Acute Respiratory Infection among Nigeria's Under-five Children:

A Quest for the Cause

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DECLARATION

I Rosa Isegbuyota Useh declare that this dissertation titled: Acute Respiratory Infection among Nigeria's Under-five Children: A Quest for the cause; submitted for the degree of Master of Social Science in Population Studies and sustainable development at the North West University Mafikeng campus is my own original work and has not been previously submitted by me to another University / Faculty and all resources that have been used or quoted have been duly acknowledged.

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LIST OF ABBREVIATIONS

ARI - Acute respiratory infections

BMF – Biomass fuel

FCT - Federal Capital Territory

LDC - Less Developed Country

LGAs - Local Government Areas

N.C - North Central,

N.E - North East,

N.W - North West,

OPEC- Petroleum Exporting Countries

RSV- Respiratory Syncytial Virus

S.E - South -East,

S.S - South-South,

S.W - South – West,

URI - Upper Respiratory tract Infection

WHO – World Health Organisation

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ABSTRACT

Acute respiratory infections (ARI) are the main cause of morbidity and represent one of the main causes of death among Nigerian children younger than 5 years of age. In this connection, the Nigerian 2008 DHS reports the prevalence of ARI among the under-five population to have been at 3%. As the cause for this morbidity is neither specified nor documented, the aim of this study therefore, was to establish and document the cause/causes of this prevalence among under–five children from different zones of Nigeria. The study employed the Logistic Regression Model to identify the variables that have a bearing on the acute respiratory infection status of the under-five population of Nigeria.

It was elicited from the 2008 DHS Report that the North East Zone had the highest prevalence of ARI among the under-five children in Nigeria as it was reported at 10%, followed by the South-South Zone at 6.6%. The South West Zone recorded the lowest at about 1.7% at the end of the survey.

The conclusion is that the use of biomass fuel and the presence of very young children in the same rooms were associated with the development of ARI among under-five children. However, environmental factors, such as the climatic conditions that promote certain types of vegetation in some zones in addition to the issue of the very erratic and inadequate electricity supply do contribute to the health problems of the under-fives in Nigeria.

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CHAPTER 1

INTRODUCTION

1.1 Background

Acute respiratory infections (ARI), primarily pneumonia are the leading cause of the burden of diseases and deaths in children worldwide (Janjua *et al.* 2012: 2). These infections represent 30-40 per cent of the paediatric medical consultations, which contribute between 20 to 40 per cent of hospitalizations of under-five children. Janjua *et al.* (2012: 2), highlight the fact that, thirty per cent of deaths among under-five children worldwide are attributable to ARI and the majority of these deaths occur in Asia and Africa. They also state that more than 50 per cent of the cases occur in India, China, Pakistan, Bangladesh and Nigeria. According to Cashat-Cruz, Morales-Aguirre & Mendoza-Azpiri (2005: 84), the incidence of ARI – pneumonia and the rate of mortality in children younger than 5years in the developing countries are ten times higher than in the industrialized countries.

In Asia, Pakistan is ranked third after India and China, with 9.8 million episodes of ARI in children below the age of 5 years (Janjua *et al.* 2012: 2). In China and Beijing, the highest incidence of ARI occur in children under 1 year of age with 4.2 episodes per child per year in contrast to 2.1 episodes per child per year among children aged between 4 to 5years old (Sharma *et al.* 1998: 291). According to India's 1992-1993 national family health survey, about three-quarters of households use unprocessed biomass materials as their primary fuel for cooking, as such the daily air pollution exposure from cooking with biomass typically exceed health-based guidelines by factors of 20 or more (Mishra *et al.* 1999: 119).

In the Americas, 100,000 annual deaths caused by ARI in children younger than 1 year have been reported since the 1980s and almost 99% of these deaths have occurred in the developing countries of Brazil (40%), Mexico (19%), Peru (14%), Bolivia (7%) and Haiti (5%) which have contributed 85 per cent of the deaths (Cashat-Cruz *et al.* 2005: 87).

Biomass fuel is used by billions of people in the less developed countries as their main source of domestic energy for both cooking, lighting and warming their homes (Laumbach & Kipen 2012: 4; Fullerton *et al.* 2008: 844; Grigg 2007: 287; Ezzati & Kammen 2001: 619). Biomass fuels are the materials burnt to make fire used for cooking and heating homes. They are solid fuels from biological, crop origin such as wood, coal, agricultural residues, bushes, tree leaves, charcoal, and cow dung (Mishra, Retherford & Smith 1999: 119). They are the most widespread traditional source of indoor pollution exposure on a global scale. People are exposed to this indoor pollution on a daily basis especially women and young children who spend the greater part of their time at home (Laumbach & Kipen 2012: 5). According to Mehta and Shahpar (2004: 53), the prevalence of solid fuel use are higher in the rural areas of developing countries and biomass–exposed children are more likely to live in a rural area and to be in households of a lower standard of living and to live in lower-quality housing (Fullerton, Bruce & Gordon 2008: 845).

1.2 Problem statement and substantiation

The global incidence of ARI condition according to Rudan *et al.* 2004: 895), among under-five children is nearly 90% which are largely from the developing world.

Although the prevalence of ARI amongst Nigeria's under-five children was reported at 3% in the 2008 DHS, the cause or causes of this were however, not systematically identified and

documented in the report. The Nigerian 2008 DHS report, states that socio-economic factors prevailing in the country predisposes people of low socio- economic status to the risk of ARI and Sofoluwe's report (in Fullerton *et al.* 2008: 844), has associated childhood pneumonia and bronchiolitis in Nigeria to indoor cooking smoke and since a high proportion of Nigeria's population use wood and other solid fuels for cooking, a link is established between the causes of ARI and the environment as the environment determines the choice of cooking fuel that the women and young children have access to for lighting, warming of homes and cooking. An urban based study in the Nigerian Idikan community of Ibadan, reported an annual incidence of ARI ranging from 6.1 to 8.1 episodes per child per year and the episodes were highest in the first two years of a child's life. It is noteworthy that, more than 80% of the episodes attended to at the Idikan community clinic were considered mild (Iyun & Tomson 1996: 437).

Although other studies have associated acute respiratory infection (ARI) in children under - five years to the use of biomass fuel in households in the developing countries, there has been limited evidence given on ARI amongst Nigerian children even though a high proportion of the population use wood and other solid fuels for cooking. The survey also showed that 3 per cent of the children under the age of five years have had ARI symptoms in the two weeks preceding the survey. Thus this study's main objective was to elicit evidence for identifying the risk factors for ARI among Nigeria's under-five children in the different zones of the country.

1.3 Rationale / Justification / Relevance / significance section.

The rationale of the study was to establish the cause(s) of acute respiratory infection (ARI) among under-five children in Nigeria. It is a general norm that establishing the cause(s) of a

health problem can lead to solving that problem. In the case of ARI, coming up with plausible intervention strategies towards ameliorating the under-five mortality rate in the country has to emanate from its causes. This is in line with addressing one of the Millennium Development Goals of ''reducing by two-thirds the under-five mortality rate'' by 2015 (2008 NDHS: 5).

1.4 Main aim and objectives of the study

The main aim of this study was to establish the cause(s) of the prevalence of ARI among under-five children in Nigeria. And the specific objectives of the study were to:

- Establish the degree of prevalence of ARI among under-five children in the different zones.
- Establish links if any, between ARI and types of cooking fuels used.
- Identify the socio-economic factors contributing to the prevalence of ARI among under-five children.

1.5 Basic hypothesis/central theoretical statements

The hypotheses that guided the study were:

- That there was no significant difference in the prevalence of ARI amongst under five children in the different zones in Nigeria
- That there were no significant differences between the prevalence of ARI among under five children and the type of cooking fuels used in the different zones.
- That there must be significant association between the socio-economic factors and ARI among under five children in Nigeria.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

Acute respiratory infection (ARI) is one of the leading causes of morbidity and mortality in children under -five years. 30 percent of deaths in children of less than 5 years old are attributed to ARI. It is one of the many infectious diseases that involve the respiratory tract which could either be the lower or upper part of the respiratory tract. Lower respiratory infections such as pneumonia tend to be far more serious conditions than the upper respiratory infections such as the common cold. Although some disagreement exists on the exact boundary between the upper and the lower respiratory tracts, the upper respiratory tract is generally considered to be the airway above the glottis or the vocal cords. This includes the nose, sinuses, pharynx and larynx. Typical infections of the upper respiratory tract include tonsillitis, pharyngitis, laryngitis, sinusitis, otitis media, certain types of influenza, and the common cold. Symptoms of URIs can include coughs, sore throat, running nose, nasal congestion, headache, low grade fever, facial pressure and sneezing.

Various studies have demonstrated an association between use of biomass fuel at household level and ARI episodes among under-five children. Results from a rural setting in Pakistan showed the incidence of ARI was 7 episodes per child per year. The incidence of ARI was higher in children living in houses where biomass fuel was used and who accompanied their mothers while cooking compared with children living in houses where fossil fuels was used who did not accompany their mothers while cooking. Compared with the latter group, the incidence of ARI was also higher in children living in houses where biomass fuel was used but who did not accompany their mothers during cooking (Janjua *et al.* 2012:1-2). Another study from the peri-urban community of Karachi reported incidence rates of 7 episodes of

ARI per child per year. Iyun and Tomson (1996: 437) report on a community survey in Gambia, and their findings were that each child experienced an average of one episode of serious ARI before reaching the age of five.

Indoor air pollution is still associated with the widespread use of biomass fuels which kill nearly one million children annually, mostly as a result of acute respiratory infections. According to Global health risks, indoor air pollution is responsible for 2.7% of the global burden of disease (WHO 2009: 23). The greatest health impact involving ARI from air pollution world-wide affects the poorest and the most vulnerable population. The number of people, the amount of exposure intensity and the time spent exposed to the source of pollution are far greater in the developing countries than in the developed countries. It is estimated that about 76 per cent of all global particulate matter 'air pollution' occurs indoors in the developing countries (Mehta & Smith 2006: 43). Studies have shown that acute respiratory infections (ARI) pose the greatest threat to child survival around the world and are the leading causes of the global burden of disease which have been linked to exposure to pollutants from domestic biomass fuels used in many households in less developed countries of the world (Cashat- Cruz, Morales-Aguirre, & Mendoza-Azpiri 2005: 84).

Biomass fuel smoke are known to contain various irritants, cilia toxic fractions, and mucous coagulating agents, including irrespirable particulates, carbon monoxide, nitrogen oxides, formaldehyde, and polyaromatic hydrocarbons and biomass smoke, like fossil fuel, and cigarette emissions, all produce inhalable particles. Continuous exposure to high levels of these air pollutants can impair the clearing ability of the lungs and render them more susceptible to infection (Mishra & Retherford 1997: 2).

The adverse health effects of indoor air pollution are often exacerbated by lack of ventilation in homes using solid fuels and the poor design of stoves that do not have flues or hoods to take smoke out of the living area (Fullerton *et al.* 2008: 844). The indoor air levels of particles in biomass burning homes have been calculated to exceed 1000μg/m^3 This contrasts with the US Environmental protection agency's 24-hour ambient air quality standard of 150μg/m^3 micrograms per cubic meter PM_{10} and mean particulate matter levels from the WHO guidelines for air quality classified at 50μg/m^3 for PM_{10} and 25μg/m^3 for $PM_{2.5.}$ (Fullerton *et al.* 2008: 844). The negative health effects of these pollutants are particularly severe for young children who tend to stay indoors and are often carried on their mothers' backs or laps while their mothers are cooking (Laumbach & Kipen 2012: 3; Janjua *et al.* 2012: 2; Fullerton *et al.* 2008: 844; Mehta *et al.* 2004: 53; Mishra *et al.* 1997: 2).

Laumbach *et al.* (2012: 6) have noted that the most firmly established health effects of biomass fuel emissions are acute respiratory tract infections in children. WHO concludes that exposure to indoor air pollution doubles the risk of pneumonia and other acute lower respiratory tract infections in children and this might account for half of the roughly 800,000 annual worldwide deaths of the under five children. The Meta-analysis of 24 studies conducted found that exposure to biomass fuels increased the risk of pneumonia by almost 2-fold and meta- analysis that included 8 studies, found a greater than 3-fold increased risk of acute respiratory tract infection in children (Laumbach *et al.* 2012: 7).

Cashat–Cruz *et al* (2005: 84), who have focused on the risk factors for acquiring respiratory infections especially in the developing countries, have conjectured that social factors such as poor living conditions under restricted family income, low parental education levels, environmental factors like cigarette smoke pollution within the house, or smoke from

firewood burning inside the house and overcrowding increase the risk of ARI in children. They add that there are also factors related to the child him/herself that predispose the child to ARI. These are factors, such as low birth weight, malnutrition coupled with micronutrient deficiency and not being breast fed. According to Gruber (1995: 51), these risk factors are interdependent and combine to increase susceptibility to respiratory illness. Several studies have also associated acute respiratory infection in children to the indoor use of biomass fuel especially when using inefficient stoves under poor ventilation (Janjua *et al.* (2012: 6); Mehta & Shahpar (2004: 53).

Laumbach and Kipen (2012: 3-4), also associate ARI to smoke inhalation and their focus was on two broad sources of air pollution. That is, biomass fuels and motor vehicles with emphases on the growing body of recent research pertaining to the relationship between the respiratory health effects and exposure to traffic related air pollution (TRAP) and the biomass fuels (BMF) air pollution. Laumbach and Kipen's argument is that, air pollution is one of the many environmental factors which play a causative role in the exacerbation of incidences of complex respiratory diseases and they add that TRAP from motor vehicles is a growing concern in both developed and developing countries. Mehta *et al* (2004), add that in contrast to large- scale industrial sources of air pollution, the sources of BMF and traffic emissions tend to be in close proximity to individual ''receptors.'' for air pollution. Grigg (2007) and Fullerton *et al* (2008) have pointed out that an association exists between exposure to pollutants contained in biomass smoke and vulnerability to infection. In other words, if a child has an existing health condition that would predispose him/her to respiratory infection, and that child is exposed to biomass fuel, that child might get ARI. Grigg (2007: 289-290) argues that there are many other 'minor' components of biomass smoke that may have effects. Acrolein, for example, causes epithelia injury, which may predispose a child to

bacterial infection. The respiratory syncytial virus (RSV) is also an important cause of acute lower respiratory tract infection in young children in the developing world and it predisposes children to bacterial co-infection in the lungs. It is, therefore, possible that the association between biomass smoke exposure and acute bacterial pneumonia are in part, meditated via an increased vulnerability to RSV (Fullerton *et al.* 2008: 843).

2.2 Etiology

Some studies have reported the main responsible microorganisms for lower respiratory infections as being: S, pneumoniac, H. Influenzae, and with less frequency, staphylococcus aureus. Among the viral agents are respiratory syncytial virus (RSV), parainfluenza virus, measles and less frequently, adenovirus and influenza. Other microorganisms that have been reported in lower respiratory tract infections in children younger than a year group are Streptococcus, such as Chlamydia trachomatis, Ureaplasma urealyticum, Mycoplasma pneumonia, M.hominis, Pneumocystis cari-nii, and cytomegalovirus. P. carinii has acquired greater importance with the arrival of the HIV epidemic in the developing countries (Cashat-Cruz *et al.* 2005: 84-85). Respiratory syncytial virus (RSV) has been reported to be occurring frequently in all climatic and geographical areas, with sharp peaks of activity over a period of 2-4 months, and its seasonality varied among regions. The virus is known as the leading viral cause of respiratory infection in children in developing countries. The peak of RSV infection typically occurs in the cold season in the temperate climates and in the rainy season in the tropical climates. Primary respiratory infection through RSV increases the risk of secondary bacterial pneumonia and viral or bacterial co-infections and this is a common occurrence in young children with pneumonia in developing countries (Rudan, Boschi-Pinto, Biloglav, Mulholland & Cambell 1986).

2.3 Risk factors associated with ARI

Medical researchers have identified several risk factors associated with acute respiratory infection in under-five children in developing countries (Rudan *et al.* 1986). They have categorized the risk factors under: definite, likely and possible. The definite risk factors are the conditions related to the child him/herself like malnutrition, low birth weight, non-exclusive breastfeeding during the first 4 months of the life of an infant and not being immunized against measles within the first 12months of life plus indoor pollution and crowding. The likely risk factors are parental smoking, zinc deficiency in the child's food, mother's experience as a caregiver and the presence of other diseases in the child, such as diarrhea, heart disease, asthma and so on. The possible risk factors are mother's education, rainfall that result in humid conditions, high altitude combined with cold air, vitamin A deficiency in the child, and out-door pollution (Rudan *et al.* 1986).

Fullerton *et al* (2008: 844), postulates that young children living in households exposed to solid fuels have a two to three times risk of developing acute lower respiratory tract infection as opposed to those living in households using cleaner fuels. Ezzati and Kammen (2001: 623), in their study in rural Kenya, report that increased exposure to indoor PM_{10} increases the frequency of ARI. Hence they suggest a public health programme for reducing the adverse impacts of indoor air pollution in developing countries which should focus on measures to reduce the average exposure to below - 2000$\mu g/m^3$.

2.4 Types of fuel

Around 2.4 billion people rely on biomass fuel as their main source of energy for cooking, heating and lighting and a further 0.6 billion people use coal around the world (Fullerton *et al.* 2008: 844; Ezzati *et al.* 2001: 619). According to Mehta and Shahpar (2004: 53), the use

of solid fuel is quite prevalent in the rural areas of most developing countries. For instance, around 80% of the Indian households use solid fuels as their primary household cooking fuel. In Pakistan, about 66% of households (22% in urban areas and 90% in rural areas) use some form of biomass fuel (Janjua *et al.* 2012: 2). Nigeria uses wood for cooking just like any other Less Developed Country (LDC) of the world. In about 66 per cent of households, and more than 83% of these households are in the rural areas. The various types of solid fuels or biomass fuels are grouped as dried animal dung and scavenged twigs and grass. These are cheap, inefficient and pollute the most and are at the bottom of the energy ladder. Crop residues, wood and charcoal are higher level of biomass, while kerosene, coal and bottled or piped gas are most efficient (non- BMF) combustible energy sources. Electricity is at the top of the energy ladder. Households in different settings use several fuels, which are influenced by socio-economic status as well as preference. There are four factors identified as most relevant in the household's choice of fuel type. These are: (1) Cost of fuel, type of stove used and easy accessibility to fuel supply; (2) Cooking practice and the stove design; (3) cultural preferences and (4) the potential health impact (Fullerton *et al.* 2008: 844; Mishra, Retherford & Smith 1999: 119).

2.5 Toxic products in biomass smoke

The inefficient burning of biomass on an open fire or traditional stove generates large amounts of particulate matter as well as carbon monoxide, hydrocarbons, oxygenated organics, free radicals and chlorinated organics. The particulate matter component of the smoke is classified according to the size, with inhalable material <10μm in aerodynamic diameter referred to as PM_{10}. The 24-h mean particulate matter levels set in the WHO guidelines for air quality are 50μg/m^3 for PM_{10} and 25μg/m^3 for $PM_{2.5}$, but in many parts of the developing world, the peak indoor concentration of PM_{10} often exceeds 2000μg/m^3

(Fullerton *et al.* 2008: 844). Biomass smoke, just like fossil fuel and cigarette emissions, all produce inhalable particles of elemental carbon, carbon monoxide, nitrogen oxide and hydrocarbons and the indoor air levels of particles in biomass burning regularly exceed 1000μg/m^3 (Grigg (2007: 287).

2.6 Ventilation system

Mechanical ventilation systems in kitchens are often not regulated by building codes (Kimball 1998; Manclark 1999). Although a window may be adequate to meet code requirements, most kitchen designers as well as indoor air quality experts, believe that a mechanical ventilation system is necessary in the kitchen. Kitchen ventilation systems are usually located over the cooker top, which is considered to be the primary source of odors, grease, and moisture. Exhaust systems, remove air as well as heat, moisture, odors, and grease from the kitchen to the outside. There are many variables involved in designing an effective exhaust ventilation system for the cooking area in a kitchen. The following are recommended variables to be considered when designing a kitchen with ventilation system: Type of cooking- whether it is for household or for commercial purpose; type of cooking appliance as this will be determined by the type of cooking; type of cooking appliance, type of cooking fuel, location of the range and/or cooker top within the kitchen, size and location of the hood, if used; size and length of ducts needed to connect from the fan to the exterior vent, type and size of fan used in the system and make-up or replacement air available to the fan.

2.7 Risk factors for acquiring respiratory infections

2.7.1 Living conditions

The World Health Organisation reports the global health risk associated with indoor smoke from solid fuels as causing damage to lungs. About 21 percent of lower respiratory infection deaths worldwide are as a result of indoor smoke from solid fuel. Of these deaths, about 64 per cent occur in low- income countries, especially in South- East Asia and Africa. More than half the world's population still uses wood, dung, coal or agricultural residues on simple stoves or open fires for cooking. Cooking using solid fuels under limited ventilation can lead to high exposure to indoor smoke and a greater associated health risk (WHO Global health risk 2009: 23).

2.7.2 Low parental education

Low parental education impacts on the level of the quality of life for the children and for the parents as well on every aspect of life. Restricted family income often dictates the life style, such as where the family can live as usually they cannot afford good housing, clean energy for lighting and cooking and may live in a poor ventilated house with no separate room for cooking.

2.7.3 Overcrowding

This increase the risk of exposure to respiratory disease pathogens that are released into the surrounding air from sneezing and coughing of infected people and because of the limited space caused by overcrowding, there will be interference with cross ventilation as a result, people will tend to breathe in same air that is saturated with the droplets from the cough and

sneeze which will cause them to be infected with respiratory infection. This situation can be fatal with young children whose immune system is not strong enough to protect them from falling sick from these respiratory disease pathogens.

2.7.4 Environmental factors

More than three million under-five children die each year from environment-related causes and conditions (WHO 2013). This makes the environment one of the most critical contributors to the global toll of more than ten million child deaths annually. Polluted indoor and out-door air, contaminated water, lack of adequate sanitation, toxic hazards, disease vectors, ultraviolet radiation and degraded ecosystems are all potential environmental risk factors for children and their mothers especially in the developing countries. Children as young as five years old sometimes work and play in hazardous settings as poor mothers and their children are at a higher risk, as they are exposed to the most degraded environments, and are often unaware of the health implications (WHO 2013)

Thus the risk of significant respiratory disease is linked closely to characteristics of a host of environmental exposure as indicated above. There are many causes of environmental pollution, and biomass and motor vehicles are two broad sources of air pollution identified by researchers. Domestic fires burning biomass such as wood, charcoal, dung, crop residues and other raw plant materials for cooking or heating remain the cause and most important source of exposure to air pollution world-wide. Traffic related pollution, tobacco smoke and industrial smokestacks are major sources of outdoor air pollution as well. Air pollution is only one of many factors for which a causative role in the incidence of respiratory disease has been advanced. Current evidence has indicated that biomass fuel smoke plays a causative role

in the death of children living in homes where biomass fuels are used, and they suffer from lower respiratory tract infection.

2.7.5 Poverty

Previous studies have shown poverty to be one of the risk factors among the under-five children that increases their susceptibility to ARI. (Cashat-Cruz *et al.* 2005: 84). In situations where there are restrictions in family income, certain conditions are created that can increase the risk of ARI in children. This ranges from poor nutrition resulting in poor health, to poor housing with inadequate ventilation and the likelihood of using cheap and inefficient fuel for cooking. According to Fullerton *et al* (2008: 844), the adverse health effects of indoor air pollution are often exacerbated by lack of ventilation in homes using biomass fuel. Moreover, cheap fuels are inefficient and cause more pollution which increases the risk of ARI in a child or children living in such environments.

2.7.6 Factors related to the child and the risk of ARI

2.7.6.1 Child's health status

A child's general state of health is very important when considering factors that increase the risk of a child being susceptible to ARI. A sick child with a compromised immune system will easily be susceptible to infection of any kind including respiratory infection if exposed to the bacteria or virus that causes the disease. This is due to the defence mechanism which has been weakened and cannot fight to protect the body from the bacteria or virus that has gained entrance to the child's body. There are certain conditions that can contribute to the weakening of a child's immune system. Some children in low and middle income countries continue to suffer from under nutrition, malnutrition and being under weight because they consume

insufficient protein and energy foods. The adverse effects of this are often compounded by deficiencies of vitamins and minerals, particularly iron, Vitamin A and zinc. A child with poor nutrition or inadequate nutrition suffers more frequent and severe infectious illnesses which increase the risk of exposure to ARI (WHO, Global health risk.2009: 13). According to the global health risks report for 2004, about 20% (112million) of children under-five years were under-weight by more than two Standard deviations below the recommended growth Standard median weight for a child's age in under developed countries (WHO, Global health risk. 2009: 13).

2.7.6.2 HIV and AIDS

The HIV epidemic has also contributed substantially to childhood pneumonia in children and babies living with HIV. Symptoms of HIV infection vary by age and individual child. As the HIV infection becomes more advanced, children start to develop opportunistic infections which may include acute respiratory infection amongst others. M. tuberculosis remains an important cause of pneumonia in children with HIV and uninfected children. Studies have shown that antiretroviral programmes can reduce the incidence and severity of HIV associated pneumonia in children through the prevention of HIV infection, use of co-trimoxazole prophylaxis and treatment with antiretrovirals (Rudan *et al.* 1986).

CHAPTER 3

METHODOLOGY

3.1 Brief Description of the Study Area

Nigeria is located in the West African Sub-Region, and it lies between latitudes 4°16' and 13°53' north and longitudes 2°40' and 14°41' east. Nigeria is bordered by the Niger Republic to the north, Cameroon is to the east, Benin Republic is to west while bounded on the south by the Atlantic Ocean. Nigeria is known for her different social groups and distinct cultural traits. There are about 374 identifiable ethnic groups, with the Igbo, Hausa, and Yoruba recognised as the country's major groups. It is made up of 36 states with a Federal Capital Territory (FCT), which is divided into six geopolitical zones: North Central, North East, North West, South East, South-South, and South West. It is also divided into administrative states and each state is subdivided into local government areas (LGAs), and each LGA is divided into localities. There are 774 constitutionally recognized local government areas (LGAs) in the country. Nigeria is a member of the Oil and Petroleum Exporting Countries (OPEC) of the world and generates 99 per cent of its export revenue from its oil and gas reserves.

Nigeria has a tropical climate with distinct wet and dry seasons associated with the movement of the two dominant winds, the rain-bearing south westerly winds and the cold, dry, and dusty north easterly winds commonly referred to as the Harmattan. The temperature oscillates between 25° and 40°C, and rainfall ranges from 2,650 millimetres in the southeast to less than 600 millimetres in some parts of the north, mainly on the fringes of the Sahara Desert. The vegetation that results from these climatic differences consists of mangrove swamp forest

in the Niger Delta and Sahel grassland in the north. The dry season occurs from October to March with a spell of cool, dry, and dusty Harmattan wind felt mostly in the north in December and January. The wet season occurs from April to September.

The 2006 Population and Housing Census puts Nigeria's population at 140,431,790, with a national population growth rate estimated at 3.2 per cent per annum. With this population, Nigeria is the most populous nation in Africa and its population is unevenly distributed across the country. About16.09% of the population is under-five years (22,594,967) and 24.9 % of the population, are women (34,961,107).

Socio-economic information on Nigeria

The socio-economic characteristic of the Nigerian population households as sampled in the 2008 NDHS revealed that about 50 percent of the population is female. The sex ratio is 99: 100 (the number of men per 100 women). The ratio in rural areas is lower than that of urban areas (97:101). The results show that the household population has a greater number of younger people than older people. Forty-five percent of the total population is under 15 years of age while 4 percent is 65 or older. The proportion of the population in each age group declines as age increases; the lowest age group (0-4) has the largest proportion of the population (17 percent), while the highest five-year age group (75-79) has the smallest proportion (less than 1 percent), (2008 NDHS:11).

Household composition - Households in Nigeria are predominantly headed by men (81 percent). Female-headed households are more common in urban areas (21 percent) than in rural areas (19 percent). There has been a slight increase in the proportion of female-headed

households from 17 percent in the 2003 NDHS to 19 percent in the 2008 NDHS (NDHS 2008).

Female-headed households are typically poorer than male headed households. Economic resources are often more limited in larger households.

Moreover, where the size of the household is large, crowding also can lead to health problems.

The 2008 NDHS indicates that the average household size is 4.4 persons, compared with 5.0 persons in the 2003 NDHS. This shows a modest decline over the past five years. The average household size is slightly lower in urban areas (4.1 persons) and in rural areas (4.6 persons).

The proportion of households with nine or more members is higher in rural areas (10 percent) than in urban areas (7 percent), (NDHS 2008: 13).

Education - Education is a key determinant of the lifestyle and societal status an individual enjoys. Studies have consistently shown that educational attainment has a strong effect on health behaviours and attitudes (NDHS 2008: 13).

Educational Attainment- The proportion of the population that has attained any education varies among Nigeria's geopolitical regions. The North West and North East have the highest proportion of persons with no education—roughly seven in ten women and half of men—while the South South has the lowest percentage who have never been to school, 15 percent among females and 8 percent among males. South West has the highest proportion of females and males who completed more than a secondary education (10 percent and 13 percent, respectively). As expected, educational attainment is positively related to household wealth

status. Females and males in the highest wealth quintiles are more likely to be educated than those in the lowest wealth quintiles (NDHS 2008:14).

There are urban-rural differences in educational attainment, with more educated people in the urban than in the rural areas (NDHS 2008:14).

Housing Characteristics - Presents information on a number of household dwelling characteristics, the proportion of households using various types of fuel for cooking. These characteristics reflect the household's socio-economic situation. They also may influence environmental conditions—for example, in the case of the use of biomass fuels, exposure to indoor pollution—that have a direct bearing on household members' health and welfare. The proportion of households with electricity in Nigeria is 50 percent. There are more households with electricity in urban areas (85 percent) than in rural areas (31 percent).

Cement is the most common material used for floors, with 42 percent of households having floors made of cement (49 percent urban and 39 percent rural). In rural areas, 46 percent of households have floors made out of earth/sand, compared with 9 percent in urban areas. About 43 percent of the households in Nigeria live in housing units with only one bedroom, while about three in ten households (29 percent) live in housing units with three or more bedrooms.

About 40 percent of households cook inside the house, while about one-quarter (25 percent) cook outdoors. The percentage of households that cook in their dwelling is higher in urban areas (43 percent) than in rural areas (38 percent). Wood is the most common fuel used for cooking, reported by 66 percent of households. Wood is more commonly used in rural areas (83 percent) than in urban areas (37 percent). Twenty-six percent of all households use

kerosene for cooking. More households in the urban areas (52 percent) use kerosene for cooking than those in rural areas (11 percent).

The percentage of households using solid fuel is high (70 percent), including 86 percent of households in rural areas and 42 percent of households in urban areas. Among the households that reported use of solid fuel for cooking, the majority (94 percent) were using an open fire/stove without a chimney or hood—92 percent of urban households and 95 percent of rural households (NDHS 2008: 23).

Wealth index- It serves as a proxy for measuring the long-term standard of living. It is based on data from the household's ownership of consumer goods; dwelling characteristics; type of drinking water source; toilet facilities; and other characteristics that are related to a household's socio-economic status. (NDHS 2008: 25).

Household possessions -The availability of durable consumer goods is a good indicator of a household's socioeconomic status. Moreover, particular goods have specific benefits. For instance, having access to a radio or a television exposes household members to innovative ideas; a refrigerator prolongs food storage; and a means of transport allows greater access to many services away from the local area. 74 percent of households own a radio (84 percent in urban areas and 69 percent in rural areas), and 39 percent own a television (69 percent in urban areas and 23 percent in rural areas). A mobile telephone is owned by 50 percent of households (76 percent in urban areas and 35 percent in rural areas), while 16 percent of households own a refrigerator.

The proportion of households owning various means of transport.

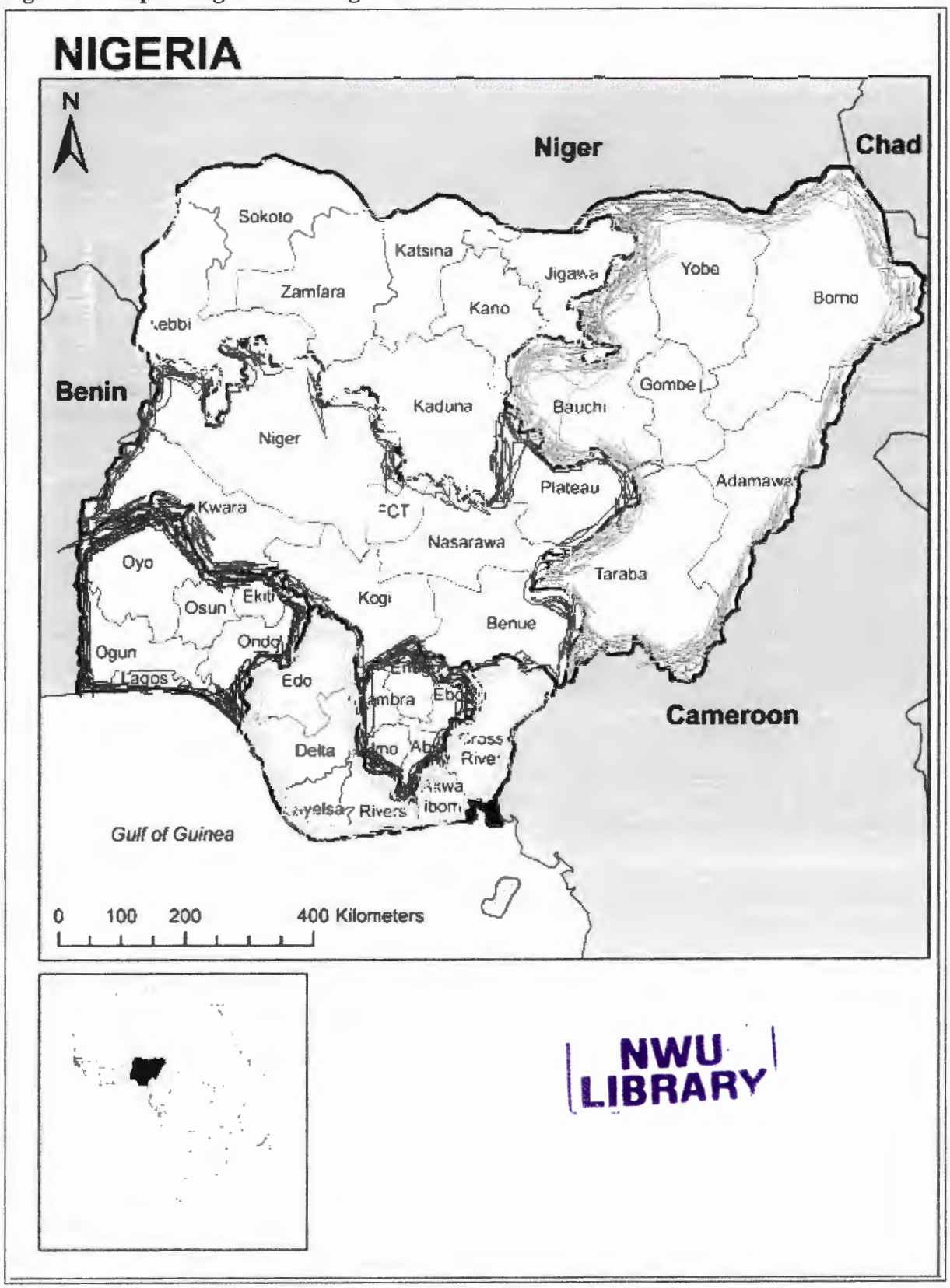
Twenty-three percent of the households own a bicycle (11 percent in urban areas and 29 percent in rural areas), while only 8 percent own a car, and 24 percent own a motorcycle.

Only 3 percent own a canoe (1 percent urban and 4 percent rural), and 3 percent own an animal-drawn cart (1 percent urban and 4 percent rural). Less than 1 percent owns a boat with a motor. Among the means of transport listed, the bicycle, motorcycle/scooter, canoe, and animal drawn cart are more common in rural areas than in urban areas. (NDHS, 2008: 25)

3.2 Study Design

This study was cross-sectional in design and utilized the 2008 DHS data. Individual recode data-set was on married women of childbearing age between 15-49 years and their under-five children, more detailed information about the procedures are available in the DHS, 2008 report (National Population Commission and ICF Macro, 2009). Household and individual characteristics covered by the 2008 NDHS that were taken as being relevant to the risk of ARI included: availability of a separate room as kitchen; number of rooms in the house; type of materials used for building the house; rural or urban; sex of the child; mother's educational level; tribe; religion (Christian, Catholic, Muslim, others) and zone (North Central, North East, North West, South East, South -South, and South West).

Figure 1: Map of Nigeria showing the six zones



Source: National Population Commission (NPC) [Nigeria] and ICF Macro. 2009. N

KEY: N.W N.E N.C S.E S W

3.3 Sample Size

The 2006 EA census frame was used in the 2008 NDHS sample to select 888 clusters using a stratified two-stage cluster design. That is, 286 urban and 602 rural. Since this study was based on secondary data, the sample size was determined by the available primary data. A representative sample of 36,800 households was selected for the survey, with a minimum target of 950 completed interviews per state. The number of households was distributed proportionately among its urban and rural areas for each state.

The study focused on1161 children under the age of five years that reported symptoms of ARI in the last two weeks before the survey in 2008 in Nigeria, out of a total of 24,975 children age between 0 to 4years. Information used for the database was collected from married women of childbearing age and having children under the age of five years during the survey. The data (children recode) was extracted from the measure DHS database and approval was sought from the National Population Commission and ICF Macro, 2009 before being used in this study.

3.4 Description of Variables

3.4.1 Dependent variable

This is to establish if a child had experienced Symptoms of Acute Respiratory Infections (ARI) in the two weeks preceding the survey: These included; coughing and short/rapid breathing. Children who had experienced ARI were coded as **1** and **0** if they had not.

3.4.2 Independent Variables

The key independent variable

The key independent variable was household cooking fuels with a focus on biomass or solid fuel (firewood, coal, wood, straw/shrubs/grass, agricultural crops or animal dung). Other categories included clean fuels, such as electricity, liquefied petroleum gas, natural gas, biogas, kerosene and coal/ignite.

3.4.3 Other independent variables:

These were: Age of the child; sex of the child; age of the mother; level of education; place of residence; religion and the household wealth index.

3.5 Conceptual frame work for the effect of exposure to cooking fuel smoke infecting respiratory system of the under five children in Nigeria

It is believed that the age of the mother, her level of education, where she reside in even her religion and her socio-economic status can to a great extent influence her choice of cooking fuel which ends up predisposing children living in such households to acute respiratory infection. Young mothers tends to be inexperience on how to protect their babies from exposure to indoor smoke as they also tend to be ignorant of how to care for the very young children and how to prevent respiratory infections.

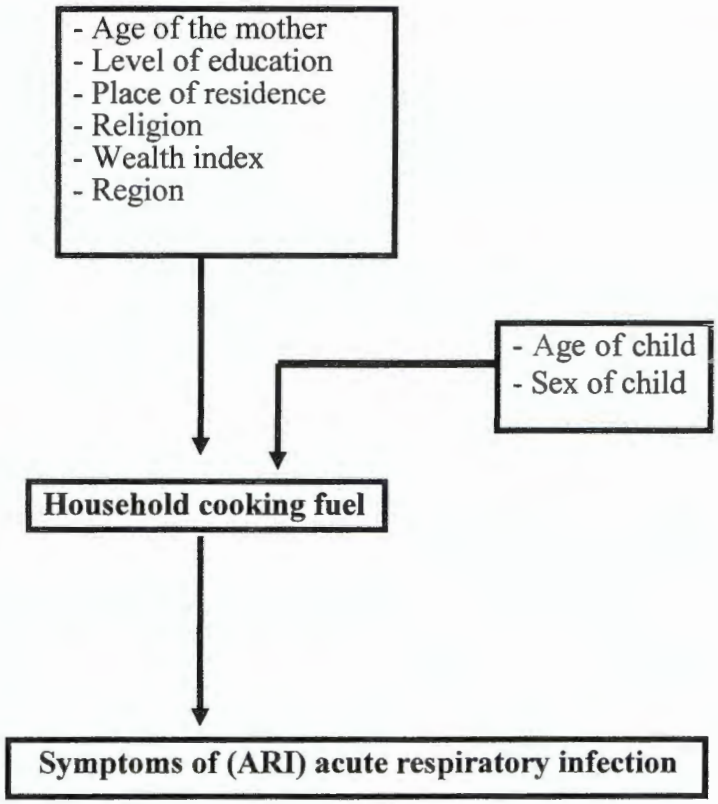
The level of education of mothers is of utmost importance as the educated woman can access a health care facility more easily than the uneducated mother. This is because the former has means and also she knows the value of making use of the health care facilities for both for under-five care and for a sick child. She is also more likely to use the modern orthodox medicine than the less educated or the uneducated mother.

The socio-economic status of the mothers dictates where they live and this greatly influences the cooking fuel used. The well-educated women are employed and live in good areas with modern facilities where they have separate kitchens, such as, they are unlikely to cook indoors using wood as a source of fuel.

It has also been discerned in the study that religion can also be a risk factor for an under- five child. For instance, Moslem children are constantly in danger of exposure to indoor smoke due to the fact that the 'Puddah' mother is not supposed to be seen in public and therefore does everything behind closed doors.

The age of the child can also be a contributing factor to predisposition to ARI. The very young children of between 0 -1year are likely to be at greater risk of exposure to in-door smoke. It is also thought that the child's sex can also increase the risk of the under-five child in a household to ARI. The natural affinity that exist between mothers and their male children creates a kind of attachment which could result into the risk of excessive exposure the young male children to cooking smoke and thus the risk of ARI.

Figure 2: Conceptual frame work for the effect of exposure to cooking fuel smoke infecting respiratory system of the under five children in Nigeria



3.5.1 Operational Definition of the variables:

Symptoms of ARI: 0=No symptom
1=Experienced at least one of the symptoms

Household cooking fuel: Biomass fuel=1; Clean fuel=2

Age of the mother: 15-19=1; 20-24=2; 25-29=3; 30-34=4; 35-39=5; 40-44=6; 45-49=7

Level of Education: No education =0; Primary=1, Secondary=2; Higher=3

Place of residence: Urban=1; Rural=2

Religion: Christians=1; Islam=2; Traditional=3; Others=4

Region (zone)	North Central=1; North East=2; North West=3; South East=4; South South=5; South West=6
Wealth Index:	Poorest =1; Poorer =2; Middle =3; Richer =4; Richest =5
Age of the child:	0-year; 1 year; 2 years; 3years; 4 years
Sex of the child:	Male =1; Female = 2

3.6 Inclusion and Exclusion Criteria

The study was restricted to under-five years children of women aged 15-49 years irrespective of their health status. Also included are the under-five children whose mothers have responded to the question on whether their under-five children had experienced coughing that was accompanied by short rapid breathing in the two weeks preceding the survey of Nigeria 2008 DHS. However, children who died before their fifth birthday were excluded from the analysis because the study was not looking at those that died from ARI but those that are alive and are at risk of ARI. Also, those under –five children whose mothers did not provide information on cooking fuel or said they don't cook in the house were excluded from the analysis.

3.7 Methods of Analysis

3.7.1 Univariate

This involved the construction of frequency distribution table (see table 4) of the key variables (symptoms of acute respiratory infection, household cooking fuels) and other relevant socio-demographic variables.

3.7.2 Bivariate

At this stage, cross-tabulation of the dependent variable (acute respiratory infection) was performed on the key independent variable (household cooking fuels) and other socio-demographic characteristics of the under five children by their mother's age, level of education, place of residence, religion, wealth index, sex and age of the child.

3.7.3 Multivariate

Multivariate analysis was used to examine the differences in the prevalence of ARI in the six zones in Nigeria because of its usefulness in determining differences in two or more outcomes simultaneously. Logistic regression model was used to identify the variables that are related to the acute respiratory infection status of the children in each zone at the level of 0.05 significance and $p < 0.05$.

The logistic regression is of the form;

$$\log\left\{\frac{\gamma}{1-\gamma}\right\} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta_n x_n$$

Where: $\gamma = 1$ represents the proportion of under-five children who had experienced acute respiratory infection symptoms in the two weeks preceding the survey and $\gamma = 0$ if otherwise. The independent variables are x_is (i=1 to n) such as cooking fuel, place of residence, mother's level of education etc. and β_is (i=1 to n) are the regression parameters to be worked out.

3.8 Study Limitations

The information provided on the variables in this study, are limited as a result of the use of secondary data. Also, the representativeness of the focused under- five children across the

country might be a challenge as the primary data collector did not incorporate the focus for this study while designing their data collection instruments. There could also be an element of recall bias on the part of the mothers interviewed with respect to the health conditions of their children at the time of data collection. The stated health conditions might not be the true state of health of the children since there were no laboratory tests or clinic records to confirm the mothers' claims during the data collection. The sample size for the study was too small to be able to generalise the findings to other parts of the country, only about 0.1% (24,975) of the total number (22,594,967) of under-five children in the country were included in this study of which about 1161 children showed symptom of ARI.

CHAPTER4

RESULTS

4. Results

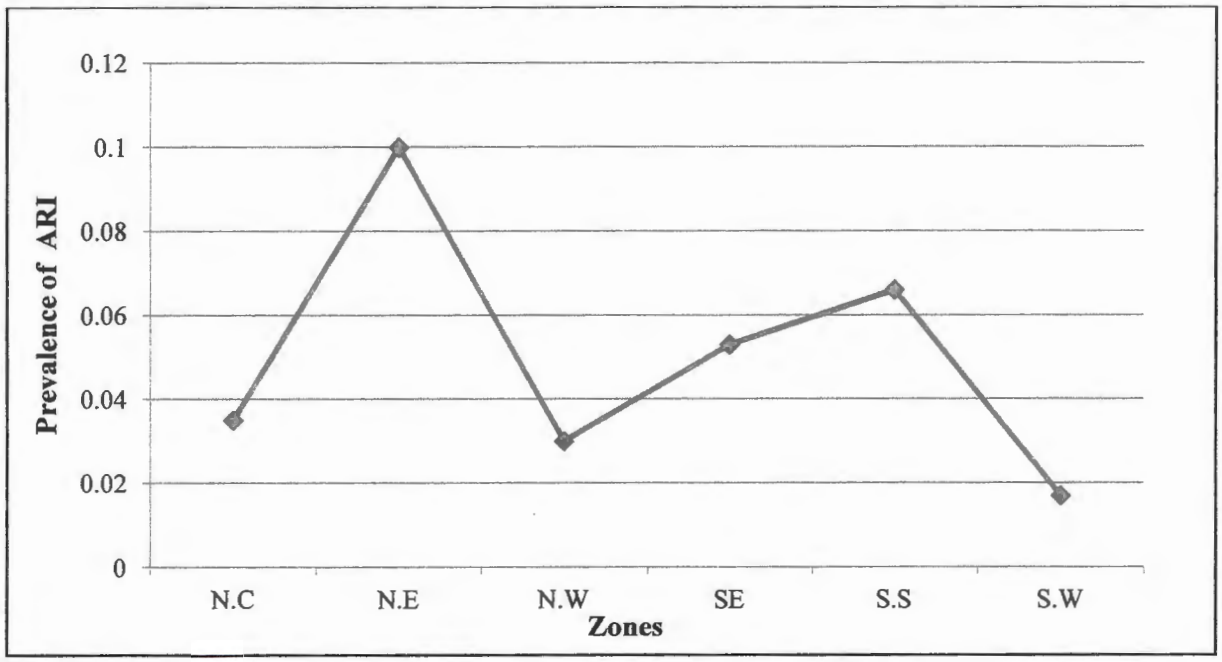
This chapter provided basic background information of the individual respondents. The chapter began by describing basic demographic, socioeconomic and household characteristics of the respondents. It showed the association between the child's socio-demographic characteristics and acute respiratory infection in different regions in Nigeria. Included in this chapter is a section where a multivariate analysis was used to identify the predictors of ARI in different regions in Nigeria. This information was useful for the interpretation of the findings presented in the later part of this report. (See appendix)

4.1 Bivariate Analysis

4.1.1 Proportion of Under-five Children with Symptoms of ARI by Socio-demographic Characteristics according to Regions in Nigeria

In figure 4.1.1, the data shows that the proportion of under-five children presenting ARI symptoms in the two weeks prior to the survey was highest in the North East (0.1), higher in South- south (0.066) and lowest in the South West (0.017). In the southern part of Nigeria, a higher proportion of under-five children showed symptom of ARI in the South- South zone (0.066) than any other region in the south. In the north, the under-five children in North Central zone recorded the highest (0.035) symptom of ARI with the exception of the North east zone.

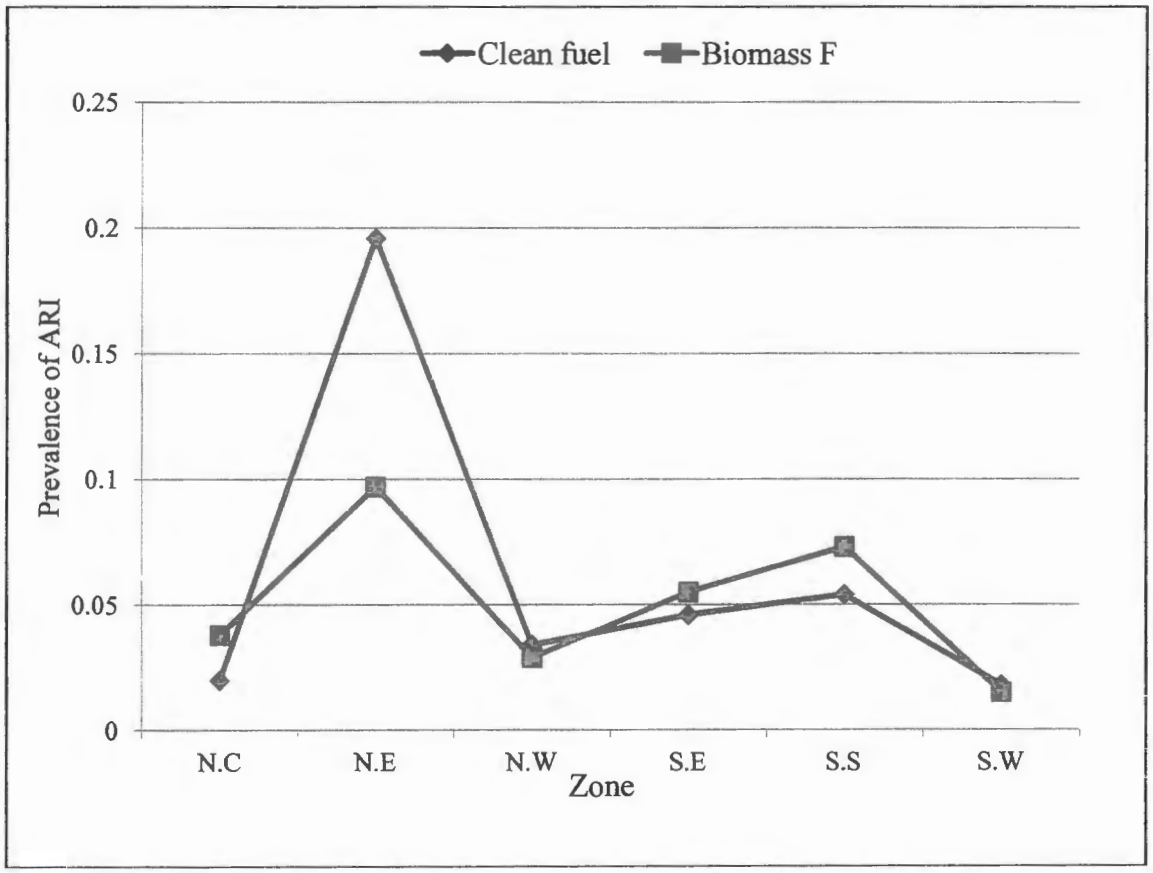
Figure 4.1.1: The proportion of under- five children with ARI symptoms by zone in Nigeria



4.1.2 Proportion of Under-five Children with ARI symptoms in respect of Mother's type of Cooking Fuel according to the different Zones

In figure 4.1.2, the data shows that there were differences in symptoms of ARI among under-five children and the type of cooking fuel used in the household across the regions in Nigeria. The prevalence of ARI was seen to be higher among under-five children living in households where clean fuel was used than households using biomass fuel, for example in the North East (0.196), in the North West (0.032) and in the South West (0.018). However the prevalence of ARI among under-five children living in households using biomass fuel was seen to be higher than in households using clean fuel in the following zones North Central (0.038), South East (0.055) and South-South (0.073). There was such a gap noticed between the prevalence of ARI among under-five children living in households using clean fuel (0.196) and those using biomass fuel (0.097) in the North East (see table 4 in appendix).

Figure 4.1.2: The proportion of under-five children with ARI's symptoms in respect of Mother's type of Cooking Fuel according to the different Zones.



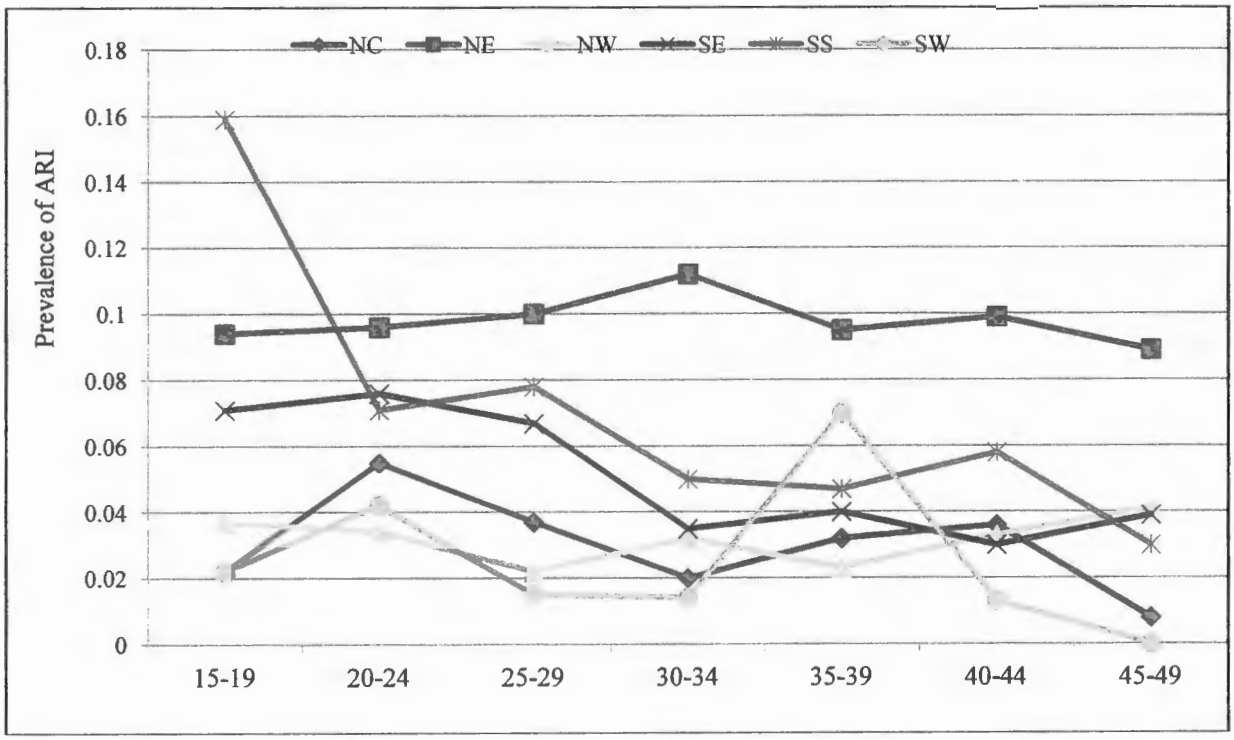
4.1.3 Proportion of Under-five Children with ARI's symptoms by Mother's Age according to zones in Nigeria

Figure 4.1.3 shows evidence that among the under five children of women aged 15-19 years, the prevalence of ARI was highest in the South -South (0.159) and least in the South West (0.02) and North Central (0.02) and across the regions, the pattern of differential in prevalence of ARI among under-five children was similar among women aged 15-19, 25-29 and 40-44 years. The data as shown in figure 4.1.3 further revealed that in all the mother age groups, the pattern of ARI among the children was similar in the North East and could be approximated as 0.1. While in South West, When compared to other age segments, the

highest was found among children of mothers in age group 20-24, 30-34, 45-49, 20-24 and 15-19 years in the North Central (0.055), North East (0.112), North West (0.041), South East (0.076) and South -South (0.159) respectively.

Although, the North East region seems to experience higher ARI prevalence across all age groups except age group 15-19 years, ARI symptoms among the under-fives appeared to reduce with older mothers in the South East and South-South zones.

Figure 4.1.3: The proportion of under- five children with ARI's symptoms by Mother's Age according to zones in Nigeria

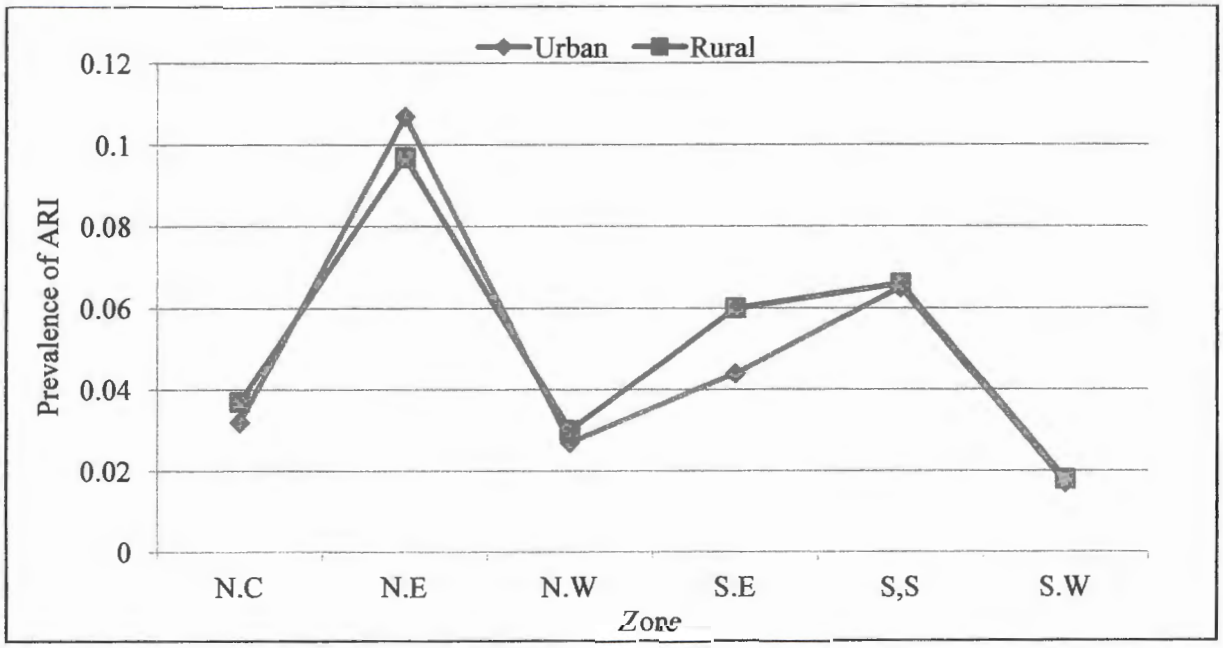


4.1.4 Proportion of under-five children with ARI symptoms by zone according to place of residence in Nigeria

Comparing the proportion of under-five children who had symptoms of ARI in the two weeks preceding the survey in the rural and urban areas of all the regions in Nigeria, the data depicts the under-five children in the North East zone as having been severely affected and South West zone as the least affected, irrespective of their place of residence. However, in all the regions, the patterns of ARI symptoms among the under –five children were similar with higher prevalence observed in the rural areas. The North East is an exception where a reverse pattern was observed in the urban area (0.107).

The second highest zone recording ARI among the under –five was the South –South zone with (0.065) urban and (0.066) rural area. The other zones are as follow South East, 0.06 rural and (0.044) urban, North Central (0.037) rural and (0.032) urban; North West, (0.03) rural and (0.027) urban.

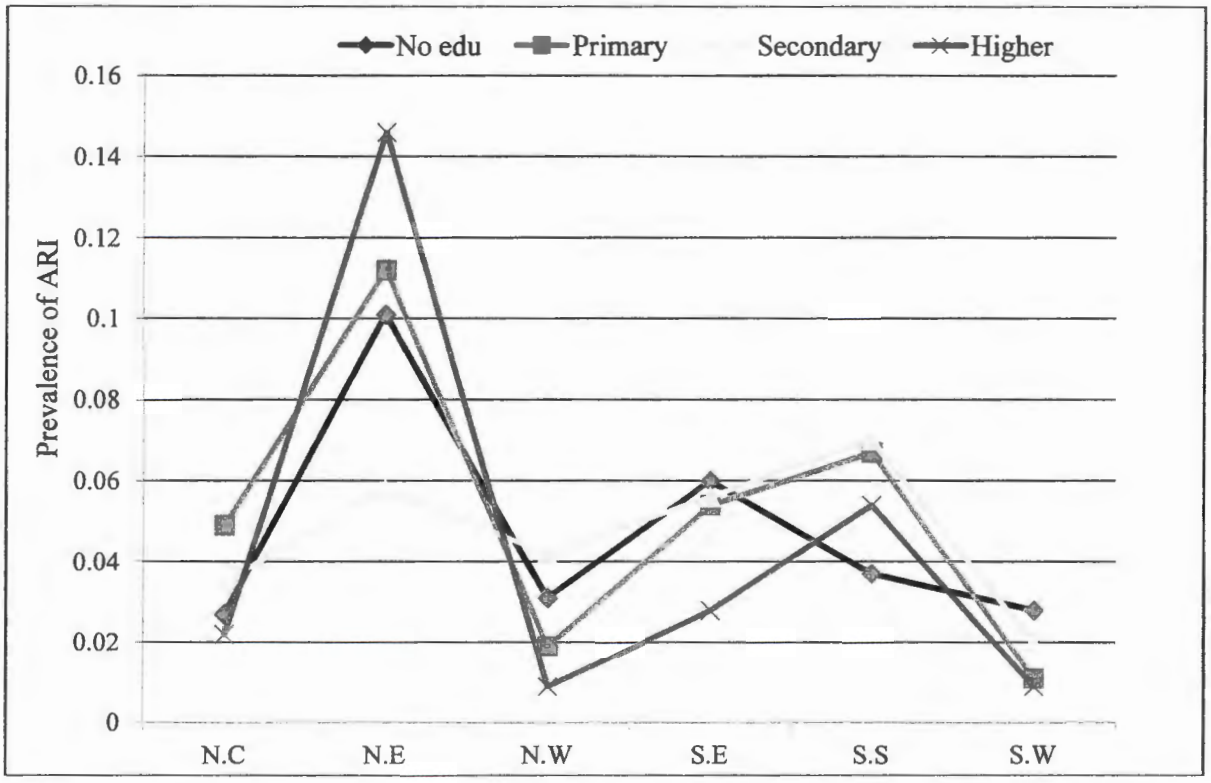
Figure 4.1.4: The proportion of under- five year old children with ARI symptoms by zone according to place of residence in Nigeria



4.1.5 Proportion of under-five Children with symptoms of ARI by zone according to Maternal Level of Education

As shown in figure 4.1.5 below, variation exists in the prevalence of ARI among under-five children and mother's levels of Education. However, there is evidence in the data that the prevalence of symptoms of ARI among under-five children was lowest among children of mothers with higher education in four of the six regions in Nigeria. These regions are North Central (0.022); North West (0.009), South East (0.028) and South West (0.009). It is noteworthy that the highest ARIs symptoms were observed among in the North East (1.146) whose mothers had higher education.

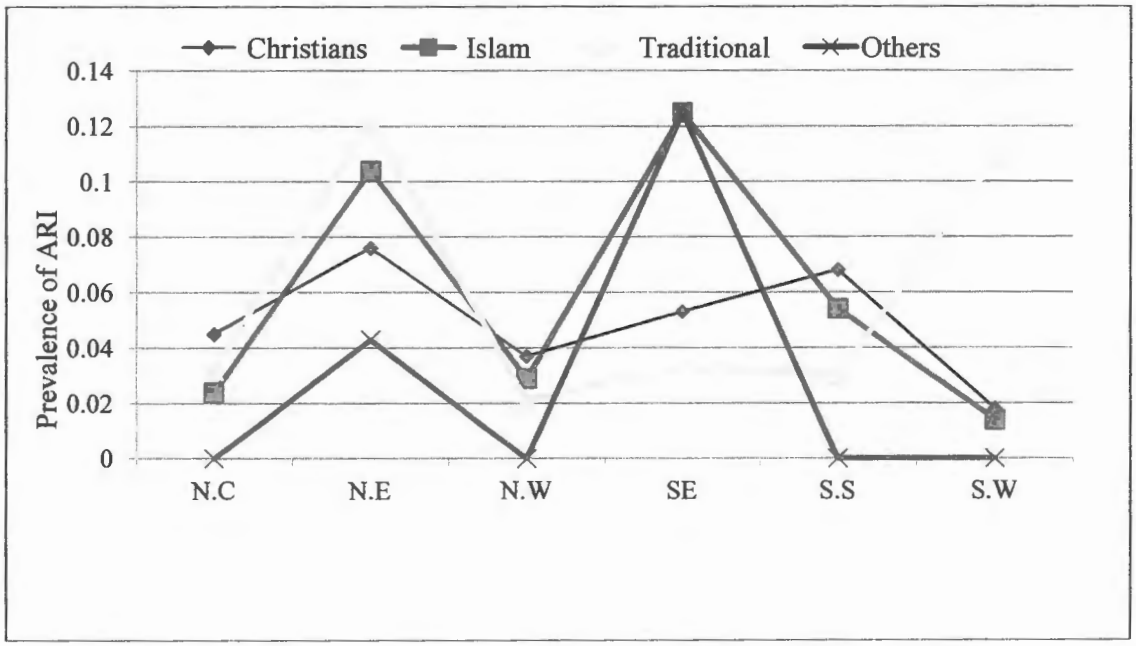
Figure 4.1.5: The proportion of under- five Children with symptoms of ARI by zone according to Maternal Level of Education in Nigeria



4.1.6 Proportion of under-five children with symptoms of ARI according to Mother's Religion by Zone

The data as shown in figure 4.1.6 overleaf, demonstrates that the prevalence of ARI among under-five children was higher among Christians than Muslims in four out of the six regions. These are North Central (0.045), North West (0.037), South- South (0.068) and South West (0.018). Highest cases of ARI were found among under-five children whose mothers practiced traditional religion and reside in North East (0.122) and South West (0.108) zones compared to children of mothers in other religions. The highest prevalence of symptoms of ARI among under-five children was found among the Christians in North East (0.076) and the least was in South West (0.018). In the South East (0.125) the highest prevalence of ARI symptoms was seen among the under-five children of mothers in Islam and the lowest cases were reported in the South West (0.014) in the same religion.

Figure 4.1.6: The proportion of under-five children with ARI symptoms according to Mother's Religion by Zone



4.1.7 Proportion of under-five children with symptoms of ARI according to Mother's Wealth Index by Zone

In figure 4.1.7, the data shows that the prevalence of ARI was more among the under-five children of the poorest mothers (0.128) in the South–South zone, followed by the poorer mothers (0.122) in the North East than with the under-five children from the poorest mothers (0.005) in the South West zone.

In the North Central zone, the highest prevalence of ARI among the under –five children was seen among the poorer group (0.045) closely followed by the middle wealth quintile (0.041), then the poorest wealth quintile (0.034), but lowest among the under five children in the richer wealth quintile (0.023).

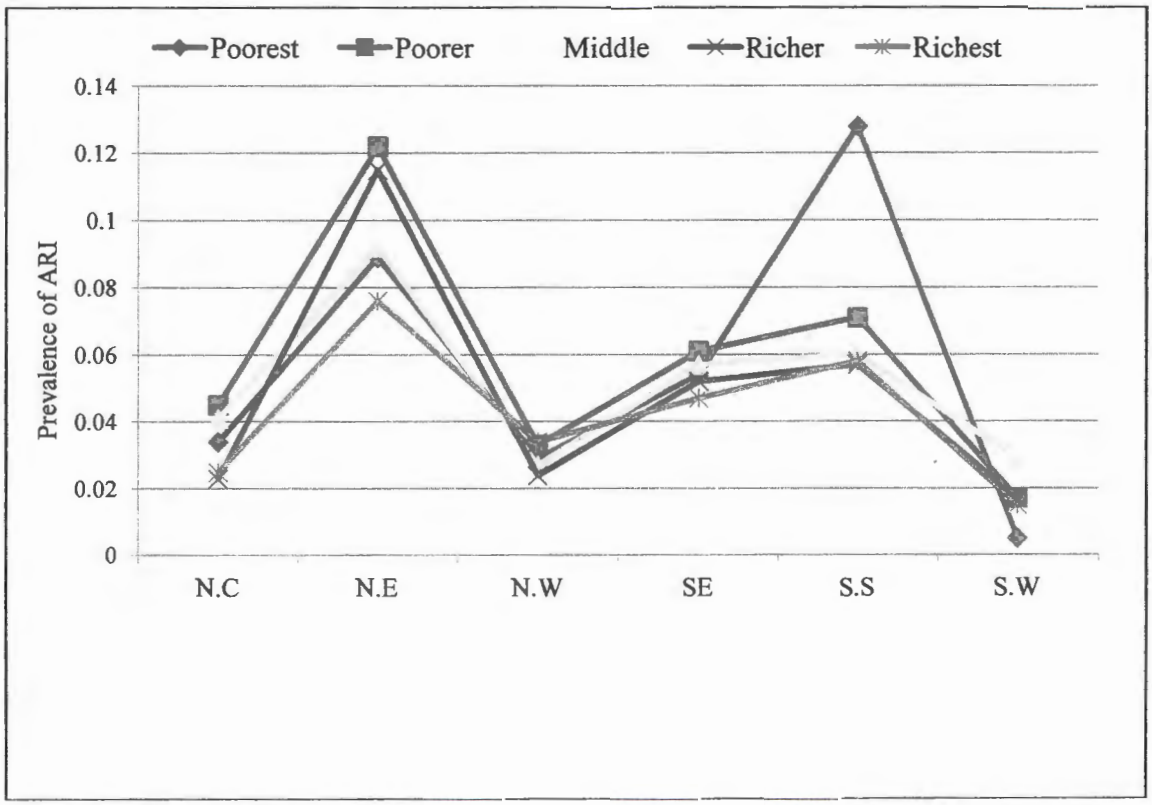
In the North West zone, there was no major significant difference in the prevalence of ARI among the under five children according to the different wealth quintiles. However the highest prevalence of ARI was recorded among the under-five children in the richest wealth quintile (0.034) and closely followed by those in the poorer wealth quintile (0.033). The lowest record of ARI symptoms were observed among the under-five children in the richer wealth quintile (0.024) followed by the middle wealth quintile (0.027) and the poorest (0.029).

The South East zone shows a descending step like pattern in the prevalence of ARI among the under five children according to the different wealth quintiles. There is an observable prevalence decrease among the under-five children as the wealth quintile progresses from poorer to richest.

In the South-South zone, the prevalence of ARI can be said to be similar to what was reported in the South East zone except for the fact that the poorest wealth quintile (0.128) recorded the highest proportion of ARI among the under-fives and the gap between it and the next wealth quintiles which was the poorer wealth quintile (0.071) observed was very wide. Between the middle (0.060) and the richest (0.058) and richer (0.057) there was little difference in the prevalence of ARI among the under-five children in this zone.

It was only in the South West zone that the lowest prevalence of ARI was recorded among the under-five children in the whole country and also the lowest among the different wealth quintiles (0.005). The highest proportion of under-five children with ARI symptoms was recorded among the middle wealth quintile (0.029), followed by both the richer and the poorer wealth quintiles at (0.017) and the richest wealth quintile (0.015).

Figure 4.1.7: The proportion of under-five children with ARI symptoms according to Mother's Wealth Index by Zone



4.1.8 Proportion of under-five children with ARI symptoms according to Child's Age by Zone

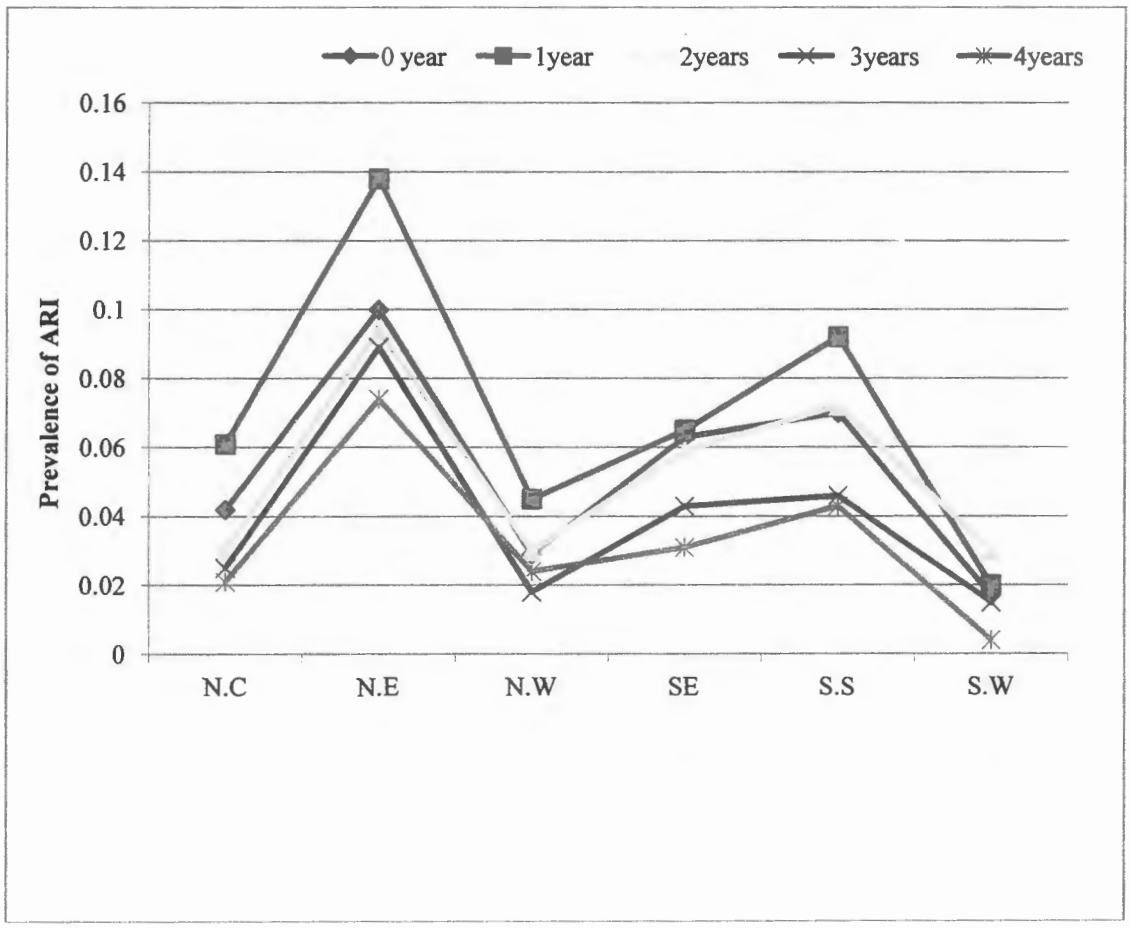
The proportion of under-five children in Nigeria reported to have had symptoms of ARI during the two weeks before the survey was observed to be highest among the one year olds in five of the six zones, namely North Central (0.061), North East (0.138), North West (0.045), South East (0.065) and South-South (0.092) with the exception of South West zone that recorded the highest prevalence among the 2years old (0.03). Likewise the lowest prevalence was observed among the 4years old across the country except for the North West zone that recorded its lowest prevalence among the 3years old children (0.018) while South West zone recorded its lowest proportion of ARI amongst the 4years as (0.004).

In North East zone the highest proportion of under-five children with ARI was among the one year olds (0.138) followed by the less than a year olds (0.1). These were closely followed by the 2year olds (0.094) and the 3year olds (0.089) with the 4year olds at (0.074).

The North West zone like the North East zone had the highest proportion of ARI among the one year old children (0.045), followed by the 2years old (0.03), then the zero year old (0.029). The lowest prevalence was among the 3years old (0.018) followed by the 4years old children (0.024).

The findings in the South West is somewhat different from the other zones, the highest proportion of under-five children with ARI was seen among the 2years old (0.03) followed by the one year old categories (0.02) and the zero year old, with the lowest proportion of ARI among the under-five children been recorded among the 4years old children, followed by the 3years old children (0.015).

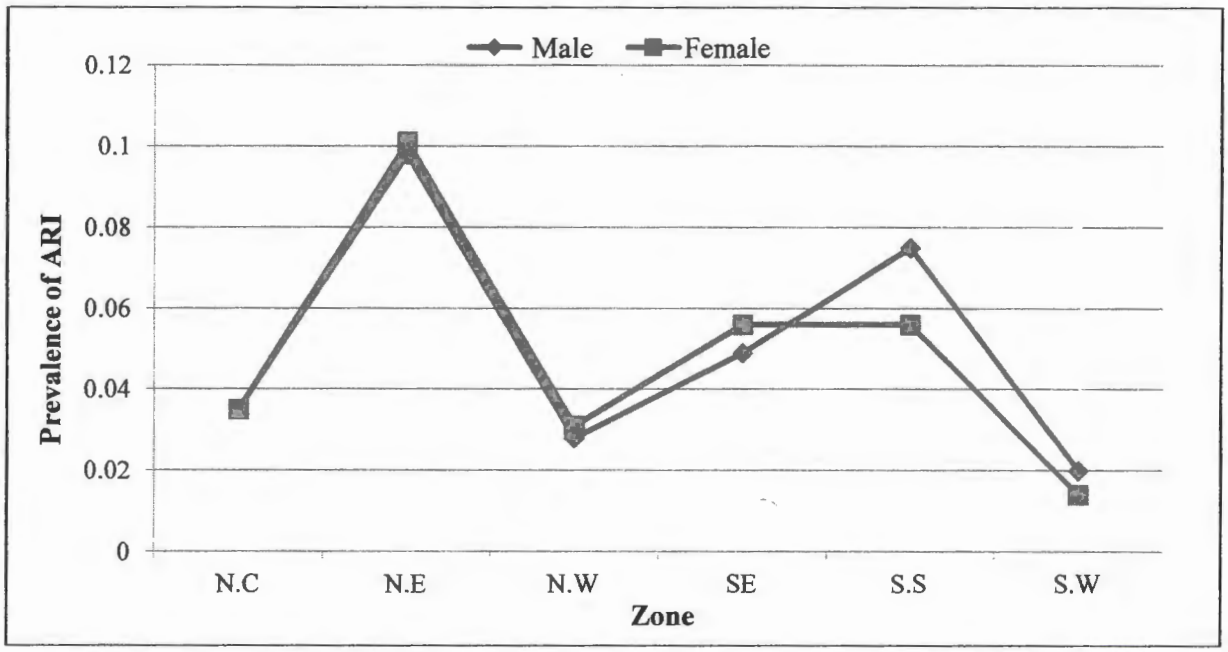
Figure 4.1.8: The proportion of under-five children with ARI symptoms according to Child's Age by Zone



4.1.9 Proportion of under- five children with ARI symptoms according to Child's Sex by Zone.

The sex differential in the prevalence of symptoms of ARI among under-five children living in the six zones of Nigeria in the two weeks prior to the survey showed North East (0.10) as having the highest proportion of female under five children with ARI. The proportion of female under-five children with ARI in the North West was (0.031) and in the South East (0.056). However the reverse was the case in the South-South (0.075) and South West (0.02) where the male under-five children were in the higher proportion of those with ARI. In the North Central zone there was no difference in the proportion of female and male (0.035) under-five children with ARI.

Figure 4.1.9: The proportion of under- five children with ARI symptoms according to Child's Sex by Zone



4.2 Multivariate analysis

This section presents the frequency distribution of under five children across the six zones in Nigeria by their mothers' socio-demographic characteristics in table 4.2.1 and the logistic regression of symptoms of ARI among the under five in table 4.2.2 .

4.2.1: Frequency Distribution of under five children with Symptoms of ARI by Socio-Demographic Characteristics in percentage

The Regional Frequency Distribution table showed the distribution of the under five children in each of the six zones by their mothers demographics in percentage in the last two weeks before the survey from the selected clusters that participated in the Nigeria Demographic Health survey of 2008.

Table 4.2.1: Frequency distribution of Under-five Children with Symptoms of ARI by Socio-demographic characteristics according to Regions in Nigeria

Background Characteristics	North Central (%)	North East (%)	North West (%)	South East (%)	South South (%)	South West (%)
Age						
15-19	2.2	9.4	3.7	7.1	15.9	2.2
20-24	5.5	9.6	3.4	7.6	7.1	4.2
25- 29	3.7	10	2.2	6.7	7.8	1.5
30- 34	2.0	11.2	3.2	3.5	5.0	1.4
35-39	3.2	9.5	2.3	4.0	4.7	0.7
40-44	3.6	9.9	3.3	3.0	5.8	1.3
45-49	0.8	8.9	4.1	3.9	3.0	0.0
Household cooking fuel: - Clean fuel	2.0	19.6	3.4	4.6	5.4	1.8
- Biomass fuel	3.8	9.7	2.9	5.5	7.3	1.5
Mother's level of education						
- No education	2.7	10.1	3.1	6.0	3.7	2.8
- Primary	4.9	11.2	1.9	5.4	6.7	1.1
- Secondary	3.5	5.8	4.2	5.6	7.0	2.0
- Higher	2.2	14.6	0.9	2.8	5.4	0.9
Place of residence			2.7			
- Urban	3.2	10.7	3.0	4.4	6.5	1.7
- Rural	3.7	9.7		6.0	6.6	1.8
Reiigion						
- Christians	4.5	7.6	3.7	5.3	6.8	1.8
- Islam	2.4	10.4	2.9	12.5	5.4	1.4
- Traditional	3.2	12.2	2.1	3.3	3.0	10.8
- Others	0.0	4.3	0.0	12.5	0.0	0.0
Wealth Index						
- Poorest	3.4	8.9	2.9	5.4	12.8	0.5
- Poorer	4.5	12.2	3.3	6.1	7.1	1.7
- Middle	4.1	9.2	2.7	5.7	6.0	2.9
- Richer	2.3	11.5	2.4	5.2	5.7	1.7
- Richest	2.5	7.6	3.4	4.7	5.8	1.5
Age of child						
- 0 year	4.2	10	2.9	6.3	7.0	1.7
- 1year	6.1	13.8	4.5	6.5	9.2	2.0
- 2years	3.0	9.4	3.0	5.9	7.2	3.0
- 3years	2.5	8.9	1.8	4.3	4.6	1.5
- 4years	2.1	7.4	2.4	3.1	4.3	0.4
Sex of child						
- Male	3.5	9.8	2.8	4.9	7.5	2.0
- Female	3.6	10.1	3.1	5.6	5.6	1.4
Total	121	397	224	128	217	72

Source: National Population Commission (NPC) [Nigeria] and ICF Macro. 2009.

4.2.2 Logistic regression of Symptoms of ARI among Under-five Children by both Mothers' and children's Background Characteristics according to the Zones

Multivariate analysis was used in this study in order to highlight the differences in the factors influencing the prevalence of ARI among the under five children in the zones and compare these across the six zones in Nigeria.

South - South zone

The logistic regression model in table 4.2.2 (See table 4.2.2 on page 47) revealed that, the chances of ARI among under-five children by their mothers' age group in the South-South zone were lower in the older mothers than in children with mothers in the age group 15-19 years. For instance, in the same region, under-five children of women who were between the ages of 45-49 were 0.19 times less likely to have symptoms of ARI in the two weeks before the survey compared with children of women aged 15 -19. Also, the likelihood of symptoms of ARI among under-five children of women aged 30-34 years was 0.37 times less likely than in the children of women in age group 15-19 years. However, symptom of ARI was found to be 2.26 times more likely among under-five children whose mothers had secondary education than with children of mothers with no formal education. ARI among under-five children by their mothers' wealth quintile was lower in all the categories. Under -five children with mothers' wealth quintile from poorer to richest were 0.49 times less likely to have ARI symptom than children of mothers in the poorest wealth quintile. Female children in this zone were 0.73 times less likely to have ARI than their male counterparts as seen among the under five children. It is worth noting that no significant differential was found between place of residence and symptoms of ARI among under-five children in all the regions in Nigeria.

North West zone

Looking at levels of education, under-five children in the North West whose mothers are primary school holders were found to be 0.60 times less likely to experience ARI symptoms relative to those whose mothers are without any formal education and the one year olds were 1.60 times more likely to have ARI than the zero year old children.

South East zone

Having higher education was a protective factor against the risk of symptoms of ARI among under-five children in the South East zone. Children of women with higher education were 0.29 times less likely to have symptoms of ARI than their counterparts belonging to mothers with no formal education.

South West zone

In the South West zone, symptoms of ARI among under five children was 0.30 less likely in households using biomass fuel than in households where clean fuel were used. Under -five children of mothers with primary and higher education were 0.25 times less likely to have ARI than the children of mothers without formal education as seen in the last two weeks to the survey. Children of mothers in Traditional religion were 9.91 times more likely to exhibit symptoms of ARI than children of mothers in the Christian religion. The very young children especially the 2years old were 2.02 times more likely to show ARI symptoms than the zero year old children while the older four year old were 0.23 times less likely to have ARI.

North Central zone

The data shows the under-five children of mothers in Islam religion in the North Central as less likely by 0.60 times to have symptoms of ARI in the last two weeks before the survey than did children of mothers in the Christian religion. The 4years old children were seen to be 0.50 times less likely to show symptoms of ARI than the zero year olds children did.

North East zone

In the North East the data showed the children of poorer background to be 1.34 times more likely, to show symptoms of ARI than the children from poorest background. The likelihood of ARI symptoms among under-five children in the last two weeks prior to the survey among households using biomass fuel was 0.40 times less than in those households using clean fuel. So was the odds of ARI among the under five children reduced in the 4year olds by 0.70times than in the zero year old children, but seen to be 1.44 times more likely among the one year old children.

Table 4.2.2: Logistic regression of Symptoms of ARI among Under-five Children by both Mothers' and children's Background Characteristics according to the Zones

Background Characteristics	North Central	North East	North West	South East	South South	South West
Age	O.R (S.E)	O.R (S.E)	O.R (S.E)	O.R (S.E)	O.R (S.E)	O.R (S.E)
15-19*(RC)*	1.00	1.00	1.00	1.00	1.00	1.00
20-24	2.78(0.55)	1.13 (0.23)	0.96 (0.27)	1.11(0.55)	0.47*(0.31)	2.01(0.78)
25-29	2.02(0.55)	1.27(0.23)	0.62(0.28)	1.11(0.53)	0.57(0.30)	0.74(0.79)
30-34	1.11(0.59)	1.42(0.23)	0.92(0.28)	0.59(0.56)	0.37**(0.32)	0.65(0.81)
35-39	1.61 (0.59)	1.15(0.25)	0.67(0.31)	0.58(0.57)	0.31**(0.35)	0.30(0.89)
40-44	2.11 (0.63)	1.22(0.29)	1.02(0.33)	0.48(0.67)	0.40*(0.43)	0.82(0.91)
45-49	0.64(1.01)	1.13 (0.38)	1.21(0.37)	0.48(0.94)	0.19*(0.84)	*Na*
Cooking fuel						
Clean fuel*(RC)*	1.00	1.00	1.00	1.00	1.00	1.00
Biomass	2.01(0.51)	0.40*(0.27)	0.90(0.34)	1.11(0.31)	1.31(0.23)	0.30*(0.42)
Education						
No education	1.00	1.00	1.00	1.00	1.00	1.00
Primary	1.42(0.24)	1.18(0.15)	0.60*(0.26)	0.71(0.39)	2.13(0.39)	0.25**(0.41)
Secondary	0.97(0.30)	0.61 (0.26)	1.25(0.31)	0.61(0.41)	2.26*(0.39)	0.49**(0.38)
Higher	1.01 (0.63)	1.88(0.47)	0.32(0.93)	0.29*(0.57)	2.10(0.49)	0.25*(0.59)
Residence						
Urban *(RC)*	1.00	1.00	1.00	1.00	1.00	1.00
Rural	0.90(0.26)	0.90(0.15)	1.08(0.23)	1.36(0.22)	0.82(0.19)	0.90(0.33)
Religion						
Christian*(RC)*	1.00	1.00	1.00	1.00	1.00	1.00
Islam	0.60* (0.23)	1.42(0.18)	0.76(0.32)	2.77(1.05)	0.86(0.49)	0.66(0.27)
Traditional	1.07(0.69)	1.80(0.51)	0.43(0.88)	0.51(0.62)	0.43(0.79)	9.91**(0.63)
Wealth Index						
Poorest*(RC)*	1.00	1.00	1.00	1.00	1.00	1.00
Poorer	1.33 (0.26)	1.34*(0.13)	1.18(0.17)	1.16(0.49)	0.49**(0.27)	2.74(0.94)
Middle	1.29(0.28)	0.95 (0.18)	0.95(0.22)	1.16(0.46)	0.41**(0.26)	5.48(0.92)
Richer	0.84(0.39)	1.18 (0.22)	0.89(0.30)	1.07(0.47)	0.36**(0.27)	1.80(0.98)
Richest	1.37(0.56)	0.56(0.44)	1.26(0.43)	1.37(0.55)	0.40**(0.35)	1.28(1.02)
Child's age						
0year *(RC)*	1.00	1.00	1.00	1.00	1.00	1.00
1 year	1.47(0.25)	1.44*(0.15)	1.60*(0.19)	1.12(0.26)	1.40(0.20)	1.15(0.36)
2years	0.71 (0.30)	0.90(0.17)	1.07(0.21)	1.03(0.27)	1.13(0.22)	2.02*(0.33)
3years	0.60 (0.30)	0.86(0.17)	0.63(0.24)	0.81(0.30)	0.74(0.24)	0.95(0.38)

4years	0.50*(0.33)	0.70*(0.18)	0.86(0.23)	0.54(0.35)	0.73(0.25)	0.23*(0.67)
Child's sex						
Male *(RC)*	1.00	1.00	1.00	1.00	1.00	1.00
Female	0.98(0.188)	1.03(0.11)	1.09(0.14)	1.05(0.19)	0.73*(0.15)	0.66(0.25)
Constant	0.01(0.807)	0.17(0.41)	0.05(0.61)	0.08(0.76)	0.19(0.54)	0.05(1.25)

***Highly Significant at 0.01 or 0.1%; *Significant at 0.05 or 5%; OR: Odds Ratio; S.E: Standard Error; R.C: Reference Category; n.a: Not applicable.*

Source: National Population Commission (NPC) [Nigeria] and ICF Macro. 2009.

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5. Introduction

This chapter presents the discussion, conclusion and recommendations for the study as gleaned from all the preceding chapters.

5.1 Discussion

This study was aimed at establishing the association between the prevalence of ARI among under-five children in the different zones in Nigeria and the type of fuel used for cooking, lighting and warming up the homes. This was achieved by determining the differences in the degree of prevalence among the different zones through using logistic regression. The results of the study have demonstrated an association between the use of biomass fuel and the prevalence of ARI among the under five children by zones in Nigeria. There were no significant differences in the prevalence of ARI among the under-five children between the rural and urban areas across the zones except for the North East zone, which showed ARI to be more among the under five children in urban areas than rural area. In the other zones, the findings were consistent with previous studies that stated that ARI among under-five children to be more in the rural areas than in the urban areas. (Fullerton *et al.* 2008: 845).

In the North East zone, 10% of under-five children had ARI followed by 6.6% in the South-South zone and 1.7% in the South West zone during the two week before the survey. Various factors might be responsible for this phenomenon which can be linked to both the environment, and the host. The environmental factor could be related to the prevailing weather pattern in the country that results in the vegetation of the north being completely

different from the south; Nigeria has a tropical climate with distinct wet and dry seasons which favours the Respiratory syncytial virus (RSV) to thrive. Respiratory syncytial virus is responsible for acute lower respiratory tract infection in young children in developing world and predisposes to bacterial co-infection in the lung (Grigg 2007: 289). RSV is the leading cause of respiratory infection in children in developing countries. It occurs frequently in all climatic and geographical areas. The peaks typically occur in the cold season in the in temperate climates and in the rainy season in the tropical climates (Rudan *et al.* 1986). The country's unique weather of plenty rainfall in the south which increases humidity in the air and the arid dry cold dusty weather in the north are perfect for RSV, as this increase the risk of ARI in children.

The North East zone had a higher percentage of under-five children with ARI living in households using clean fuel than in households using biomass fuel with the majority from poor backgrounds. Prevalence of ARI was more among the very young children aged a year and less. The ARI was less prevalent as the children grew older but also high in children of mothers with no formal education. The reason for the North East zone having the highest prevalence of ARI among the under five children can be related to environmental and a host of other factors. The environmental factors can be associated with the dry cold and dusty weather of the north, living conditions of the family that is greatly influenced by mother's level of education, and socioeconomic status. The host factor is related to the child's age and general health status, North East zone is in the arid semi desert region of the country where there are no trees and shrubs that can be used for firewood. The poor households are likely to use the lower categories of biomass fuel for cooking which are less expensive and burn slowly with increasing pollutant emissions, thus increasing the risk of ARI in the young children. The difference in the prevalence of ARI among the under-five children living in

households using clean fuel was higher in the North East than in children from households using biomass. Reasons for this might be that most households used kerosene fuel for cooking instead of wood as wood might not be easily available in the arid region as in the south that has forest and mangrove vegetation. Where woods are available, it might cost more and majority of the poor would prefer to use the less costly fuel which are known for their inefficient burning and produce a lot of poisonous substances in the smoke. This process increases the risk of ARI among the very young children.

The use of kerosene stoves for cooking tends to be done indoors with children staying in the same room and they get exposed to the poisonous fumes or smoke. Kerosene is more harmful to the premature lungs of young children because the fumes can be breathed in more deeply into the lungs which could lead to a greater severity of illness (Sharma *et al.* 1998: 296). Over-crowding is common among the poor especially in the north. This can contribute to the high prevalence of ARI among the very young children whose immune systems are weak. These can be easily infected by bacteria and virus infections that are air bourn in an over crowded place since there is not proper ventilation and they tend to breathe in same air that is contaminated. Likewise sleeping in the open because of lack of proper shelter can expose young children to the extreme cold experienced in the north, thus increasing their risk of being infected by RSV because the prevailing condition is very conducive for it. Children from very poor socio-economic backgrounds also stand the risk of poor and inadequate nutrition, poor water supply and poor sanitation leading to poor personal hygiene from caregivers which can further predispose them to ARI. Apart from the smoke form industries, the erratic and inadequate electricity supply in Nigeria has forced most household to use generators which has increased the amount of pollution in the atmosphere in the country hence increasing the risk of ARI in children.

Age of the children was also taken as a risk factor that might have increased the prevalence of ARI in this region in relation to the other prevailing factors. The data used for this study revealed that ARI was more in the very young children of 0 -2 years during the last two weeks before the survey. This high prevalence of ARI might have been due to the presence of (RSV) respiratory syncytial virus infection in children the very young children as reported by Rudan *et al* (1986), that RSV was highest among children aged less than 2years with the most severe disease occurring in infants aged 3weeks to 3 months (Rudan *et al.* 1986). Immunisation of children is advised and early in life, Ministry of Health to consider including Hib vaccine to the current schedule to prevent and reduce respiratory infection in children especially the very young ones. The only vaccines for the prevention of bacterial pneumonia (excluding pertussis) are Hib and pneumococcal vaccines (Rudan *et al.* 1986). Mothers must be educated and encouraged to take their children for immunisation because mothers in the north of Nigeria are known not to want to immunise their children for the unfounded fear that it might harm their children.

Religion can also influence and increase the risk of ARI among the under -five children in the north as most Muslim women are in 'puddah' - a religious practice that restricted married Muslim women to stay indoors since they are not allowed to be seen in public unveiled. Their faces can only be seen by their husbands. These categories of mothers might be reluctant to take their children for immunisation and are more likely to expose their young children to indoor smoke as they tend to do their cooking indoors and the children are always with them playing around thus increasing their risk of ARI. Another possible reason for the high prevalence of ARI among the under-five children in this region might be because of the size of the windows of the houses that are built in a way that is meant to reduce the impact of the dusty wind but creating poor ventilation and increasing the risk of smoke to be trapped

indoors for longer periods thus increasing the risk of ARI for the children. This same reason might be responsible for the fact that the prevalence of ARI is high among under-five children across all age groups of mothers unlike in the south especially in South- south zone where the age of the mothers were a protective factor from ARI among their under-five children.

South-South zone was second highest zone in the prevalence of ARI among the under-five children. The use of biomass fuel increased the likelihood of ARI in children living in households that used it for cooking. This was consistent with the findings in the South East and North Central zones. Reasons for this might be the easy access to wood for cooking which are expected to be more affordable and available because the type of the prevailing vegetation- mangrove swampy forest in the Niger-Delta. The level of poverty in the region is less than that of the north east and the likelihood of families combining the use of clean and biomass fuels for household needs is possible.

The South-South zone has a clear cut pattern of ARI prevalence as very high among under-five children from poor background and less among the rich children. This finding was consistent with previous studies unlike in the other zones where the prevalence was similar in all wealth quintile. ARI was higher among the children of the educated mothers than with children of mothers with no formal education. Reasons for this phenomenon might be related to the fact that children are sent out from home early to pre- school to allow mothers go to work and earn their keep as most of the women in the south are educated and very enterprising than their counterparts in the north of Nigeria. The risk of RSV in humid climate of the south due to the amount of rainfall in the region was seen to be high and could be the leading cause of ARI in young children. Respiratory infection especially in children spread so

fast and per-school atmosphere increased the risk of ARI. Because of the prevailing climatic situation in the country that favours the risk of ARI due to the possible RSV infection, children should be immunized to protect them from the deadly childhood disease that can increase their risk of ARI. Primary respiratory infection by this virus increased the risk of secondary bacterial pneumonia and viral or bacterial co-infection. This was a common finding in young children with pneumonia in developing countries (Rudan *et al.* 1986); Grigg 2007: 289). Age was seen to influence the risk of ARI among young children in the South-South zone. The prevalence of ARI among the under five children was very high with young mothers aged 15-19 years than what obtained with children of older women. Unlike in the North East zone where ARI among the children was high with all mothers age group.

The above-mentioned phenomenon in the South-South might be linked to mother's level of experience. In the case of older women it could be that their previous experience helped them to protect their under-five children from exposure to ARI. They probably know the importance of getting their children immunised and early too, to reduce the risk of exposure. It could also be that the older women are less likely to have under-five children in their homes since they are likely to have stopped giving birth a while back. In the same vain the younger women might have lacked the experience of how to protect their under-five children from the risk of ARI in the kind of environment they lived in with their young children. This experience of mothers being able to protect their young ones comes with time and exposure to the same situation. Vaccination efforts should be made early in life to prevent or reduce the risk RSV leading to ARI.

The South West zone had the lowest prevalence of ARI among the under-five children in the last two weeks before the 2008 survey in Nigeria. This was evident in the proportion of

under-five children with ARI in households using biomass fuel. Like previous studies have alluded to, that the risk of ARI was increased with mother's low level of education among others. This zone was one part of Nigeria where education was seen to be more developed than in other parts of the country (Iyun & Tomson 1996: 439). It is therefore not surprising that the lowest prevalence of ARI was reported among the under-five children there.

The level of knowledge and sophistication that education gave might be the reason they knew the benefit of immunisation for their children and used it to their advantage by taking their children for it and early too. They are more likely to live in better accommodations, able to afford more luxury and comfort and protect their under-five children from the risk of ARI. They are more likely to use clean fuel for cooking, lighting and even warming the rooms if there was a need. With their level of knowledge and education are more likely to invest on other alternative ways of generating electricity for use at home instead of using generator powered by diesel that smoke a lot and increased the pollution level in the air.

There was no significant difference in the proportion of ARI among under-five children in this region living by their place of residence whether the child lived in the rural or urban area. This probably might be related to the level of development in this region that bridged the gap between the rural and urban life.

Conclusion- An association has been established between the use of biomass fuel for cooking in Nigeria and the prevalence of ARI among the under-five children living in South-South, South East and North Central Zones. Two of these zones have other things in common apart from having high proportion of under-five children with ARI living in homes that used clean fuel. They are homes to the most densely populated and commercial cities in the country,

example Lagos, Ibadan, Kano, and Kaduna to mention but a few and because of the magnitude of commercial activities going on in these cities that can also increase traffic related air pollution which can affect children carried around by mothers on business trips.

Furthermore, there are numerous offices in these cities with a high dependency and usage of generators for both home and businesses as the electricity supply is extremely poor. This situation increases the production of smoke and pollution in the air thus increasing the risk of ARI among the very young children. Thus all the foregoing put together coupled with the cold, dry dusty wind of the north and the humid climate in the south which support RSV infection in children can be said to be responsible for the high prevalence of ARI among under-five children in the North East and South-South zone. The situation requires intervention from the country's Ministry of health to consider including Hib vaccine to the present list of immunisations for the under-five children against pneumococcus and H. Influenza. Prevention and minimization of the risk of ARI among under-five children can be accomplished by promoting maternal education and by improving socioeconomic standards which leads to better nutrition and improved health status in the children from poor backgrounds.

5.2 Conclusion

The conclusion is that the age of the mothers; the use of Biomass; the level of mothers' education; wealth index; ages of the children; and zones where participants lived significantly affected the prevalence of ARI among the under-five children. In addition, the hypotheses for the study have been tested and rejected because there were no significant differences in the prevalence of ARI among under- five children among the country's zones. But North East zone had the highest proportion of ARI, followed by South-South while the South West

recorded the lowest of them all. There was a significant difference in the prevalence of ARI and the type of cooking fuels used by households in the different zones.

The study revealed a significant association between the socio-economic factors influencing ARI among under five children in the zones. ARI among under- five children was seen in all age group of mothers, irrespective of mother's level of education, whether poor or rich, among those using clean fuel as well as biomass fuel for cooking although slightly more amongst households using biomass fuel in three zones and less among those households using biomass in the North East almost by 50% when compared to the proportion of those using clean fuel.

This uncommon phenomenon showed that smoke from the use of biomass fuel alone might not be responsible for ARI among under -five children. Environmental factors could have come into play, such as the effect of the weather and the two different types of climates in the country that support RSV which are known to possibly have predisposed young children to secondary bacterial infection that increased the risk of ARI among them. Pollutions from use of generators and kerosene stoves cannot be ruled out because these are harmful to the lungs of young children exposing them to the risk of ARI and are present in almost every household. Another aspect that was not explored in this study due to the limitation of the data used was the children's general state of health. According to Gruber (1995: 52) and Cashat-Cruz *et al.* (2005: 87) risk factors such as the prematurity and low birth weight, malnutrition and deficiency of vital vitamins in the child can predispose the child to definite risk of ARI, also the presence of P.carinii in HIV infected children.

5.3 Recommendations

Based on the discussion and the findings, the following are the recommendations:

- That Conjugated vaccine for Hib should be added to the current list of immunizations for children in Nigeria to reduce their risk of exposure to pneumococcus and H. Influenza.
- Mothers should be educated on the importance of vaccination for their children within the first 12 months of life; proper nutrition for the children within the same period; educate mothers on the benefits of breastfeeding their children and accessing antenatal care during pregnancy for the early detection of HIV and prevention of mother to child transmission (PMTCT) of HIV.
- Department of Health to work together with the Imams and clergy to get them to support the immunisation programme for the under five children and reach the mothers through them. In particular, those women in 'puddah' in the north, to reach them through their husbands by creating awareness around the benefit of immunising children early in life.
- Institute a Public health policy to regulate air pollution in the use of generators in order to reduce the menace of air pollution.
- The Traffic department should devise a regulatory policy on traffic emissions on Nigeria's roads to curb the amount of pollution from car exhaust released into the atmosphere.
- The Nigerian government should give priority to the provision of electricity for her citizenry through exploring other alternatives for energy sources as Nigeria has an advantage for solar energy since it is located on the equator and has unlimited access to sun light through out the year.

- The International business community and organisations should be urged to invest in Nigeria electricity generation and supply at an affordable cost both to the country and citizens so that clean energy is made available for both domestic and other uses.

REFERENCES

Cashat-Cruz, M., Morales-Aguirre, J. J., & Mendoza-Azpiri, M. (2005). Respiratory Tract Infections in Children inDeveloping Countries. *Seminars in Pediatric Infectious Diseases* , 84 - 92.

Ezzati, M., & Kammem, D. M. (2001). Quantifying the Effect of Exposure to Indoor Air Pollution from Biomass Combustion on Acute Respiratory Infections in Developing Countries. *Environmental Health Perspectives , 109* (5), 481-488.

Ezzati, M., & Kammen, D. M. (2001). Indoor air pollution from biomass combustion and acute respiratory infections in Kenya: an exposure -response study. *The Lancet, 358*, 619 - 624.

Fullerton, D. G., Bruce, N., & Gordon, S. B. (2008). Indoor air pollution from biomass fuel smoke is a major health concern in the developing world. *Royal Society of Tropical Medicine and Hygiene* (102), 843 - 851.

Grigg, J. (2007). Effect of biomass smoke on pulmonary host defence mechanisms. *Paediatric Respiratory reviews , 8*, 287 - 291.

Gruber, W. C. (1995). The Epidemiology of Respiratory Infections in Children. *Seminars in Pediatric Infectious Diseases , 6* (2), 49 -56.

Iyun, F. B., & Tomson, G. (1996). Acute respiratory infections - Mothers' perceptions of etiology and treatment in South- Western Nigeria. *Social Science & Medicine , 42* (3), 437-445.

Janjua, N., Mahmood, B., Dharma, V., Sathiakumar, N., & Khan, M. (2012). Use of biomass fuel and acute respiratory infections in rural Pakistan. *The Royal Society for Public Health* , 1 - 8.

Laumbach, R. J., & Kipen, H. M. (2012). Respiratoty health effects of air pollution:Update on biomass smoke and traffiv pollution. *Clinical reviews in allergy and Immunology , 129* (1), 3 - 11.

Mehta, S., & Shahpar, C. (2004). The health benefits of interventions to reduce indoor air pollution from solid fuel use:a cost - effectiveness analysis. *Energy for Sustainable Development , VIII* (3), 53 - 59.

Mehta, S., Gore, F., Pross-Ustun, A., Rehfuess, E., & Smith, K. (2006). Modeling household solid fuel use towards reporting of the Millennium Development Goal indicator. *Energy for Sustainable Development , X* (3), 36 - 45.

Mishra, V. K., Retherford, R. D., & Smith, K. R. (1999). Biomass Cooking Fuels and Prevalence of Tuberculosis in India. *International Journal of Infectious Diseases , 3* (3), 119-129.

Mishra, V., & Retherford, R. (1997). Cooking Smoke Increases the Risk of Acute Respiratory Infection in Children. *International Institute for Population Sciences* (8), 1- 4.

Nair, H., Nokes, J. D., Gessner, B. D., Dherani, M., Madhi, S. A., Singleton, R., et al. (2010). Global burden of acute lower respiratory infections due to respiratory syncytial virus in young children: a systematic review and meta-analysis. *The lancet* ,(375) 1545 - 1555.

National Population Commission, (2006). 2006 population and housing census of the federal republic of Nigeria Page 1

Nigeria Demographic and Health Survey 2008. Abuja, Nigeria: National Population Commission and ICF Macro.

National Population Commission (NPC) [Nigeria] and ICF Macro. 2009. *Nigeria Demographic and Health Survey 2008.* Abuja, Nigeria: National Population Commission and ICF Macro.

Organization, W. H. (2009). Global Health Risks: Mortality and burden of disease attributable to selected major risks. *WHO Library Cataloguing -in- Publication Data* .

Rudan, I., Boschi-Pinto,C., Biloglav, Z., Mulholland, K., & Cambell, H.(1986).Epidemiology and etiology of childhood pneumonia. *Bulletin of the World Health Organisation* [Online] Available: http://www.int/bulletin/volumes86/5/07-048769/en/

Sharma, S., Sethi, G. R., Rohtagi, A., Chaudhary, A., Shankar, R., Bapna, J. S., et al. (1998). Indoor Air Quality and Acute Lower Respiratory Infection in Indian Urban Slums. *Environmental Health Perspectives , 106* (5), 291-297.

WHO, 2013. The environment and health for children and their mothers. www.who.int/ceh/publications/factsheets/fs284.

APPENDIX A

Table 4: Proportion of Under-five Children with Symptoms of ARI by Socio-demographic characteristics according to Regions in Nigeria

Background Characteristics	North Central	North East	North West	South East	South South	South West	Total
Age of mothers							
15 - 19	0.022	0.094	0.037	0.071	0.159	0.022	79
20 - 24	0.055	0.096	0.034	0.076	0.071	0.042	272
25 - 29	0.037	0.100	0.022	0.067	0.078	0.015	344
30 - 34	0.020	0.112	0.032	0.035	0.050	0.014	221
35 - 39	0.032	0.095	0.023	0.040	0.047	0.070	139
40 - 44	0.036	0.099	0.033	0.030	0.058	0.013	74
45 - 49	0.008	0.089	0.041	0.039	0.030	0.000	37
Household cooking fuel- Clean fuel	0.020	0.196	0.034	0.046	0.054	0.018	183
- Biomass fuel	0.038	0.097	0.029	0.055	0.073	0.015	967
Mother's level of education							
- No education	0.027	0.101	0.031	0.060	0.037	0.028	552
- Primary	0.049	0.112	0.019	0.054	0.067	0.011	276
- Secondary	0.035	0.058	0.042	0.056	0.070	0.020	290
- Higher	0.022	0.146	0.009	0.028	0.054	0.009	40
Type of place of residence							
- Urban	0.032	0.107	0.027	0.044	0.065	0.017	326
- Rural	0.037	0.097	0.030	0.060	0.066	0.018	836
Religion							
- Christians	0.045	0.076	0.037	0.053	0.068	0.018	523
- Islam	0.024	0.104	0.029	0.125	0.054	0.014	616
- Traditional	0.032	0.122	0.021	0.033	0.030	0.108	18
- Others	0.000	0.043	0.000	0.125	0.000	0.000	2
Wealth Index							
- Poorest	0.034	0.089	0.029	0.054	0.128	0.005	299
- Poorer	0.045	0.122	0.033	0.061	0.071	0.017	300
- Middle	0.041	0.092	0.027	0.057	0.060	0.029	227
- Richer	0.023	0.115	0.024	0.052	0.057	0.017	189
- Richest	0.025	0.076	0.034	0.047	0.058	0.015	145
Age of child							
- 0 year	0.042	0.100	0.029	0.063	0.070	0.017	281
- 1year	0.061	0.138	0.045	0.065	0.092	0.020	327
- 2years	0.030	0.094	0.030	0.059	0.072	0.030	226
- 3years	0.025	0.089	0.018	0.043	0.046	0.015	181
- 4years	0.021	0.074	0.024	0.031	0.043	0.004	146
Sex of child							
- Male	0.035	0.098	0.028	0.049	0.075	0.020	594
- Female	0.035	0.101	0.031	0.056	0.056	0.014	566
Total	0.035	0.100	0.030	0.053	0.066	0.017	1161

Source: National Population Commission (NPC) [Nigeria] and ICF Macro. 2009

APPENDIX B

Dear Sir/Madam

Confirmation of proof reading and language editing of the Dissertation Report for the Master of Social Science (Population Studies and Sustainable Development) at the Mafeking Campus of the North West University

This is to certify that I proof read and edited student no **23231246, Mrs Rosa Useh's** Dissertation report entitled: **Acute Respiratory Infections among Nigeria's Under-five Children: A Quest for the Cause.** The modifications, I suggested have been effected to my satisfaction. I therefore, recommend the submission of the report for further processing.

Signed:---NCK Neeta--- Dated: 08/10/2013

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