 Data collection

Data of deaths and admission were collected from hospital register and patients' case files. A structured chart form which was organizes into three sections labeled A-C (see appendix) was used to retrieve data. Section A was used to access socio-demographic characteristics. Section B was used to collect information on past medical history of the children. Information on causes of death, duration of admission and if child was referred was documented using questions in section C. Other information obtained from the hospital records included the total number of admission of children below the age of five within the period of review. Data that were not available were classified as "missing".

### 3.6 Study Variables

The variables sought to address the objectives of this study included independent variables such as age, sex, weight, religion, area of town lived, parents' occupation and others. Immunization history, clinical diagnoses and duration of hospitalization were also collected. Outcome variable was death or discharge.

### 3.7 Data analysis

Information collected in each structured chart form was hand coded which was facilitated by the use of coding guide developed by the researcher after a careful review. A template was then designed using Statistical Package for Social Sciences (SPSS - version 16.0 Equinox) and was used for data entry and analysis. Data cleaning and editing was carried out to detect and correct errors. Data were summarized using frequency distribution for qualitative variables while descriptive statistics such as mean and standard deviation were used for quantitative variables. Bivariate analysis - Chi-square was used to evaluate association between categorical variables and logistic regression analysis was carried out to further determine level of significance. Level of significance was set at 5%.

The weight of the children was classified as normal weight, underweight and overweight following the weight (kg) for age (month) table for both sexes designed by UNICEF (Apendix).

Causes (specific diagnosis) of death were collected from case notes and after proper review, were classified into the following Global Burden of Disease (GBD) categories: infectious and parasitic diseases, respiratory infections, conditions arising during the perinatal period, nutritional deficiencies, congenital anomalies and others (Nte *et al.*, 2003).

### 3.8 Ethical Consideration

Ethical approval for the study was obtained from the Oyo State Ethical Review Committee (see appendix for the letter of approval). Researcher was also given permission to carry out research by the Chief Medical Officer (CMO)/director of the hospitals. Data collected were used for research purposes and confidentiality was maintained. To maintain confidentiality, names were not recorded; hospital numbers were recoded thus making it impossible to connect data collected with individuals. However, the code was kept under lock and key by the researcher.

### 3.9 Limitations

There were incomplete data in all the selected hospitals, variables with not enough information (more than 30 percent missing values) were not included in the analysis.

# CHAPTER FOUR

## 4.0 RESULT

During the five-year review, 19,203 (9152 in Oluyoro Catholic Hospital, 5870 in Oni Memorial Hospital and 4181 in Eleta Catholic Hospital) under-five children were admitted in the three health facilities. There were 2146 (11.2%) death during this period and all were included in the analysis. Fifty six percent of them were males while 44.0% were females giving a male to female ratio of 1.3:1.

### 4.1 Socio-demographic characteristics of the children

Table 4.1 shows the distribution of socio-demographic characteristics of the children. Over half (54.4%) of the mortality were from Oluyoro Catholic Hospital, 23.7% were from Oni Memorial Hospital and 21.9% were from St Mary Catholic Hospital, Eleta. The mean ages of the children were 8.5(SD=5.5) days, 6.1(SD=3.1) months and 26.4(SD=13.1) months for neonates, post-neonates and children aged 12-59 respectively. Proportion of children who died within the first 28 days of life (neonates) were 1152(26.8%), post neonatal deaths was 1190(27.7%) while highest proportion 1950(45.5%) of death occurred among children aged 12-59 months.

The mean weights for neonates, post-neonates and children aged 12-59 months were 2.6(SD=0.8) kg, 5.9(SD=2.0) kg and 9.8(SD=3.1) kg respectively. The weight of about half 2161(54.1%) of the children fell within the normal range for their various ages, 1800(45.0%) were under-weight while 35(0.9%) were over-weight. Most 3857(94.5%) of the children were brought to the health facilities by either or both parents. For position among siblings, 536(28.9%) of the children were first born of their families, 528(28.4%) were second born of their families while 792(42.7%) were in position three and above. Predominantly, admission occurred more (64.1%) during the rainy season than in the dry season (35.9%). Over half 2728(63.6%) of the children were not taken to any health facility before being presented at the hospitals where records were reviewed, only 1564(33.4%) were referred from other health facilities.

### 4.2 Socio-demographic characteristics of parents

Table 4.2 shows characteristics of the parents whose records were available. They include father's occupation out of which 875(28.6%) were professionals, 823(26.9%) were unskilled

while 688(22.5%) and 676(22.0%) were skilled and semi-skilled workers respectively. The children's parents were mostly married 1985(86.5%) while the remaining 209(13.5%) were single or widowed parents. Majority 1659(91.1%) of the children were from monogamous family while 163(8.9%) were from polygamous family. Over half 1203(58.1%) of the children were from families with only 1 to 2 children, 654(31.6%) were from families with just 3 to 4 children and 215(10.3%) from families with 5 children and above. More 2291(54.3%) admission and deaths occurred among children whose parent were Muslim than those who came from Christian 1927(45.7%) families. Higher proportion 3133(73.9%) of the parents of the children came from the congested areas of Ibadan while 1104(26.1%) were from non-congested part (sub-urban).

**Table 4.1: Distribution of Children's Socio-Demographic Characteristics**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Name of Hospital (N=4292)** | | |
| Catholic hospital Oluyoro | 2336 | 54.4 |
| Oni memorial hospital | 1016 | 23.7 |
| Eleta catholic hospital | 940 | 21.9 |
| **Gender (N=4292)** | | |
| Male | 2402 | 56.0 |
| Female | 1890 | 44.0 |
| **Age (N=4292)** | | |
| Childhood | 1950 | 45.5 |
| Post neonates | 1190 | 27.7 |
| Neonates | 1152 | 26.8 |
| **Weight (N=4014)** | | |
| Normal weight for age | 2161 | 54.1 |
| Under weight | 1800 | 45.0 |
| Over weight | 35 | 0.9 |
| **Who brought child (N=4080)** | | |
| Parents | 3857 | 94.5 |
| Others | 223 | 5.5 |
| **Position among siblings (N=1856)** | | |
| Position 3 above | 792 | 42.7 |
| 1st | 536 | 28.9 |
| 2nd | 528 | 28.4 |
| **Child referred (N=4292)** | 1564 | 36.4 |
| Yes | 2728 | 63.6 |
| No | | |

**Table 4.2: Distribution of parent's characteristics**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Father's occupation (N=3062)** | | |
| Professionals | 875 | 28.6 |
| Unskilled | 823 | 26.9 |
| Skilled | 688 | 22.5 |
| Semi-skilled | 676 | 22.0 |
| **Parent's marital status (N=2294)** | | |
| Married | 1985 | 86.5 |
| Single | 309 | 13.5 |
| **Family type (N=1822)** | | |
| Monogamous | 1659 | 91.1 |
| Polygamous | 163 | 8.9 |
| **No of children in family (N=2072)** | | |
| 1 – 2 children | 1203 | 58.1 |
| 3 – 4 children | 654 | 31.6 |
| Above 5 children | 215 | 10.3 |
| **Religion (N=4218)** | | |
| Islam | 2291 | 54.3 |
| Christian | 1927 | 45.7 |
| **Area in town (N=4237)** | | |
| Congested areas | 3133 | 73.9 |
| Non-congested area (Sub-Urban) | 1104 | 26.1 |

**Table 4.3: Children Immunisation History**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Immunisation history (N=4292)** | | |
| Appropriate immunisation | 1386 | 32.2 |
| Never immunised | 1124 | 26.2 |
| Not available | 1104 | 25.8 |
| Partial immunisation | 678 | 15.8 |
| **Total** | 4292 | 100 |

Table 4.3 above shows the percentage distribution of immunisation history of the children, 1386(32.2%) had appropriate immunisation, 678(15.8%) had partial immunisation while 1124(26.2%) were not immunised and 1103(25.8%) of record on immunisation were not available.

## 4.3 FACTORS ASSOCIATED WITH MORTALITY IN UNDER-FIVE CHILDREN

The relationship between children's characteristics and mortality is shown in table 4.4. There was significant relationship between weight of the under-five children and mortality ($P < 0.05$). Less than half, (44.1%) of the children who died and over half (52.4%) of children who recovered had normal weight. There was also association between immunisation and under-five mortality ($P < 0.05$). Proportion of children who had appropriate immunisation was 16.1% among those who died and higher (36.2%) among children who recovered. Significant result was also found for season ($P < 0.05$). Other variables that were significantly associated with mortality included position among siblings, who brought child to the hospital and child referred (See Table 4.4 for details).

The relationship between the characteristics of the children's parents and mortality is shown in Table 4.5. There was significant association between area of town lived and mortality ($P < 0.05$). Predominant proportion (81.9%) of children who died and 66.0% of those who recovered lived in the congested part of the city. There was also a significant result for father's occupation and mortality ($P < 0.05$). The proportion of children whose father's occupation were professionals was 21.1% among children who died and greater (34.8%) among those who recovered. Relationship also existed between parent's marital status and mortality ($P < 0.05$). Majority of (87.2%) of the parents whose children died were married. There was also relationship between number of children in the family and mortality ($P < 0.05$). Family type was not significantly related to mortality (See Table 4.5 for details).

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**Table 4.4: Relationship between children's characteristics and mortality**

| Variable | Frequency (%) | | ` | Chi-square | P-value |
|---|---|---|---|---|---|
| | Died | Recovered | Total | | |
| **Weight** | | | | | |
| Normal weight for age | 832(44.1) | 1116(52.4) | 1948 | 13.360 | 0.004 |
| Underweight | 1045(55.4) | 986(46.3) | 2031 | | |
| Over weight | 8(0.5) | 27(1.3) | 35 | | |
| **Position among siblings** | | | | | |
| 1st | 307(34.7) | 229(23.6) | 536 | 59.073 | 0.000 |
| 2nd | 208(31.6) | 248(25.5) | 528 | | |
| Position 3 above | 298(33.7) | 494(50.9) | 790 | | |
| **Seasons** | | | | | |
| Wet | 1289(60.1) | 1465(68.3) | 2752 | 31.141 | 0.000 |
| Dry | 857(39.9) | 681(31.7) | 1538 | | |
| **Who brought Child** | | | | | |
| Parents | 1903(94.5) | 1954(94.6) | 3857 | 0.016 | 0.899 |
| Others | 111(5.5) | 112(5.4) | 223 | | |
| **Immunisation history** | | | | | |
| Appropriate immunisation | 612(16.1) | 775(36.2) | 1387 | 35.946 | 0.000 |
| Not immunised | 573(26.7) | 551(25.6) | 1124 | | |
| Not available | 614(28.6) | 491(22.7) | 1103 | | |
| Partially immunised | 348(28.5) | 330(15.4) | 678 | | |
| **Child referred** | | | | | |
| Yes | 846(41.3) | 718(33.5) | 1564 | 24.287 | 0.000 |
| No | 1296(58.7) | 1428(66.5) | 2749 | | |

**Table 4.5: Association between Parents' characteristic and mortality**

| Variable | Frequency (%) | | ` | Chi-square | P-value |
|---|---|---|---|---|---|
| | Died | Recovered | Total | | |
| **Religion** | | | | | |
| Islam | 1165(56.0) | 1126(52.7) | 2291 | 4.605 | 0.032 |
| Christian | 916(44.0) | 1011(47.3) | 1927 | | |
| **Father's occupation** | | | | | |
| Semi-skilled | 370(26.5) | 306(18.3) | 676 | 1.004 | 0.000 |
| Artisans/skilled | 378(27.1) | 310(18.6) | 688 | | |
| Unskilled | 352(25.3) | 471(28.2) | 823 | | |
| professionals | 294(21.1) | 581(34.8) | 875 | | |
| **Parent's Marital status** | | | | | |
| Married | 888(87.2) | 1097(86.0) | 1985 | 9.721 | 0.021 |
| Single/widowed | 130(12.8) | 179(14.0) | 297 | | |
| **Area of town** | | | | | |
| Congested areas | 1731(81.9) | 1402(66.0) | 3131 | 1.417 | 0.000 |
| Non-congested (sub-urban) | 382(18.1) | 722(34.0) | 1104 | | |
| **No of children in family** | | | | | |
| 1-2 children | 551(62.0) | 652(55.1) | 1203 | 20.637 | 0.000 |
| 3-4 children | 274(30.9) | 380(32.1) | 654 | | |
| >5 children | 63(7.1) | 152(12.8) | 215 | | |
| **Family type** | | | | | |
| Monogamous | 763(91.1) | 896(89.3) | 1659 | 1.726 | 0.422 |
| Polygamous | 75(8.9) | 88(11.7) | 161 | | |

## 4.4 Regression Analysis

Variables of children's characteristic which were significantly associated with mortality in the bivariate analysis were further analysed using logistic regression and shown in Table 4.6. Logistic regression on children's characteristic revealed that those who were underweight had two times higher risk of dying than children with normal weight (OR = 1.92, CI = 1.03, 1.26). Children who were referred from other health facilities had two times higher risk of dying compared with those that were not (OR = 2.11, CI = 0.34, 0.67). Regression analysis showed that under-five children were two times more likely to die during the rainy season compared with the dry season (OR = 2.31, CI = 0.47, 0.79). Children who had no immunization were also two times more likely to die compared with children with appropriate immunization (OR = 2.20, CI = 1.09, 1.83).

Logistic regression of the parents' characteristic revealed that children whose father were unskilled were two times more likely to die than children whose parents were professionals (OR = 2.00, CI = 0.35, 0.71). Also, children whose parents lived in the congested part of the city were two times more likely to die compared with children from sub-urban areas (OR = 2.05, CI = 1.54, 2.71). Moreover, children from families with only 3–4 children were less likely to die when compared with families with 1-2 children (OR = 0.55, CI = 1.17, 10.80).
(See Table 4.6 and 4.7 for details)

**Table 4.6: Regression analysis of children's characteristics.**

| Variables | B | SE | Sig | Exp(B) | 95% CI |
|---|---|---|---|---|---|
| **Weight** | | | | | |
| Normal weight for age* | | | | | |
| Underweight | -0.248 | 0.758 | 0.021 | 1.921 | 1.032 – 1.264 |
| Overweight | 0.106 | 0.064 | 0.394 | 0.942 | 0.435 – 0.882 |
| **Child referred** | | | | | |
| No* | | | | | |
| Yes | 0.182 | 0.067 | 0.038 | 2.11 | 0.348 – 0.673 |
| **Position among siblings** | | | | | |
| Position above 3* | | | | | |
| 1st | -0.920 | 0.273 | 0.001 | 1.799 | 0.233 – 0.681 |
| 2nd | 0.340 | 0.143 | 0.017 | 1.404 | 1.062 – 1.858 |
| **Seasons** | | | | | |
| Dry* | | | | | |
| Rainy | -0.497 | 0.130 | 0.000 | 2.308 | 0.471 – 0.785 |
| **Immunisation history** | | | | | |
| Apropriate immunisation* | | | | | |
| Partial immunisation | 0.077 | 0.172 | 0.656 | 1.080 | 0.770 – 1.514 |
| Never immunised | 0.186 | 0.213 | 0.383 | 2.204 | 1.093 – 1.829 |
| Not available | -0.015 | 0.175 | 0.931 | 0.985 | 0.699 – 1.387 |

Key: * = reference category

**Table 4.7: Regression analysis of Parent's characteristics**

| Variable | B | SE | Sig | Exp(B) | 95% CI |
|---|---|---|---|---|---|
| **Area of town** | | | | | |
| Non congested area* | | | | | |
| Congested area | | | | | |
| | 0.716 | 0.143 | 0.000 | 2.047 | 1.545 – 2.710 |
| **Father's occupation** | | | | | |
| Professionals* | | | | | |
| Semi-skilled | -0.581 | 0.178 | 0.001 | 0.562 | 0.395 – 0.794 |
| Unskilled | -0.692 | 0.179 | 0.000 | 2.003 | 0.353 – 0.710 |
| Skilled | -0.086 | 0.174 | 0.619 | 0.917 | 0.652 – 1.290 |
| **No of children in family** | | | | | |
| 1-2 children* | | | | | |
| 3-4 children | 1.268 | 0.567 | 0.025 | 0.553 | 1.170 – 10.784 |
| › 5 children | -0.933 | 0.250 | 0.000 | 0.393 | 0.241 – 0.642 |
| **Parent's marital status** | | | | | |
| Married* | | | | | |
| Single/widowed | -0.382 | 0.172 | 0.418 | 0.631 | 0.593 – 1.945 |

Key: * = reference category

### 4.5 Distribution of the Causes of Death

The distribution of the cause of death is shown in Table 4.8. The disease with highest proportion was malaria (24.7%), followed by neonatal sepsis (8.8%), bronchopneumonia (8.4%), birth asphyxia (7.3%) gastroenteritis (7.9%), anaemia (7.1%), measles and post measles debility (5.8%), sepsis (5.1%), prematurity (3.9%), meningitis (2.0%), respiratory tract infections (1.2%), mecomium aspiration syndrome (1.2%), undernutrition (1.1%), neonatal jaundice (0.9%), febrile convulsion (0.9%)low birth weight (0.8%), aspiration pneumonitis (0.5%) and others (3.7%) while (8.6%) were inconclusive.

**Table 4.8**: **Hospital diagnosis of the illness in children that died**

| Cause | Frequency | Percentage |
|---|---|---|
| Malaria | 527 | 24.7 |
| Neonatal sepsis | 189 | 8.8 |
| Bronchopneumonia | 180 | 8.4 |
| Gastroenteritis | 153 | 7.9 |
| Anaemia | 153 | 7.2 |
| Measles and PMD | 125 | 5.8 |
| Sepsis | 108 | 5.2 |
| Birth asphyxia | 103 | 5.1 |
| Prematurity | 83 | 3.7 |
| LBW | 71 | 3.1 |
| Meningitis | 43 | 2.0 |
| Meconium aspiration syndrome | 26 | 1.2 |
| Respiratory tract infections | 26 | 1.2 |
| Undernutrition | 25 | 1.1 |
| Fibrile convulsion | 20 | 0.9 |
| Neonatal jaundice | 19 | 0.8 |
| Diarrhea and dehydration | 14 | 0.7 |
| Aspiration pneumonitis | 10 | 0.5 |
| Died on admission before diagnosis could be made | 185 | 8.4 |
| Others | 86 | 3.3 |
| Total | 2146 | 100.0 |

### 4.5.1 Causes of Mortality among Neonates

Death among neonate represents 26.8% of the total death and it it shown in Table 4.9. Neonatal sepsis was the predominant cause of death (33.7%) followed by birth asphyxia (18.0%), prematurity (14.0%), low birth weight (12.3%), mecomium aspiration syndrome (4.6%), bronchopneumonia (3.3%), malaria (2.3%), while 5.2% were inconclusive.

### 4.5.2 Causes of Mortality among Post-neonates

In Table 4.10, it is shown that the death of 25.9% were caused by malaria among post-neonates, followed by bronchopneumonia (16.5%), gastroenteritis (12.6%), sepsis (10.0%), anaemia (5.9%), cerebrospinal meningitis (3.7%), measles and post measles debility (3.5%) while 9.1% were inconclusive.

### 4.5.3 Causes of Mortality among Children aged 12-59 months

Childhood mortality was caused predominantly by malaria (35.2%) followed anaemia (11.2%), measles and post measles debility (10.8%), gastroenteritis (7.8%), bronchopneumonia (6.6%), sepsis (3.4%), cerebrospinal meningitis (1.9%), protein energy malnutrition/marasmus (1.7%) while 10.4% were inconclusive. This is shown in Table 4.11.

**Table 4.9: Causes of Mortality among Neonates, post neonates and childhood**

| Cause of mortality | Frequency | Percentage |
|---|---|---|
| Neonatal sepsis | 189 | 33.7 |
| Birth asphyxia | 103 | 18.0 |
| Prematurity | 83 | 14.5 |
| LBW | 71 | 12.3 |
| Mecomium aspiration syndrome | 26 | 4.6 |
| Bronchopneumonia | 19 | 3.3 |
| Malaria | 13 | 2.3 |
| Died on admission before diagnosis could be made | 30 | 5.2 |
| Others | 42 | 6.1 |
| Total | 576 | 100.0 |

**Table 4.10: Causes of mortality among post-neonates**

| Cause | Frequency | Percentage |
|---|---|---|
| Malaria | 153 | 25.9 |
| Bronchopneumonia | 97 | 16.5 |
| Gastroenteritis | 74 | 12.6 |
| Sepsis | 60 | 10.0 |
| Anaemia | 35 | 5.9 |
| Cerebrospinal meningitis | 22 | 3.7 |
| Measles & PMD | 20 | 3.5 |
| Died on admission before diagnosis could be made | 54 | 9.1 |
| Others | 80 | 13.0 |
| Total | 595 | 100.0 |

**Table 4.11: Causes of mortality among childhood (aged 12-59 months)**

| Cause | Frequency | Percentage |
|---|---|---|
| Malaria | 343 | 35.2 |
| Anaemia | 109 | 11.2 |
| Measles & PMD | 105 | 10.8 |
| Gastroenteritis | 76 | 7.8 |
| Bronchopneumonia | 64 | 6.6 |
| Sepsis` | 33 | 3.4 |
| Cerebrospinal meningitis | 19 | 1.9 |
| PEM/marasmus | 17 | 1.7 |
| Died on admission before diagnosis could be made | 101 | 10.4 |
| Others | 209 | 21.4 |
| Total | 975 | 100.0 |

### 4.6 Distribution of cause of death according to Global Burden of Diseases (GBD) categories

Figure 4.1 shows distribution of causes of death according to the Global Burden of Diseases (GBD) categories. Over half (55.4%) were caused by infectious and parasitic diseases, 15.2% by conditions arising during the perinatal period such as birth asphyxia, LBW etc, 9.8% were caused by respiratory infections, 8.4% by nutritional deficiency and 0.3% caused congenital anomally while others (2.3%) were inconclusive.

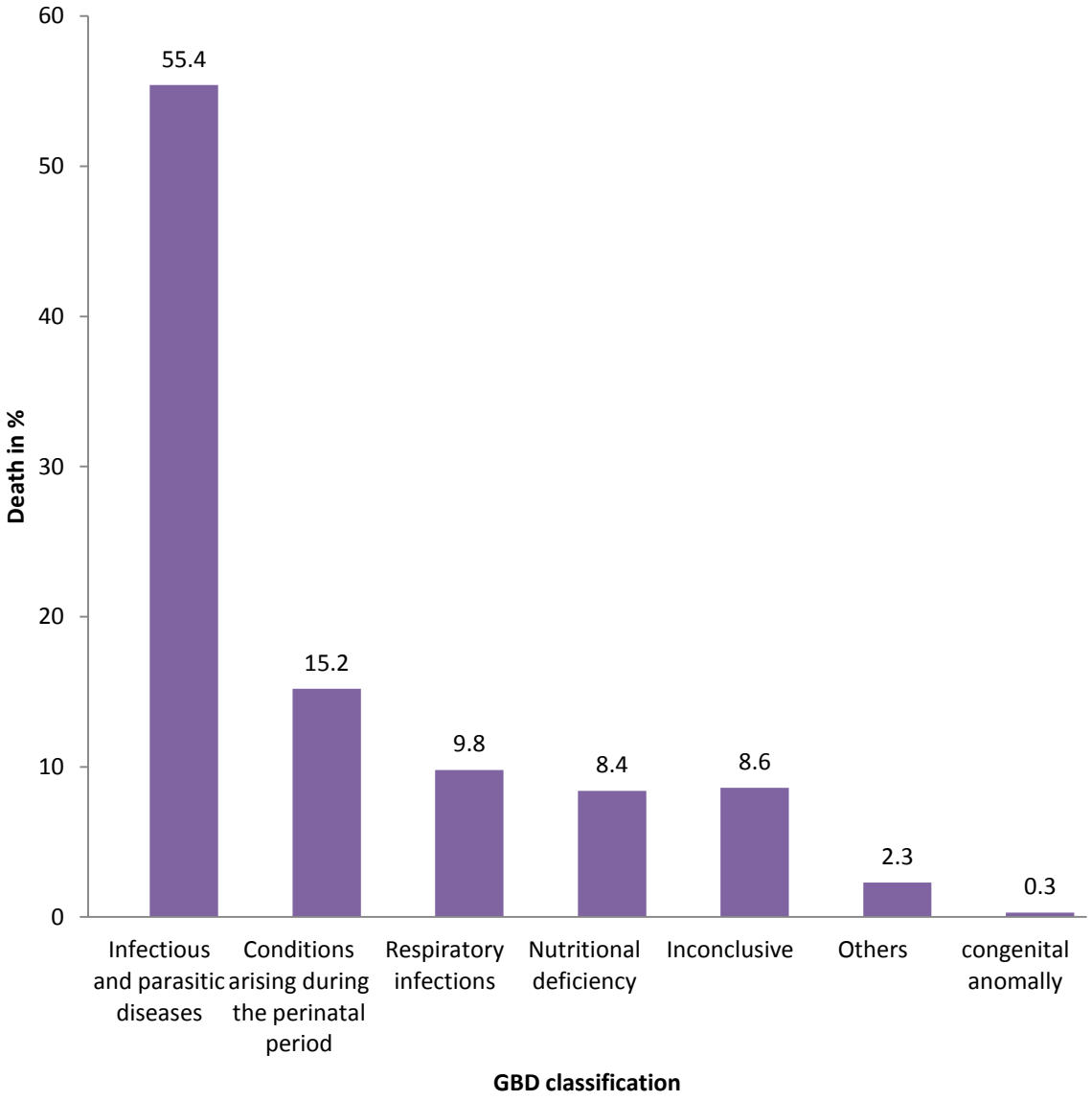


Figure 4.1: Percentage of death according to Global Burden of Disease (GBD) Categories

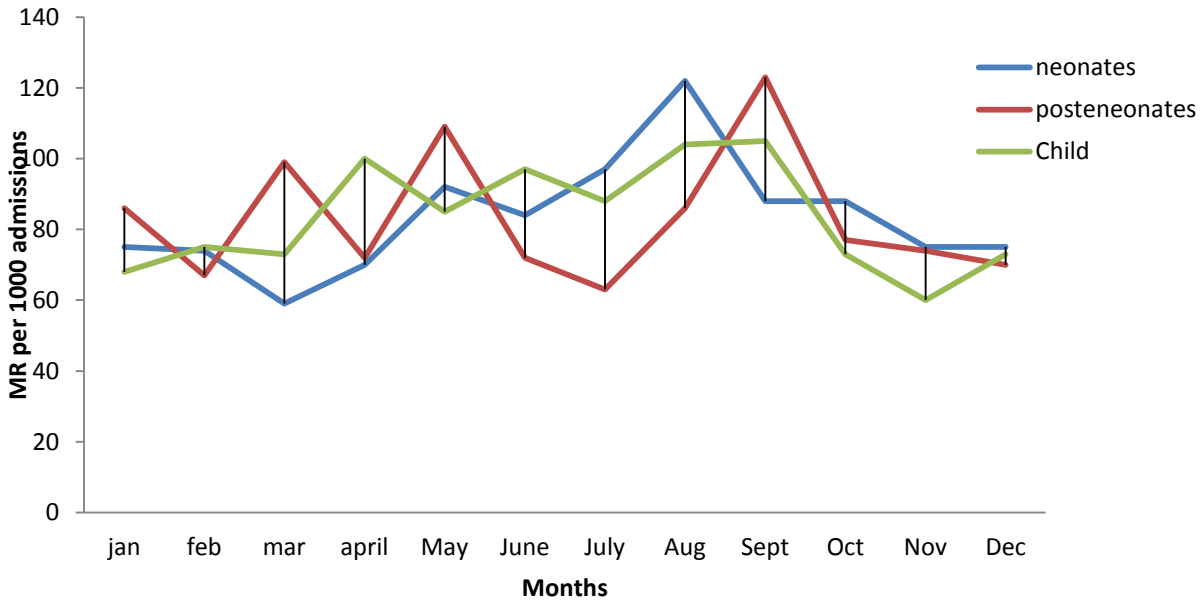


Figure 4.2: Mortality trend of each age group in the different month of the year

Figure 4.2 shows the trend of mortality in each age group at different month of the year. These months were categorized into rainy season (April – October) and dry season (November – March). The mortality rates (per 1000 admissions) for each month were calculated for all the years summed together.

**Table 4.12 Proportion of some selected causes of death during the rainy and dry seasons**

| Causes | Rainy season | | Dry season | | Total |
|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | |
| Neonatal sepsis | 101 | 60.1 | 67 | 39.9 | 183 |
| Birth asphyxia | 100 | 57.1 | 75 | 42.9 | 168 |
| Low birth weight | 59 | 59.0 | 42 | 42.0 | 101 |
| Malaria | 318 | 60.5 | 208 | 39.5 | 526 |
| Gastroenteritis | 101 | 58.4 | 72 | 41.6 | 173 |
| Bronchopneumonia | 130 | 56.8 | 99 | 43.2 | 229 |
| Septicaemia | 63 | 58.3 | 45 | 41.7 | 108 |
| Measles | 63 | 50.4 | 62 | 49.6 | 125 |

The percentage distribution of the children that died as a result of some selected causes is shown in the table above. It was generally observed that more death occurred during rainy season when compared with the dry season.

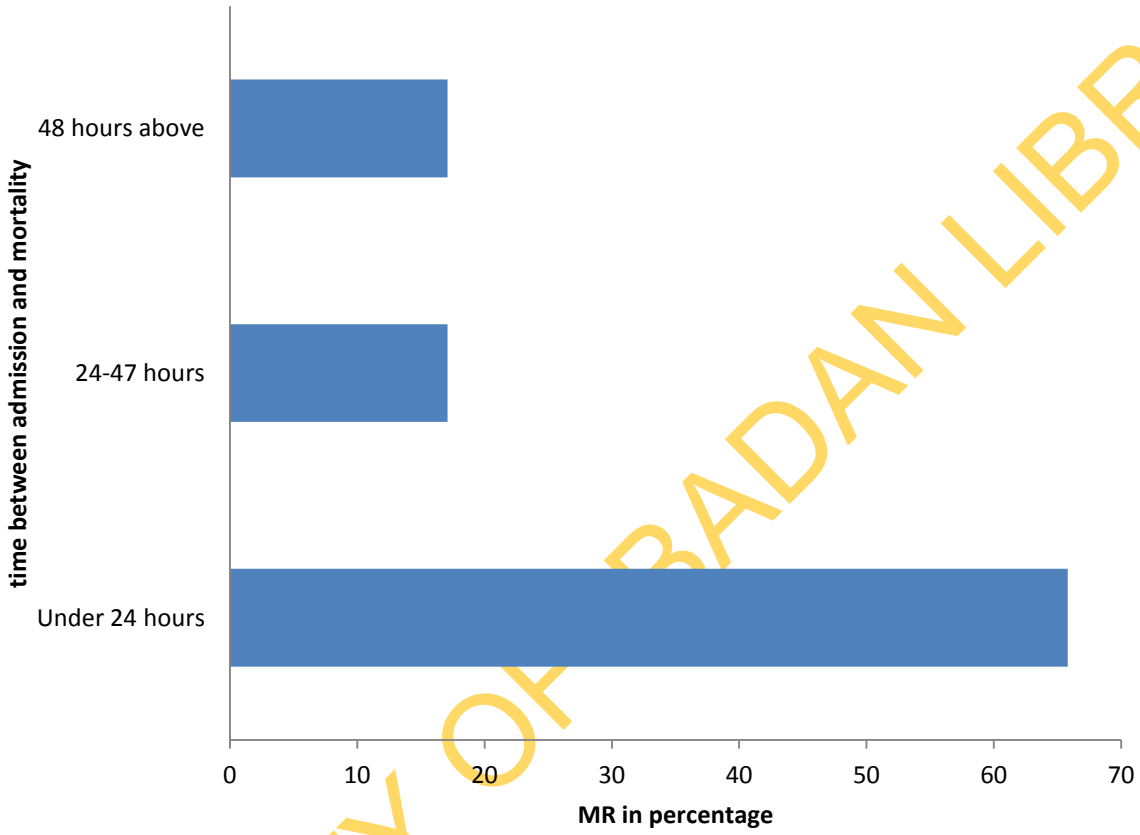


Figure 4.3: Time (in hours) between admission and death

About two thirds (65.8%) of the cases died under 24 hours after admission, 17.1% died between 24 and 48 hours after being admitted while the remaining 17.1% died at various times after 48 hours.

### 4.7 Time (in hour) spent between admission and death among different age groups

Time (in hour) spent on hospitalization before death by each age group is shown in Figure 4.4. In all the age groups, predominant proportion died within the first 24 hours, (61.7%) in neonates, (66.6%) in post-neonates and (67.7%) among the children aged 12-59 months respectively. Lower proportions were observed in the age groups for deaths that occurred between 24-48 hours and those who died after 48 hours above after being admitted into the various health facilities. (See Figure 4.3 for details).

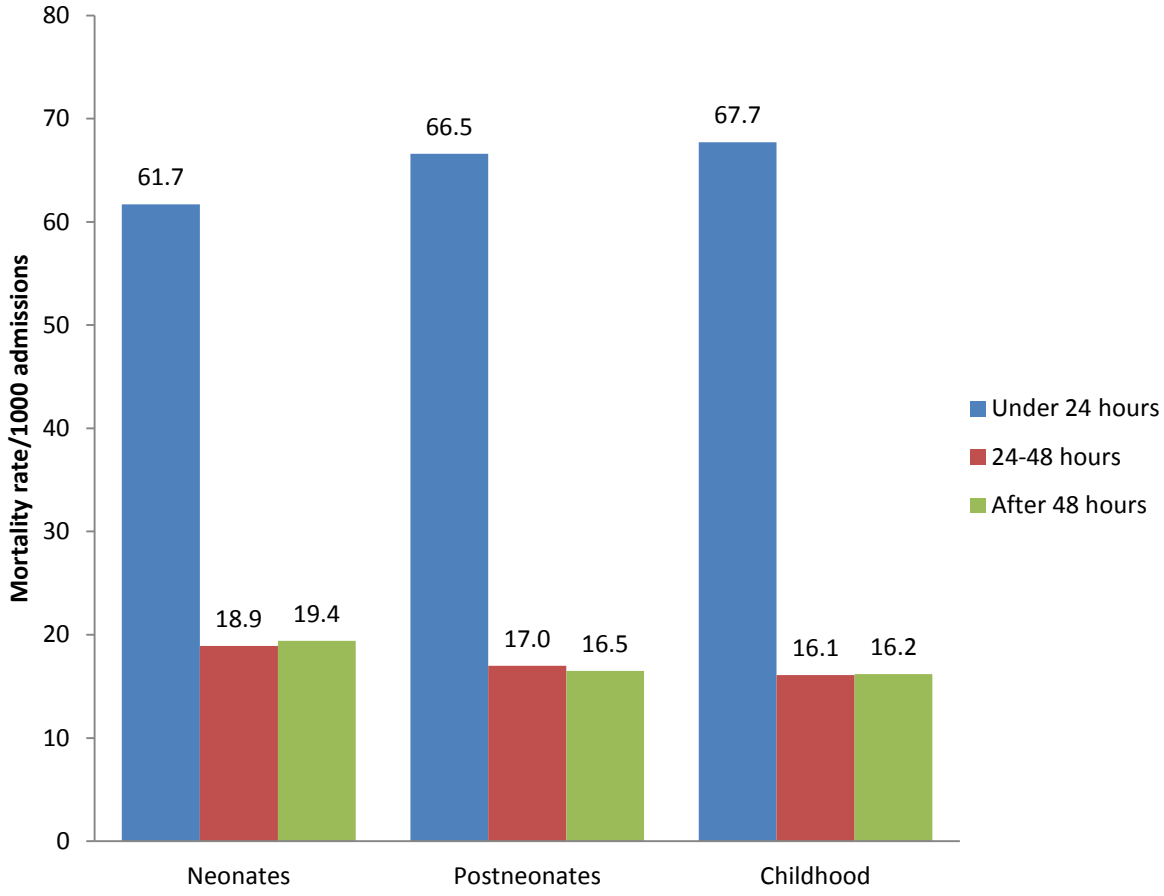


Fig 4.4: Time between admission and mortality in each age category

## 4.8 Age specific mortality rates in the health facilities

Figure 4.5 shows the mortality rate per 1000 admissions of the different age groups according to the health facilities. Neonate had the highest rate (115.8/1000) in Oni& Sons Children hospital followed by post-neonates (82.0/1000) and then children aged 12-59 months (74.3/1000). Slightly higher death rate (130.8/1000) was calculated for age 1-11 months in Oluyoro Catholic Hospital followed by 123.3 /1000 and 128.7/1000 for neonates and children aged 12-59 months respectively. The largest rate (277.9/1000) was calculated for post neonates in St Mary's Catholic Hospital, Eleta followed by 12-59 months (118.9/1000).

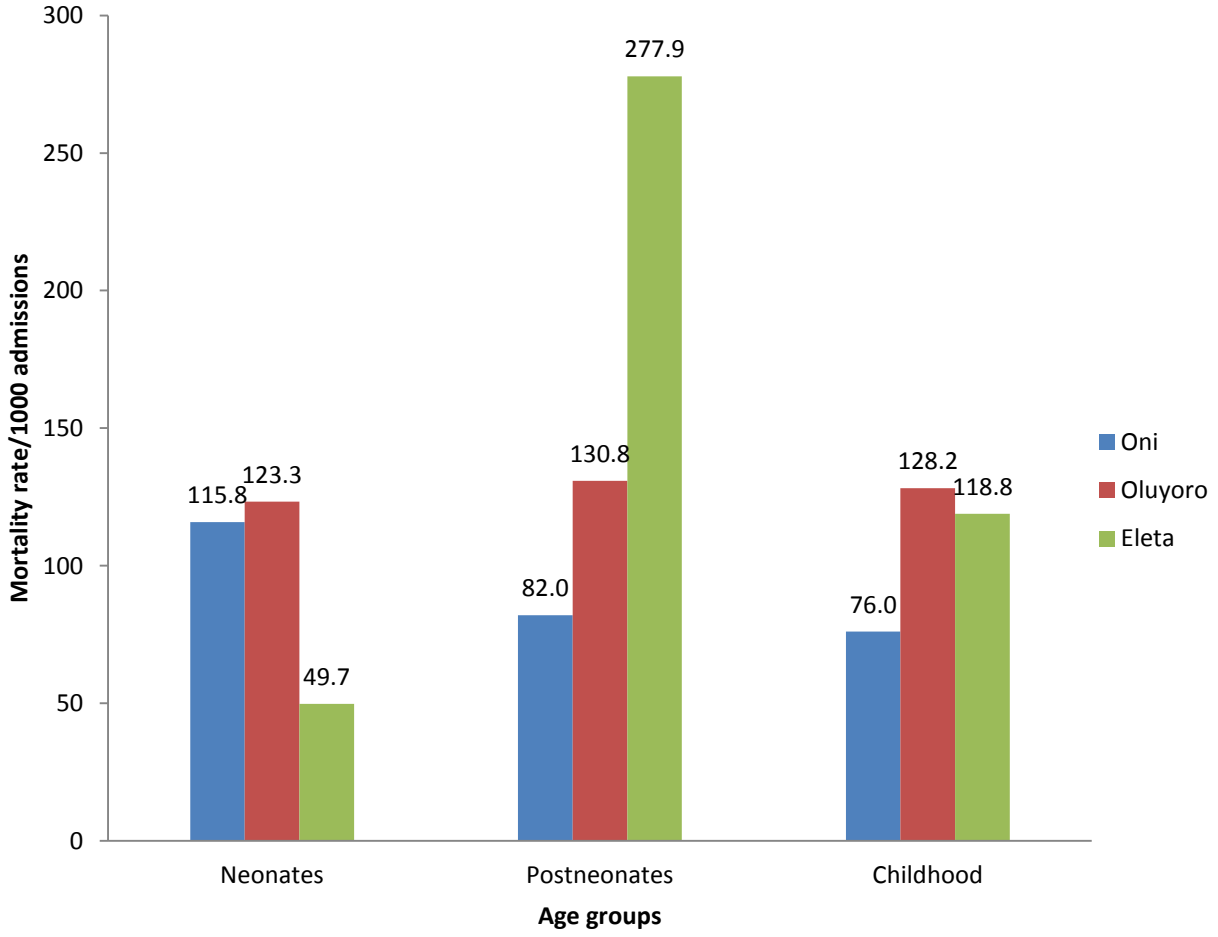


Figure 4.5: Age specific mortality rates in each hospital

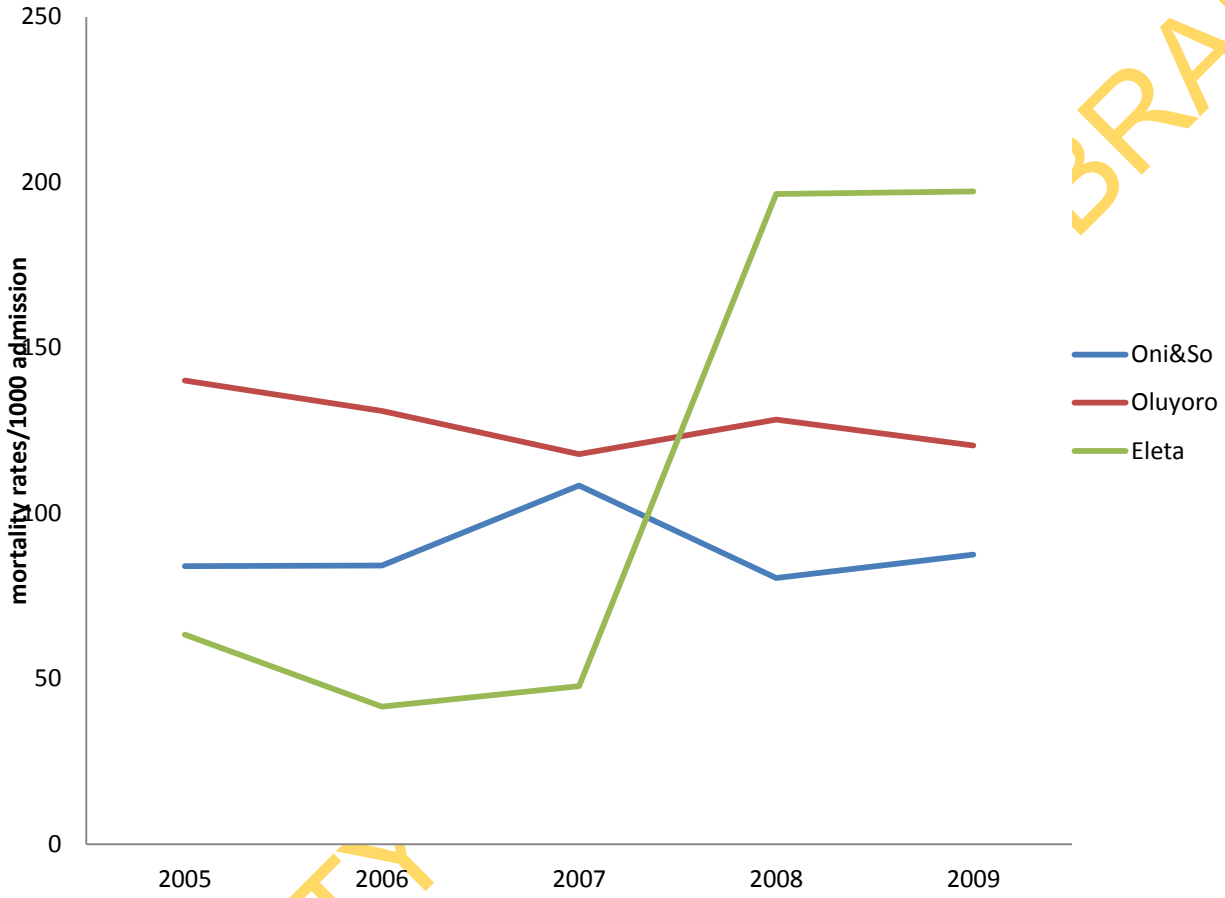


Figure 4.6: Graph showing annual mortality trend in each hospital

Annual trend in mortality in the three hospitals is shown in the Figure above. St Mary's Catholic hospital had the lowest rates between 2005 and 2007 but the rate increased in 2008 and 2009. Trend of mortality in Oni & Sons State Hospital follows an irregular pattern with mortality rate peaking at 108.4 in 2007 but below 100.00 in the other years of study. There was reduction in the mortality trend in Oluyoro Catholic Hospital reaching the lowest rate (117.9) in 2007.

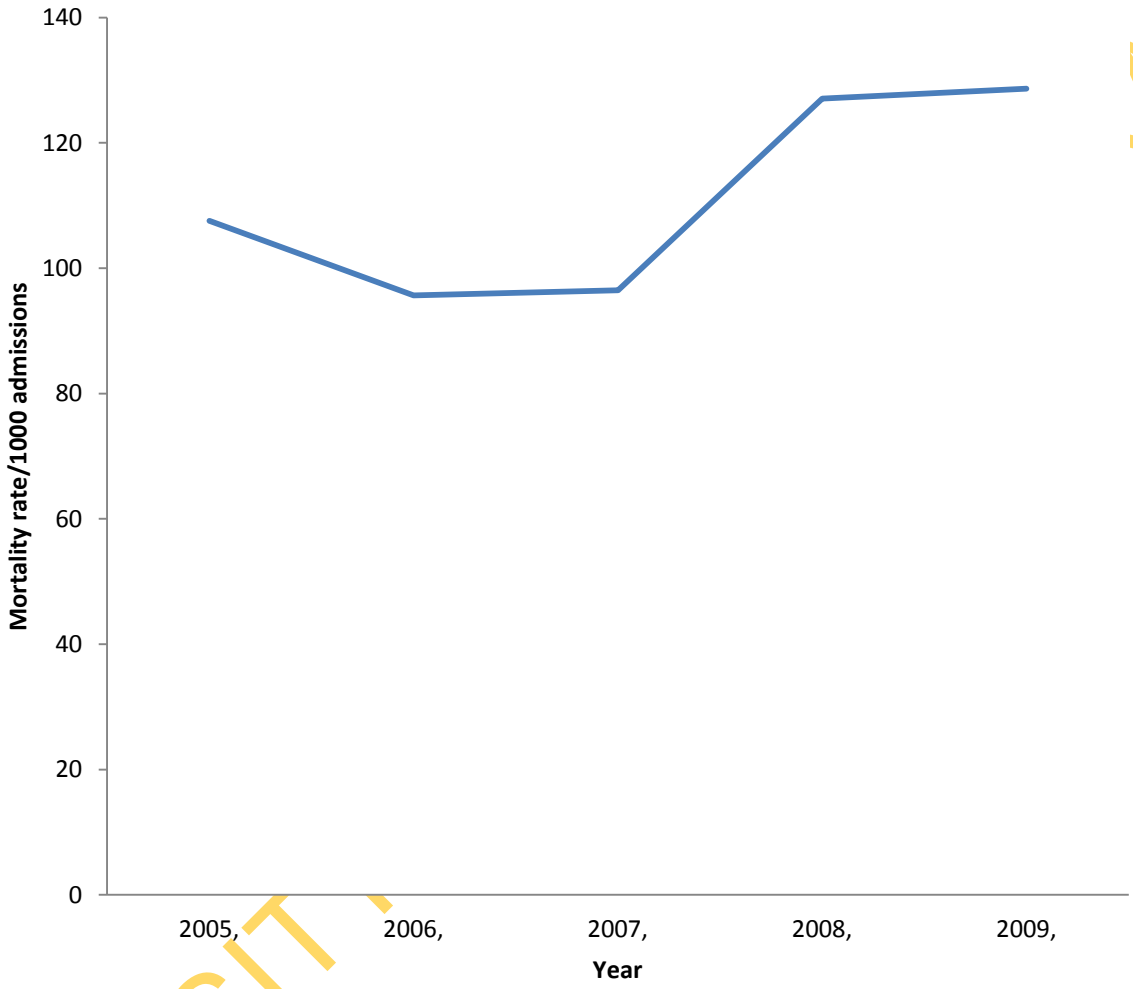


Figure 4.7: Trend of annual mortality rate in the hospitals

The trend of annual mortality rate combining all the health facilities is shown in Figure 4.6. The lowest rate (95.7 per 1000 admissions) was observed in the year 2006 and highest rate (128.7/1000 admissions) in 2009. Combined mortality in percentage ranged between 9.6% in the year 2006 and 12.9% in 2009.

# CHAPTER FIVE

## 5.0 DISCUSSION

This study examined causes of death and the factors influencing pattern of under-five deaths over a period extending from the fifth year into the new millennium. This period is saddled with MDG targets, the fourth of which specifically aims to reduce childhood deaths by two-thirds of the baseline year status by 2015. Although the target of the fourth MDG is still some years away, early evaluation is desirable in order to have a step-wise and guided approach to meeting this target. The discussion was grouped under the following headings; factors influencing mortality, causes of mortality, time between admission and death, under-five mortality rates and trend of mortality. This study builds on previous researches on factors influencing mortality pattern among under-five children especially in Ibadan.

### 5.1 Factors influencing mortality among under-five children

More male children than female were admitted in this study and mortality rate was higher in male in the health facilities within the years under review. Similar gender differentials in rates of hospitalization have been reported in many other studies. In a retrospective study carried out by Onyiriuka (2005) where he reviewed the admission and outpatient attendance registers as well as the case records of all the children at St Philomena Catholic Hospital (SPCH), Benin City, Nigeria, he discovered that 53.6% of the children admitted were male while females were 46.4%, but mortality was 1.7 times higher in female than in the male children. Another study by George *et al*., (2009) in the Department of Paediatrics, University of Port-Harcourt Teaching Hospital, Port-Harcourt, Nigeria confirmed that sixty one deaths were recorded out of a total of 2,174 admissions into the paediatric wards during the study period. These deaths were made up of 34 males and 27 females giving a ratio of 1.3:1. In another study carried out in Port Harcourt by Nte *et al*. (2006), 53.3% of the children that died were males while 47.4 were females. Prevalence in mortality was also significantly higher in male than female children also in a study carried out in a colony of East Dehil, India by Grover *et al* (2004). There is no ready explanation for the male preponderance in hospital admissions. It is probable that parents have a higher propensity to accept hospital admission for their ill sons than for their ill daughters. This is a possibility

because of the cultural parental preferences for male children. This would however require further research and would be the focus of another study.

In this study, the highest number of admissions occurred in children aged 12-59 months and the peak of mortality occurred in the same age group. This finding is in contrast to the retrospective study carried out by Obi *et al.* (2009) in the University of Benin, Benin City where the largest number of admission occurred in children below the age of one year, but mortality was highest in children between the ages of 1-2 years, a result similar to the findings in this study. This study is in contrast to that of Fatuga *et al*. (2007) in Sagamu and Ayoola *et al* (2005) in Ibadan where neonatal mortality predominated. The result in this study may be as a result of the occurrence of some diseases such as measles and its complications and the severity of malaria in this age group that is age 12–59 months. Moreover, the immunity acquired from the mother must have waned at this stage and the children are trying to develop their own immunity. Also, children above the age of one year are more likely to be fed with diets poor in protein after they have been taken off breastfeeding, since the parents may not be able to afford balance diet for them, thereby lowering their resistance to infections. It is not surprising therefore that mortality was highest among children aged 12-59 months.

The weight is a factor that may influence mortality among in under-five children according to the result in this study. Children who were underweight were more likely to die compared with children with normal weight. It is possible that the number of children that came in preterm birth and low birth weight were responsible for this significance of mortality and weight. It is believed that birth weight is sensitive to many factors and is the major determinant of whether a newborn will survive and thrive. Apart from the newborn, many of the post-neonates and children aged 12-59 months had low weight are underweight. It is probable that the children are not properly and adequately with balanced diet in this part of the world due to poverty and ignorance. The low weighted children presented in these hospitals confirm the level of malnutrition in the children.

The result from this study also shows that more children were admitted during the rainy season. This indicates that there is seasonal variation in morbidity and mortality among children under-five in Ibadan. This is supported by the findings reported by Abdullahi *et al.* (2007). In the study carried out in Ghana and other studies from some other African countries; peak mortality was reported during the rainy season. This finding is in concordance with that of Onyiriuka (2005)

where slightly more cases were admitted during the wet season (52.3%) than the dry season (47.7%). This could be attributed to the epidemiological models of some diseases such as malaria, bronchopneumonia and diarrhea diseases among others, occur more during the rainy season than in the dry season. Anopheles mosquitoes that transmit the organism that causes malaria have better also have better conducive environment to breed in wet season.

In this study, greater proportion of children who died than those who recovered were from the congested areas of the city. Available data indicated that residence might be associated with under-five mortality. Sharma (2010) in his study in Nepal confirmed that mortality in urban area is consistently lower than in the rural areas. Under-five mortality was 35.9% lower in urban area than in rural area. NDHS (2008) also reported mortality among under-five children with geographical differences. Furthermore, Antai (2010), in his study carried out to examine the trends in urban population growth and urban under-five mortality between 1983 and 2003 in Nigeria, he concluded that living in socio-economically disadvantaged areas is associated with increased childhood mortality.

It is believed that those who lived in the non-congested part of Ibadan city are likely to be more knowledgeable and earn better income compared to those who lived in congested areas. They are therefore likely to report promptly to the hospital with their sick children. Moreover, their children are more likely to be well fed hence suffer less severity of disease. The non-congested areas of the city are also usually cleaner and with proper waste disposing facilities such as toilets and drainages, while the congested areas are usually devoid of these facilities. Poor economic circumstances of Nigeria which is usually reflected in the areas people reside greatly increases the risk of mortality for children under-five years of age.

The association between father's occupation and mortality observed may be due to the fact that the kind of job that one does sometimes influences ones income and level of education which also reflect on the level of ones' understanding of health and diseases. In other words, being professionals might have positive influence on decisions taken by the parents positively resulting in the survival of their children relative to those were unskilled or artisans. This is in agreement with the study conducted by Hossain *et al*. (2009) in Rajshahi, Bangladesh. He observed that parent's occupations and income were strong socio-economic indicators that are associated with

child mortality. Moreover, there is a big disparity between rich and poor people in Nigeria in access to healthcare as it is with all aspects of life, with higher and increasing mortality rate amongst the poor people. It is therefore necessary for the governments to focus on the barriers that stop the poorest children, i.e. children from low economic class from getting access to the health care and nutrition that will improve their chances of survival.

Only 32.2% of the children in this study were fully immunised. Result on immunisation from this study can be compared with that of Sadoh *et al.* (2009) in Benin City where only 44.3% of the children studied were completely immunised. Proper and adequate immunisation has been shown to reduce mortality among under-five children. A study by Sharma (2010) in Nepal confirmed that immunisation programmes have played a huge part in fighting child mortality in the country. In Nigeria, Immunization rate coverage has improved over the years. For instance, according to Magashi, (2011) in Public health diary, the coverage for Measles has showed a rise from 25.30% in 2003 to 32.70% in 2006 while that DPT was 36.3% in 2006. It can be inferred from this study that appropriate immunisation could save the lives of under-five children since those who were not immunised at all were at higher risk of dying compared with those who were fully immunised.

The position of an under-five child among his siblings may also influence mortality. In this study, first child was more at risk of dying, it is therefore possible that parent's experience in handling the health of their children comes from the number of the children they have. Parents, especially mothers might have had some basic knowledge in understanding the health of their previous children and were able to react better when their younger children fell sick.

### 5.2 Causes of mortality among under-five children

The result on the cause of death in this study is similar to that of the study carried out by Onyiriuka (2005) in Benin City where malaria (61.6%), gastroenteritis (16.6%) and acute lower respiratory tract infection (8.7%) were the commonest diseases among under-five children. Ojikutu (2008) in Lagos State, Nigeria also reported in his examination of the pattern of under-five mortality in Lagos state that the most common killers of under-five are pneumonia, sepsis and anaemia. The causes of death in this study is also similar to that of Ayoola *et al.* (2005) in Ibadan and Huicho *et al.* (2006) in Peru, but a contrasting result was reported by George *et al.*

(2009) in Port Harcourt where HIV/AIDS was the commonest cause of death in under-five children (21.2%) followed by bronchopneumonia (15.8%). The role of HIV/AIDS as a cause of under-five death appears to have diminished. The exact reason is unknown as the socio-economic situation of most Nigerian families had not improved remarkably over the period studied. It is most likely that mothers now get diagnosed early when they go for antenatal care and prevention of mother to child transmission is instituted early. This has resulted in fewer children infected with the virus.

Malaria accounted for almost one quarter of the total death and the leading cause of mortality in all age groups except in the neonates in this study despite the high level of campaign and interventions against the diseases. This is a similar result to that of Ayoola *et al* (2005) in Ibadan where malaria was the leading cause of death in children aged 12-59 months followed by malnutrition, meningitis and measles. The leading role of malaria as a cause of childhood hospitalization and mortality in this study has also been documented by other investigators in Nigeria and other endemic areas. The part of town lived by most of the patients that died may have contributed to the occurrence of the disease and poor outcome of the disease. Many of them were from highly populated and congested areas with poor environmental condition like stagnant waters and poor sewage, where mosquitoes can easily breed. Gastroenteritis and diarrhea was also high as a cause of mortality, this may also be due to the fact that majority of the children who died were from very dirty area of the city without proper waste disposals and toilets.

With respect to neonatal mortality, the main causes of death in this study is similar to the findings in a retrospective study carried out by Akindele *et al*. (1992) where she reviewed the trend in newborn mortality over a ten-year period at the University College Hospital, Ibadan, Nigeria. Low birth weight and respiratory distress were the two most common causes of death among neonates followed by septiceamia and birth asphyxia. Also, in a case control study carried out by Deribew *et al*. (2005) in Ethiopia to determine the under-five mortality in Gilgel Gibe Field Research Center, prematurity and pneumonia were the two most common diseases of death among neonates. However, common causes of neonatal mortality according to a study by Ogunlesi *et al.* (2006) to evaluate the implications of MDG4 in the department of paediatrics in Olabisi Onabanjo Teaching Hospital (OOUTH), Sagamu showed that preterm births and

asphyxia were responsible for over 60% of the mortality; others include NNS, neonatal jaundice and neonatal tetanus. All these studies have similar causes and support the findings in this study.

The finding of this study concerning causes of death among post-neonate children and those aged 12-59 months are in agreement with the studies of Deribew *et al*. (2005) in Gilgel Gibe, Ethiopia where the three most important causes of death among post neonates were pneumonia, malaria and acute diarrhea. Also the result reported in that of Ayoola *et al.* (2005) for this age group (post neonates) confirmed the findings of this study.

### 5.3 Time between admission and death

Over half of the mortality in this study occured within 24 hours of hospitalisation This is similar to the study of Ayoola *et al.* (2005) in Ibadan where 48.8% of death occurred within the first 24 hours. Fatuga *et al.* (2006) at the Paediatric Department of Olabisi Onabanjo University Teaching Hospital, Sagamu also reported that most deaths (69.1%) occurred within 48 hours of hospitalization. Nte *et al*. (2006) in Port Harcourt also reported that 40.8% of death occurred within 24 hours. The reason for this may be that the children were brought to the hospital in critical conditions; this has to do with the attitudes of parents or guardians of these children. It is probable that one of the main contributors of the high death rate of under-five children in health facilities is late presentation. In his study, Nte *et al*. (2006) reported that 17 percent of the children were so ill that the full registration process with the opening of folders could not be completed while over 40 percent died within 48 hours.

Another probable factor that could have led to high mortality within the first 24 hours is the socio-economic status of the parents/guardians which affect the health seeking behavior. According to Uzochukwu and Onwujekwe (2004) in a study in the south-eastern part of Nigeria and Malik *et al*. (2006) in Sudan, the least poor groups had a higher probability of seeking treatment at the hospitals, and private clinics and in using laboratory procedures. The least poor also used the patent medicine dealers and community health workers which may lack health professionals less often for the treatment of malaria. Caregivers usually go through different treatment option before consulting health facilities ending with obvious delay in seeking care.

In this study, there were more non-referral cases when compared with cases that were referred from other health facilities. This is in contrast to the result of Ayoola *et al.* (2005) in Ibadan where 58.2% were emergency referral cases from other hospitals. The late response of the children to bring their sick children to the hospital and to embrace modern medicine may be the reason for increased mortality. It is possible that parents or guardians did not make decision on time to take their children to hospitals due to their low socio-economic status, or because of the over-riding influence of culture and traditions. It is probable that some of these deaths could have been averted if the services at the hospital were free and patients were encouraged to present early in the course of their illness.

### 5.4 Under-five mortality rates

Mortality rates were high among all the age groups considered in this study. The overall mortality rate of 11.2% obtained in this study was comparable to 12.6% reported between 1996 and 2005 in OOUTH, Sagamu by Fatuga *et al.* (2006) and 10.8% obtained in Southern Sudan by Mahfouz *et al*. (2009). Interestingly, U5MR obtained in this study was higher than the 2.8% reported by George *et al.* (2006) in Port Harcourt. The annual mortality was high throughout the five year period except for the dip in 2006 and 2007. Overall, mortality rate of the children increased in 2008 and 2009. The reason for this is not known, but may be as a result of multiple industrial actions in health sector reported at this time in the state. Hence, child mortality rate in Ibadan, Nigeria do not seem to have changed remarkably.

The various mortality rates gotten at hospital level and within the various age group were high and comparable with that of a study carried out in Butarija, Ethiopia by Shamebo (1993) in a year follow up study where there were 306 deaths of children under the age of five years. Estimated cumulative under-five mortality rate for the study period was 293 and the infant (0-11 months) mortality rate was 136 per 1000 per live births. This result confirms that the under-five mortality rate is very high in this part of the world especially in Nigeria.

### 5.5 Trend of under-five mortality

Two thousand, one hundred and forty six deaths were recorded out of the 19,203 under-five children who were admitted. This number accounted for an overall mortality rate of 11.8/1000 admissions. In the three hospitals admission rate was lowest in St Mary's Catholic Hospital,

Eleta in year 2005, but lowest in year 2007 in Oluyoro catholic hospital and Oni and Sons state hospital. Reason for this is not known.

Catholic Hospital, Eleta had the lowest mortality rates in the first three years of review, but highest rate in 2008 and 2009. There was a steady fall in the under-five mortality of Oluyoro Catholic Hospital throughout the review period. The rate of under-five mortality in Oni and Sons Children Hospital rose gradually and peaked in 2007 before dropping again. Overall, under-five mortality dropped and remained relatively stable between 2006 and 2007 before rising drastically till the end of the study period. Annual trend in mortality in this study was generally lowest in 2006 (9.6%) and highest in 2009 (12.9%).

## 5.6 CONCLUSION

The findings of this study pose considerable challenge to all health stakeholders, especially the government and the public health workers. The chances of under-five children's survival in Ibadan are low as confirmed in this study and deaths were caused mainly by preventable diseases. The high under-five mortality rate in Ibadan gives no hope of meeting up the expectation of reducing the rate by two-third by year 2015. This study, by reviewing the record of morbidity and mortality of under-five in selected secondary health facilities in Ibadan, identified some of the influencing factors of under-five mortality and various causes of death. The study exposes the level of ignorance of some parents and guardians which is reflected in high mortality rate, partial or no immunization, late presentation of sick child and economic factors affecting under-five mortality such as parent's occupation.

Review of information from secondary health facilities of this kind draws attention to the pattern of childhood morbidity and mortality in the community. Strategic steps if taken by everyone, especially by stake holder – the health practitioners and the governments can drastically reduce some diseases and put an end to others.

The Millennium Development Goals adopted by 147 Heads of States in 2001, address the world most staggering health and poverty issues. Meeting the goals or even substantial progress towards meeting them would produce a healthier, more economically sound world. Preventing the deaths of children is a matter of political will by implementing proven, cost effective interventions to mitigate contributory factors such as highlighted in this study.

## 5.7 RECOMMENDATION

1. Immunisation which is one of the most effective, safest and efficient public health interventions must be encouraged. Government must ensure that parents are perpetually motivated to take their children for vaccination. The immunisation programme should be extended to remote parts of the country in order to cover a considerable population.

2. Child health intervention such as oral rehydration therapy and proper hygiene that emphasize hand-washing and proper stool disposal could reduce diarrhea prevalence and associated child mortality. These are steps in the right direction of reducing under-five children mortality.

3. Public health practitioners must be ready to control and prevent all forms of malnutrition through proper education of parents especially mothers in homes and market places, religious gathering and in the media on how to get cheap, adequate and balanced diet and to spend their often limited resources wisely.

4. Third world governments should rise to the challenges of poverty in their regions particularly as this phenomenon relates to the health care sector. Judicious expenditure on health should be ensured especially at state and local government level to cover cost of drugs (such as anti-malaria drugs and antibiotics) and relief during emergencies.

5. Reduction in the cost of health may encourage parents to take their sick children to hospital and seek out proper and timely care from professionals. There is a need to focus on community-level interventions aimed at increasing health facility utilization and improving the socio-economic position of parents especially in disadvantaged groups

6. Professionals with appropriate training can help develop efficient monitoring systems and emphasize health education, public information, health promotion, disease prevention, and social marketing of public health issues.

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