HOUSING CONDITIONS AND PERCEIVED HEALTH EFFECTS ON UNDER-5 CHILDREN IN OMI-ADIO, IDO LOCAL GOVERNMENT AREA, OYO STATE

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ABSTRACT

Living conditions and sanitary housing are important social determinants of health. Under-5 (U-5) children living in poor or overcrowded conditions are vulnerable to respiratory infections and other health problems. The literature on housing effects in relation to child health has shown that there is an association between housing conditions and incidence of ill health but to date, little research has been conducted on the relationship between health and housing in the Nigeria. This study aimed at assessing housing conditions and perceived health effects on U-5 in Omi-Adio (OA) community.

A community-based cross-sectional study design was conducted. A 3-stage (wards, communities and households) sampling technique was used to select 300 consenting caregivers of U-5 in OA. Pre-tested semi-structured interviewer-administered questionnaire was used to obtain information on: perceived health effects reported by caregivers three months preceeding the survey, socio-demographic and household characteristics. One hundred consenting households out of 300 participated in environmental monitoring. Temperature and Relative Humidity (RH) were monitored using Multi-function Environment metre (model: NO9AQ). Airborne Total Bacteria Count (TBC) and Total Fungi Counts (TFC) of replicate samples were determined using open plate method. Measurements were taken between 8-11am and 2-5pm daily for three months in the bedroom, sitting-room and outdoor. Results of temperature and RH were compared with American Society of Heating, Refrigerating and Air-Conditioning Engineering (ASHRAE) standard. Values for TBC and TFC were compared with American Industrial Hygiene Association (AIHA) guideline limit. Data were analysed using descriptive statistics, ANOVA, correlation and t-test.

Mean ages of caregivers and U-5 were 32.2 ± 7.0 years and 39.6 ± 12.8 months respectively. Median household size was 5.0 (range 2-9) and median number of rooms occupied by household was 2.0 (range 1-6). The ill health reported were fever (51.7%), respiratory infection (33.3%), skin infection (19.3%) and diarrhoea (6.0%). Seventy-two percent of caregivers lived in rooming apartments. Mean morning and afternoon temperatures in bedroom (31.3±3.2°C and 31.3±2.3°C), sitting-room (31.1±3.2°C and 31.2±2.2°C) and outdoor (31.8±3.3°C and 31.7±2.3°C) respectively were higher than ASHRAE standard. Geometric mean morning and afternoon RH in bedroom (69.1±5.9% and 70.5±6.0%), sitting-room (69.5±6.0% and 70.8±6.3%) and outdoor (68.5±7.1% and 70.5±7.1%) respectively

were higher than ASHRAE standard. Mean morning and afternoon TBC in bedroom ($0.68x10^2$cfu/m^3 and $0.67x10^2$cfu/m^3), sitting-room ($0.64x10^2$cfu/m^3 and $0.66x10^2$cfu/m^3) and outdoor ($0.68x10^2$cfu/m^3 and $0.67x10^2$cfu/m^3) respectively were lower than AIIIA. Bacteria isolated were Pseudomonas spp. Proteus spp. and Bacillus spp. Similarly, mean morning and afternoon TBC in bedroom ($0.43x10^2$cfu/m^3 and $0.42x10^2$cfu/m^3), sitting-room ($0.37x10^2$cfu/m^3 and $0.45x10^2$cfu/m^3) and outdoor ($0.38x10^2$cfu/m^3 and $0.34x10^2$cfu/m^3) respectively were lower than AIIIA. Fungi isolated were Aspergillus spp, Penicillium spp., Candida sp and Mucor spp. Mean TBC in bedroom of U-5C with and without reported fever episode were 70.2±36.9 and 62.4±28.6 respectively ($p<0.05$). There was a weak but significant correlation between TBC and temperature($r=-0.161$, $p<0.05$) and TBC and RH($r=-0.11$, $p<0.05$).

High temperature and relative humidity exist in houses at Omi-Adio and there were associated bacteria as well as fungi pathogens. These have negative implication on the health of under-five children. Health awareness campaign on good housing conditions is therefore recommended.

Keywords: Housing conditions, Under-five children, Perceived health effects, Airborne microbes.

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CERTIFICATION

We certify that this research work was carried out by Miss Agboluaje. Nafisat Opeyemi at the Department of Environmental Health Sciences, Faculty of Public Health, College of Medicine, University of Ibadan, Ibadan, Oyo state.

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DEDICATION

This work is dedicated to Almighty Allah who has made it a success and to my parents. Mr I. G and Mrs J. B. Agboluaje, for the concern and encouragement given to me in the course of my MPH programme.

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CHAPTER ONE

INTRODUCTION

1.1 Background

Housing is often regarded as one of the basic human needs. It ranks second after food and thereafter clothing. It is a pre-requisite for the survival of man (Omole, 2010). Housing as a unit of the environment has profound influence on the health, efficiency, social behaviour, satisfaction and general welfare of the community. It reflects the cultural, social and economic values of a society, as it is the best physical and historical evidence of the civilization of a country. Housing is one of the most important basic necessities of mankind known to tremendously affect human health and well-being (Omole, 2010; Coker *et al.*, 2007). According to them, it is widely acknowledged that adequate housing is essential for good life, and it is a key requirement for an efficient and satisfied labour force and the foundation of satisfactory community life. Individuals as well as families are entitled to adequate housing as it is of central importance for the enjoyment of all economic, social and cultural rights regardless of age, sex, economic status race, religion or other affiliations (Abiodun and Segun, 2005).

Availability of adequate housing is fundamental to living in dignity, good health, good quality of life and general well-being. Consequently, housing constitutes one of the major influences on health and well being of individuals. Many of the basic principles of the link between housing and health were elucidated more than 50years ago by American Public Health Association (APHA) committee on the Hygiene of Housing (Tracy, 2003); this was a as a result of outgrowth of concern from the massive influx into American cities of veterans looking for jobs.

Housing conditions refer to the totality of external influences (natural and man-made) which impinges on man and affects his well being. These include

a) Provision of physical protection and shelter

b) Having an adequate place for cooking, eating, washing and excretory functions which must be designed, constructed, maintained and used in a manner such as to prevent the spread of communicable disease.

c) Protection from hazards of exposure to noise and pollution.

d) Free movement from unsafe physical arrangement due to construction and maintenance and from toxic or harmful materials

e) Encouraging personal and community development, promote social relationship, reflects a regard for ecological principles and by these means promote mental health (Park, 2009)

Adedeji (2004) opined that housing issues affect the life of individuals as well as that of a nation; hence both nature and society ascribed great importance to the role it plays to bring about human comfort. The importance of providing adequate and quality housing in any country cannot be overstated nor disputed in time or space. It is a stimulant to the national economy. Although, in spite of the inseparable link between good housing and health, there are over 100 million people worldwide homeless while more than a billion live in shelters that are not only inadequate but also detrimental to their health (Sholamith, 2000)

The characteristics of the environment and the house where one lives or works can have a number of potential effects/risks on human health. These risks may be associated with nearby land uses, traffic-related exposures, building materials, and quality of housing. The effects of exposure to pollutants in the environment and home include a range of human health problems, such as lung diseases, lead poisoning, cancer, reproductive issues, birth defects, headaches, and fatigue. Lead poisoning can lead to short-term symptoms, such as loss of appetite and reduced attention span and also longer-term effects in adults and children, including brain and nerve damage, as well as hearing and vision impairment (Design for Health, 2007)

Most Nigerian cities, with the exception of the newly developed Federal Capital city of Abuja, have experienced decay in both housing and physical infrastructural facilities over the past few decades, possibly due to economic downturn in the nation. Unlike developed nations, the mortgage industry is still in its infancy in Nigeria with the real estate sector

contributing less than one percent to the nation's GDP (Punch Newspapers. 2007). The focus on the role of housing and health-related essential infrastructure and their relevance to the health status of indigenous people in Ibadan, Nigeria, should be considered in conjunction with the sections providing information on social, cultural and economic aspects (Acheson, 1998).

Housing has been identified as an important factor affecting health (Australian Bureau of Statistics and Australian Institute of Health and Welfare, 2008). Substandard and badly maintained housing together with the lack of functioning infrastructure can create serious health risks. The impact of housing on health can be through direct and indirect ways (Shaw, 2004). Direct means are associated with the material condition of housing on physical health, for example, inadequate water supply, washing facilities, sanitation and overcrowding. This can in turn influence the mental health and wellbeing of households due to the many social issues which arise from inadequate material conditions. Indirect means are about individual and community elements, including the location of the housing, closeness to essential services and the overall functioning of the community (Shaw, 2004, Carson *et al.*, 2007, Bailie and Wayte, 2006). The health effects of housing can be mediated by the design, function, cleanliness and crowding of a dwelling (Taylor, 2001).

Access to clean water is essential for healthy living. Diseases associated with the consumption of water of poor quality include gastroenteritis, diarrhoea, typhoid fever and hepatitis (Brown *et al.*, 2009). Parasitic diseases associated with contaminated water include giardiasis, dysentery and diarrhoea. Young children are particularly at risk of suffering from potentially severe consequences due to infection with water-borne diseases. Inadequate water supply may also lead to parasitic infection and may restrict water use, these have negative consequences for personal hygiene and an increased risk of infectious disease associated with the transmission of contaminated human secretions.

The accumulation of human waste such as faeces and inadequate disposal may lead to contamination of living areas (Bailie *et al.*, 2002; Pholero *et al.*, 1993). Organisms such as *Shigella*, *E. coli*, *Salmonella*, and *Rotavirus* contained in the faeces can cause gastroenteritis. Parasitic infection, hepatitis A, and strongyloidiasis are also associated with inadequate disposal of human waste (Australian Indigenous HealthInfoNet, 2008). Links between

inadequate waste disposal and health include: trauma from slipping on wet/dirty surfaces, trauma from glass or other sharp objects and infections from injuries, suffocation of children from plastic bags, fire risk from inflammable materials, and health problems associated with blocked sewerage systems (Bailie *et al.*, 2002; Menzies School of Health Research, 2000) Underground water may be contaminated from waste dumps and undisposed waste may lead to an increase in vermin and other disease vectors.

Children living in inadequate or substandard housing are at risk of lower levels of development (Cooper, 2004). Although direct causation of housing on health and development is problematic due to other socio-economic factors, extensive research has revealed that adequate, stable housing in safe, supportive neighbourhoods and communities is correlated with positive child outcomes in the areas of health, development, and wellbeing (Krieger and Higgins, 2002; Cooper, 2004). The greatest risks arise from conditions such as cold, moisture, mould, poor indoor air quality, residential application of pesticides, the presence of allergens, vermin, dust and other conditions that contribute to asthma and structural or design flaws that raise the risk of injury. Poor quality or poorly maintained housing may also be overrun with mould, dust mites, cockroaches and rodents, all of which are sources of allergens that cause asthma and other respiratory illnesses (Cohn *et al.*, 2006).

Link between housing conditions [such as dampness, coldness, asbestos, indoor pollutants (Carbon monoxide, Nitrogen oxide, Carbon dioxide etc), hygrothermal conditions (humidity and temperature), light intensity, overcrowding, density and accidents in homes] and health of individuals have been established and recognized. Also, there are ranges of specific housing factors which affect health outcomes such as respiratory symptoms such as asthma, lung cancer, depression and anxiety; skin, eye and throat infection; communicable disease such as malaria, pneumonia, dysentery, cholera, tuberculosis, injury etc (Gilbertson *et al.*, 2005)

Family income, effective parenting, safe and secure environment are the major influence on a child's life. These are directly or indirectly influenced by the family's housing conditions. The Millennium Development Goal 4: Reducing child's mortality is a significant feature of

government's policy on children. Harker (2006) highlighted the effect of housing on the physical, mental health and education of the children thus:

a) Children in overcrowded housing are up to 10 times more likely to contract meningitis than children in general.

b) There is a direct link between children in overcrowded condition and childhood tuberculosis, respiratory problems, slow growth etc.

c) Anxiety and depression occur in houses that are of poor condition as well as delay in communication skills, missing schools due to illness and infections.

1.2 Statement of the Problem

The 2006 Population and Housing Census puts Nigeria's population at [illegible],790, with a national growth rate estimated at 3.2 percent per annum. With this population [illegible]n, Nigeria is the most populous nation in Africa (National Population Commi[illegible]NPC) [Nigeria] and ICF Macro 2009) Thus, housing as well as health will be affected. Each year, there are more than 150 million cases of childhood pneumonia and nearly two million children under five lose their lives to an acute bout of pneumonia or another acute respiratory infection (WHO, 2008; Wardlaw *et al*., 2006). Pneumonia is the leading cause of death for children under the age of five – more than AIDS, malaria and measles combined (UNICEF, 2008). Ninety-five percent of all pneumonia infections in children under the age of 5 occur in developing countries. Over half of all child deaths due to pneumonia occur in just five countries: India, Nigeria, Pakistan, Democratic Republic of Congo, and Afghanistan (Black *et al*., 2010).

In the year 2004, indoor air pollution from solid fuel uses was responsible for almost 2 million annual death and 27% of this global burden of disease (in disability adjusted life years). Thus makes this risk factor second biggest environmental contributor to ill health aside unsafe water and sanitation (World Health Organisation, 2004). More than 4million children under-five die each year from environmental related caused and conditions this makes the environment one of the most critical contributor to the global toll of more than 10million child death annually. Diarrhoea kills an estimated 1.6 million children each year caused mainly by unsafe water and poor sanitation while malaria kills one million children under-five annually mostly in Africa (WHO, 2004).

1.3 Justification

Poor housing conditions are associated with a wide range of health conditions, including respiratory infections, asthma, lead poisoning, injuries, and mental health. Addressing housing issues offers public health practitioners an opportunity to address an important social determinant of health (Krieger and Higgins, 2002).

Childhood is the most precious time of life, a time of rapid development when experiences shape the adults we become. A child's healthy growth and development are dependent on many factors, including the immediate environment in which they live (Harker, 2006). However, few studies have focused on young children and for the investigation between housing conditions and perceived health effect, children are appropriate especially influence of indoor environmental variables on respiratory health They are more susceptible to indoor environmental pollutant than adults and also they spend more time indoor than adults (Yang *et al.*, 1997).

Under-5 (U-5) children living in poor or overcrowded conditions are vulnerable to respiratory infections and other health problems. The literature on housing effects in relation to child health has shown that there is an association between housing conditions and incidence of ill health To date, little research has been conducted on the relationship between health and housing in the Nigeria hence the need to carry out an assessment on housing conditions as it affect under-5 children

1.4 Objectives

1.4.1 Broad Objective

The broad objective of this study was to assess housing conditions and the perceived health effects on under-five children in Oni-Adio, Ido Local Government Area, Oyo State.

1.4.2 Specific Objectives

The specific objectives of this study were to:

1. Determine the household characteristics in selected communities of Oni-Adio.
2. Assess knowledge of caregivers/mothers of under-five children on the risks associated with housing.
3. Assess the attitude of caregivers/mothers of under-five children towards the risks associated with housing.
4. Identify the perceived health effect that could be associated with housing condition
5. Determine the hygrothermal (temperature and relative humidity) conditions in the selected households.
6. Assess the level of airborne microbes (bacteria and fungi) in selected households.

1.5 Hypotheses

The following null hypotheses were tested

H_{o1}: There is no significant association between respondents' level of education and perceived health status of a child.

H_{o2}: There is no significant association between respondents' family type and perceived health status of a child.

H_{o3}: There is no significant association between sex of the child and perceived health status of a child.

H_{o4}: There is no significant association between education and knowledge of respondents about housing condition

CHAPTER TWO

LITERATURE REVIEW

2.1 Housing

Housing is a multi-dimensional concept that is more than simply the provision of shelter (Hwang *et al*., 1999). There are at least three potential health dimensions of housing and it is through these three dimensions that health effects of housing needs to be considered.

House: The physical aspects of housing, which include the structural and design features, such as housing type, space, warmth, dryness, and fresh air.

Home: The psycho-social dimension of housing, which includes concepts of security, control, sense of attachment, permanence, and continuity (Hartig *et al*., 2003). A home potentially has tremendous significance, as it is typically where people spend most of their time, is the venue for contact with the most important members of their social network, and often represents the most significant financial and personal investment of individuals and families (Evans *et al*., 2003).

Neighbourhood: The neighbourhood and community where housing is located, which influence the availability of health and social services, recreation, schools, and employment, the safety and security of people and property; and community norms towards a wide range of issues (e.g. child rearing, value of education, crime).

The World Health Organisation (WHO) described housing as residential environment which includes the physical structure used for shelter, all necessary services, facilities, equipments and devices needed or desired for the physical and mental health and social well being of the family and individuals (Omole, 2010). According to Omole, the United Nations Habitat Group of Experts on Housing and Urban Development equally asserted that housing is neither a mere shelter nor household facilities alone. It is an essential need that comprises essential services and facilities, which make up a physical environment that link each

individuals and his family to the community in which it evolves. Therefore, environmental amenities like waste disposal, water supply and road access have special links between economic and social infrastructrue like education, health and recreation. All these are parts of the package of services designated as housing (Omole, 2010; Aribigbola, 2001).

Housing is an entity that facilitates the fulfilment of specific functions set for the individual and/or the family. These functions include providing shelter from inclement weather, guaranteeing safety and protection, facilitating rest, allowing for the use of the senses to engage in culture, facilitating the storage, processing and consumption of food, providing the resources for personal and domestic hygiene and sanitation, aiding convalescence of the sick, care of the elderly and disabled, and the development of children, and promoting a balanced family life (Pan American Health Organisation [PAHO], 2000). The development of housing serves to pull together a social agenda based on the family, an economic agenda based on the means of making a living, a cultural agenda based on traditions and customs, and an environmental agenda in the physical context. A typical man spends at least 50% of his time in the housing environment, compared with only 33% of his time at work or as a student, and 17% in other areas (PAHO, 2000).

The basis of housing is a house; yet housing is more than a physical structure when it is incorporated into the concept of the uses that it's resident make of it. Given the many functions that housing should assume, the interior areas tend to be compartmentalized in order to harmonize structure and function. Areas divided for the fulfilment of specific activities are called functional housing areas. These include bedrooms, the kitchen, bathrooms, living rooms, etc. These areas tend to have the furniture and equipment necessary for the functions that correspond to them. Functional areas thus constitute sub-environments that facilitate functions. The areas support a regimen for the concentration of a particular function, yet at the same time they interconnect with other interior and exterior functional areas (PAHO, 2000)

Every human community is made up of dwellings and their peculiar groupings in settlements. These settlements usually facilitate access to technical networks that provide energy, communication, mobility, the drinking water supply, solid waste and wastewater disposal,

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proximity to markets, job sites, and community, educational, medical, and religious services. Thus the area of interest is not only the house or the basic physical element itself, but also the facilitating environment of the surrounding area (PAHO, 2000).

2.1.1 Housing – Health Issue

Due to the fact that most individuals spend so much time inside, our homes typically account for a major share of exposures to toxics, irritants, allergens, and gases that can cause disease and hurt our health. For example:

- mould, mildew, and pests (such as cockroaches, rodents, and dust mites) can trigger asthma, the leading cause of absences from elementary school;
- carbon monoxide poisoning from combustion appliances, such as stoves, furnaces, and gas heaters, claims several hundred lives each year in the U.S. and causes flu-like symptoms at lower levels;
- lead-based paint in older housing is the primary cause of childhood lead poisoning, which reduces children's intelligence, interferes with learning, and causes behaviour problems;
- exposures to asbestos particles, radon gas, and second-hand tobacco smoke, all of which can cause cancer, are far higher indoors than outside; and
- pesticide residues in our homes can pose significant risks for neurological damage and cancer.

2.1.2 Housing – Environmental Issue

Everyone knows that pollutants in our environment directly affect our health. Though we usually think of the environment as the outside world, scientists have long known that indoor exposures far exceed outdoor levels for most pollutants. Because toxic substances (such as lead and asbestos) and harmful gases (such as carbon monoxide and radon) build up in confined spaces, indoor levels are at least 10 times higher than outdoors for many pollutants of concern.

Housing is used by the whole population, but certain groups make greater use of it than others. These groups include young children, the elderly, the unemployed, those who are sick or for other physical or mental health reasons spend a greater proportion of time within the

dwelling. The exposure to unsatisfactory housing conditions will be greater for these vulnerable groups than for the rest of the population (Braubach *et al.*, 2011).

Numerous reviews and studies in the academic literature point to an association between housing and health. However, despite the evidence linking housing to health, the direction of causality between housing and health is often unclear (Ranson, 1991). That is, if a particular housing factor is found to be associated with a disease, it is often not clear whether the housing factor gave rise to the disease or vice versa (i.e. health selection effects), or whether a third set of determinants responsible (Waters, 2001).

Owning one's home is associated with a healthier and longer life; damp and mould with wheezing, breathlessness, cough, phlegm, meningococcal infection, and respiratory diseases and asthma; overcrowding with infectious disease and poor mental health; inadequate home heating with excess winter morbidity; and unsustainable home ownership and personal debt with social isolation and mental stress (Environmental Epidemiology Unit, 1999; Shaw *et al.*, 1999). In addition, poor housing can increase risk of fire and accidents, and poor maintenance of dwellings can lead to infestations that spread infection and exacerbate allergies (Howden-Chapman and Wilson 2000). Insecurity of tenure also impacts upon health because of factors such as lack of continuity of health service provision and increased stress due to frequent moves (Phibbs, 1999).

Housing can have both a positive and a negative effect on health (Howden-Chapman and Wilson 2000). For example, rehousing the sick or vulnerable can have a positive effect in terms of reduced use of health and other social services although studies undertaken in the United Kingdom suggest that the evidence for health improvement in people who are rehoused on the grounds of their ill health is mixed (Dunn, 2000).

Housing affordability has also been found to be a key factor in relation to health. If a greater proportion of income is being absorbed by higher rents, this can result in a deterioration of health status because of reduced capacity to buy essential food items and visit the doctor (Phibbs, 1999). Homelessness has a significant impact on health (Best, 1999). In general, homeless people have been found to have much poorer health status than the general

population (Dunn, 2000). Homeless people are more likely than others to suffer from bronchitis, tuberculosis, arthritis, skin diseases and infections, frequent headaches, musculoskeletal problems, visual impairment, alcohol and drug related problems and mental disorders (Best, 1999).

The majority of studies examining the associations between health and housing have concentrated on housing tenure, overcrowding or dampness, mould and cold. A review of the evidence relating these factors to health is provided below.

2.1.2.1 Housing tenure

Various models have been developed in an attempt to explain the association between housing tenure and health (Macintyre *et al.*, 1998). One is that housing tenure is a marker for underlying causal factors such as income or social position, rather than directly promoting or damaging health. In Britain for example, housing tenure is increasingly being used as an indicator of social position (Shaw *et al.*, 1999). Alternatively, housing may be a health promoting resource accessed through income, i.e. income allows one to choose to buy a dwelling, probably in better condition and in a better physical and social environment than dwellings in the public rented sector (Macintyre *et al.*, 1998).

Another model suggests that there is a direct relationship between psychological traits such as self-efficacy or self-esteem and health, and that housing tenure is simply a marker for these psychological traits, i.e. people with these traits are more likely to have bought their homes (Macintyre *et al.*, 1998). Alternatively, owning a home may increase health promoting psychological characteristics such as self-esteem. Howden-Chapman and Wilson (2000) suggest that 'it is likely that home ownership provides a degree of control over accommodation – a secure sense of home – that is crucial to wellbeing. This theme is explored in detail in Saunders (1990) and Winter (1994).

Several studies have provided evidence that, irrespective of the cost of housing, housing tenure has a direct impact on the health and life expectancy of occupants (Howden-Chapman and Wilson, 2000). Specifically, people in rented properties, particularly those in the publicly rented sector, have higher death rates than people in owner occupied households (Macintyre

et al., 1998). The British Health and Lifestyle Survey found that owner occupiers had better health than tenants, irrespective of social class, and consultation rates in general practice have also been shown to be related to tenure, with lower rates among owner occupiers after controlling for a wide range of socio-demographic characteristics and health status (Macintyre *et al.*, 1998; Carr-Hill, 1996). In their analysis of the West of Scotland Twenty-07 Study, Macintyre *et al.*, (1998) found that housing tenure may have some directly health promoting or damaging effects. They used multivariate analysis to examine the association of various health measures with housing tenure (and car access) after controlling for potential confounders (i.e. age, sex, the interaction of age and sex, income and self-esteem). The results showed that, after controlling for the potential confounding factors, owner occupation predicted better recent mental health; better respiratory function, smaller waist/hip ratio, fewer longstanding illness conditions, fewer symptoms in the previous month, and lower systolic blood pressure. In other words, that housing tenure was associated with a range of health measures, independently of income or self esteem. The authors concluded that their findings suggest the need for further research into the health promoting or damaging effects of housing tenure.

In another analysis of the West of Scotland Twenty-07 Study, Ellaway and Macintyre (1998) examined whether an association between housing tenure and various housing and neighbourhood conditions (i.e. housing stressors such as overcrowding, dampness, hazards and difficulty heating the home; housing type; and neighbourhood conditions such as amenities, problems, crime, neighbourliness, area reputation and satisfaction) might explain why housing tenure appears to predict health. They found that housing tenure and income were not significantly associated with any of the health measures examined once housing stressors, housing type and neighbourhood conditions were considered simultaneously. The results suggested that housing tenure might have an effect on health because it is predictive of housing conditions, which are themselves health damaging or health promoting. In other words, owner occupiers tend to be able to afford homes that are in better condition and in less threatening environments and are therefore less stressful to live in.

Woodward *et al.*, (1992) used data from the Scottish Heart Health Study to examine whether the least advantaged social groups in Scotland were at greatest risk of coronary heart disease

(CHD). Housing tenure was one of four measures of social class used (the others were level of education, years of education, and the Office of Population Censuses and Surveys' definition of social class based on occupation). Housing tenure was the best measure at discriminating between the presence and absence of CHD for men and women. The authors suggested that the finding might be due to important characteristics of the accommodation, such as ventilation, dampness, or insulation; or to a health-related psychological boost due to home ownership; or because home ownership is a better indicator of wealth than occupation or education and hence of opportunity for healthy behaviour. Data from the British Household Panel Survey 1990–1992 indicated that housing tenure and structural housing problems were both independently associated with the prevalence of common mental disorders after adjustment for other measures of material standard of living (Welch and Lewis, 1998).

Housing tenure, overcrowding (i.e. more than two household members per bedroom) and the presence and number of structural housing problems (i.e. damp, condensation, leaking roof, and/or rot in wood) were three of seven variables selected to provide an assessment of each subject's material standard of living. Common mental disorders were assessed using the self administered 12 item General Health Questionnaire (GHQ). Logistic regression modelling was used to adjust for the following potential confounders--age, sex, social class (household head), the interactions between sex and social class and between age and social class; and employment status, household size, responsibility for dependent children, education, ethnicity, marital status, number of physical health problems, and region of residence. Living in rented accommodation and having two or more minor or any major structural housing problems were both independently associated with higher odds of common mental disorders after adjusting for potential confounders.

Geddes *et al*., (1993), in their study of the impact of socio-economic disadvantage on health in Adelaide, found that socio-economically disadvantaged people with access to public housing tended to have better health outcomes than those in private rental accommodation. Phibbs (1999) suggests that this indicates a possible association between health and housing affordability and or security of tenure. Sundquist and Johansson (1997a; 1997b) found that renting an apartment was associated with an increased risk of mortality in Sweden after

controlling for age, marital status, educational status and health status. In an analysis of data from the OPCS Longitudinal Study, Filakti and Fox (1995) found that people living in local authority housing had a higher mortality rate than owner occupiers, and that the differentials across tenure types had widened between the 1970s and 1980s. This finding is consistent with evidence that variations in mortality by socioeconomic status are widening (Shaw *et al*., 1999) and, given that Filakti and Fox did not control for other socioeconomic characteristics, suggests that the role tenure plays here is one as an indicator of socio-economic status.

While the literature indicates that there is an association between housing tenure and health, it is not entirely clear whether housing tenure is directly related to health or whether it is an intervening variable for factors such as housing conditions, self-esteem or income. Clearly, more work needs to be done to determine the pathways by which housing tenure affects health. In the Australian context, there appear to have been very few studies which have examined the links between housing tenure and health. In the absence of such research, it is difficult to say whether the relationship between housing tenure and health in Australia would be consistent with the international experience. However, factors such as the high level of home ownership in Australia and the fact that we have a relatively newer housing stock may affect the likelihood of an association.

2.1.2.2 Household overcrowding:

The relationship between health and overcrowding is complicated by factors such as time spent in the home, cultural differences and the condition of the housing (Anne-Marie, 2001). Few studies have shown an independent effect of crowding on physical health because the links are confounded by generally poor living conditions. People living in overcrowded homes are more likely to have low socio-economic status and higher unemployment (Howden-Chapman and Wilson, 2000) Overcrowded housing increases the risk of infectious diseases such as meningococcal disease, rheumatic fever, tuberculosis and respiratory infections. It also impacts upon mental health through factors such as high noise levels and lack of privacy (Shaw *et al*., 1999; Hopinn and Hunt 1996a) and it may also affect the educational achievement of children in the household (Howden-Chapman and Wilson, 2000). Howden-Chapman and Wilson (2000) examined the association between crowded housing and health in New Zealand using data from the 1996-97 New Zealand Health Survey

(NZHS) and the 1997 National Nutrition Survey. The Canadian National Occupancy Standard was used as the definition for overcrowding.

There is some evidence that overcrowding in childhood may be associated with adult disease (Anne-Marie, 2001). In a retrospective cohort study, Coggon *et al.*, (1993) examined the influence of domestic crowding and household amenities in early life on later mortality from all causes and from stomach cancer, chronic obstructive pulmonary disease, and rheumatic heart disease. The results indicated that death rates among subjects who were children in the 1930s were higher in those whose houses were crowded. However there was no clear relationship between overcrowding and mortality for the full cohort. Other studies have linked overcrowding in childhood to deaths from stomach cancer, respiratory problems and heart disease (Anne-Marie, 2001). Not all studies have shown an adverse effect of overcrowding on health. Hopton and Hunt (1996a) examined the impact of different aspects of poor housing on mental health in a local authority housing estate in Glasgow. The results showed that crowded housing was more likely in rental housing, where there is a greater likelihood that people will be unemployed, have lower incomes and be partially reliant on government benefits. With respect to health and risk factors, crowded housing was associated with significantly poorer self-reported mental and physical health in adults, and significantly higher prevalence rates of smoking and hazardous drinking. Asthma tended to be reported more frequently by adults living in a crowded household, but not at a statistically significant level. McNicholas *et al.*, (2000) found that the risk of meningococcal disease was strongly associated with overcrowding in the household.

Poor housing was assessed by self-report using a checklist of problems including dampness, cold, noise and crowding. Respondents were also asked whether their house was an easy target for burglars and vandals, whether it was in poor repair or badly designed. Logistic regression analysis revealed that overcrowding was not significantly associated with poorer mental health. As noted above, few studies have shown an independent effect of overcrowding on physical health because the links are confounded by other factors such as generally poor living conditions. This implies that there is a need for more research into the impact of overcrowding on health which takes into account potential confounding factors. In undertaking this literature review, no Australian studies that examined the links between

overcrowding and health were identified. It is difficult to speculate on whether overcrowding in Australian homes is likely to have a direct effect on health, particularly as data from the 1999 Australian Housing Survey indicate that the overall prevalence of overcrowding is only 4.5% (Australia Bureau of Statistics, 2000). The fact that the housing stock in Australia is relatively newer than that in England and Scotland may also affect the likelihood of any association between overcrowding and health in Australia.

2.1.2.3 Dampness, mould and cold

Damp housing is often associated with poor maintenance of the dwelling and socio-economic disadvantage of the occupants (Annie-Marie, 2001). In relation to health, cold housing and dampness and mould in the home are associated with wheezing, breathlessness, cough, phlegm, meningococcal infection, and respiratory diseases and asthma (Shaw *et al*., 1999). In particular, there appears to be a dose-response relationship between dampness and increased respiratory infection and asthma, independent of socio-economic conditions and other confounding factors (Williamson *et al*., 1997 cited in Welch, 1997). Excess winter mortality from respiratory disease, heart disease or stroke in older people may also be linked to cold housing (Best, 1999; Clinch and Healy, 2000). In their analysis of data from the Oxford Healthy Life Survey, Evans *et al*., (2000) found that being unable to keep the home warm enough in winter was more strongly associated with ill health (i.e. the self-reported prevalence of longstanding illness, and asthma specifically; and perceived health status (physical functioning, role limitations due to physical problems, social functioning ,bodily pain, general mental health, role limitations due to emotional problems, vitality, and general health perceptions) measured using the SF-36 (short form 36 questions health survey) and health service used (Ware *et al*., 1992).

Hopton and Hunt (1996a) found that reporting a problem with dampness was significantly and independently associated with poorer mental health after controlling for possible confounding factors (i.e. having a chronic illness, living in a low income household, living with children under 16 years of age, and being unemployed). Evidence of links between damp mouldy housing and respiratory illness is strongest for children as the results are less likely to be confounded by smoking or occupational respiratory problems (Anne-Marie, 2001). In a Canadian study, Dales *et al*., (1991) found that homes with dampness and mould

were associated with significantly higher prevalence rates of various respiratory symptoms in children. The association was independent of age, sex, race, education of parent/guardian, gas cooking, number of household smokers and region of residence. Further, a dose response relationship was observed between the number of mould sites and health outcomes, i.e. as the number of mould sites increased the odds ratios for the respiratory symptoms also increased.

Report on people's experience of bad housing in England found that more than one million children in England are currently in "damp, cold, infested" housing (Minton and Jones, 2005; Shelter, 2004). More than one million houses in England are considered "unfit to live in" (Shelter, 2004; Office of the Deputy Prime Minister, 2004). Young children spend 90% of their time in the home (Chaudhuri, 2004). Other groups of children are also particularly vulnerable to environmental conditions within the home, especially children with asthma or related conditions, and small, immature or preterm infants (Minton and Jones, 2005; Somerville *et al*., 2000; Venn *et al*., 2003; Emond *et al*., 1997). Substandard housing has also been found by a US study to be one of a number of factors associated with child hunger (Wehler *et al*., 2004). A major study has also found that exposure to "adverse housing conditions" in childhood increases the likelihood of certain illnesses in later life, even if these people live in good quality housing in adulthood (Marsh *et al*., 2000).

Finally, there is evidence that eliminating dampness and cold might be beneficial to children's health. In a longitudinal study designed to evaluate the effects of an improved heating system on the health symptoms of children living in a deprived housing estate in Scotland, Hopton and Hunt (1996b) found that reducing dampness and cold prevented a further deterioration in children's symptomatic health. Factors such as our milder climate and relatively newer housing stock may affect the likelihood of any association between dampness, mould and cold, and health here.

2.2 Concept of Housing and Health

Housing is the central hub of everyday living. It is a multi-dimensional concept that encompasses the characteristics of the house (physical structure and design), home (social and psychological features), and neighbourhood (physical and social characteristics, and

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2.2 Concept of Housing and Health

Housing is the central hub of everyday living. It is a multi-dimensional concept that encompasses the characteristics of the house (physical structure and design); home (social and psychological features); and neighbourhood (physical and social characteristics, and

local services) The central influence of housing on people's lives raises the possibility that housing could act as a pathway through which social and economic determinants of health influence population health (Canadian Institute for Health Information. 2004).

House is where one relaxes, entertains, sleeps, and raises a family. Housing influences the air that one breathes, the amount of individual space, the schools children go to, the financial pressures on the household budget, the availability of recreational space, and the safety and supportiveness of one's surroundings. These many interactions between housing and people's lives provide a multitude of ways that housing could affect health

Poor housing has been used both as an indicator of poverty and as a target for interventions to improve public health and reduce inequalities in health (Thomson *et al*., 2001). Although housing still has a prime place on the health inequalities agenda, it also has wider importance because small health effects can have a large impact at the population level.

The association between housing conditions and both physical and mental health, has long been recognised and is now generally accepted. Whilst there are a range of specific housing factors which affect health outcomes, the relationship between housing quality and health is complex, not least because the links between different dimensions of housing and health operate at a number of inter-related levels (Evans *et al*., 2003, Halpern, 1995, Marcus, 1997, Weich *et al*., 2002). Housing does not simply operate in isolation to influence health, rather the interplay between structural forces, the broader policy environment, employment opportunities, educational achievement, neighbourhood conditions, social relationships, and housing conditions (as well as individual factors like lifestyle) essentially determine health and health inequalities in society (Howden-Chapman *et al*., 2011).

Research evidence examining the relationship between housing quality and health has largely been developed by two separate traditions of investigation – that of social science, and epidemiological and medical research. Between and within both traditions there is a lively debate about causal links. The quality of the research evidence gathered is often affected by the problem of 'confounding' factors: those living in unsatisfactory housing tend to

experience so many other deprivations, that isolating the influence of housing on their health is difficult.

However, studies have reported consistent statistically significant associations between unsatisfactory housing conditions and the incidence of ill health. A number of reviews have also attempted to pull evidence from different sources and disciplines together (Burridge and Ormandy, 1993; Wilkinson, 1999; Rudge and Nicol, 2000).

2.2.1 Population Health

Over the past few decades, health status reports have clearly shown that health is not equal among all Nigerian (National Population Commission (NPC) [Nigeria] and ICF Macro. 2009). Regardless of the measure of health chosen, there are differences among and within Nigerian geo-political zones, and between different population groups. Health varies markedly with levels of education, employment, or income. These differences are not only limited to the extremes of the most rich and the least rich, but show a gradient across all levels. These observations have prompted the question of what makes some people healthy, and others not.

It is increasingly understood that health is influenced by much more than simply individual health behaviours and the provision of health care services. A number of factors have been identified that, when present, contribute to good health and, when absent, increase the likelihood of ill health. Population health focuses on understanding how the determinants of health influence human development and contribute to health and health inequalities in order to inform action to improve health. While the list of determinants emphasizes the role of social, environmental, and economic factors in shaping human health and well-being, there are many unanswered questions regarding the pathways through which these factors shape the health status of individuals and populations. Housing is link to many of the determinants of health raises the possibility that it may be one of the pathways through which these determinants influence health (Canadian Institute for Health Information. 2004)

2.2.2 Housing as a Determinant of Health

An increasing body of evidence has associated housing quality with morbidity from infectious diseases, chronic illnesses, injuries, poor nutrition, and mental disorders. This evidence is presented below:

2.2.2.1 Infectious Diseases

Features of substandard housing, including lack of safe drinking water, absence of hot water for washing, ineffective waste disposal, intrusion by disease vectors and pests (e.g., insects and rats) and inadequate food storage have long been identified as contributing to the spread of infectious diseases (Mood, 1993;Howard, 1993) Crowding is associated with transmission of tuberculosis (Wanyeki, *et al* , 2006) and respiratory infections (Fonseca *et al*., 1996; Denny, 1995; Murtagh *et al*., 1993; Graham, 1990). Lack of housing and the overcrowding found in temporary housing for the homeless also contribute to morbidity from respiratory infections and activation of tuberculosis (Wood *et al*., 1990; Zolopa *et al*., 1994; Kennedy *et al*., 1999; Conway, 1993).

2.2.2.2 Chronic Diseases

In more recent years, epidemiological studies have linked substandard housing with an increased risk of chronic illness. Damp, cold, and mouldy housing is associated with asthma and other chronic respiratory symptoms, even after potentially confounding factors such as income, social class, smoking, crowding, and unemployment are controlled for (Bornehag *et al*., 2001; Peat and Dickerson, 1998; Hyndman, 1998; Robinson and Russell, 1992; Hunt, 1993; Strachan, 1993; Marsh *et al* , 1999; Dales *et al*., 1991; Williamson *et al* , 1997). Water intrusion is a major contributor to problems with dampness. In 1999, eleven million occupied homes in America had interior leaks and 14 million had exterior leaks (US Census Bureau, American Housing Survey, 1999). Overcrowding and inadequate ventilation also increase interior moisture (Markus, 1993). Damp houses provide a nurturing environment for mites, roaches, respiratory viruses, and moulds, all of which play a role in respiratory disease pathogenesis (Bierman, 1996; Billings and Howard, 1998; Verhoeff *et al*., 1995; Institute of Medicine, 2000; Oie *et al*., 1999; Eggleston and Arruda, 2001). Cross-sectional epidemiological studies have also established associations between damp and mouldy

housing and recurrent headaches, fever, nausea and vomiting, and sore throats (Institute of Medicine, 2000).

Old, dirty carpeting, often found in substandard housing, is an important reservoir for dust, allergens, and toxic chemicals (Vaughan and Platts-Mills, 2000; Roberts and Dickey, 1995). Exposure to these agents can result in allergic, respiratory, neurological, and hematologic illnesses. Pest infestations, through their association with asthma, provide another linkage between substandard housing and chronic illness. Cockroaches can cause allergic sensitization and have emerged as an important asthma trigger in inner-city neighbourhoods. Children with asthma who are sensitized and exposed to cockroaches are at elevated risk for hospitalization (Rosenstreich *et al.*, 1997). Mouse allergen also acts as a clinically important cause of allergy and asthma morbidity (Phipatanakul *et al.*, 2000). Structural defects permit entry of cockroaches and rodents. Leaking pipes and other sources of water provide them with water to drink. Inadequate food storage and disposal facilities provide them with opportunities for obtaining food. Dead spaces in walls harbour pests and permit circulation among apartments in multiunit dwellings (Howard, 1993).

Living in cold housing has been associated with lower general health status and increased use of health services (Evans *et al.*, 2000). Exposure to toxic substances found in homes can result in chronic health problems. The association of passive exposure to indoor tobacco smoke with respiratory disease is well documented (Environmental Protection Agency, 1992; Weitzman *et al.*, 1990; Cook and Strachan, 1997). Poor ventilation may increase exposure to smoke. Indoor exposure to nitrogen dioxide (from inadequately vented or poorly functioning combustion appliances) has been associated with asthma symptoms. Exposure to volatile organic compounds (emitted by particle board and floor coverings) may be associated with asthma and sick building syndrome (Institute of Medicine, 2000). Moderately elevated levels of carbon monoxide (from poorly functioning heating systems) cause headache; whereas higher levels result in acute intoxication (Walker and Hay, 1999). The relationship between lead exposure (from leaded paints) and neurodevelopment abnormalities is clearly established (Rosen, 1995; Needleman *et al.*, 1990). Asbestos exposure (from deteriorating insulation) can cause mesothelioma and lung cancer (Landrigan, 1998). Polyvinyl chloride flooring and textile wall materials have been associated with bronchial obstruction during the

first 2 years of life (Jaakkola *et al.*, 1999). Residential exposure to radon, which is increased by structural defects in basements, can cause lung cancer (Lubin and Boice, 1997). Old carpeting can contain pesticide residues and other compounds such as polycyclic aromatic hydrocarbons (Lewis *et al.*, 1994; Lewis *et al.*, 1999).

2.2.2.3 Injuries

The importance of designing homes to prevent injuries has received long-standing attention (Ranson, 1991), especially with regard to reducing burns and falls (MMWR, 1996). Attributes of substandard housing that increase the risk of injury include exposed heating sources, unprotected upper-story windows and low sill heights (American Academy of Paediatrics, 2001), slippery surfaces (Nuffield Institute for Health and NHS Centre for Reviews and Dissemination, 1996), breakable window glass in sites with a high likelihood of contact, and poorly designed stairs with inadequate lighting (Tinetti, 2003). Building design and materials influence the risk of injury from fires. These hazards are frequently present in temporary accommodations provided to homeless women and young children (Conway, 1993).

2.2.2.4 Childhood Development and Nutrition

Recent analyses of longitudinal cohorts of children have examined the influence of childhood housing conditions on the subsequent development of chronic diseases. A study conducted in Britain demonstrated modest associations of inadequate ventilation with overall mortality (respiratory mortality was not specifically examined) and type of water supply with coronary heart disease mortality, independent of other measures of deprivation (Dedman *et al.*, 2001). Another cohort study suggested that recurrent periods of housing deprivation during the participants' first 33 years of life were associated with disability or severe ill health (Marsh *et al.*, 1999).

Lack of affordable housing has been linked to inadequate nutrition, especially among children. Relatively expensive housing may force low-income tenants to use more of their resources to obtain shelter, leaving less for other necessities such as food (Ellaway *et al.*, 2000). Children from low-income families receiving housing subsidies showed increased growth compared with children whose families were on a subsidy waiting list, an observation

consistent with the idea that subsidies provide a protective effect against childhood under nutrition (Meyers *et al.*, 1995). Temporary housing for homeless children often lacks cooking facilities, leading to poor nutrition (Conway, 1993).

2.2.2.5 Mental Health

Substandard housing may also adversely affect mental health, although the evidence is more tentative. Excessive indoor temperature has been linked with irritability and social intolerance (Collins, 1993; MMWR, 2001). Damp, mouldy, and cold indoor conditions may be associated with anxiety and depression (Hyndman, 1990). A study in Glasgow demonstrated that dampness was significantly and independently associated with poorer mental health (Hopton and Hunt, 1996). Crowding was associated with psychological distress among women aged 25 to 45 in London (Gabe and Williams, 1993). Homelessness and living in substandard, temporary housing has been related to behavioural problems among children (Zima *et al.*, 1994). Substandard housing conditions may lead to social isolation because occupants are reluctant to invite guests into their homes.

Substandard housing affects multiple dimensions of health. There is evidence that, in part, poor housing conditions contribute to increasing exposure to biological (e.g., allergens), chemical (e.g., lead) and physical (e.g., thermal stress) hazards, which directly affect physiological and biochemical processes. In addition, concerns about substandard housing and fear of homelessness are psychosocial stressors that can lead to mental health problems. Preliminary research has suggested that residents' perceptions of their homes (e.g., pride in and satisfaction with their dwelling and concerns about indoor air quality) are associated with self-rated health status (Dunn and Hayes, 2000). Stress induced by substandard housing may also play a pervasive role in undermining health by increasing the allostatic load (the wear and tear accumulated by an organism as a result of physiological responses to environmental stressors) (McEwen and Seeman, 1999) on the body. Excessive noise (common in poorly insulated housing units) has been associated with sleep deprivation that leads to psychological stress and activation of the hypothalamic-pituitary-adrenal axis and sympathetic nervous system. These factors are major contributors to allostatic load (the wear and tear accumulated by an organism as a result of physiological responses to environmental stressors) (Van Cauter and Spiegel, 1999).

2.3 Global perspectives of housing and its effect on health

There are a wealth of studies which have consistently documented statistically significant associations between poor housing conditions and poor health (e.g. Acheson, 1998; Evans, 2003; Ineichen, 1993; Marsh *et al.*, 2000; and reviewed by Shaw, 2004; Taske *et al.*, 2005). The greatest risks to health in housing are related to cold and damp (including moulds and fungus), which affect and exacerbate respiratory conditions. In Scotland for instance, findings from the Scottish House Conditions Survey indicate that around 1 in 10 dwellings have condensation in at least one room, though few suffer from rising or penetrating damp. Indoor air quality, dust mites and other allergens, house type and overcrowding constitute further risk factors (Communities Analytical Services, 2009). Other risks are less direct (neighbourhood effects), including a broad range of antisocial behaviour which can have a negative impact on mental well-being. In addition, neighbourhood deprivation increases the risk of poor health, even after controlling for individual risk characteristics, such as poor socio-economic status (Diez-Roux *et al.*, 1997; Kawachi and Berkman, 2003). A review by the Scotland's Prime Minister's Strategy Unit (Strategy Unit, 2005) found that poor health in deprived neighbourhoods is in part driven by a series of social and environmental factors, including poor housing and local environments, limited social networks, income, poverty and worklessness, poor local transport and access to services, low educational attainment and drug and alcohol misuse.

The association between housing conditions and physical and mental ill health has long been recognised and there are a broad range of specific elements related to housing that can affect health outcomes (Bonnefoy *et al.*, 2004). These include agents that affect the quality of the indoor environment such as indoor pollutants, cold, damp, housing design or layout (which in turn can affect accessibility and usability of housing); factors that relate more to the broader social and behavioural environment such as overcrowding, sleep deprivation, and neighbourhood quality, and factors that relate to the broader macro-policy environment such as housing allocation. Indeed according to the authors of Housing and Public Health:

> *'It is likely that the causal link between housing and health works in both directions with housing affecting an individual's health and health also affecting an individual's housing opportunities. There also appears to be a 'close ecological'*

relationship between poor housing and ill health, with increased housing deprivation at one point increasing the probability of ill health and a sustained experience of housing deprivation over time further increasing the probability of ill health" (Taske et al., 2005).

There also appears to be a significant link between housing deprivation early in life and ill health in adulthood, with poor housing in childhood associated with higher rates of hospital admissions and increased morbidity and mortality in adult life (Marsh *et al.*, 1999). Shaw (2004) has constructed a useful model for conceptualising the relationship between housing and health. The model indicates how housing affects health through direct and indirect, and 'hard' and 'soft' ways. Softness refers to the ways in which housing can influence health through its poor quality, as well as insecurity and debt, general well-being, feelings of ontological security and social status perception.

Poor quality is especially indicated in studies on housing type, with high rises and multi-dwelling accommodation evidenced as detrimental to psychological well-being, particularly for mothers with young children (Evans *et al.*, 2003). It was observed that there is also some evidence of this in the Scottish context, revealing a negative relationship between poor housing type and mental health which is particularly stark in those areas where levels of social renting are greatest. Indeed, when considering a broad range of indicators of poverty, ill health and social exclusion, Glasgow stands out as qualitatively distinct and is at the bottom of Scotland's league tables, with inequalities continuing to grow (Gowell, 2008). As Scotland's largest city, thousands of high rises were built from the 1960s onwards. Many of Glasgow's high rise and socially rented housing are located in areas of considerable deprivation, though according to findings from Scotland's Gowell programme, many residents of social rented high rises are happy with their homes and neighbourhoods.

2.4 Housing and Health in Nigeria

The most visible and obvious consequences of urbanisation in developing countries, such as Nigeria, is often rapid deterioration of urban housing and living conditions (Olotuah, 2010). According to Diogu (2002), this is traceable to the fact that urbanisation leads to explosive population growth, which is occasioned by a phenomenal leap in the quantitative housing

needs of the populace. The housing needs are not matched by effective demand since the large majority of the populace does not have the wherewithal for adequate housing. In Nigeria, the rate of provision of new housing stock has lagged severely behind the rate of population growth resulting in staggering housing deficit (Adejumo, 2008) requiring an annual production of more than 70,000 housing units to cope with the population trend (Onyebueke, 2002; Isimi, 2005; Okedele *et al.*, 2009).

The rapid increase in the population of urban centres has resulted in an increase in the cost of living because of higher demand on urban commodities. There is a dearth and high cost of urban land, and high cost of housing, which is often in short supply and out of the economic reach of the majority of the urban households (Oladapo and Olotuah, 2007). As a result such houses are without toilet and other essential utilities. Their drains are often filled with refuse deposits, which hamper the free flow of run-offs (Olanrewaju and Akinbamijo, 2002). Similarly, Ombakun and Kumuyi (1996) identified these areas as regular abodes for urban poor. Such are characterized by low income, unstable employment, low status of job, poor housing conditions, large facilities, and constant struggle for survival. Also they are distinguished by low access to limited information (Olanrewaju, 2004).

The direct effects of poor housing condition may be difficult to prove in view of many other interrelated factors which are often present with poor housing. This notwithstanding there is enough evidence about relating certain ill health to specific poor housing status (UNICEF, 2001; Azubuike and Nkanginieme, 1999; Lucas, 1990). Housing conditions include the life-support systems that make the housing unit to be comfortable for the inhabitants. A house must have good appearance and the general layout must be attractive otherwise it may be turned into slum (Jackson, 1990).

Abiodun and Segun (2005) observed that economic viability as well as level of education of owners/occupiers have been found to be major determinants of housing condition and government's effort at addressing problems of housing may not be able to achieve the desirable success without making conscious effort to improve the socio-economic status of the people.

needs of the populace. The housing needs are not matched by effective demand since the large majority of the populace does not have the wherewithal for adequate housing. In Nigeria, the rate of provision of new housing stock has lagged severely behind the rate of population growth resulting in staggering housing deficit (Adejumo, 2008) requiring an annual production of more than 70,000 housing units to cope with the population trend (Onyebuchi, 2002; Isimi, 2005; Okedele *et al*, 2009).

The rapid increase in the population of urban centres has resulted in an increase in the cost of living because of higher demand on urban commodities. There is a dearth and high cost of urban land, and high cost of housing, which is often in short supply and out of the economic reach of the majority of the urban households (Oladapo and Olotuah, 2007). As a result such houses are without toilet and other essential utilities. Their drains are often filled with refuse deposits, which hamper the free flow of run-offs (Olanrewaju and Akinbamijo, 2002). Similarly, Onibokun and Kumuyi (1996) identified these areas as regular abodes for urban poor. Such are characterized by low income, unstable employment, low status of job, poor housing conditions, large facilities, and constant struggle for survival. Also they are distinguished by low access to limited information (Olanrewaju, 2004)

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Studies have shown the deplorable conditions of urban housing in Nigeria (Wahab *et al.*, 1990; Olotuah, 2007). The studies affirm that 75% of the dwelling units in urban centres in Nigeria are substandard and the dwellings are sited in slums. The inadequacy of the quality of most of urban housing stems mainly from the poor physical state of the buildings. The studies further show that the buildings are often unsafe and insecure and do not provide adequate shelter from the elements of weather.

According to Olotuah (2010), in large urban centres poor housing conditions often manifest in the high numbers of people living in one room and paying exorbitant rents. This is physical overcrowding, which is a determinant of two major types of problems namely, a health hazard and harmful social behaviour. Crowding, poor air quality within homes as a result of inadequate ventilation, and the presence of mold and smoke contribute to poor respiratory health in general and have been implicated in the spread and/or outcome of tuberculosis (TB) (Wanycki *et al.*, 2006; Dales *et al.*, 1991)

Living conditions in individual housing were considered in terms of fitness for human habitation and from to time, standard of fitness were formulated and recommended especially in Europe. The first minimum standard of fitness was issued by the Minister of Health in England (UNCSD, 1997). Many countries particularly the former British colonies fashioned out their own regulations after the British model. Nigeria is one of such countries. Every dwelling and dwelling unit intended for use as a human habitation, occupancy or use, or held for use as human habitation, is expected to comply with all the minimum standards of fitness for human habitation in accordance with the applicable laws and building codes (North Carolina State, 1999). The Public Health Laws of Nigeria of 1959 (Cap. 103) as applicable in different parts of the country (still in force) also stipulate conditions expected of a dwelling place (Public Health Laws of Nigeria, 1959; Mathews, 2003). In particular section 6 (a-m) states in clear terms nuisance conditions which their existence in a dwelling renders the dwelling insanitary, unsafe for health and which may require specific remedial measures to abate the nuisances. Specific provisions of such regulations stipulate that human habitations are not expected to be so damp, so ill-ventilated, not littered with refuse, or lack essential sanitary facilities including adequate toilet facilities.

Houses are expected to be accessible by road, have secured drainage systems, have facilities for prompt and sanitary solid waste management, and have regular and safe water supplies, among other things. Ensuring compliance with the stipulated standards require first and foremost an education regarding the link between poor housing and health and the need to ensure hygiene of dwellings. It also requires a commitment to country and regional planning, regular inspection of houses/monitoring to ensure continuous compliance with standards and the availability of enabling environment to support good housing. Economic and social factors (in particular income level) are fundamental determinants of housing conditions in developing countries (Martin, 1999). In Nigeria, Environmental Health Officers (EHOs) previously known as Sanitary Officers or Public Health Superintendents working in the local governments has the responsibility to inspect all premises especially residential ones for the purpose of detecting and abating nuisances (Bamigboye and Ogunkeyede, 2005). According to them, the Nigerian governments over the years initiated various moves to improve housing based on the resolutions adopted at the first United Nations Conference on Human Settlement held in Vancouver, Canada, in 1976. Apart from providing some regulations, the country has also formulated a National Housing Policy in 1991 which outlines strategies to ensure the provision of decent housing for the people (UNCSD, 1997). It must be understood that the issue of ensuring that the people live in healthy houses should not be a matter of policy alone but must be carried into action so as to limit risks to which the people are exposed. Constant monitoring of compliance against standards is surely one way of achieving this. It is against this background that this study was carried out to assess the status of housing being inhabited by the people whose economic and social lives transcend beyond their place of abode.

2.5 Disparities in Housing, Disparities in Health

Exposure to substandard housing is not evenly distributed across populations. People of colour and people with low income are disproportionately affected. For example, Blacks and low-income people in United States are 1.7 times and 2.2 times more likely, respectively, to occupy homes with severe physical problems compared with the general population (US Census Bureau. American Housing Survey, 1999). People with low income are more likely to live in overcrowded homes. Disparities in asthma morbidity may be attributable, in part, to disproportionate exposure to indoor environmental asthma triggers associated with living in

substandard housing (Huss *et al.*, 1994; Kane *et al.*, 1999). Injuries occur more commonly in low-income households because of substandard conditions and a lack of resources to repair them. Clutter stemming from lack of storage space and hazardous cooking facilities also contribute to increased risk of injury from fire (Ranson, 1993). Homes of people with low income are more likely to be too warm or too cool because they are less well insulated, often have relatively expensive forms of heating such as electric baseboards, and frequently lack air conditioning. Additionally, occupants often cannot afford to pay for the energy needed to make their homes comfortable. As housing and energy prices continue to climb, low- and moderate-income households make tradeoffs between having enough food, staying warm, and living in adequate housing, with resultant adverse effects on health (Krieger and Higgins, 2002).

2.6 Housing and Child Well-being

It is known today that children's well-being does not depend only on genetics or their interactions with their parents, but also on their physical environments. And what could be more central to a child's environment than her home: the place where she eats, sleeps, and plays every day. Housing conditions affect all children, regardless of whether the home is rented or owned (Vandivere *et al.*, 2006).

Decent housing should be seen as a place for growth and a foundation for the fulfilment of life objectives, and one that provides for good physical and mental health and personal well-being (Ambrose 1997). Unfortunately, many children experience problematic housing circumstances and some has no home at all. Much of the information available on housing circumstances is available only for households that may not include children. Yet it is useful to keep in mind how many children are living in poor or low-income families, since they are likely to experience housing problems due to finances.

According to population census in the United States of America for instance, of the 73.3 million children under age 18 in the United States in 2014, 13 million (or 17.8 percent) were poor (U.S. Census Bureau, Population Division, 2012 quoted in Funders' Network for Smart Growth and Liveable communities, 2006). Nearly two in five (roughly 29 million, or 39 percent) children lived in low-income families (with incomes below 200 percent of the

poverty threshold) (Child Trends, 2000). Given the vast number of low-income and poor children, many of whom are likely to suffer from housing problems; great potential exists to change children's lives for the better through programs targeting housing. The three primary areas of well-being through which children's home environments affect them are:

- Physical health,
- Social and emotional functioning, and
- Cognitive development.

Each of the three areas of well-being—physical, social and emotional, and cognitive—are important. Success in all of the areas is necessary in order to say that, overall, a child is faring well. That is, no one would be satisfied if his or her child were merely free from medical diseases and injury; parents also want their children to be happy, confident, productive, smart, and engaged with others and society (Child Trends, 2000).

2.6.1 Physical Well-Being and Housing Conditions

Physically-healthy children are free from diseases such as asthma or chronic colds, and they are neither overweight nor underweight. They are also safe from accidents, injuries, and poisoning. Adequate nutrition, sleep, exercise, and preventive health care all contribute to a child's healthy physical functioning.

A child's physical health depends on the characteristics of the home in which he lives (Breysse *et al.*, 2004). The physical quality of housing may lead to childhood diseases including asthma, lead poisoning, and respiratory distress, as well as accident, injury, or even death. Factors that can lead to such diseases include structural conditions relating to building quality and maintenance, safety hazards, functional systems (for example, ventilation, smoke alarms, heating/cooling, plumbing) or environmental toxins including lead, asbestos, and neurotoxins. All of these hazards are preventable and treatable, but if unaddressed they can lead to significant health care costs and can cause unnecessary strain on the health care system.

2.6.2 Social and Emotional Well-Being and Housing Conditions

Social and emotional functioning refers to children's relationships with others, social skills, and feelings about themselves. Parents, educators, and societies hope to raise children who get along well with others, feel positively about themselves, and demonstrate the good character values and mental health that allow them to work towards their goals and be hopeful about their future. Some of the same features of housing that affect children's physical health also influence their social and emotional functioning.

2.6.3 Cognitive Development and Housing Conditions

Cognitive development describes children's abilities to mature in ways that allow them to learn in school and solve problems, make good decisions, and acquire essential literacy, mathematical, and technological skills. Cognitive development is affected by many of the same housing features that affect children's physical health and social and emotional well-being.

2.7 Housing Policy

Housing policy may be defined as government action to achieve housing objectives. These objectives could include the improvement of the quality of the housing stock of dwellings or dealing with homelessness. Another definition of housing policy would be government intervention in the housing field. The difference is that some interventions in the housing field may be directed at objectives outside the field (Clapham, 2010). It may also refer to the process of making important organizational decisions, including the identification of different alternatives such as programs or spending priorities, and choosing among them on the basis of the impact they will have. Policies can be understood as political, management, financial, and administrative mechanisms arranged to reach explicit goals. Agbola and Alabi (2000) also defined it as a plan of action, a statement of aim and ideas.

Housing policy is thus a guideline provided by government which is aimed at meeting the housing need and demand of the people through a set of appropriate strategies including fiscal, institutional, legal and regulatory frameworks (Agbola, 1998). A housing policy therefore provides a guide which delimits action and sets goals but does not necessarily specify any defined strategies for achieving the goal other than broad strategies. It establishes

guidelines and limits for discretionary actions by individuals responsible for implementing the overall plans of action (Olatubara, 2002). Duruzocchi (1999) noted that some housing policy decisions (written or implied) express the overall past work of government while others are goal statement or prescription of elemental rules for the conduct of personal or organizational affairs. Policies are thus well reasoned, carefully articulated and presented documents (Olatubara, 2002).

Housing policy is essentially necessary as a guide or control on the various actors in the housing sector. The main objectives of housing policy according to Duruzocchi, (1999), are to obtain the optimum use of existing housing resources in other to ensure adequate housing for the people, guide the location of new housing, and be responsive to the housing needs of special people

2.8 Housing Standards Regulation

Housing standards is a measure by which government regulates housing in the country. It reflects the minimum situation/specification/ regulation which housing shouldn't go beyond or in which housing is safe otherwise it becomes substandard and unsafe. With the broadening concept of housing, the concept of housing standards has also changed. The standards are no longer confined to narrow health criteria like per capita space and floor space.

Social and economic characteristics such as family income, family size and composition, standard of living, lifestyle, stage in life cycle, education and cultural factors must be taken into consideration in determining housing standards. Because of cultural diversity and other factors such as climate and social traditions, standard of housing must vary from country to country and from region to region (Park, 2009).

However, minimum standard are still maintained by building regulations, the aim being improvement of housing and environmental conditions for the majority of families within the limit set by available resources and objectives. The following standards are those recommended by EHC (1949).

Site:

1. It must be elevated from its surroundings so that it is not subjected to flooding during rain.
2. It must have independed access to a street of adequate width.
3. It should be away from breeding places of mosquitoes and flies.
4. It should be away from nuisances such as excessive noise, traffic, smoke etc.
5. The soil should be dry, well drained and safe for building the structure

Set back: this is an open space for proper lighting and ventilation. In rural areas it is recommended that the built up area must not exceed one-third of the total area; in urban area where land is costly, the built up area may be up to two-thirds. The set back should be such that there is no obstruction to lighting and ventilation

Floor: The floor should be pucca and satisfy the following criteria:

1. It should be impermeable so that it can be easily washed and kept clean and dry. Mud floors tend to break up and cause dust they are not recommended.
2. The floor must be smooth and free from cracks to prevent the breeding of insects and harbourage of dust.
3. It must be dam-proof.
4. The height of the plinth should be 2 feet (0.61meters) to 3feet (0.91 meters).

Walls: The walls should be

1. reasonably strong
2. should have low heat capacity and not absorb heat and conduct the same
3. unsuitable for harbourage of rats and vermins
4. weather resistant
5. not be easily damaged and
6. smooth

These standards can be attained by 9-inch (0,23 meter) brick-wall plastered smoothly

Roof: The height of the roof should not be less than 3.05 meter (in the absence of air conditioning) for comfort. The roof should have a low heat transmittance coefficient

Rooms: The number of living rooms should not be less than two, at least one of which can be closed for security. The other may be open on one side if that side is a private courtyard. The number and areas of room should be increased according to size of family, so that the recommended floor space per person may be made available.

Floor area: The floor area of a living room should be at least 120 sq.ft (12 sq. meters) for occupancy by more than one person and at least 100 sq feet (10 sq.meters) for occupancy by a single person. The floor area available in living room per person should not be less than 50 sq. feet; the optimum is 100 sq.feet.

Cubic space: Unless means are provided for mechanical replacement of air the height of rooms should be such as to give an air space of at least 500 c.ft. per capita, preferably 1,000c.ft.

Windows:

1. Unless mechanical ventilation and lighting are provided, every living room should be provided with at least 2 windows and at least one of them should be directly on to an open space
2. The windows should be placed at a height of not more than 3 feet (1meter) above the ground in the living rooms
3. The window area should be one-fifth of the floor area. Doors and windows combined should have two-fifth of the floor area.

Lighting: The daylight factor should exceed one per cent over half the floor area

Kitchen: Every dwelling house must have a separate kitchen. The kitchen must be protected against dust and smoke; adequately lighted; provided with water supply; provided with sink for washing and fitted with arrangements for proper drainage. The floor of the kitchen must be impervious.

Privy: A sanitary privy is a must in every home, belonging exclusively to it and readily accessible. In most developed areas of the world, the majority of dwelling units are equipped with water carriage systems.

Garbage and refuse: These should be removed from the dwelling at least daily and disposed of in a sanitary manner.

Bathing and washing: The house should have facilities for bathing and washing belonging exclusively to it and providing proper privacy.

Water supply: The house should have a safe and adequate water supply available at all times.

2.9 Indoor Air Quality

Indoor air quality (IAQ) may be defined as the nature and condition of the air inside buildings, including the extent of pollution caused by smoking, dust, mites, mould spores, radon, gases and chemicals from materials and appliances (Microsoft Encarta, 2009). It refers to the quality of air inside buildings as represented by concentration of pollutants and thermal conditions that affect health, comfort and performance of occupants (EPA, 1991). The indoor environment in any building is a result of the interaction between the site, climate, building system, construction techniques, contaminant sources (building materials and furnishings, moisture, processes and activities within the building, and outdoor sources), and building occupants (EPA, 1991).

Clean air is a basic requirement of life (WHO, 2010). The quality of air inside homes, offices, schools, day care centres, health care facilities or other private and public buildings where people spend a large part of their life is an essential determinant of healthy life and people's well-being (WHO, 2010).

Indoor exposure to air pollutants causes very significant damage to health globally – especially in developing countries. Despite this, public health awareness on indoor air pollution has lagged behind than on outdoor air pollution (WHO, 2010) with many people

associating public exposures to air pollution primarily with urban outdoor settings (Smith, 2002).

Air pollution is a major environmental health problem affecting developed and developing countries around the world (WHO, 2000). Concentrations of indoor air pollutants depend not only on building associated sources of emissions and ventilation exhaust patterns but also concentration of pollutants in outdoor air and their migration patterns indoor. Health effects on children depend on the biologically active dose received in target tissues mediated by such host characteristics as host defences and activity levels (Flynn *et al*., 2000).

2.10 Microbial load in air of a housing environment

Air movements favour the maintenance of microorganisms in the aerial media while their deposition is barely affected by gravity due to their small size diseases (Soto, 2009). Factors such as temperature, humidity, light and nutrient availability are determinants of microbial survival and abundance. Although pathogenic species are scarce in the air, some microorganisms travel by aerial transmission and are involved in serious processes causing pneumonia and other diseases (Soto, 2009).

Microbial pollution is a key element of indoor air pollution. It is caused by species of bacteria and fungi, growing indoors when sufficient moisture is available (WHO, 2009). Exposure to microbial contaminants is clinically associated with respiratory symptoms, allergies, asthma and immunological reactions (WHO, 2009).

The indoor air pollutants of relevance to health are widely heterogeneous, ranging from pollen and spores of plants coming mainly from outdoors, to bacteria, fungi, algae and some protozoa emitted outdoors or indoors. They also include a wide variety of microbes and allergens that spread from person to person (WHO, 2009).The concentration of microorganism in the air varies not only in the course of a season but also throughout the day (Stryjakowska-Sekulska *et al*., 2007).

The American Industrial Hygiene Association (AIHA) published a guideline for the amount of fungal spores in different indoor environments, for example guideline for residential

buildings is less than 500 cfu/m^3 and for commercial buildings are less than 250 cfu/m^3. According to the instructions of the Biological Aerosols Committee of the American Conference of Governmental Industrial Hygienists (ACGIH), the normal indoor aerial microflora should be qualitatively similar to, and quantitatively lower than the one of the open atmospheric outdoor air (i.e. Indoor/Outdoor ratio should be below 1) (Soto *et al*, 2009). European Community Commission has proposed five different categories to evaluate the level of microbial contamination in the indoor air of non-industrial environments (ECC, 1993).These categories are outlined in Table 2.1.

Table 2.1. Categories of microbial contaminants for indoor air in non-industrial environments.

Contamination Category	Bacteria (CFU/m^3)	Fungi (CFU/m^3)
Very Low	< 50	< 25
Low	< 100	< 100
Intermediate	< 500	< 500
High	< 2000	< 2000
Very high	> 2000	> 2000

Source: Sotto *et al.*, 2009.

2.10.1 Fungi

Fungi are ubiquitous eukaryotic organisms, comprising an abundance of species. They may be transported into buildings on the surface of new materials or on clothing. They may also penetrate buildings through active or passive/natural ventilation (WHO, 2009). Fungi are found in the dust and surfaces of every house, including those with no problems with dampness. Their growth indoors can occur only in the presence of moisture (WHO, 2009). While moulds are commonly thought to grow only in warm, moist, dark environments, recent research has shown that mould can grow even in dry climates (Davis, 2001).

Airborne levels of fungi vary seasonally, owing to seasonal changes in environmental factors, like temperature, relative humidity, rainfall (precipitation) and wind speed (Jang, 2009). The relationships between the number of airborne spores and hyphal fragments and the diversity

of fungi in indoor and outdoor environment are very strong from May to October (Kung'u, 2005).

Aerial fungi are much more important than bacteria as agents for allergic diseases. Many fungal species of *Acremonium, Alternaria, Aspergillus, Cladosporium, Fusarium, Penicillium, Stachybotrys and Trichoderma* have been shown to potentially produce mycotoxins and have been isolated in infestations causing adverse health effects (Davis, 2001). They have also been identified as triggers for rhinitis, asthma and dermatitis. *Candida, Rhodotorula and Cryptococcus* are lipophilic yeast able to colonize human skin and they form part of the normal microflora of mouth, skin and nails (Soto *et al.*, 2009). *Geotrichum Spp* is common contaminant of grains, fruits, dairy products, paper, textiles, soil and water, and often present as part of the normal human flora. The species *Geotrichum candidum* can cause a secondary infection (geotrichosis) in association with tuberculosis. This rare disease can cause lesions of the skin, bronchi, mouth, lung, and intestine (Noel, 1997).

2.10.2 Bacteria

Bacteria are ubiquitous prokaryotic single-cell organisms, comprising an abundance of species. They can be found in the dust and on the surfaces of every house, including those with no damp problems. The main sources of bacteria in the indoor environment are outdoor air, people and indoor bacterial growth. Bacteria from outdoor air and those originating from people are considered to be fairly harmless; bacteria growing actively or accumulating in the indoor environment, however, may affect health (WHO, 2009). High levels of bacteria concentration indoors is an indication of high occupancy rate, poor ventilation, or poor building maintenance. Similar to mould, some bacteria are associated with water-damaged building materials (Kung'u, 2007). Environmental bacteria generally associated with mouldy building materials include *Acinetobacter, Bacillus, Flavobacterium, Nocardia, Streptomyces and Thermomonospora* (Kung'u, 2007). Also associated with water-damaged material are the filamentous bacteria and the *Actinomycetes* (Kung'u, 2007). *Staphylococcus spp and Micrococcus spp* are dispersed into the air from human skin, oral and nasal surfaces, and hair. These bacteria are associated with nosocomial infections in health care facilities (Kung'u, 2007).

In a study carried out by Soto *et al*., 2009 in a University complex in Spain, the isolated bacteria corresponded to species of *Micrococcus, Staphylococcus and Streptococcus*, and to a lesser extent to *Bacillus, Neisseria, Acinetobacter, Pseudomonas and Corynebacterium*. This study however did not take into cognizance the effect of meteorological conditions such as the temperature and relative humidity which have been stated to have an effect on the microbial growth and the organisms.

2.11 Thermal Comfort in a housing environment (Indoor Temperature and Relative Humidity)

A number of variables such as the activity level, age, and physiology of each person interact to determine whether people are comfortable with the temperature of the indoor air (EPA, 1991).

Temperature and humidity are two of the most important indicators of a building's IAQ. They are also extremely important to the occupant's perception of IAQ. Uniformity of temperature is important for comfort. Temperature stratification is a common problem caused by convection, the tendency of light, warm air to rise and heavier, cooler air to sink. If air is not properly mixed by the ventilation system, the temperature near the ceiling can be several degrees warmer than at the floor level (EPA, 1991).

Radiant heat transfer may cause people located near very hot or very cold surfaces to be uncomfortable even if the measured air temperature are within the comfort range of 20-24°C in dry season and 23-26°C in summer/raining season (EPA, 1991).

Water vapour, usually measured as relative humidity or the percentage of water vapour held by the air compared to the saturation level, is a factor in thermal comfort (EPA, 1991) not usually considered to be an indoor contaminant or a cause of health problems. Most commonly reported health effects are airways symptoms, such as cough and wheeze, but other respiratory effects, and skin and general symptoms have also been reported. Associations with both new-onset asthma and asthma exacerbations have been documented especially in children, and to some extent also in adults (Romieu *et al*., 2001; Jaakkola, Jaakkola, 2001).

Raising relative humidity reduces the ability to lose heat through perspiration and evaporation, so that the effect is similar to raising the temperature. Humidity extremes can also create other IAQ problems. Excessively high or low relative humidity can produce discomfort, while high relative humidity can promote the growth of mould and mildew (EPA, 1991).

High indoor relative humidity is problematic in mild and hot climates; very low relative humidity may be a problem in a cold climate. In a cold climate, low outdoor humidity combined with overheating may decrease the indoor relative humidity to levels that provoke skin symptoms and nasal dryness and congestion (WHO, 2009).

CHAPTER THREE

METHODOLOGY

3.1 Description of study area

The study was carried out in Omi-Adio, Ido Local Government Area (ILGA), Oyo State, Nigeria. Omi-Adio is political ward (Ward Nine) in the LGA. The populace is predominantly Yoruba.

The LGA has its headquarters at Ido, a rural community situated along Eruwa-Ibadan road. Ido town was founded by Agum in the mid 18th century. Ido local government came into being in May 1989 when it was carved out of the former Akinyele LGA. It shares boundaries with Oluyole LGA and Odeda LGA of Ogun state in the South, Ibarapa East LGA in the West, Afijo, Akinyele and Ibadan North LGAs to the North while Ibadan North-West and Ibadan South-West LGAs bounded it to the East.

The LGA is blessed with fertile land and the main occupation of the people is farming and trading. Food crops and cash crops such as cassava, cocoa, palm trees, oranges, pineapples, plantain, maize, banana and kola nut are produced and then sold in the market. Ido LGA can be aptly referred to as one of the fruit baskets of the state. Parts of the LGA have some industries and other economic ventures such as the Nigerian National Petroleum Corporation depot, Apata, Nigerian Wire and Cable Industry, Nigerian Mining Corporation, NIPOL (manufacturer of plastics), Union Beverages Nigeria Ltd, Labia Canning Industries and Lafia Hotel. The LGA also enjoys the services of medium and small scale industries for the processing of agricultural profile such as cassava and cashew nuts. Some principal towns such as Apata, Ijokodo, Apete and Omi-Adio have access to electricity supply though the supply is erratic. Most parts of the LGA lack pipe-borne water. There are three maternity centres in the LGA and they are located in Ido, Akufo and Omi-Adio. There are six dispensaries in the LGA which are located at Ido, Omi-Adio, Apete, Akufo, Odetola and Kogue.

The LGA consists of 10 wards (Appendix I) with Omi-Adio being one of them. It has sixty eight primary schools and eight secondary schools, six maternity centres, about twenty health centres and four customary courts. The Population of Ido Local Government Area is about 103,261 with Omi Adio communities having a total population of 24,532. (Town Planning Division; Ido Local Government, Ido, Oyo State).

3.1.1 Omi-Adio Town

Omi-Adio is a rural town founded in the 19th century by a group of warriors. Omi-Adio itself consists of 34 communities. The major occupations of the people are farming and trading. Inhabitants of the communities in the town are a mix of Christians and Moslems with few adherents of traditional religion. The town, which is located in the outskirts of Ibadan, has forest reserves and grassland vegetation. Dry and rainy seasons are experienced at various periods throughout the year. Omi-Adio has major roads that link it with Ido town, Abeokuta and Apata. Residents of Omi-Adio enjoy electricity supply, Global Systems for Mobile communication (GSM) and a number of borehole water. There are three (3) government primary school and two (2) secondary schools in the town with many other private primary schools. Also present are 36 churches and [illegible] mosques. The only major industry in Omi-Adio is the Nigerian Mining Corporation. However several small scale industries like concrete block and furniture making industries are also present. There is one government owned health facility- a primary health care centre and several private health centres. The total population of Omi-Adio community according to1991 census is 11,094 with males numbering 5,418 and female numbering 5,676. (According to the National Population Commission, 1991).

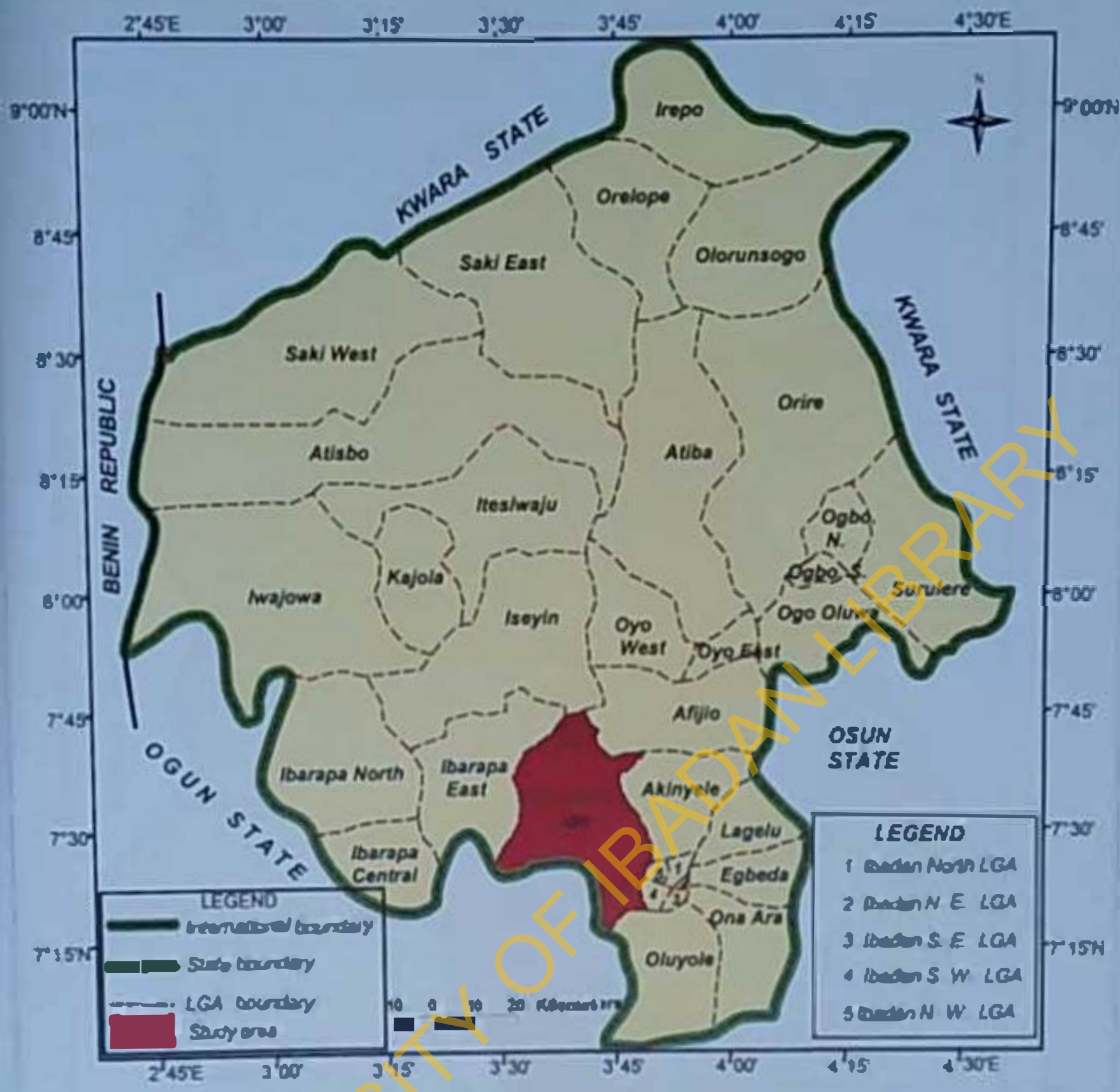

Figure 3.1 Map of Oyo State showing thirty-three (33) Local Government indicating Ido Local Government Area

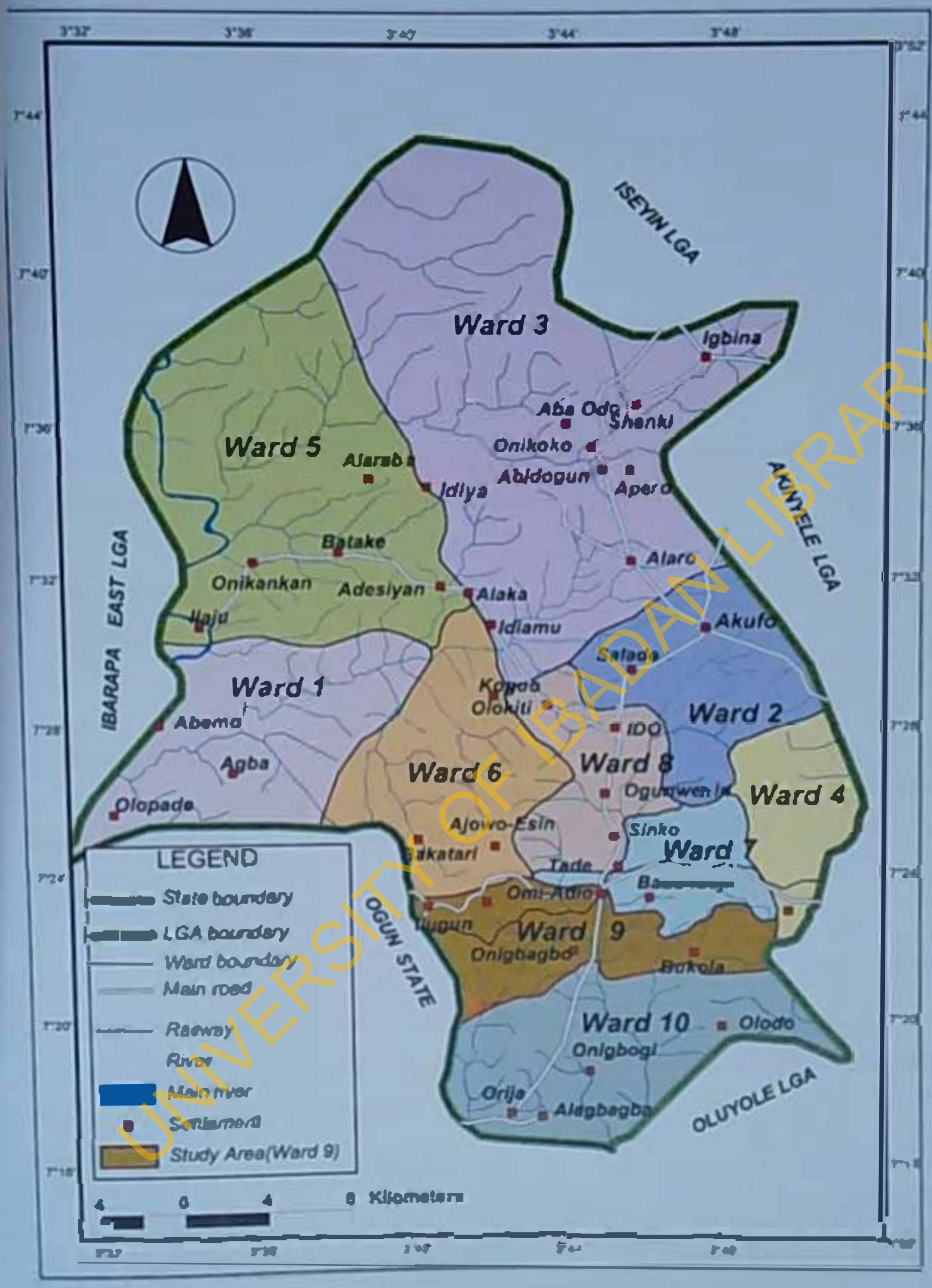

Figure 3.2 Ward map of Ido Local Government indicating Ward nine (9), the Study Area

3.2 Study Design

The study was community based cross-sectional in nature with two components: a descriptive and laboratory components.

3.3 Study Population

The study population comprises of children under-five in Omi-Adio in Ido local Government Area.

3.4 Study Participants

The study participants include mothers/caregivers of children under-five in the selected households of Omi-Adio in Ido local Government Area.

3.5 Sample Size determination

The sample size was calculated using the formula,

$$n = \frac{Z\alpha^2 pq}{d^2}$$ (Kirkwood and Sterne, 2003)

Where n = sample size

p = prevalence of mould and/or dampness of 25% in the homes for asthma exacerbation or upper respiratory illnesses (IOM, 2004)

q = 1-p

Zα = confidence interval set at 95% = 1.96

d = precision limit = 0.05

Based on the Institute of medicine, IOM, 2004, study on Damp indoor spaces and health. Washington DC, a prevalence of mould and/or dampness of 25% in the homes for asthma exacerbation or upper respiratory illnesses was adopted.

p = 25% = 0.25

q = 1 - 0.25 = 0.75

therefore $n = \frac{1.96^2(0.25)(0.75)}{(0.05)^2}$

$= \frac{3.8416(0.25)(0.75)}{0.0025}$

$= 0.7203$

$$= \frac{0.0025}{288}$$

Adjusting for anticipated 5% non response rate:

$$= \frac{5 \times 288}{100} = 14.4$$

Therefore n = 288 + 14 = 302 ~ 300

3.6 Sampling technique

A 3-stage (Wards, Communities and Households) sampling technique was used to select 300 consenting Mothers/Caregivers (M/Cs) of U-5C in Omi-Adio. Firstly; the ward was divided into four strata using the major roads and streams on the map. Secondly; in each stratum, communities were purposefully selected based on population size. Thirdly; households that have under five children and have lived in that house for at least two years will be included in the study.

3.7 Validity of the Instruments

Several measures were taken to ensure that the instrument was valid and reliable. Experts – a medical sociologist, environmental health specialists, paediatricians, medical statisticians, epidemiologists and health education specialists – were consulted to review the instrument for face and content validity. The instrument which was drawn in English was translated to Yoruba. This was done in order not to lose the meaning of the items in the questionnaire during the process of translation. The investigator who is also fluent in Yoruba and English also reviewed the Yoruba and English versions for accuracy.

3.8 Reliability of the Instruments

The two versions of the instrument i.e. the English and Yoruba version were pre-tested among 45 subjects in Lagelu LGA. This local government area has similar characteristics with Ido LGA. The reliability of the instrument was determined by subjecting it to measure of internal consistency with the use of Cronbach's Alpha coefficient correlation

According to this approach, a result showing correlation coefficient greater than 0.05 is said to be reliable. The result of the analysis of the data collected during the pre-test was 0.741 which shows that the instrument was very reliable.

3.9 Data Collection Methods

Data was collected using the following methods and tools.

3.9.1 Survey

Semi-structured questionnaire was administered by interview method to obtain information on demographic characteristics; household characteristics; characteristics of the child; knowledge about good housing condition were scored on 17-point scale with respondents' that score above eleven (11) were categorized to have good knowledge while those below were categorized as having poor knowledge, attitude of mothers towards risk associated with housing were scored on 5-point scale with respondents' that score above three(3) were categorized to have positive attitude while those below were categorized as having negative attitude, and health status of the child (Appendix II (English) and Appendix III (Yoruba version).

3.9.2 Observation

Observation was made on the houses and recorded in the observation checklist form. This was done immediately after interviewing the respondent. The checklist is attached as Appendix IV.

3.9.3 Sample collection and Analysis

3.9.3.1 Air sampling

Microbiological quality of indoor air was assessed in selected locations of the house as specified in Table 3.1. Air samples for microbial analysis were allowed to settle by gravity directly on the Petri plates filled with sterile Nutrient and Potatoes Dextrose agar (Appendix V for preparation of media) and exposed in sampling points for a period of 4minutes at a height of 1.5m at the centre of the room in the living and bed room for the indoor sampling and at least 2m away from the building for outdoor sampling (Mentes *et al*., 2009). All samples were collected in daytime and were taken to the laboratory and analysis. Incubation

duration and temperature conditions for bacteria and fungi were 2 days at 37°C and 4 to 7 days at 25°C respectively.

Total number of bacteria and fungi colonies in the air of selected rooms (bedroom, sitting room) and outdoor was determined using Koch sedimentation method (Buttner *et al*, 1997) according to Polish Standard PN 89/Z-04008/08. The number of microorganisms expressed as CFU/ m^3 was estimated according to the equation (Polish Standard PN):

$$Cfu/m^3 = \frac{a \times 10,000}{p \times t \times 0.2}$$

Where:

a – the number of colonies on the Petri plate

p – the surface of the Petri plate

t – the time of Petri plate exposure

0.2 – the constant

3.9.3.2 Microbial Evaluation

The total number of colony forming units (cfu) was enumerated by counting the number of growth on each plate and converted to number of organisms per plate. Bacterial colonies were characterized by morphology and microscopic examination. The fungi colonies were counted, and isolated fungi genera was identified according to the classification methods given in morphological atlases [29 – 31].

Table 3.1: Total Number of Air Samples collected in different locations

Investigated locations	Number of samples from one point	Number of petri dishes in one sampling	Number of total petri dishes
Bedroom	100	4	400
Sitting room	100	4	400
Outdoor	100	4	400
Total	300	12	1200

3.10 Environmental measurement

The hygrothermal conditions(Temperature and Relative Humitlity) (Appendix VI for the form) used to determine the comfort levels as well as free microbial condition of the rooms are described below:

3.10.1 Temperature

Temperature was measured using a Multi-function Environment meter (model NO9AQ), a combined instrument measuring Relative humidity, Light intensity, Noise as well as Temperature. The measurement was done by switching on the power of the instrument then the pointer button on the instrument is moved to temperature point on the instrument and the result was read. The procedure was repeated for each of the hundred households.

3.10.2 Relative Humidity

The relative humidity was measured using a Multi-function Environment meter (model: NO9AQ), a combined instrument measuring Relative humidity, Light intensity, Noise as well as Temperature. The measurement was done by switching on the power of the instrument then the pointer button on the instrument is moved to relative humidity point on the instrument and the result was read. The procedure was repeated for each of the hundred households.

Plate 3.2: Investigator conducting environmental measurements

3.11 Data Management and Analysis

Data collected were checked for completeness, cleaned, coded and stored using SPSS (version 15.0) statistical computer software. Data was analysed using descriptive statistics was presented in tables and charts. Summary statistics was presented as means and standard deviations. Cross tabulation was made between variables within and between groups. This was classified into two by two contingency tables. ANOVA, correlation, t- test and was used to determine association between categorical and non-categorical variables at p-value of <0.05. The results are presented using tables, pie charts and bar graphs.

3.12 Ethical considerations

An introductory letter was obtained from the Department in respect of the study and was handed to the Baale of the community and n feedback was given to proceed on the research work (Appendix VII). Also, an approval letter was collected from the Oyo State Ministry of Health Ethical Review Board and UI/UCH Ethical Review Committee, University of Ibadan, Ibadan (Appendices VIII and IX). The purpose of this was to ensure that this proposal conformed to the generally accepted scientific principles and international ethical guidelines related to human subjects' researches

Informed consent (Appendices X and XI for the English and Yoruba version respectively) was obtained from the study respondents. Respondents had the choice of participating or withdrawing their consent freely at any time. Confidentiality of each participant's responses was maintained during and after the collection of data; only registration numbers were assigned to each questionnaire and no name was required on the questionnaire. The registration numbers assigned to completed questionnaire were to facilitate data entry and analysis and no one can link the identity of the participants with the registration numbers.

3.13 Limitations of the study

The study focused on housing condition in relation to its perceived health effect. At the initial stage some study participants were not willing to give all information required by the researcher for one reason or the other. Efforts were made to reduce this problem by assuring the participants that information given by them would be kept confidential and that no name

is required on any questionnaire. They were also assured that the results of the study would not be linked with their households or communities.

Ascertaining the authenticity of responses provided by respondents is often a daunting challenge (Okoye, 2006). This study however is no exception. It is possible that some of the responses volunteered by respondents may not be true reflections of reality in their various households or houses or in terms of what they do or would do or would not do. It has been assumed that since participation is voluntary, and necessary ethical issues were given considerations, then all the responses provided which form the basis of the findings of this study are assumed to be correctly and honestly made.

CHAPTER FOUR

RESULTS

This chapter presents the findings of the study. The results of the survey which includes the socio-demography characteristics of the parents/care givers, child characteristics, household characteristics, knowledge about housing conditions, attitudes of mothers towards risks associated with housing and perceived health status of the child were presented first. The second section shows the findings of the observation on the housing condition. Results of the environmental data were presented in the last part of this chapter. The results were presented in frequencies, mean and standard deviation and statistical significance difference at $p<0.05$ of some of the variables (ANOVA, correlation, chi-square and t-test) were also shown.

4.1 Socio-demographic Characteristics of the Parents/Care givers

Overall, 300 respondents were surveyed. The age of the respondents ranged from 19 to 64 years with a mean of 32.2 ± 6.98 years (Figure 4.1). Majority, 288 (96%) were married. 8 (2.7%) were separated while 2 (0.7%) each were singles and divorced respectively (Table 4.1). More than half of the respondents, 161 (53.7%) were Christians, 138 (46.0%) practice Islam and 1 (0.3%) was a follower of traditional religion. Yoruba ethnic group accounted for 271 (90.3%) of the respondents with 13 (4.3%) and 12 (4.0 %) were Hausa and Igbo respectively (Table 4.1).

One hundred and twenty eight respondents (42.7%) had secondary school education. 105 (35.0%) had primary school education, 37 (12.3%) had tertiary education and 30 (10.0%) had no formal education. Slightly more than half, 152 (50.7%) of the respondents reported that their husband completed secondary school, 75 (25.0%) said their husband went to tertiary institution, 54 (18.0%) stated that their husband completed primary schools while 19 (6.3%) reported that their husband had no formal education (Table 4.1).

More than half of the respondents, 175 (58.3%) engaged in trading, 84 (28%) were artisans, 28 (9.3%) were civil servants, 9 (3%) were farmers and 4 (1.3%) were students and

housewives. Among all the respondents, 115 (38.3%) reported that their husbands were artisans, 49 (16.3%) said their husband were civil servants, 48 (16%) reported trading as their husbands' occupation, 31 (10.3%) mentioned that their husbands were farmers and 57 (19%) stated that their husband were engaged in other form of occupation such as cleric man, driver, factory worker, coach (Table 4.1).

Table 4.1 reveals the respondents family type, number of wives, number of children in the family and household size. Majority of the respondents, 296 (92%) reported monogamous as their family type while 24 (8%) said they were polygamous, with the number of wives ranging between 2-8. The median number of children in the family was 3.0 with a range of 1-7 children. Number of under-five children ranged from 1-5 with a median of 1 and the median household size was 5.0 with a range of 2-9.

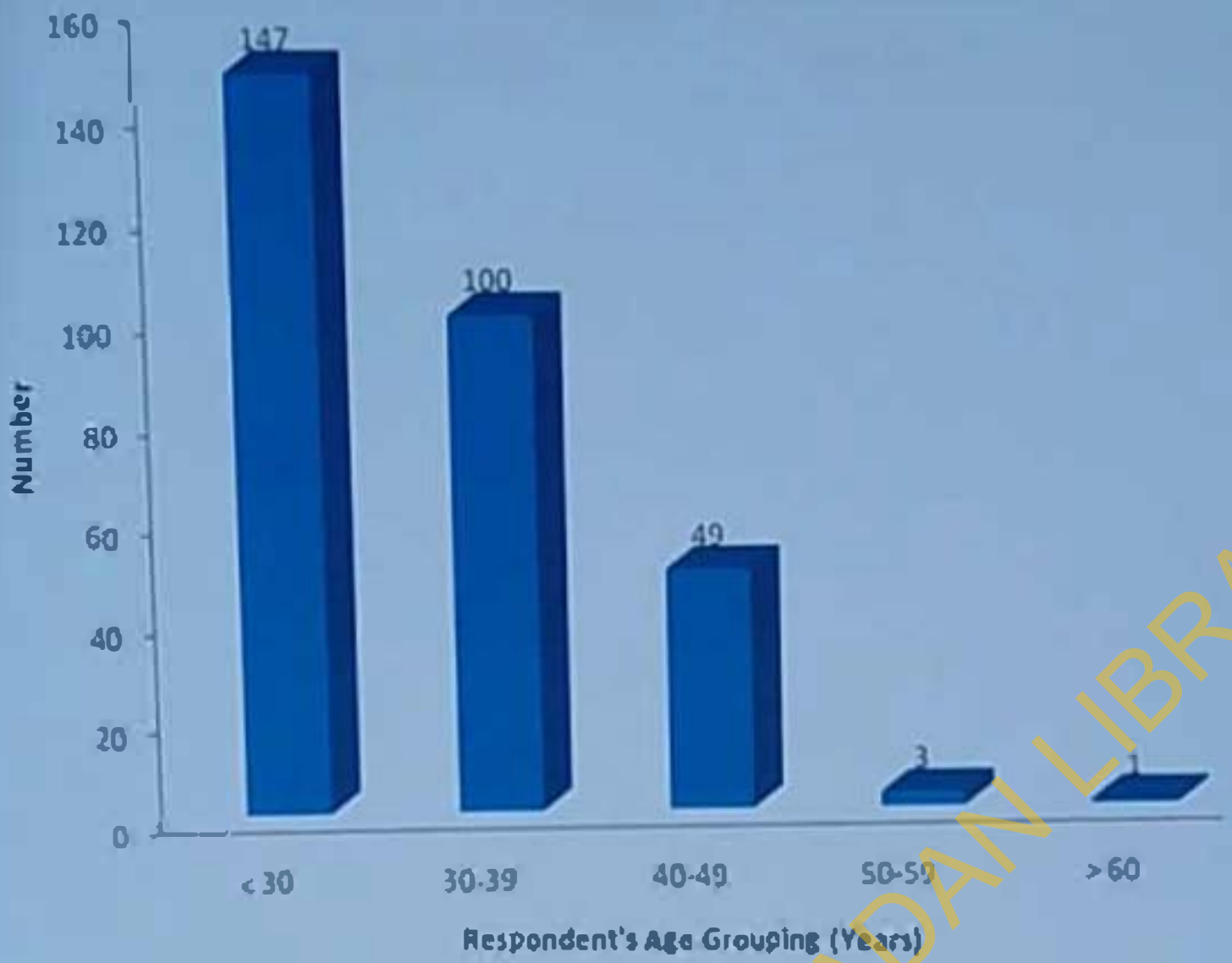

Figure 4.1: Age Distribution of the respondents.

Table 4.1: Socio-demographic Characteristics of the Respondents N = 300

Demographic Characteristics	Number	%
Marital Status		
Single	2	0.7
Married	288	96.0
Divorced	2	0.7
Separated	8	2.7
Religion		
Christianity	161	53.7
Islam	138	46.0
Traditional	1	0.3
Ethnicity		
Yoruba	271	90.3
Hausa	13	4.3
Igbo	12	4.0
Others *	4	1.3
Educational Status of the Respondents		
No Formal education	30	10.7
Completed Primary School	105	35.0
Completed Secondary School	128	42.7
Tertiary	37	12.3
Husband's Educational Status		
No Formal education	19	6.3
Completed Primary School	54	18.0
Completed Secondary School	152	50.7
Tertiary	75	25.0
Respondents' Occupation		
Trading	175	58.3
Artisan	84	28.0
Farming	9	3.0
Civil servant	28	9.3
Others **	4	1.3

Table 4.1: Socio-demographic Characteristics of the Respondents (cont'd)

Demographic Characteristics	Number	%
Husband's Occupation		
Trading	48	16.0
Artisan	115	38.3
Farming	31	10.3
Civil servant	49	16.3
Others ***	57	19.0
Family Type		
Monogomous	276	92.0
Polygamous (Range=2-8)	24	8.0
Number of children in the family		
Range	1-7	
Median	3	
Number of under-five children in the family	1-5	
Range	1	
Median		
Household Size		
Range	2-9	
Median	5	

* Others include Igbira, Togo and Igede

** Others include students and housewives

*** Others include clergymen, driver, factory worker contractor, students, security man, petrol attendant, coach and footballer

4.1.1 Characteristics of the child

The age of the child ranged from 24-60 months with 85 (28.3%) aged 24 months, 95 (31.7%) aged 36months while 65 (21.7%) aged 48 months and 55 (18.3%) aged 60 months (Table 4.2). One hundred and fifty two (50.7%) of the children were males and 148 (49.3%) were females. Figure 4.2 depicts information on the child's birth order, 113 (37.7%) of the children were first born, 76 (25.0%) were second born. 47(15.7%) were third born while 30(10.0%), 25(8.3%), 8(2.7%) and 1(0.3%) were in fourth, Fifth, Sixth and Seventh order respectively. Information on the sleeping materials of the child was sought, more than half of the mothers, 207(69.0%) reported bed, 76(25.3%) said mat, 12(4.0%) stated carpet, 2(0.7%) said bare floor and 3 (1.0%) of the mothers reported rug as their children sleeping material (Table 4.2).

Two hundred and thirty (76.7%) of the mothers reported that their children had started schooling and 70 (23.3%) said their children had not started. Of the 230 children who had started schooling, 125(41.7%) schooled around residential areas. 59(19.7%) schooled very close to major roads, 17(5.7%) had their school location very close to market, 2(0.7%) very close to hospital (Table 4.2).

Table 4.2: Characteristics of the children

Characteristics	Number	%
Children's age (months)		
Mean	39.6±12.85	
24	85	28.3
36	95	31.7
48	65	21.7
60	55	18.3
Sleeping materials		
Bed	207	69.0
Mat	76	25.3
Carpet	12	4.0
Rug	3	1.0
Bare Floor	2	0.7
Children schooling		
Yes	230	76.7
No	70	23.3
Proximity of school to various places		
Market	17	5.7
Major road	59	19.7
Hospital	2	0.7
Residential area	125	41.7
None of the above	27	9.0

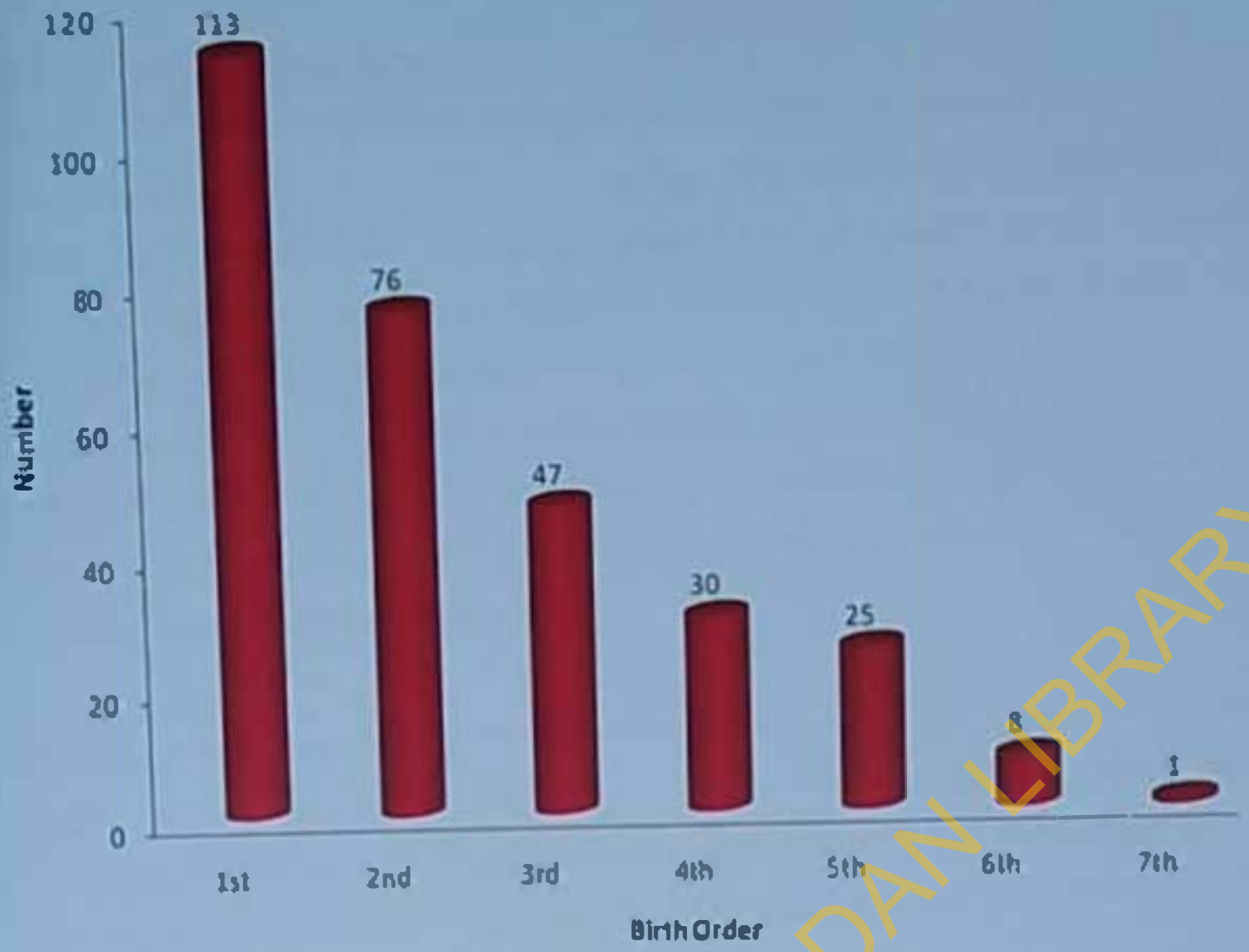

Figure 4.2: Birth order of the children

4.1.2 Housing characteristics

Respondents were asked about the number of rooms in the house, number of rooms occupied by the household. Table 4.3 shows 6.04±3.5 as the mean number of rooms, ranged from 2-20 excluding kitchen and toilet. The mean number of rooms occupied by the respondents' household was 1.97 ± 1.07 with a range of 1-6 rooms. Question on number of adult over 15 years in the household was asked and the mean number was 2.07±0.52 while the range was 1-5. The mean number of under-five children sleeping with index child in the same room was 1.18 ± 0.38 with the minimum of 1 and maximum of 2 children. Adult over 15 years sleeping with index child in the same room had a mean number of 1.95±0.59 with minimum of 1 and 7 as the maximum number (Table 4.3).

Information on the number of year respondent's household has been living in the house was sought. The mean number of years was 5.09 ± 3.82 with the minimum of 2 and 21 years as the maximum. On the ownership of the house, more than half, 203 (69%) stated that they were tenants, 79 (26.3%) said they were owners by acquisition and 14 (4.7%) reported that they were owners by family house (Table 4.3).

4.1.3 Water Supply, Sanitation and Power Supply Status of Households

In Table 4.4, 191 (64.7%) reported well water as their drinking water source, 34 (11.3%) said they fetch their drinking water from borehole, 10 (3.3%) drinks tap water, 5 (1.7%) said they get their drinking water from stream and 57 (19.0%) stated that they fetch their drinking water from other sources-rain and sachet water.

One hundred and forty seven (49.0%) of the respondents revealed that they had pit latrine in their house, 119 (39.7%) uses water closet and 34 (11.3%) said they go to bush whenever they want to defecate (Table 4.4).

On the alternative source of power, 127 (42.3%) said lantern was their alternate source of power, 121 (40.3%) reported generator, 47 (15.7%) mentioned rechargeable, 4 (1.3%) stated candle and 1 (0.3%) said they use local lamp as their alternative power supply source (Table 4.4).

Table 4.3: Housing Characteristics N = 300

	Number	%
Number of rooms in the house (Excluding Toilet and kitchen)		
Mean	6.0(SD=3.4)	
1-5	126	42.0
6-10	148	49.3
11-15	9	3.0
16-20	17	5.7
Number of rooms occupied by the household		
Mean	1.9 (SD=1.0)	
1-3	276	92.0
4-6	24	8.0
Number of adult over 15 years in the household		
Mean	2.0(SD=0.5)	
1-3	291	97.0
4-5	9	3.0
Under-five sleeping with index child in same room(n= 113)		
Mean	1.1(SD=0.3)	
1	93	31.0
2	20	6.7
Years of living in the house		
Mean	5.0(SD=3.8)	
1-5	202	67.4
6-10	72	24.0
11-15	21	7.0
16-20	4	1.3
21 and above	1	0.3
House Ownership		
Owners (Family House)	14	4.7
Owners (acquisition)	79	26.3
Tenants	207	69.0

Table 4.4: Water Supply, Sanitation and Power supply status of Households (Total=300).

Variable	Number	%
Source of drinking water		
Tap Water	10	3.3
Stream	5	1.7
Borehole	34	11.3
Well	194	64.7
*Others	57	19.0
Type of toilet facilities		
Water Closet	119	39.7
Pit Latrine	147	49.0
Bush	34	11.3
Alternative Power Source		
Lantern	127	42.3
Candle	4	1.3
Generator	121	40.3
Local Lamp	1	0.3
Rechargeable	47	15.7

*Others: Rain water, Sachet water.

4.1.4 Types of Animal Raised by Respondents and Location of Shed

Table 4.5 shows, 116 (38.7%) rearing animal while 184 (61.3%) don't rear animals. Out of the 116 respondents that rear animal in their surroundings, slightly more than half, 67 (51.8%) mentioned chicken as the type of animal they rear, 43 (37.1%) said goat, 2 (1.7%) each stated that they rear dog and duck while equal number 1 (0.9%) revealed cattle and cat respectively. On the animal shed location, 74 (63.8%) reported that they had animal shed and 42 (36.2%) had no shed. Of the 74 respondents that had animal shed, 33 (44.6%) said their animal sheds were located within the house, 30 (40.5%) revealed that it was located outside the house and 11 (14.9%) stated that it was attached to the house.

Table 4.5: Types of Animal Raised by Respondents and Location of Shed

Variable	Frequency	%
Rearing of animal		
Yes	116	38.7
No	184	61.3
(n = 300)		
Types of animal		
Goat	43	14.3
Cattle	1	0.3
Cat	1	0.3
Dog	2	0.7
Chicken	67	22.3
Duck	2	0.7
(n = 116)		
Availability of animal shed		
Yes	74	63.8
No	42	36.2
(n = 116)		
Location animal shed		
Attached to the house	11	14.9
Within the house	33	44.6
Outside the house	30	40.5
(n = 74)		

Table 4.5: Types of Animal Raised by Respondents and Location of Shed

Variable	Frequency	%
Rearing of animal		
Yes	116	38.7
No	184	61.3
(n = 300)		
Types of animal		
Goat	43	14.3
Cattle	1	0.3
Cat	1	0.3
Dog	2	0.7
Chicken	67	22.3
Duck	2	0.7
(n = 116)		
Availability of animal shed		
Yes	74	63.8
No	42	36.2
(n = 116)		
Location animal shed		
Attached to the house	11	14.9
Within the house	33	44.6
Outside the house	30	40.5
(n = 74)		

4.1.5 Knowledge about housing condition

Table 4.6 below describes the respondents' knowledge about housing condition. From the table, large number of the respondents' are knowledgeable on things that can result from inadequate housekeeping, 277(92.3%) and 23 (7.7%) said yes and no respectively to fungal growth, 284 (94.7%) and 16 (5.3%) said yes and no respectively to odour and 280 (93.3%) and 20 (6.7%) said yes and no respectively to vector infestation. This shows that majority of the respondents knew that inadequate housekeeping can cause.

In Table 4.6, the respondents described the practices which makes the house clean. 137 (45.7%) said sweeping only, 3 (1.0%) said dusting only while 112 (37.3%) chooses sweeping and dusting and 48 (16.0%) said sweeping, dusting and mopping. This implies that majority knew the practices that can make a house clean.

It can also be noted from the table that great number of the respondents knew noise from the following can affects ones health: Generator, 228(76.0%) agreed while 72 (24.0%) disagreed; Grinding machine, 220 (73.3%) agreed while 80(26.7%) disagreed and Traffic, 222 (74.0%) agreed while 78(26.0%) disagreed. This means that majority of the respondents have knowledge on things that can affects their health.

From table 4.6, the respondents response to sources of indoor air pollutants in the building include: renovation with 170 (56.7%)and 30 (13.3%) said yes and no respectively; painting. 106 (35.5%) and 194 (43.3%) said yes and no respectively; pest control spray 106 (35.5%) and 194 (43.3%) said yes and no respectively; smoke from generating set 246 (82.0%) and 54 (18.0%) said yes and no respectively; while for smoke from cooking fuel 251(83.7%) and 49 (6.7%) said yes and no respectively.

Table 4.6 also revealed that 214 (71.3%) of the respondents agreed that rearing of animal/poultry cause infection to children while 86 (28.7%) disagreed. This shows that majority of the respondents knew that animals/poultry can be source of infection to young children.

From table 4.6, 256 (85.3%) of the respondents agreed that smoke from cooking facilities may result in difficulty in breathing while 44 (14.7%) disagreed. This denotes that majority of the respondents knew that smoke from cooking facilities can affects one's health.

In Table 4.6, 51(17.0%) of the respondents said having two windows is better for adequate ventilation but majority, 249(83.0%) disagreed. It can be concluded that majority don't know usefulness of ventilation to health.

It can also be noted that greater number of the respondents, 210 (70.0%) agreed that presence of food in the house can lead to breeding of insect and uncleanliness that could be unhygienic for sleeping while 90 (30.0) disagreed. This means that majority of the respondents knew that litters of food items in the house can be breeding site for insects and unhygienic for sleeping.

The mean knowledge about housing condition was 11.6±3.2 (Table 4.8). Slightly more than half of the respondents, 183 (61%) had scored above the mean knowledge score and were grouped as having good knowledge about housing condition while 117(39%) respondents scored below the mean knowledge score and were categorized as having poor knowledge about housing condition.

It can be concluded from Table 4.8 that majority of the respondents had good knowledge of housing condition as related to health of the children especially the under-fives.

Table 4.6: Respondents' Knowledge about some variables on Housing Conditioos (n=300)

Knowledge variable	Number	%
Inadequate housekeeping cause		
1) Fungal growth		
Yes	277	92.3
No	23	7.7
2) Odour		
Yes	284	94.7
No	16	5.3
3) Vector infestation		
Yes	280	93.3
No	20	6.7
House cleaning method		
Sweeping only	137	45.7
Dusting only	3	1.0
Sweeping and Dusting	112	37.3
Sweeping, dusting and mopping	48	16.0
Noise from the following affects ones health		
1) Generator		
Yes	228	76.0
No	72	24.0
2) Grinding machine		
Yes	220	73.3
No	80	26.7
3) Traffic		
Yes	222	74.0
No	78	26.0

Table 4.6: Respondents' Knowledge about some variables on Housing Conditions (n=300) (cont'd)

Knowledge variable	Number	%
Sources of indoor air pollutants in the building		
1) Renovation		
Yes	170	56.7
No	130	43.3
2) Painting		
Yes	106	35.5
No	194	43.3
3) Pest control spray		
Yes	106	35.5
No	194	43.3
4) Smoke from generating set		
Yes	246	82.0
No	54	18.0
5) Smoke from cooking fuel		
Yes	251	83.7
No	49	6.7
Rearing of animal/poultry cause infection to children		
Yes	214	71.3
No	86	28.7
Smoke from cooking facilities may result in difficulty in breathing		
Yes	256	85.3
No	44	14.7
For adequate ventilation, having two windows is better		
Yes	51	17.0
No	249	83.0
Presence of food in the house leads to breeding of insect and uncleanliness that could be unhygienic for sleeping		
Yes	210	70.0
No	90	30.0

4.1.6 Attitude towards risks about housing condition

Table 4.7 describes the respondents' attitude about risks towards housing condition. From the table out of 300 respondents that responded to having more than three people sleeping in a room is healthy, 16 (5.3%) strongly agreed, 14 (4.7%) agreed while 21(7.0%) were not sure, 8(2.7%) disagreed and 241(80.3%) strongly disagreed. This implies that majority of the respondents knew that having more than three people sleeping in a room is not healthy.

It can also be noted from the table that out of 300 respondents that responded to opening of window for natural ventilation is better than using fan, 180(60.0%) strongly agreed. 31(10.3%) agreed while 19(6.3%) were not sure. 2(0.7%) disagreed and 68(22.7%) strongly disagreed. It can be deduced that few respondents knew that natural ventilation is the best

Table 4.7 also shows that out of 300 respondents that responded to sleeping in a room sprayed with insectide does not affect one's health, 12(4.0%) strongly agreed, 4(1.3%) agreed while 5(1.7%) were not sure, 9(3.0%) disagreed and 270(90.0%) strongly disagreed. This means that greater number of the respondents knew that to sleeping in a room sprayed with insectide affect one's health.

Table 4.7 revealed that out of 300 respondents that responded to use of mosquito coil is better than mosquito net, 20(6.7%) strongly agreed, 5(1.7%) agreed while 4(1.3%) were not sure, 10(3.3%) disagreed and 261(87.0%) strongly disagreed. It can be concluded that majority of the respondents knew that use of mosquito net is better than using mosquito coil.

The mean of attitude towards risks about housing condition was 3.37±0.8 (Table 4.8). Slightly more than half of the respondents, 156 (52%) had scored above the mean attitude score and were grouped as having positive attitude towards risks about housing condition while 144 (48%) respondents scored below the mean attitude score and were categorized as having negative attitude towards risks about housing condition.

It can be concluded from this table that majority of the respondents had good attitude towards risk associated with housing.

Table 4.7: Respondents Attitude about risks towards housing condition (n=300)

Attitude variable	Responses				
	SA (%)	A (%)	NS (%)	DA (%)	SD (%)
Having more than three people Sleeping in a room is healthy	16(5.3)	14(4.7)	21(7.0)	8(2.7)	241(80.3)
Opening of window for natural Ventilation is better than using fan	180(60.0)	31(10.3)	19(6.3)	2(0.7)	68(22.7)
Sleeping in a room sprayed with insectide Does not affect one's health	12(4.0)	4(1.3)	5(1.7)	9(3.0)	270(90.0)
Use of mosquito coil is better than Mosquito net	20(6.7)	5(1.7)	4(1.3)	10(3.3)	261(87.0)

NOTE:

SA- STRONGLY AGREED

A - AGREED

NS - NOT SURE

DA - DISAGREED

SD - STRONGLY DISAGREED

Table 4.8. Knowledge and Attitude towards good and risks about housing conditions (n = 300)

Variable	Frequency	Percentages %
Knowledge		
Good	183	61.0
Poor	117	39.0
Range	0-16	
Mean	11.6±3.2	
Attitude		
Positive	156	52.0
Negative	144	48.0
Range	0-4	
Mean	3.37±0.8	

4.1.7 Perceived health status of children

The health status of a child is very crucial. Only 100 (33.3%) of the respondents' children had respiratory infection. Eighty-one (27.0%) out of 100 experienced it in the last 3month while 18 (6.0%) experienced in the last 6 month and 1 (0.3%) experienced in the last 1 year. Majority of the respondents' children, 155 (51.7%) experienced malaria of which 129 (43.0%) out of 155 had malaria in the last 3month, 23 (7.7%) had it in the last 6month and 3 (1.0%) had it in the last 1 year. About 58 (19.3%) of the respondents' children had skin infection of which 37 (12.3%) out of 58 had skin infection in the last 3month, 20 (6.7%) had it in the last 6month and 1 (0.3%) had it in the last 1 year. Eighteen (6.0%) of the respondents' children had diarrhoea of which 15 (5.0%) out of 18 experienced diarrhoea in the last 3month and 3 (1.0%) experienced it in the last 6month (Table 4.9).

Aside above infections, the respondents were asked what other infections the children went to the hospital for and if any member of the family were ill when the child was sick. Of all the 300 respondent, 95 (31.7%) said their children went to the hospital for various diagnoses such as fever 70 (23.3%), diarrhoea 2 (0.7%); cough 6 (2.0%); teething 3 (1.0%); eye irritation 1 (0.3%); rashes 13 (4.3%). Only 63 (21%) of the family members of the children fall ill the last two weeks of the survey (Table 4.9).

Table 4.9: Perceived health effect status of the child.

Variable	Frequency	%
Respiratory infection (n = 100)		
In the last 1 year	1	0.3
In the last 6months	18	6.0
In the last 3months	81	27.0
Malaria (n = 155)		
In the last 1 year	3	1.0
In the last 6months	23	7.7
In the last 3months	129	43.0
Skin infection (n = 58)		
In the last 1 year	1	0.3
In the last 6months	20	6.7
In the last 3months	37	12.3
Diarrhoea (n = 18)		
In the last 6months	3	1.0
In the last 3months	15	5.0
Children Attended Hospital for Other Infections (n = 300)		
Yes	95	31.7
No	205	68.3
Other infection diagnosed during visit to Hospital(n = 95)		
Fever	70	23.3
Diarrhoea	2	0.7
Cough	6	2.0
Teething	3	1.0
Eye irritation	1	0.3
Rashes	13	4.3
Members of the family falling ill when the child was sick (n = 300)		
Yes	63	21.0
No	237	79.0

4.1.8 Hypotheses testing

Hypothesis one states that there was no significant association between respondents' level of education and perceived health status of the children. This hypothesis was rejected as there was a significant association between respondents' level of education and perceived health status of the children ($p < 0.05$) (Table 4.10).

Hypothesis two states that there was no significant association between respondents' family type and perceived health status of the children. This hypothesis was accepted as there was a no significant association between respondents' family type and perceived health status of the children ($p > 0.05$) (Table 4.10).

Hypothesis three states that there was no significant association between sex of the child and perceived health status of the children. This hypothesis was accepted as there was a no significant association between sex of the child and perceived health status of the children ($p > 0.05$) (Table 4.10).

Hypothesis four states that there was no significant association between respondents' level of education and knowledge of respondents' about housing condition. This hypothesis was rejected as there was a significant association between respondents' level of education and knowledge of respondents about housing condition ($p < 0.05$) (Table 4.11).

Table 4.10: Relationship between Respondents, Education, Family Type, Gender and Perceived Health.

Variable	Perceived health status of the child			
	Yes (%)	No (%)	χ2	p-value
Respondents' education				
No formal education	10 (33.3)	20 (66.7)	8.848	0.031
Primary school completed	22 (21.0)	83 (79.0)		
Secondary school completed	49 (38.3)	79 (61.7)		
Tertiary completed	14 (37.8)	23 (62.2)		
Family type				
Monogamous	87 (31.5)	189 (68.5)	0.033	0.855
Polygamous	8 (33.3)	16 (66.7)		
Gender				
Male	51 (33.6)	101 (66.4)	0.506	0.477
Female	44 (29.7)	104 (70.3)		

Table 4.11: Relationship between Respondents' Education and Knowledge category

Variable	Respondents' knowledge				
	Poor (%)	Good (%)	Total (%)	χ^2	p-value
Respondents' education					
No formal education	18(60.0)	12(40.0)	40(100)		
Primary school completed	37(35.2)	68(64.8)	105(100)	11.429	0.010
Secondary school completed	54(42.2)	74(57.8)	128(100)		
Tertiary completed	8(21.6)	29(78.4)	37(100)		

4.2 Building construction characteristics

One hundred consenting households out of 300 participated and were observed. Based on structure of the house, more than half, 68 (68%) lived in bungalow, 23 (23%) lived in a flat (Plate 4.2) and 9 (9%) lived in a storey building. Based on occupancy, majority, 72 (72%) of the building were rooming apartments and 28 (28%) were self-contained apartments. It was noted that 10 (10%) of the building were incomplete and 90 (90%) were completed (Table 4.11).

Majority of the houses, 98 (98%) used cement as the wall material while 2 (2%) used mud (Plate 4.1). Seventy of the respondents used wood as their window material while 30 (30%) used glass. The door material used was wood, 89 (89%) and metals 11 (11%). Asbestos accounted for 71 (71%) of the ceiling material, 17 (17%) carton, 1(1%) cement and 11 (11%) ceiling (Table 4.12).

4.2.1 Floor cover material

The following materials were the floor cover used in the respondents living rooms, 33 (33%) cement, 30(30%) Linoleum, 15 (15%) rug, 8(8%) mud,5 (5%) mud plus cow dung, 7 (7%) cement plus red paint and 2(2%) tiles while that of bedroom were 42(42%) linoleum, 33(33%) cement, 8(8%) cement plus red paint, 8(8%) mud, 5(5%) mud plus cow dung, 3(3%) rug and 1(1%) tiles (Table 4.13).

4.2.2 Types of Ventilation used in different locations of the houses in Omi-Adio community

Types of ventilation used include Air-conditioner (AC) ranged 1-2; fans ranged 1-3; windows ranged 2-5 as well as door ranged 1-2 (Table 4.13). Figure 4.3 gives information on the location of the means of ventilation in the 100 houses visited. Four (4%) of the respondents had their Air-conditioner located in the sitting room while 1 (1%) had theirs in both sitting room and bedroom. Nine (9%) of the respondents had fan located in the bedroom, 17 (17%) in the sitting room and 38 (38%) in both. Four (4%) of the respondents had windows located in the sitting room while 45 (45%) had it located in both. Seven (7%) of the respondents had door located in both sitting room and bedroom.

Plate 4.1: Typical house in ward nine (Omi Adio community)

Plate 4.2. Another type of house in ward nine (Omi-adios community)

Table 4.12: Participants' building construction characteristics (Total=100).

Characteristics	Number	%
Type of building		
Based on structure		
Flat	23	23.0
Bungalow	68	68.0
Storey building	9	9.0
Based on occupancy		
Rooming apartment	72	72.0
Self contained apartment	28	28.0
Status of building		
Completed	90	90.0
Uncompleted	10	10.0
Building material		
Wall		
Cement	98	98.0
Mud	2	2.0
Window		
Wood	70	70.0
Glass	30	30.0
Door		
Wood	89	89.0
Metal	11	11.0
Ceiling		
Asbestos	71	71.0
Cement	1	1.0
Carton	17	17.0
None	11	11.0

Table 4.13: Floor cover of the participants' Houses and Types of Ventilation used in different locations of the houses in Onl-Adio community (Total=100)

Characteristics	Number	%
Living room		
Linoleum	30	30.0
Rug	15	15.0
Mud	8	8.0
Tiles	2	2.0
Mud + cow dung	5	5.0
Cement	33	33.0
Cement + red paint	7	7.0
Bedroom		
Linoleum	42	42.0
Rug	3	3.0
Mud	8	8.0
Tiles	1	1.0
Mud + cow dung	5	5.0
Cement	33	33.0
Cement + red paint	8	8.0
Number of Air-conditional per 100 houses		
Range	1-2	
(n = 5)		
Number of Fan per house		
Range	1-3	
(n = 64)		
Number of windows per house		
Range	1-4	
(n = 49)		
Number of Door per house		
Range		
(n = 7)	1-2	

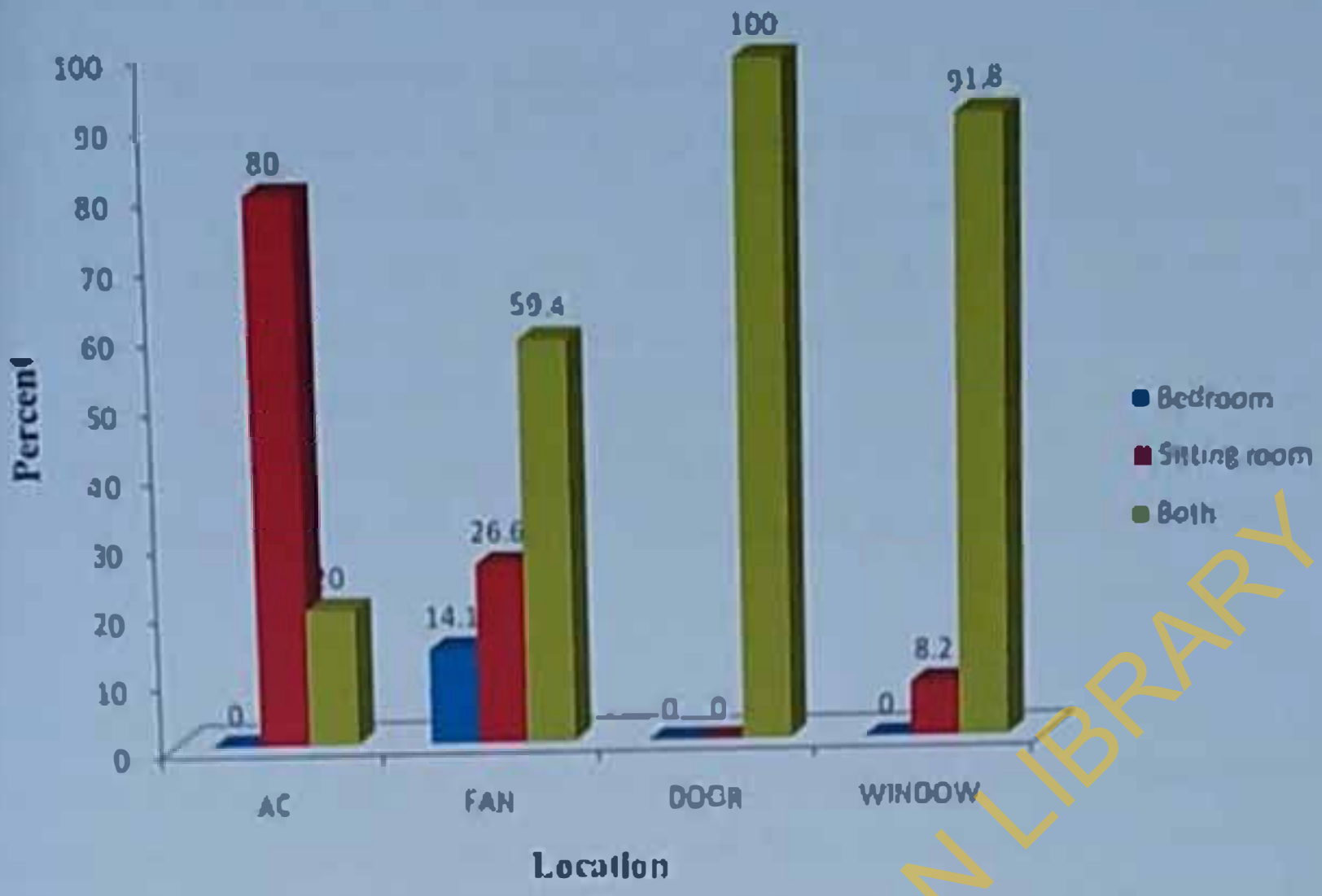

Figure 4.3. Types of Ventilation used in different locations of the houses in Omi-Adio community

4.2.3 Cooking facility and food storage location

Figure 4.6 depicts information observed on the cooking facility the respondents used, 58 (58%) used stove, 27 (27%) used firewood, 7 (7%) used charcoal while 5 (5%), 2 (2%), 1 (1%) used gas cooker, sawdust and electric cooker respectively. On the cooking location, it was observed that 44 (44%) used kitchen for preparing their meal, 31 (31%) cooked outside their room, 23 (23%) used the front of their room for cooking while only 2 (2%) cooked inside the room (Figure 4.7). Majority, 63 (63%) stored their food in the bedroom while the remaining respondents, 26 (26%) and 11 (11%) used kitchen and stores for their food storage (Figure 4.8).

4.2.4 Waste management strategy

As proper disposal of waste is one way to ensure good hygiene, different waste disposal methods were observed in the participants' houses. These included the use of refuse bins, open burning, open dumping and burying. Only refuse bin was located both inside and outside 1(2.6%) and 38(97.4%) the house respectively. Nineteen (100%) of the participants burned their refuse outside the house while 41 (100%) dumped their refuse outside the house. None of the participants buried their waste in the community (Figure 4.9)

Figure 4.4. Percentage distribution of different cooking facilities used in the households sampled in Omi-adio communities.

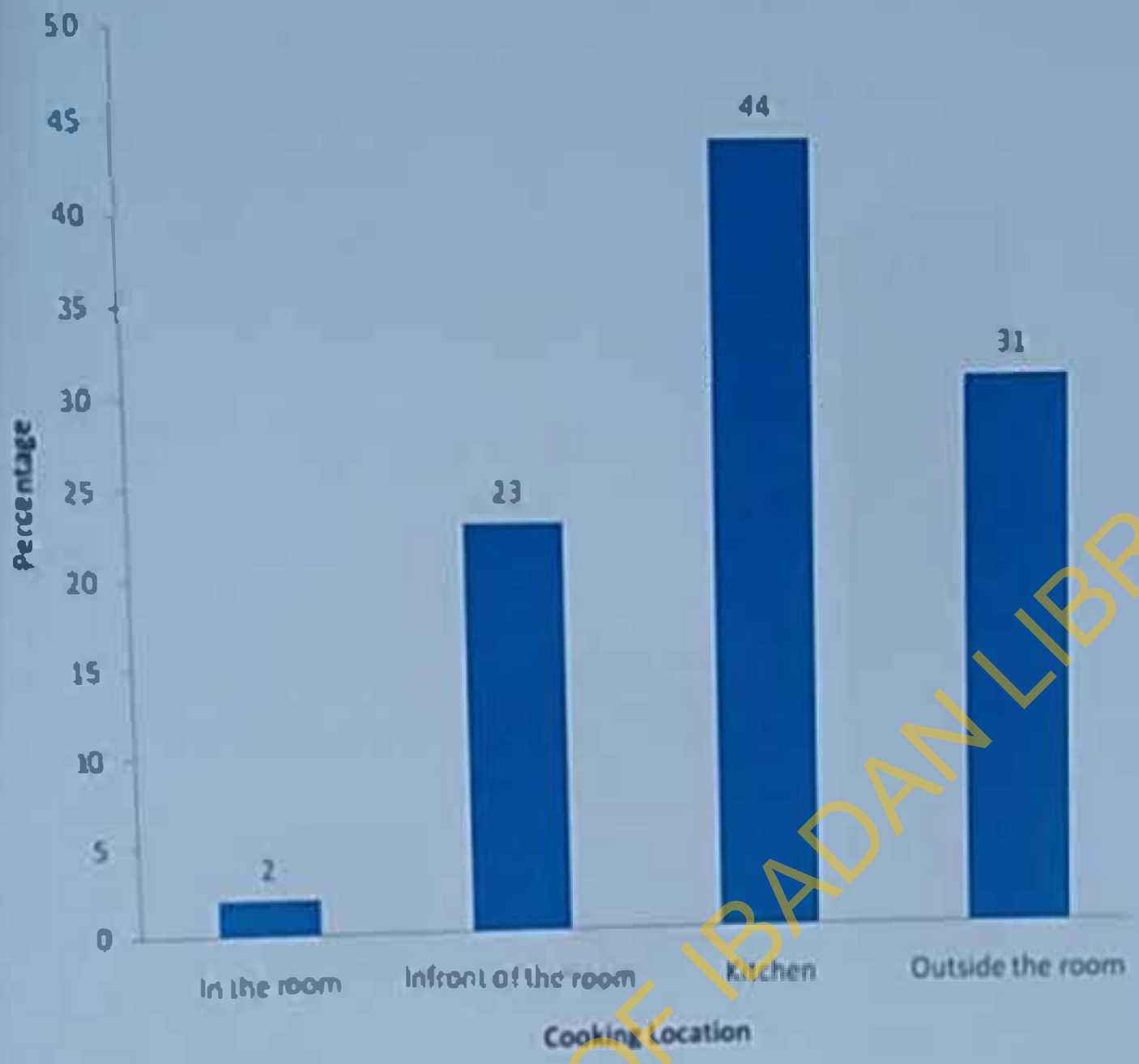

Figure 4.5. Percentage distribution of different cooking locations used in the households sampled in Omi-adio communities.

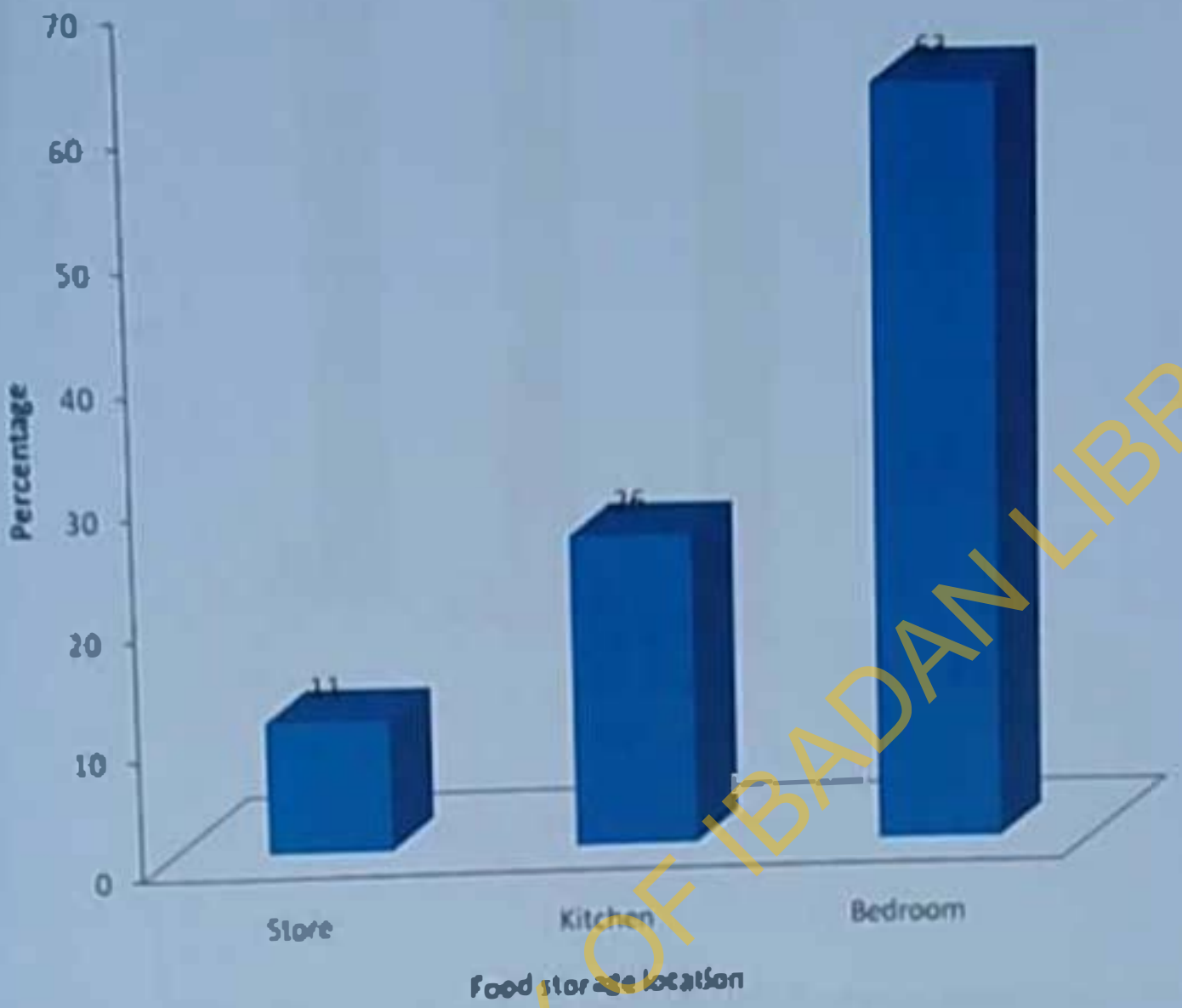

Figure 4.6. Percentage distribution of different food storage locations used in the households sampled in Omi-adio communities.

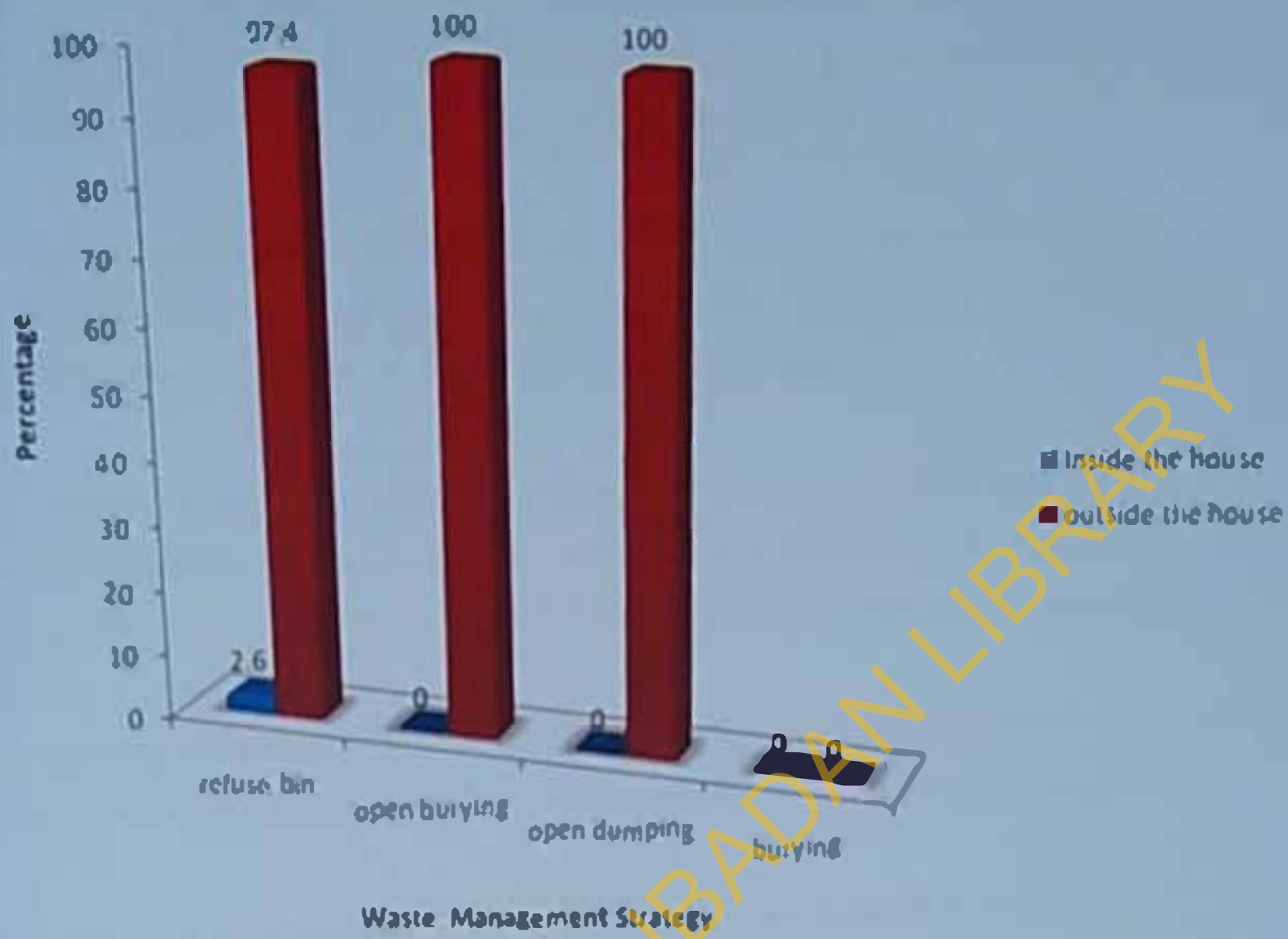

Figure 4.7. Percentage distribution of different waste management strategies used in the households sampled in Omi-adio communities.

4.3 Temperature and Relative humidity

Table 4.14 shows that the mean morning and afternoon temperatures in bedroom (31.3±3.2°C and 31.3±2.3°C), sitting-room (31.1±3.2°C and 31.2±2.2°C) and outdoor (31.8±3.3°C and 31.7±2.3°C) respectively were all higher than ASHRAE standard.

Geometric mean morning and afternoon relative humidity in bedroom (69.1±5.9% and 70.5±6.0%), sitting-room (69.5±6.0% and 70.8±6.3%) and outdoor (68.5±7.1% and 70.5±7.1%) respectively were all higher than ASHRAE standard (Table 4.14).

4.3.1 Indoor morning and afternoon Temperature and Relative humidity

Mean morning and afternoon temperatures in the indoor environment was (31.6 ± 3.3°C and 32.7 ± 21.2°C) with a range of (15°c to 52°c and 15°c to 331°c) respectively (Figure 4.10).

Mean morning and afternoon relative humidity in the indoor environment was (69.9 ± 5.9% and 68.8 ± 6.6%) with a range of (61% to 86% and 60% to 87%) respectively (Figure 4.10).

4.3.2 Outdoor morning and afternoon Temperature and Relative humidity

Mean morning and afternoon temperature in the outdoor environment was (31.2 ± 2.2°C and 31.7 ± 2.3°C) with a range of (15°c to 37°c and 17°c to 37°c) respectively (Figure 4.10).

Mean morning and afternoon relative humidity in the outdoor environment was (70.8 ± 6.3% and 55% to 88%) with a range of (55% to 86% and 70.5 ± 7.1%) respectively (Figure 4.10).

Temperature and relative humidity in the morning and afternoon for indoor and outdoor were significantly higher than the standard and there was significant difference for relative humidity, $p<0.05$.

Table 4.14: Hygrothermal conditions in the indoor and outdoor environment

Variables	Means±S.D	Min	Max	**ASHARE
Bedroom morning				
Temperature (°C)	31.3±3.2	15	47	23.5-25.5
Relative humidity (%)	69.1 ±5.9	61	86	30.0-50.0
Bedroom afternoon				
Temperature (°C)	31.3 ±2.3	15	35	23.5-25.5
Relative humidity (%)	70.5 ±6.0	61	86	30.0-50.0
Sitting room morning				
Temperature (°C)	31.1±3.2	15	62	23.5-25.5
Relative humidity (%)	69.5±6.0	62	86	30.0-50.0
Sitting afternoon				
Temperature (°C)	31.2 ±2.2	15	37	23.5-25.5
Relative humidity (%)	70.8 ±6.3	55	86	30.0-50.0
Outdoor morning				
Temperature (°C)	31.8 ±3.3	15	51	23.5-25.5
Relative humidity (%)	68.5 ±7.1	60	87	30.0-50.0
Outdoor afternoon				
Temperature (°C)	31.7 ±2.3	17	37	23.5-25.5
Relative humidity (%)	70.5 ±7.1	55	88	30.0-50.0

**ASHARE (American Society of Heating, Refrigerating and Air Conditioning Engineers) standard

Figure 4.8. Mean indoor and outdoor temperature and relative humidity in different location

4.4 Total bacteria and fungi Count

Table 4.15 shows the mean morning and afternoon total bacteria count in bedroom ($0.68x10^2$cfu/m^3 and $0.67x10^2$cfu/m^3), sitting-room ($0.64 x10^2$cfu/m^3 and $0.66x10^2$cfu/m^3) and outdoor ($0.68x10^2$cfu/m^3 and $0.67x10^2$cfu/m^3) respectively were lower than AIIIA

Similarly, mean morning and afternoon total fungi count in bedroom ($0.43x10^2$cfu/m^3 and $0.42x10^2$cfu/m^3), sitting-room ($0.37x10^2$cfu/m^3 and $0.45x10^2$cfu/m^3) and outdoor ($0.38x10^2$cfu/m^3 and $0.34x10^2$cfu/m^3) respectively were lower than AIIIA (Table 4.15)

4.4.1 Indoor morning and afternoon bacteria and fungi counts

The morning indoor bacteria ranged fmm $0.14 x10^2$cfu/m^3 to $1.58 x10^2$cfu/m^3 with mean of 66.5 ± 32.1 The afternoon indoor bacteria ranged from $0.23 x10^2$cfu/m^3 to $1.65 x10^2$cfu/m^3 with mean of 67.3 ± 34.4 (Figure 4.11).

Fungi ranged from $0.11 x10^2$cfu/m^3 to $1.45 x10^2$cfu/m^3 in the morning. The mean indoor morning fungi were 40.3 ± 23.9. Fungi ranged from $0.11 x10^2$cfu/m^3 to $1.58 x10^2$cfu/m^3 in the afternoon. The mean indoor afternoon fungi were 43.7 ± 30.1 (Figure 4.11).

4.4.2 Outdoor morning and afternoon bacteria and fungi counts

The morning outdoor bacteria ranged from $0.11 x10^2$cfu/m^3 to $1.61 x10^2$cfu/m^3 with mean of 68.8 ± 36.1. The afternoon outdoor bacteria ranged from $0.17 x10^2$cfu/m^3 to $1.60 x10^2$cfu/m^3 with mean of 67.6 ± 36.7 (Figure 4.11).

Fungi ranged from $0.11 x10^2$cfu/m^3 to $1.37 x10^2$cfu/m^3 in the morning. The mean indoor morning fungi were 38.6 ± 22.5. Fungi ranged from $0.11 x10^2$cfu/m^3 to $1.37 x10^2$cfu/m^3 in the afternoon. The mean indoor afternoon fungi were 34.2 ± 17.3 (Figure 4.11)

Bacteria and fungi counts in the morning and afternoon for indoor and outdoor were significantly lower than the standard and there was significant difference for fungi, $p<0.05$

Table 4.15: Microbiological air contamination in different location

Investigated locations	Time of taking samples	Total number of bacteria (cfu/m³)	Total number of fungi (cfu/m³)	*AIHA
Bedroom	Morning	0.68×10^3	0.43×10^2	5.0×10^2
	Afternoon	0.67×10^3	0.42×10^2	5.0×10^2
Sitting room	Morning	0.64×10^3	0.37×10^2	5.0×10^2
	Afternoon	0.66×10^3	0.45×10^2	5.0×10^2
Outdoor	Morning	0.68×10^3	0.38×10^2	5.0×10^2
	Afternoon	0.67×10^3	0.34×10^2	5.0×10^2

*AIHA: the American Industrial Hygiene Association for Residential Buildings

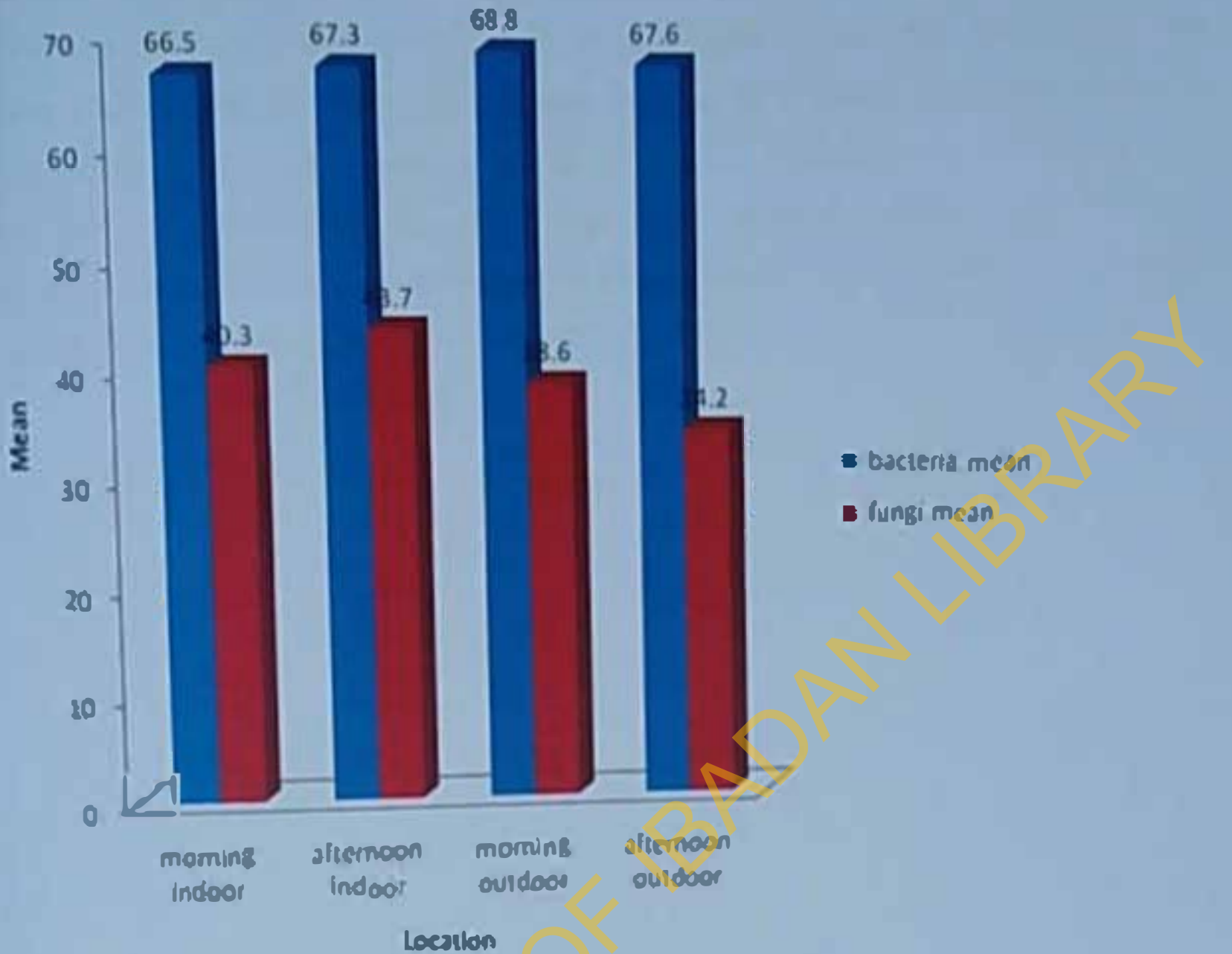

Figure 4.9. Mean indoor and outdoor bacteria and fungi in different location

4.5 Predominant bacteria species and fungi species

Analysis of bacterial flora composition in investigated locations revealed bacteria from the following genera: Micrococcus spp., Bacillus spp., Pseudomonas spp. and Proteus spp. Quality characteristics of fungal flora isolated from the air of bedrooms showed species of fungi like: Penicillium spp., Aspergillus spp., Mucro spp., Rhizopus spp Nuerospora spp., Streptomycin spp.,Geotricum spp., and Candida spp. Presented in Figures 4.10-4.13 as a percentage is contribution of particular species of bacteria and fungi in bedroom, sitting room as well as outdoor respectively in mornings and afternoons.

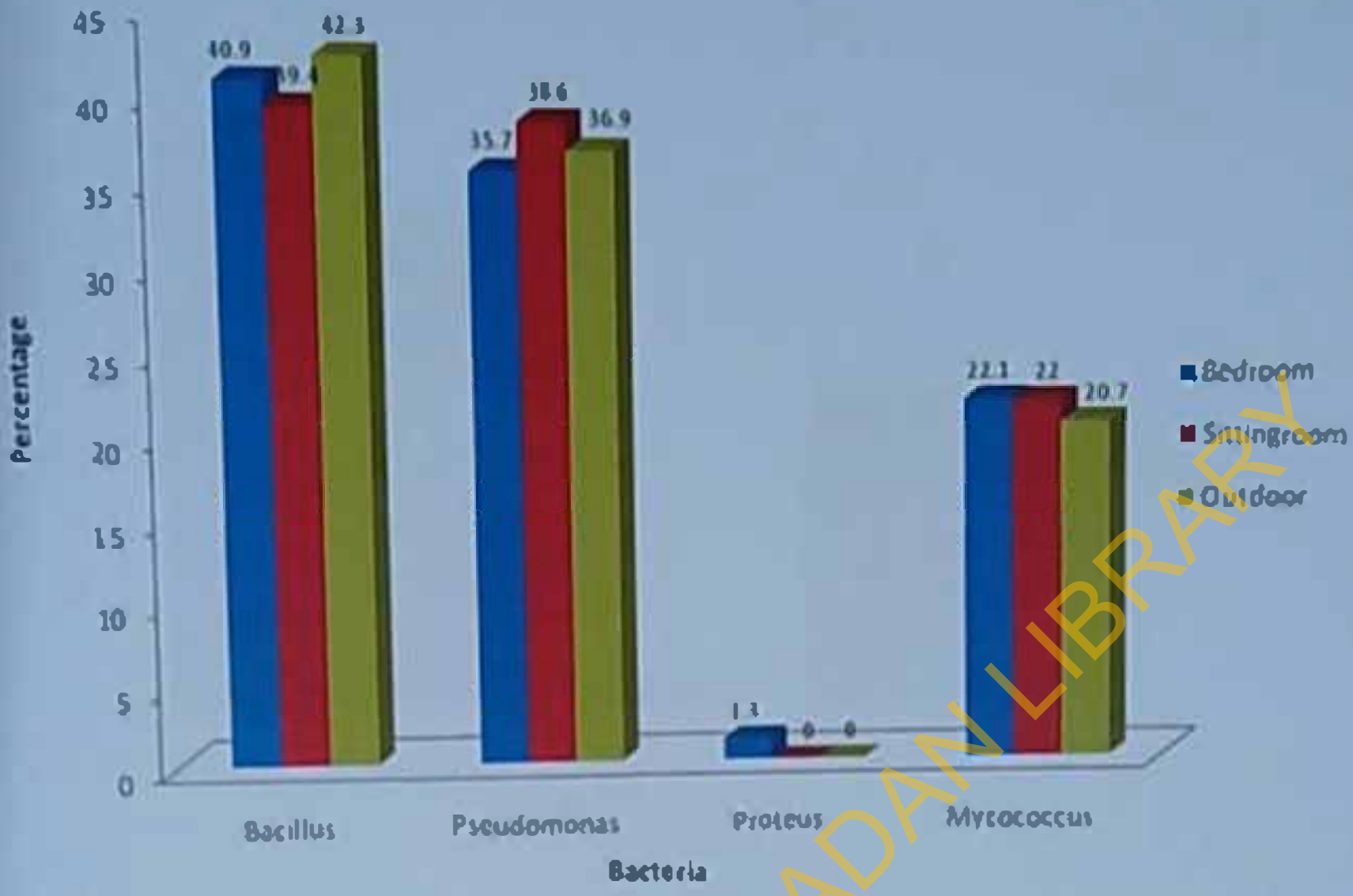

Figure 4.10. Bacteria species detected in different location in the morning

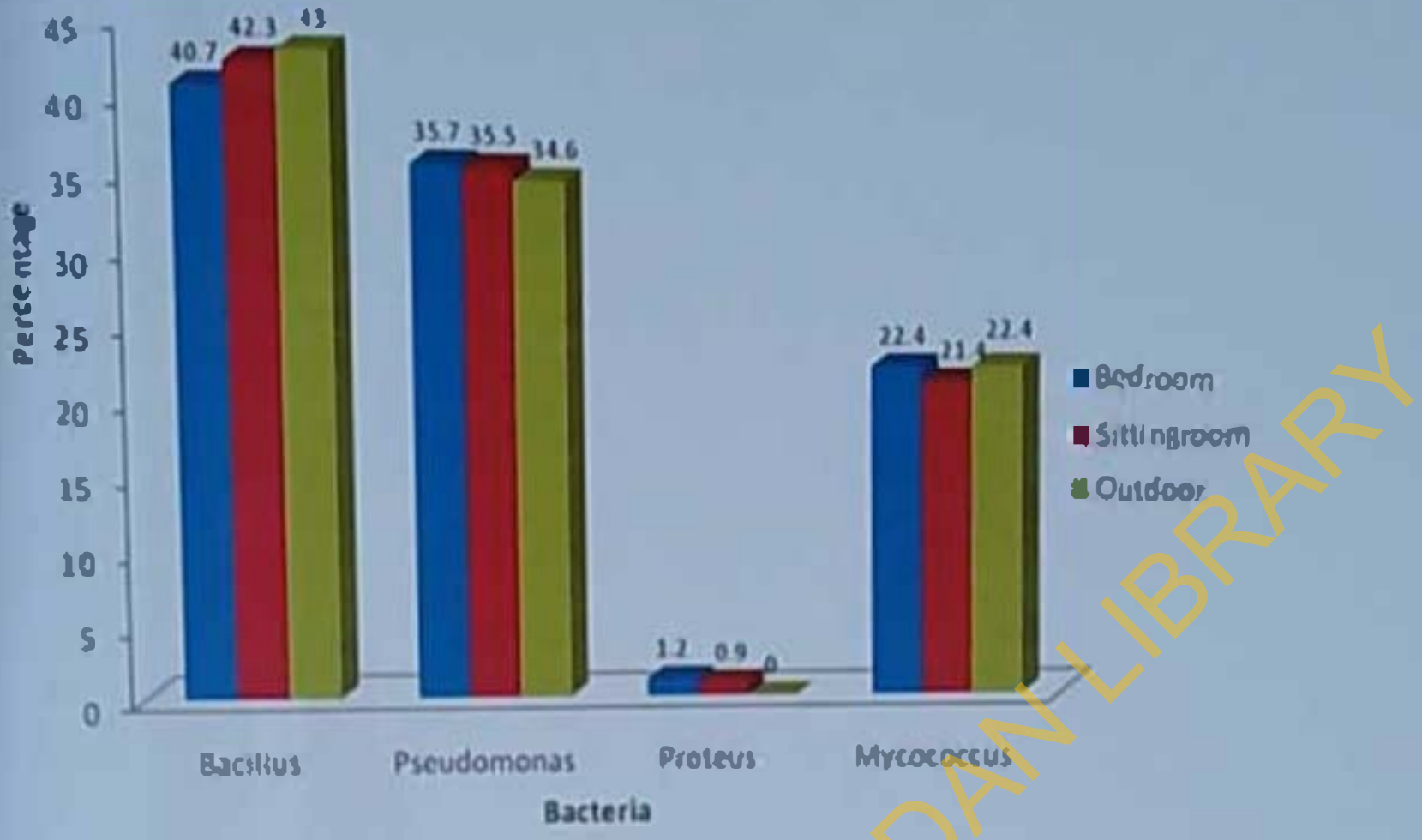

Figure 4.11. Bacteria species detected in different location in the afternoon

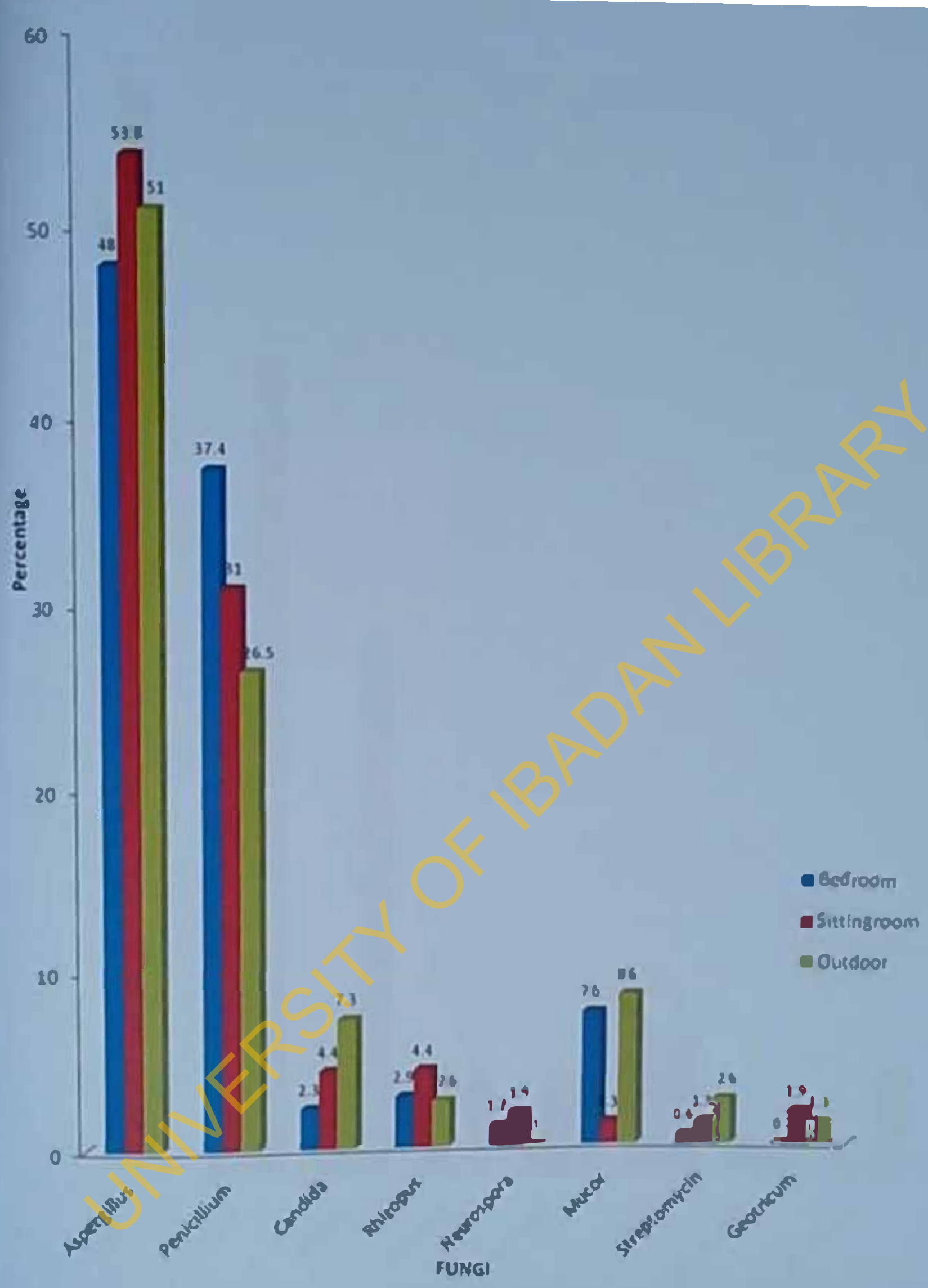

Figure 4.12. Fungi species detected in different location in the morning

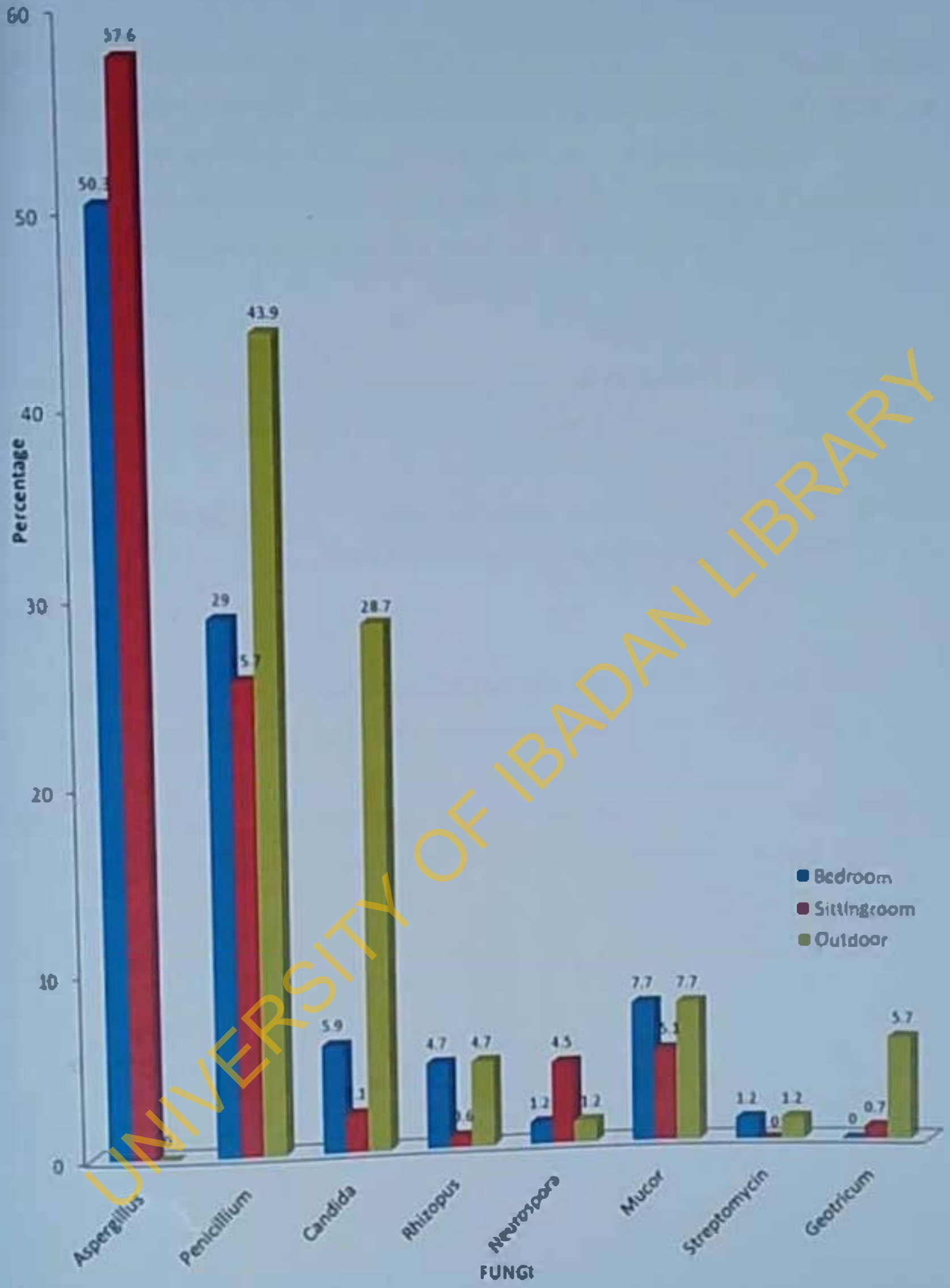

Figure 4.12. Fungi species detected in different location in the afternoon

4.6 Correlation between Airborne microbes (Bacteria and Fungi count), Hygrothermal conditions (Temperature and Relative humidity) and Perceived health (Resproratory Infection, Fever, Skin infection and Diarrhoea)

There was a weak but significant correlation between total bacteria count and temperature ($r = -0.161$, $p<0.05$) likewise total bacteria count and relative humidity ($r = -0.110$, $p<0.05$) (Table 4.16).

There was a weak but significant correlation between relative humidity and skin infection ($r = 0.109$, $p<0.05$) likewise relative humidity and diarrhoea ($r = 0.206$, $p<0.05$) (Table 4.17).

There was a weak but insignif.cant correlation between temperature and respiratory infection ($r = 0.052$, $p>0.05$) likewise relative humidity and respiratory infection ($r = -0.028$, $p>0.05$) (Table 4.17).

There was a weak but signif.cant correlation between total bacteria count and fever ($r = -0.091$, $p<0.05$) likewise total fungi count and fever ($r = 0.085$, $p<0.05$) (Table 4.18).

There was a weak but insignificant correlation between total bacteria count and respiratory infection ($r = -0.005$, $p>0.05$) likewise total fungi count and respiratory infection ($r = 0.072$, $p>0.05$) (Table 4.18).

Table 4.16: Correlation matrix between Hygrothermal conditions and Airborne Microbes

	Temperature	Relative humidity	Bacteria	Fungi
Temperature	1.000			
Relative humidity	-0.108**	1.000		
Total bacteria count	-0.161**	-0.110**	1.000	
Total fungi count	-0.002	-0.001	-0.056	1.000

** Correlation is significant at the 0.01 level (2 tailed)

Table 4.17: Correlation matrix between Hygrothermal conditions and Perceived health

	Respiratory Infection	Fever	Skin Infection	Diarrhoea	Temperature	Relative Humidity
Respiratory infection	1.000					
Fever	0.454**	1.000				
Skin infection	0.377**	0.293**	1.000			
Diarrhoea	0.066	0.186**	0.155**	1.000		
Temperature	0.052	0.032	0.040	0.035	1.000	
Relative humidity	-0.028	-0.016	0.109**	0.206**	-0.108**	1.000

** Correlation is significant at the 0.01 level (2 tailed)

Table 4.18: Correlation matrix between Airborne Microbes and Perceived health

	Bacteria	Fungi	Respiratory Infection	Fever	Skin Infection	Diarrhoea
Bacteria	1.000					
Fungi	-0.056	1.000				
Respiratory infection	-0.005	0.072	1.000			
Fever	-0.091*	0.085*	0.454**	1.000		
Skin infection	-0.058	-0.008	0.377**	0.293**	1.000	
Diarrhoea	-0.038	0.008	0.066	0.186**	0.155**	1.000

* Correlation is significant at the 0.05 level (2 tailed)

** Correlation is significant at the 0.01 level (2 tailed)

CHAPTER FIVE

DISCUSSION

5.1 Socio-demographic Characteristics of the Parents/Care givers

A large majority of the study respondents were married, as expected they are mothers of children or caregivers who take care of children less than five years of age. Furthermore, more than half of the respondents engaged in trading while about a quarter were artisans and a few were civil servants. Moreover, less than half of the respondents had secondary school education and about one tenth had tertiary education. In addition to this, slightly more than half of the respondents reported that their husband completed secondary school while o quarter indicated that their husband had tertiary education. This has a lot of implication on the socio-economic status (SES) of the respondents and their household. By implication, SES of an individual affects health and housing and housing has effect on health. Mobogunje, (2004) also pointed out that the affordability of housing is a potential stressor for individuals and families. Spending a greater proportion of household income on housing might be a mechanism by which SES influences health, since money spent on housing will not be available for other necessities (e.g. utilities, food, clothing, transportation, recreation).

Socio-economic status can closely be linked with housing stressors. According to Asinyanbola (2010), housing stressors - housing attributes that could be stress-inducing are high rent/cost, lack of space, housing discomfort, physical housing condition and dissatisfaction with housing - on the physical well-being of women and men. Examining only the proportion of household income spent on housing misses the other expenses within households and the decisions that individuals and families make to trade these off. Some of these costs may depend on the setting, as suggested by a California study, in which low SES families experienced higher mortality rates if they resided in high SES neighbourhoods compared to those who resided in low SES neighbourhoods (Yen and Kaplan, 1999). Typically, a lower SES neighbourhood would exacerbate the negative effects of low individual SES and be associated with poorer health outcomes.

Children who were survey in the study were of the mean age of 39.6 ± 12.85 months with a range of 24-60 months. Male and female children were of almost the proportion. Information on the sleeping materials of the child pointed out that more than half of the mothers interviewed reported that their children sleep on bed while about a quarter indicated that their child sleep on mat. This is expected owing to the fact that the site where the study was conducted was a predominantly rural town with majority involved in farming. A large majority of the respondents also reported that their child had started schooling. This could be due to free education policy of the state government which makes it mandatory for parents to send their children to school for the first 12 years of their lives.

5.2 Knowledge of caregivers/mothers of under-five children on the risks associated with housing

The respondents appear to have a good knowledge of some health effects of inadequate housekeeping. For instance, almost all the respondents indicated that inadequate housekeeping predisposes a house to fungal growth, bad odour and vector infestation. However, almost half of the respondents pointed out that sweeping only as a practice can make house clean while about half also stated that sweeping in addition to dusting of home items and mopping the floor will make house to be clean. This finding is corroborated by that of Zhao *et al.*, (1993), Hunt and McKenna (1992); Packer *et al.*, (1991) and Gielen *et al.*, (1995) who suggested that poor housing has been linked to increased levels of limiting long term illness, respiratory and infectious diseases, accidents, psychological problems and perceived poor general health, and even increased mortality.

Noise and health

Findings from the study indicated that a large majority of the respondents were affirmative that noise from the generator, grinding machine and traffic can affect health. This finding is corroborated by a review of literature on housing and health which pointed out that noise has effects on health. The health effects of noise are twofold: auditory and non-auditory (Islington Local Involvement Network [Housing and Health working group], 2013). The review pointed out that the first is about hearing impairment and occurs almost exclusively in industrial settings as environment noise levels do not generally produce these effects. Non-auditory effects from noise disturbance including those occurring in domestic and other

environmental settings include, mental pressure and stress that can trigger irritation and aggression, sleep disturbance, interruption of speech and social interaction, disturbance of concentration (and hence of learning and long-term memory), and cardiovascular effects. The Chartered Institute for Environmental Health (CIEH) 2008, comments that there is no real evidence that noise per se induces mental illness, however, there is some evidence to suggest that noise sensitive people are more prone to mental illness and that the effects of noise may be more pronounced in mentally ill people.

However, Smith, (1991) in his own opinion asserted that there is little solid evidence linking environmental noise in residential areas with subsequent health problems. It is unlikely that outdoor sources of noise, or noise from neighbours in adjoining or nearby buildings, would be capable of causing physical damage to one's hearing. Community health surveys have found no direct effect of noise on the prevalence of psychiatric disorders (Stansfeld, 1992).

Sources of indoor air pollutants

A large majority of the respondents were able to mention some sources of indoor air pollution which include renovation of building, painting, pest control spray, smoke from generating and smoke from cooking fuel. A large majority of the respondents in addition agreed that smoke from cooking facilities may result in difficulty in breathing. In a recent expert review of the health effects of exposure to airborne particles in the home, the findings of observational, human, epidemiological, and toxicological animal studies were reviewed. The most common airborne particles arise from environmental tobacco smoke, cooking, certain heating appliances, and human activity. The level of indoor particles is strongly correlated with outdoor levels and raises personal exposure substantially (Thomson *et al.*, 2003). Short-term increases in ambient particles are strongly associated with increased mortality and morbidity; acute cardiopulmonary impairment being the predominant impact and vulnerable groups such as the elderly people and people with asthma being most at risk.

Arshad *et al.*, (1992), Hide *et al.*, (1994) and Health Evidence Bulletins, Wales (1998) also pointed out that exposure to certain foods and house dust mites during early childhood is thought to greatly increase the risk of a child with an atopic family history becoming symptomatic during the first two years of life. In some studies, Pocock *et al.*, (1994),

Schwartz, (1998) and Moller and Kristensen (1992), it was found that children are the group most sensitive to lead exposure and can suffer behavioural problems and lower intelligent quotient (IQ) levels. According to them, blood lead and tooth lead measures during the first few years of life show a small, but highly significant, inverse association with child IQ from age 5 upwards. A doubling of body lead burden (from 10 to 20 m g/dl blood lead or from 5 to 10 m g/dl tooth lead) is associated with a mean deficit in full scale IQ of 1-2 IQ points.

In relation to ventilation in the house a large majority were not in support of the notion that having two windows in a house is adequate for ventilation. This implies that a house will need more that two windows for cross ventilation. However, the finding is corroborated with Herving *et al.*, (1994) who found that poor ventilation has been associated with increased relative humidity, increased levels of house dust mite, poor lung function and increased respiratory symptoms. Ventilation is necessary for fresh air and sick-building syndrome symptoms. Throwing more on this, Seppänen and Fisk, (2002) compared natural ventilation and air-conditioning (with or without humidification) and found that air-conditioning is often associated with a statistically significant increase in the prevalence of one or more sick-building syndrome symptoms in office buildings and some homes.

Findings from the study also show that majority of the respondents agreed that rearing of animals most especially poultry predisposes children to various forms of infection. This finding is supported by Attwood (2007). The author stated that there are many disease agents that can cause disease in multiple species of animals including humans. People are exposed to the bacteria, protozoa, fungi, viruses and parasites that cause zoonoses in a number of ways and therefore anyone working with or handling animal's needs to know about zoonoses and the precautions they must take to minimise their risk of infection. People who have close contact with large numbers of animals such as farmers, abattoir workers, shearers, knackery workers and veterinarians are at a higher risk of contracting a zoonotic disease. Members of the wider community are also at risk from those zoonoses that can be transmitted by family pets (Attwood, 2007). The Centre for Disease Control and Prevention [CDC] (2013), also affirmed that farm animals including cows, sheep, pigs, chickens and goats, can pass diseases to people. Therefore, one should thoroughly wash your hands with running water and soap after contact with them or after touching things such as fences, buckets, and straw bedding

that have been in contact with farm animals, adults should carefully watch children who are visiting farms and help them wash their hands well.

5.3 Attitude of caregivers/mothers of under-five children towards the risks associated with housing

It was also observed that slightly more than half of the respondents had scored above the mean attitude score. These positive attitudinal dispositions towards risks associated with poor housing condition. Findings from this study show that a large majority were not favourably disposed to the fact that having more than three people sleep in a room is healthy. Overcrowding is a common aspect of bad housing. This is further supported by other researches. In a study of temporary accommodation in London (Page, 2002) it was found nearly two thirds (61%) of bed and breakfast accommodation used for long term accommodation was occupied at a rate of 2 persons per room. During the 1990s there was a significant reduction in use of such accommodation but it is increasingly being reutilised in the face of the rise in homeless application and as a response to the increase in asylum seekers. The latter is a particular problem in light the high incidence of mental ill-health amongst asylum seekers (Page, 2002). Children appear to be significantly affected in such accommodation with increased irritability, tension, increased aggression and lower levels of interaction with other children and poorer educational attainment and mental adjustment (Standing Conference on Public Health, 1994). Intriguingly there also appears to be a very stark impact of overcrowding in early life with studies suggesting that adult ill-health is significantly affected (respiratory disease, stomach cancer and short stature and attendant diseases such as heart disease) (Page, 2002).

Not only that, almost all was of the opinion that sleeping in a room sprayed with insecticide does affect one's health. More than half of the respondents also indicated that disposition to the use of mosquito net as opposed to the use of mosquito coil. These are all positive attitudinal disposition. The findings are supported by various other studies. The perceived side effects of insecticide indoor spraying could motivate a poor acceptance of using indoor spray interventions. For instance, side effects are more commonly reported in insecticide spraying personnel (Morello, 1991; Chester *et al*., 1992; Bauma and Neshit, 1995), but some minor side effects have been observed in villagers exposed to some indoor sprayed

insecticides (Moretto, 1991; Chester *et al*., 1992; Charlwood *et al*., 1995). Side effects vary with the chemical type of the insecticide used and their residuality. Humans exposed to pyrethroids may experience abnormal skin sensations and upper respiratory irritation, as well as sneezing and coughing. The most common symptoms associated with organophosphates are headache, dizziness, fatigue, nausea, breathing problems, abdominal cramps and tingling in extremities (Rodriguez *et al*., 2006).

5.4 Perceived health effect that could be associated with housing condition

While measuring the health status of respondents' children, about one third of these children had respiratory infection. About half of respondents' children had experienced malaria at the time of the study while a few (one fifth) had experienced skin infection as well as diarrhoea. As at the time of this study, about one third of the respondents indicated that their children had been hospitalized with various health conditions ranging from fever, diarrhoea, cough, teething, eye irritation, rashes among others. Damp and mouldy conditions have a number of direct and indirect impacts on health and mental well-being. Dampness directly reduces the ambient air temperature within the dwelling. This is caused by a direct reduction of thermal insulation properties of the building fabric and heating systems attempting to remove atmospheric water through evaporation. Thus with marginal heating supplies the premises will feel colder in damp conditions causing dissatisfaction. Evidence has suggested that a temperature of 21°C (Boardman, 1991, Burridge and Ormandy, 1993) is necessary to provide an adequate level of comfort. This is frequently unachievable in premises with significant dampness. Haverinen *et al*., (2001) also reports an association between moisture damage and respiratory infections, whilst Engvall *et al*., (2001a) reports a "pronounced increase in symptoms compatible with sick building syndrome and structural dampness in residential accommodation.

It also has to be acknowledged that economic factors do play a part in this equation. People on low fixed incomes, long term sick or the mentally ill often find themselves in the least desirable of homes with significant dampness. By their very socio-economic position they are least able to afford to heat their homes to a recognised level of comfort (Standing Conference on Public Health, 1994). Mites have been the basis of a significant number of studies connecting mites with asthma and allergy (Hyndman *et al*., 1994; Cloosterman *et al*.,

1997; de Montis, 1998; Chinn *et al.*, 1998; Warner, *et al.*, 1998a, Strachen. 1998; Gotzsche *et al.*, 1998; Smith *et al.*, 1999). Dampness has therefore been suggested to be a strong, consistent indicator of risk of asthma and respiratory symptoms (e.g. cough and wheeze) (WHO, 2009). Moulds in the house on the other hand are strong immunosuppressors and significant allergens. They have been linked as risk factors for asthma (Garrett *et al.*, 1998; Jedrychowski and Flak 1998; Norback *et al.*, 1999; Engvall *et al.*, 2001b; Kilpelainen 2001), and atopic dermatitis (Garrett *et al.*, 1998). Due to their action the body attempts to respond to their presence through natural defence mechanisms including coughing and sneezing, excess mucus production or rhinitis. Studies have shown links to persistent cold like symptoms in adults and children (Husing and Kimbrough, 1997; Koskinen *et al.*, 1999). The American Academy of Paediatrics on Environmental Health (1998) have issued a statement on the toxic properties of mould and indicate impacts as diverse as upper respiratory irritations, rash and pulmonary haemorrhage.

5.5 Hygrothermal (temperature and relative humidity) conditions in the selected households

The mean morning and afternoon temperatures in bedroom, sitting-room and outdoor were all higher than ASHRAE standard. Geometric mean morning and afternoon relative humidity in bedroom, sitting-room and outdoor were all higher than ASHRAE standard. Humidity in indoor spaces is one of the most important factors that determine the indoor air quality, and many health related problems in the indoor environment (e.g., sick building syndrome [SBS]), can be associated with high indoor humidity and damp buildings (Clausen *et al.*, 1999). Ventilation with fresh air is a way to alleviate the problems of high indoor humidity, but ventilation requires energy to condition the air and to run the fans of the ventilation systems. Therefore, there is an interest in designing buildings for a suitable balance between moisture supply and required ventilation. However, it must always be considered that ventilation is important not only for reducing the indoor moisture levels but also for diluting other indoor air contaminants. The humidity condition of indoor air is the result of moisture supply from current activities and the actual ventilation rate.

One must also consider how building materials and interior furnishings will buffer the variation in indoor humidity. High indoor humidity is among the most important reasons for

harmful accumulation of moisture in the building envelope and can be a direct or indirect reason for extra energy consumption for thermal conditioning (heating or cooling) of the occupied spaces of buildings.

5.6 Airborne microbes (bacteria and fungi) in selected households

The result of this study show that the mean morning and afternoon total bacteria count in bedroom, sitting-room and outdoor respectively were lower than AIHA. Similarly, the mean morning and afternoon total fungi count in bedroom, sitting-room and outdoor were lower than AIHA. This implies that bacteria and fungi counts in the morning and afternoon for indoor and outdoor in selected communities were significantly lower than the standard and there was significant difference for fungi. Analysis of bacterial flora composition in investigated locations revealed bacteria from the following genera: Micrococcus spp., Bacillus spp., Pseudomonas spp. and Proteus spp. Quality characteristics of fungal flora isolated from the air of bedrooms showed species of fungi like: Penicillium spp., Aspergillus spp., Macro spp., Rhizopus spp Nucrospora spp., Streptomycin spp., Geotricum spp., and Candida spp.

The finding is similar with that of Yassin and Almouqatea, (2010) which was done to determined air quality sampling using the 'open plate technique'. In their study, airborne indoor and outdoor bacteria and fungi were assessed during the spring season using conventional methods to investigate the enumeration and identification of airborne micro organisms. Although a culture-based analysis is most widely used for bio-aerosol, four public places located in urban residential areas were selected for indoor/outdoor air bin-pollutant measurement. The public places included kitchens, classrooms, recreational areas, laboratories. Public parks are an important facility associated with the environmental exposure of children. Cultivation and total microscopic enumeration methods were employed for the sample analysis. Twenty-six groups of bacteria and fungi, either of human or environmental origin were detected. Environmental agents generally predominated while significantly higher counts were detected as the level of hygiene or standard of housing dropped. Seven genera of fungi, mainly members of the genus Aspergillum, were isolated from all residents.

Bacteria shows higher growth numbers as opposed to the slow growing fungi. Kumar *et al.*, (2011) also observed that the concentration and quality of microbes in urban atmosphere may affect human health and environment. In recent years, interest in air microbiology has been focused on air sampling strategies, indoor-outdoor distribution of microbes and climatic influences on microbial population.

5.6.1 Perceived Health Effects, Hygrothermal Conditions and Airborne Microbes

In the review of health effects of relative humidity in indoor environments by Arundel *et al.*, (1986) it was suggested that the relative humidity can affect the occurrence of allergies and respiratory infections. This corroborates our finding of a mild but significant correlation between relative humidity and skin infections.

Analysis of the relationship between Hygrothermal conditions (temperature and relative humidity) and airborne microbes (bacteria and fungi) showed that there was significant correlation. This may be because temperature and relative humidity are closely associated with microbial growth (Yassin *et al.*, 2010). Although the findings of Kumar *et al.*, 2011 showed correlation between the hygrothermal conditions and microbial proliferation, the findings were not statistically significant.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The quality of the home or housing quality has a substantial impact on health; a warm, dry and secure home is associated with better health. In addition to basic housing requirements, other factors that help to improve well-being include the neighbourhood and security of tenure. Although the exact relationship between poor housing and health is complex and difficult to assess, however, research based on the various sources of housing and health data suggests that poor housing is associated with increased risk of cardiovascular diseases, respiratory diseases and depression and anxiety most especially among children under the age of five. Housing-related hazards that increase the risk of illness include damp, mould, excess cold and structural defects that increase the risk of an accident (such as poor lighting, or lack of stair handrails). The strength of the evidence linking such factors to ill health varies. It can be concluded from the research is that there appears to be a significant relationship between poor housing and mental health both at an individual premises level and at a community level.

High temperature and relative humidity exist in houses at Omi-Adio and there were associated bacteria as well as fungi pathogens. These have negative implication on the health of under-five children. Health awareness campaign on good housing conditions is therefore recommended.

6.2 Recommendations

Due to occurrence of rapid rate of urbanisation occurring in the community, the consequences of which have been severely degenerated urban environment, unplanned growth and decay should be checked and prevented. These measures would prevent poor housing quality, save our built environment and improve the life expectancy of the average Nigerian.

Moreover, it is suggested that government of the day begin to take initiative on new housing policy and thus making housing available for the population. Healthy Cities Initiatives need to be given consideration in making our cities, towns and other settlement more health promoting.

In addition to all these, sanitary services in the areas need urgent attention, particularly water supply and waste disposal facilities. However, mini-water-works or boreholes public toilets in strategic places in the area are recommended under Urban Basic Service Programme. Also, the efforts of the Waste Management Authority should be well supported through adequate funding so that facilities for effective services to more areas can be enhanced. In the light of this, Local Government Authority should call to their primary responsibility to ensure regular collection of refuse in these areas.

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APPENDIX 1

Wards in Ido Local Government Area, Oyo State.

Wards	Names of wards
1	Ilaju
2	Akufo
3	Akindele/Akinware
4	Apete
5	Botake/Idiya
6	Erinwusi/Koguo
7	Gbekuba
8	Ido
9	Omi. Adio
10	Ogundele/Siba

APPENDIX II

QUESTIONNAIRE ON HOUSING CONDITIONS AND ITS PERCEIVED HEALTH EFFECT AMONG UNDER-FIVE CHILDREN IN OMI-ADIO COMMUNITY,OYO STATE, NIGERIA.

INTRODUCTION: I am Agbolunje Nafisat O., a post graduate student from the Department of Epidemiology, Medical statistics and Environmental Health, Faculty of Public Health, College of Medicine, University of Ibadan. I am presently carrying out a research titled: **"Housing Conditions and perceived health effects on under-five children in Omi- Adio, Ido Local Government, Oyo State.** This research is purely for academic purpose. The findings will be of immense benefit in the area of identifying housing conditions and effect on under-five children. Please feel free to express your opinion and be assured that your response will be kept strictly confidential. Your honest and sincere response to the following questions will be highly appreciated.

Thanks for your co-operation

SERIAL NUMBER ____

INSTRUCTIONS: PLEASE TICK (√) OR FILL IN ANSWERS WHERE APPROPRIATE

SECTION A: Demographic Characteristics of Parents/ Caregivers

1.	Age of Respondent(last birthday)	..... years
2.	Marital status	1. Single [ ] 2.Married [ ] 3.Divorced [ ] 4.Widowed [ ] 5. Separated [ ] 6. Co-habiting [ ]
3.	Religion	1. Christianity [ ] 2. Islam [ ] 3. Traditional [ ]
4.	Ethnicity	1. Yoruba [ ] 2. Hausa [ ] 3. Igbo [ ] 4. Others specify .....
5.	Educational status	1. No formal education [ ] 2. Primary completed [ ] 3. Secondary completed [ ] 4. Tertiary [ ] 5. Others [ ]

6.	Educational status of husband	1. No formal education [ ] 2. Primary completed [ ] 3. Secondary completed [ ] 4. Tertiary [ ] 5. Quranic [ ]
7.	Occupation	1. Trading [ ] 2. Artisan [ ] 3. Farming [ ] 4. Civil servant [ ] 5. Others, specify .....
8.	Husband's occupation	1. Trading [ ] 2. Artisan [ ] 3. Farming [ ] 4. Civil servant [ ] 5. Others, specify .....
9.	Family Type	1. Monogamous [ ] 2. Polygamous [ ]
10.	If polygamous, how many wives?	.....
11.	Number of children in the family?	.....
12.	Number of under-five children in the family	.....
13.	Household size	.....

SECTION B: Characteristics of the Child

14. Age of the index child .... (in months).
15. Sex of the child: 1. Male [ ] 2. Female [ ].
16. Birth order..... .....
17. Which of the followings does the child sleeps on? 1. Bed 2. Mat 3. Camel 4. Rug 5. B are floor 6. Others, specify .....
18. Has the child in question started schooling? 1. Yes [ ] 2. No [ ]
19. Is his/her school very close to the following: 1. Market [ ] 2. Major road [ ] 3. Hospital [ ] 4. Residential area [ ] 5. None of the above [ ]

SECTION C: Household Characteristics

20. Number of rooms in the house (excluding toilet and kitchen) .....
21. Number of rooms occupied by the household .....
22. Number of adult over 15years in the household .....
23. Number of children under-five sleeping with the index child in the same room .....

24. Number of adult over 15years sleeping with the index child in the same room .....

25. How long have you been living in this house ..... years

26. House ownership (tenure type) 1.Owners (family house) [ ] 2.Owners (acquisition) [ ] 3. Tenants [ ]

27. Source of drinking water 1.Tap water [ ] 2.River [ ] 3.Stream [ ] 4.Borehole [ ] 5.Well [ ] 6. Others, specify .....

28. Type of toilet facility used by household 1.Water closet [ ] 2.Pits latrine [ ] 3.Bush [ ] 4.Sanplat latrine 5. Others, specify .....

29. How many household uses the toilet facility? .....

30. What is alternate Source of power/ light used by household 1.Lantern [ ] 2.Candle [ ] 3.Generator [ ] 4.Local lamp [ ] 5.Others, specify .....

31. Do you rear domestic animals/ poultry? 1. Yes [ ] 2. No [ ]

31i. If yes, which of these following animal/poultry do you rear?

	Yes	No
Goat		
Cattle		
Cat		
Dog		
Chicken		
Duck		

31ii. Do you have animal/poultry shed? 1. Yes [ ] 2. No [ ]

31iii. Where is the animal/poultry shed located? 1. Attached to the house [ ] 2.Within the house [ ] 3.Outside the compound [ ] 4. No animal shed [ ] 5. Others, specify .....

SECTION D: Knowledge about Housing Condition

32. Which of the following can inadequate housekeeping cause?

	Yes	No
Fungal growth		
Odour		
Vector infestation		

33. House cleaning method include 1 Sweeping only [ ] 2. Dusting only [ ] 3 Sweeping and Dusting [ ] 4. Mopping only [ ] 5. Sweeping, dusting and mopping [ ]

34. Noise from the following can affect one's health?

	Yes	No
Generator		
Grinding machine		
Traffic		

35. Sources of indoor air pollutants in the building include:

	Yes	No
Renovation		
Painting		
Pest control spray		
Smoke from generating set		
Smoke from cooking fuel		

36. Can rearing of animal/poultry cause infection to children? 1. Yes [ ] 2. No [ ]

37. Smoke from cooking facilities may result in difficulty in breathing 1. Yes [ ] 2. No [ ]

38. For adequate ventilation, having two windows is better 1. Yes [ ] 2. No [ ]

39. Presence of food in the house can lead to breeding of insect and uncleanliness that could be unhygienic for sleeping 1. Yes [ ] 2. No [ ]

SECTION D: Knowledge about Housing Condition

32 Which of the following can inadequate housekeeping cause?

	Yes	No
Fungal growth		
Odour		
Vector infestation		

33 House cleaning method include 1 Sweeping only [ ] 2. Dusting only [ ] 3.Sweeping and Dusting [ ] 4. Mopping only [ ] 5. Sweeping, dusting and mopping [ ]

34. Noise from the following can affect one's health?

	Yes	No
Generator		
Grinding machine		
Traffic		

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	Yes	No
Renovation		
Painting		
Pest control spray		
Smoke from generating set		
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36. Can rearing of animal/poultry cause infection to children? 1. Yes [ ] 2. No [ ]

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38. For adequate ventilation, having two windows is better 1. Yes [ ] 2. No [ ]

39. Presence of food in the house can lead to breeding of insect and uncleanliness that could be unhygienic for sleeping 1. Yes [ ] 2. No [ ]

SECTION E: Attitude of Mothers towards Risk Associated With Ironing

Instruction: For each statement, please indicate by ticking (√) whether you strongly Agree (SA), Agree (A), Not Sure (NS), Disagree (D), or Strongly Disagree (SD)

S/N	Statement	SA	A	NS	D	SD
40	Having more than three people sleeping in a room is healthy					
41	Opening of window for natural ventilation is better than using fan					
42	Sleeping in a room sprayed with insectide does not affect one's health					
43	Use of mosquito coil is better than mosquito net					

SECTION F: Perceived Health Status of the Child

44. Which of the following symptoms has the child experienced?

Symptoms	Ever experienced	Frequency		
		In the last 1year	In the last 6month	In the last 3month
Persistent Cough				
Dry cough				
Shortness of breath				
Cough and shortness of breath				
Chest tightness				
Difficulty in breathing				

SECTION E: Attitude of Mothers towards Risk Associated With Housing

Instruction: For each statement, please indicate by ticking (√) whether you strongly Agree (SA), Agree (A), Not Sure (NS), Disagree (D), or Strongly Disagree (SD)

S/N	Statement	SA	A	NS	D	SD
40	Having more than three people sleeping in a room is healthy					
41	Openingof window for natural ventilation is better than using fan					
42	Sleeping in a room sprayed with insecticide does not affect one's health					
43	Use of mosquito coil is better than mosquito net					

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		In the last 1year	In the last 6month	In the last 3month
Persistent Cough				
Dry cough				
Shortness of breath				
Cough and shortness of breath				
Chest tightness				
Difficulty in breathing				

Difficulty in sleeping				
Wheezing				
Dry/Itching Skin				
Rashes				
Headache				
Fever				
Fatigue				
Dizziness				
Watering eyes				
Sore throat				
Running nose				
Eye irritation				
Nose irritation				
Throat irritation				
Throat irritation				
Redness of eyes				
Brownness of eyes				
Diarrhoea				

45. Has the child been taken to any hospital because of any infection? 1 Yes [ ] 2 No [ ]

46. If Yes, what kind of illness was diagnosed.....

47. Did any family members have any of No 44 during the past two weeks? 1 Yes [ ] 2 No [ ]

APPENDIX III

IWE IWADI LORI IPO ILEGBE ATI AILERA TI EYAN LERO LAARIN AWON OMO TI KO TO OMO ODUN MARUN NI AGBEGBA OMI-ADIO.

ORO ASOSIWAJU: Oruko mi ni Agbolaaje Nafisat O., akeko ti ipele keji eko ni eka alera gbogbo gbo to n keko peto lori ilera agbegbe ni agbon to n bojuto isele ojiji, alakosile eto ilera ati ilera ayika ni eka ilere gbogbo gbo ti ile-iwe giga ilu Ibadan.

Mo se iwadi lowo-lowo lori akole iwadi yi: "Ipo Ilegbe ati ailera ti eyan lero laarin awon omoti ko to omo odun marun ni agbegba Omi-Adio ni ibile Ido ni ipile Oyo. Iwadi yi wa fun eto eko nikan. Iwadi yi yo je itonlowo gidigidi fun sise idamo awon ipo Ilegbe ati awon akopa ti o le fa fun awon omo ti ko ti to omo odun marun. E jowo e gbiyanju lati so ohun ti e ri se aiwipe e ri daju pe a o pa awon idahun yin mo dara dara. A o layo fopulopo fun idahun tooto ati ifarajin yin.

E se pupo fun ifowosowopo yin.

Yomba lesese_____

ASE:E JOWO, E FALA TABI KI E KO AWON IDAHUN SI IBI TO BA YE

IPELE A: ORO IGBE-AYE OBI TABI ALAGBATO

1.	Ojo ori iya ni ojobi to gbeyin	oclun.....
2.	Ipo Igbeyawo	1. Apo [ ] 2.mo ti segbeyawo [ ] 3.a ti konawa sile[ ] 4.opo[ ] 5. A ti yago funra wa [ ] 6. A n gbe papo laiusegbeyawo [ ]
3.	Esin	1. onigbagbo [ ] 2. musulumi [ ] 3. Elesin abelaye [ ]
4.	Eya	1. Yoruba [ ] 2. Hausa [ ] 3. Ibo [ ] 4. Awon esin miran [ ]
5.	Iye iwe ti iya ka	1. mi o kawe kankan [ ] 2. Mo kawe alakobere pan [ ] 3. Mo kawe girama pari [ ] 4. Iwe giga [ ] 5. Mo ka keru [ ]

6.	Iye iwe ti baba ka	1.mi o kawe Kankan [ ] 2.Mo kawe alakobere pari [ ] 3. Mo kawe girama pari[ ] 4. Iwe giga [ ] 5. Mo ka keeu [ ]
7.	Ise ti iya nse	1. onisowo[ ] 2. Onise-owo [ ] 3. Agbe [ ] 4. Osise ijoba [ ] 5. Awon ise miran [ ]
8.	Ise ti baba nse	1. onisowo [ ] 2. Onise-owo[ ] 3. Agbe [ ] 4. Osise ijoba [ ] 5. Awon ise miran [ ]
9.	Iro idele	1.Oko kan aya kan [ ] 2. Oko kan aya pupo [ ]
10.	To ba je alaya pupo, iyawo melo?	.....
11.	Iye awon omo to wa ninu ebi	.....
12.	Iye awon omo ti ko ti to omo odun marun ninu ebi	.....
13.	Apapo gbogbo ebi	.....

IPELE B: AWOMONI IRU OMO TA NSO

14. Ojo ori omo (ni ojo ibi to gbeyin) ..... Osu

15. Eya omo na: 1. Okunrin [ ] 2. obinrin [ ]

16 Ipo ibi.....

17. Ori ibusun wo ni omo na sun? 1. Beedi [ ] 2. Ori eni [ ] 3. Ori capeti [ ] 4. Ori roogi [ ] 5. Ilele [ ] 6. Awon ibi miran [ ]

18. Nje omo na ti bere si ni lo si ile iwe? 1. beeni [ ] 2.beeko [ ]

19. Nje ile-iwe na sunmo ibi won yi peki-peki? 1. oja [ ] 2. Opopona [ ] 4. Ile-iwosan [ ] 5. Ile ti awon eyan n gbe [ ]

IPELE D: AWOMONI FUN ILE

20 Iye yara to wa ninu ile yi (yato si ile igbe. ile idana ati ayika.).....

21 Iye yara ti egbu .....

22. Iye agbalagba ti ojo ori won ju marun din logun meloo lowa in inu ile yin.....

23. Iye omo meelo ti ojo ori won ko to marun loun sun ti omo na .....

24. Iye ngbalagba ti ojo ori won ju marun din logun loun sun ti omo na.....

6.	Iye iwe ti baba ka	1.mi o kawe Kankan [ ] 2.Mo kawe alakobere pari [ ] 3. Mo kawe giramu pari[ ] 4. Iwe giga [ ] 5. Mo ka keeu [ ]
7.	Ise ti iya nse	1. onisowo[ ] 2. Onise-owo [ ] 3. Agbe [ ] 4. Osise ijoba [ ] 5. Awon ise miran [ ]
8.	Ise ti baba nse	1. onisowo [ ] 2. Onise-owo[ ] 3. Agbe [ ] 4. Osise ijoba [ ] 5. Awon ise miran [ ]
9.	Ito idele	1.Oko kan aya kan [ ] 2. Oko kan aya pupo [ ]
10.	To ba je alaya pupo, iyawo melo?	.....
11.	Iye awon omo to wa ninu ebi	.....
12.	Iye awon omo ti ko ti to omo odun marun ninu ebi	.....
13.	Apapo gbogbo ebi	.....

IPELE B: AWOMONI IRU OMO TA NSO

14. Ojo ori omo (ni ojo ibi to gbeyin) ..... Osu
15. Eya omo na: 1. Okunrin [ ] 2. obinrin[ ]
16. Ipo ibi.....
17. Ori ibusun wo ni omo na sun? 1. Beedi [ ] 2. Ori eni [ ] 3. Ori capeeti [ ] 4. Ori roogi [ ] 5. Ilele [ ] 6. Awon ibi miran [ ]
18. Nje omo na ti bere si ni lo si ile iwe? 1. beeni [ ] 2. beeko [ ]
19. Nje ile-iwe na sunmo ibi won yi peki-peki? 1. oja [ ] 2. Opopona [ ] 4. Ile-iwosan [ ] 5. Ile ti awon eyan n gbe [ ]

IPELE B: AWOMONI FUN ILE

20. Iye yara to wa ninu ile yi (yato si ile igbe, ile idana ati ayika.).....
21. Iye yara ti egba .....
22. Iye agbalagba ti ojo ori won ju marun din logun meloo lowa in inu ile yin .....
23. Iye omo meelo ti ojo ori won ko to marun loun sun ti omo na .....
24. Iye agbalagba ti ojo ori won ju marun din logun loun sun ti omo na.....

25. Odun melo ni e ti n gbe ninu ile yi.....

26. Taalo ni ile ti e un gbe? 1. Ile molebi [ ] 2. Ile arawa [ ] 3. Ayalegbe [ ]

27. Kini Orisun omi ti eun mu? 1. Omi ero [ ] 2. Omi okun [ ] 3. Omi odo
4. Omi kangadero [ ] 5. kanga 6. Awon orison omi miran [ ]

28. Iru ile iyagbe wo ni eun lo? 1. ile iyagbe igbalode [ ] 2. salanga 3. ojugbo
4. Bi bo igbe mole [ ] 5. Orisin miran, e salaye .....

29. Eyin meelo ti molebi tounlo ile iyagbe naa? .....

30. Iru ina miran wo le un lo leyin ina ijoba? 1. Laniem oni shadi [ ] 2.candle [ ]
3.generator [ ] 4. Atupa [ ] 5. Omiran, e salaye .....

31. Nje e n sin nkan osin? 1. beeni [ ] 2. beeko [ ]

31i. Tobaje beeni, ewoninu awon nkan osin yin ni esin?

	Beeni	Beeko
Ewure		
Aguntan		
Oloungbo		
Aja		
Ediye		
Pepeye		

31ii. Nje eni ile nkan osin? 1. Beeni [ ] 2. Beeko [ ]

31iii Nibo ni ile nkan osin yin wa? 1.wa legbe ile [ ] 2. Wa ninu ogba [ ] 3. owa lojude [ ]
4.ko si ile ewure tabi tadire [ ]

IPELE E: OYE NIPA BI ILE SE YE KO RI

32. Ewoo ninu awon wonyi ni aitunlese lela?

	Beeni	Beeko
Kokoro aifojuri		
Oorun		
Kokoro		

33. Awon ona wo ni aun gba tun ile se? 1. Gbigbale lasan [ ] 2. Gbigbonle lasan [ ]
3. Gbigbale ati Gbigbole [ ] 4. Ninu le lasan [ ] 5.Gbigbale, Gbigbole ati Ninu le [ ]

34. Ariwo lati ibi awon nkan wonyi le se akoba fun ilera ara wa?

	Beeni	Becko
Generator		
Eto ilogi tabi ata		
Opopona		

35. Orisun nkan loun ba ategun je ninu ile je:

	Beeni	Becko
Atunse ile		
Kikun ile		
Nkan ti afin fin koriko		
Eefin lati generator		
Eefin lati ibi idana		

36. Nje nkan osin le fa aisan si omo kekere lam? 1. Beeni [ ] 2. Becko [ ]
37. Eefin lati ibe idanale fa ailemi dada? 1. Beeni [ ] 2. Becko [ ]
38. Fun wiwa ategun, fereese kan si lo? 1. Beeni [ ] 2. Becko [ ]
39. Ounje ninu ile le fa sisin kokoro ati idoti ti ole fa airorun sun dada
1. Beeni [ ] 2. Becko [ ]

IPELE E: IWUWASI IVA SI EWU TO KO MO ILE GBIGBE.

ASE: fun ero kookan, e je ka mo idahun yin nipa fifala si boya e faramo gan-an (SA), faramo (A), ko daniloju (NS), mi o faramo (D), tabi mi o faramo rara (SD)

Nomba	Oro	SA	A	NS	D	SD
40	Nini ju eniyan meta lo to n sun sinu ;ara dara fun ilera					
41	Sisi ferese fun ategun ati odo olanla wa dara ju ilio faanu lo					

33. Awon ona wo ni aun gba tun ile se? 1. Gbigbale lasan [ ] 2. Gbigbonle lasan [ ]
3. Gbigbale ati Gbigbole [ ] 4. Ninu le lasan [ ] 5.Gbigbale, Gbigbole ati Ninu le [ ]

34. Ariwo lati ibi awon nkan wonyi le so akoba fun ilera ara wa?

	Beeni	Beeko
Generator		
Emi ilogi tabi ata		
Opo pona		

35. Orisun nkan toun ba ategun je ninu ile je:

	Beeni	Beeko
Atunse ile		
Kikun ile		
Nkan ti afin fin koriko		
Eefin lati generator		
Eefin lati ibi idana		

36 Nje nkan osin le fa aisan si omo kekere lara? 1. Beeni [ ] 2. Beeko [ ]

37. Eefin lati ibe idanale fa ailemi dada? 1. Beeni [ ] 2. Beeko [ ]

38. Fun wiwa ategun, fereese kan ti to? 1. Beeni [ ] 2. Beeko [ ]

39. Ounje ninu ile le fa sisin kokoro ati idoti ti ole fa airotun sun dada
1. Beeni [ ] 2. Beeko [ ]

IPELE E: IWUWASI IYA SI EWU TO RO MO ILE GBIGBE.

ASE: fun oro kookan, e je ka mo idahun yin nipa fifala si boya e faramo gan-an (SA), faramo (A). ko daamoju (NS), mi o fara mo (D). tabi mi o faramo rara (SD)

Nombo	Oro	SA	A	NS	D	SD
40	Nini ju eniyan meta lo to n sun sinu yara dara fun ilera					
41	Sisi feresc fun ategun ati odo olomun wa dara ju lilo faanu lo					

42	Sisun ninu iyara ti ati fin ogun ceson si koni nkan si itera wa					
43	Lilo koili dara ju lilo neeti lo					

IPELE F: IPO ILERA OMO

44. Ewo ninu awon ami won yi ni omo yin ti ni inu re?

Ami	Iriri	Bo se sele lemo-lemo si		
		Ni iwongba odun kan	Ni won gba osu meta	Ni won gba osu meta
Iko lemo-lemo				
Oju to n dami				
Ailemi dada/emi loke-loke				
Egbo ona ofun				
Mimi leekokan				
Mimi pelu inira				
Kala/imu to n somi				
Aisorun sun				
Oyi oju				
Iko awugbe				
On fifo				
Ara yiyun				
Ibe				
Iko pelu ailemi dada				
Rire				
Oju didun				
Egbo imu				
Ona ofun didun				
Ara susu				
Irora nya				

Oju pipon				
Ojo sisu				

42. Nje e ti mu omo na lo si ile iwosan nitori aisan ri? 1. beeni [ ] 2. beeko [ ]

43. To ba je beeni, ewo ninu awon ailera? .....

44. Nje ikankan ninu molebi yin ni ikankan ni awon ailera/aisan ti a ko soke yi laarin osu meji seyin? 1. beeni [ ] 2. beeko [ ]

APPENDIX IV

OBSERVATIONAL CHECKLIST FOR ASSESSMENT OF HOUSES

Date..... Serial no.....

Address.....

.....

.....

.....

SECTION A: BUILDING CONSTRUCTION CHARACTERISTICS

Type of building

Based on structure: Flat [ ] bungalow [ ] Mansonate [ ] Storey building [ ]

Based on occupancy: Face me face you [ ] Self contained [ ]

Status of building: Complete [ ] Uncompleted

Building material

Material	Wall	Window	Door
Wood			
Concrete			
Mud			
Sand			
Tiles			
Red Brick			
Glass			
Metal			

Ceiling Material

Material	Conditions	
	Damp	Dry
Asbestos		
Concrete		
Carton		
None		

Rooling Material: Aluminium [ ] Thatch [ ] Concrete [ ]

SECTION B: FLOOR COVERING

Material	Living Room	Bed Room
Carpet		
Rug		
Wood		
Mud		
Tiles		
Mud+Cow Dung		
Concrete		
Concrete+red paint		
Others		

SECTION C: MEANS OF VENTILATION

Means of ventilation	Number owned	Absent	Present Functional	Non functional	Location Bedroom	Sitting room
Air conditioner						
Fan						
Door						
Window						

SECTION D:

COOKING FACILITY USED: Stove [ ] Firewood [ ] Charcoal [ ] Gas cooker [ ] Electric cooker [ ] Sawdust [ ]

LOCATION: In the room [ ] in front of the room [ ] within the house [ ] outside the house [ ]

Food storage location.....

SECTION E: WASTE MANAGEMENT STRATEGY

Means of waste disposal	Absent	Present		Location	
		Functional	Non functional	Inside house	Outside house
Refuse bin					
Open burning					
Open dumping					
Burying					

APPENDIX V

PREPARATION OF MEDIA

Nutrient agar, Potatoes dextrose agar, Plate count agar, and other media can be used for total bacteria count or total fungi or total viable counts of organisms.

NUTRIENT AGAR

28g of Nutrient agar was homogenised into 1litre of distilled water using water bath at 100°C. This was then autoclaved at 121°C for 15mins. The medium was cooled to 45°C after autoclaving before pouring into plates and used for subsequent bacteria plating.

POTATOES DEXTROSE AGAR

39g of Potatoes dextrose agar was homogenised into 1litre of distilled water using water bath plus streptomycin to inhibit bacteria growth, using water bath at 100°C . This was then autoclaved at 121°C for 15mins. The medium was cooled to 45°C after autoclaving before pouring into plates and used for subsequent fungi plating.

ISOLATION OF ORGANISM FROM THE MEDIA

The nutrient agar was incubated overnight (24 hours) while Potatoes dextrose agar was incubated for 3-5 days.

TOTAL BACTERIA AND FUNGI COUNT

The count was done by counting different colonies on each agar plates after incubation.

(Olutiola P.O., Famurewa O.F. and Sonntag A.S. (1991) Printed in Germany by Heidelberger ver Lagsanstalt and druckerei. Gimbh Heidelberg. Pg 94-135.

APPENDIX VI

MEASUREMENT FORM

Periods	Parameters	House No:			House No:			House No:			House No:			House No:		
		Indoor		Outdoor	Indoor		Outdoor	Indoor		Outdoor	Indoor		Outdoor	Indoor		Outdoor
		BR	SR		BR SR			BR	SR		BR	SR		BR	SR	
Morning (8am 10pm)	Temperature															
	Relative humidity															
	Light intensity															
Afternoon (2-4pm)	Temperature															
	Relative humidity															
	Light intensity															

APPENDIX VII

INTRODUCTORY LETTER FROM THE DEPARTMENT TO THE COMMUNITY

DEPARTMENT OF EPIDEMIOLOGY, MEDICAL STATISTICS & ENVIRONMENTAL HEALTH
FACULTY OF PUBLIC HEALTH
COLLEGE OF MEDICINE
UNIVERSITY OF IBADAN, NIGERIA.

ACADEMIC STAFF

02 March, 2011

Head of Community
Obafemi Awolowo
Ibadan.

Dear Sir

Re: Godfred O. AGBOLA MPH

This is to certify that Godfred O. Agbola has been a student in the Department of Epidemiology, Medical Statistics and Environmental Health, Faculty of Public Health, College of Medicine, University of Ibadan, Ibadan, Nigeria.

She is currently conducting a research on "Housing conditions and Perceived health effects among underfive children in Obafemi Awolowo" for the award of Master Degree in Environmental Health.

Kindly accord her necessary assistance to facilitate her work.

Thank you.

Dr. Olufemi T. Fawole

Approval letter from Oyo state Ministry of Health Ethical Review Board

TELEGRAMS..........   TELEPHONE..........

MINISTRY OF HEALTH

[illegible]

PRIVATE MAIL BAG NO. [illegible], OYO STATE OF NIGERIA

[illegible]

Our Ref. No: AD 13/479/130   Date: 16th July, 2011

The Principal Investigator,
Department of [illegible]
and [illegible] Health,
Faculty of [illegible], College of Medicine,
University of Ibadan,
Ibadan

Attention: [illegible]

[illegible]

[illegible]

[illegible] Oyo State, Nigeria

[illegible]

Wishing you all the best

[illegible]
Director, Planning, Research & S[illegible]
Secretary, Oyo State Research Ethical Review Committee

APPENDIX IX

ETHICAL APPROVAL FROM THE UI/UCH ETHICAL REVIEW COMMITTEE

INSTITUTE FOR ADVANCED MEDICAL RESEARCH AND TRAINING (IMRAT)
COLLEGE OF MEDICINE, UNIVERSITY OF IBADAN, IBADAN, NIGERIA.
E-Mail - imratcomui@yahoo.com

UI/UCH EC Registration Number: NHREC/05/01/2008a

NOTICE OF FULL APPROVAL AFTER FULL COMMITTEE REVIEW

Re: Hearing Conditions and Perceived Health Effects among under Five Children in [illegible] Community

UI/UCH Ethics Committee assigned number: UI/EC/[illegible]

Name of Principal Investigator: Nafisat O. Adebisi [illegible]

Address of Principal Investigator: Department of EMSEH, College of Medicine, University of Ibadan, Ibadan

Date of receipt of valid application: [illegible]/2011

Date of meeting when final determination on ethical approval was made: 21/07/2011

This is to inform you that the research described in the submitted protocol, the consent forms, and other participant information materials have been reviewed and given full approval by the UI/UCH Ethics Committee.

This approval dates from 21/07/2011 to [illegible]. If there is delay in starting the research, please inform the UI/UCH Ethics Committee so that the dates of approval can be adjusted accordingly. Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the UI/UCH EC assigned number and duration of UI/UCH EC approval of the study. It is expected that you submit your annual report as well as an annual request for the project renewal to the UI/UCH EC early in order to obtain renewal of your approval to avoid disruption of your research.

The National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the Code including ensuring that all adverse events are reported promptly to the UI/UCH EC. No changes are permitted in the research without prior approval by the UI/UCH EC except in circumstances outlined in the Code. The UI/UCH EC reserves the right to conduct compliance visit to your research site without previous notification.

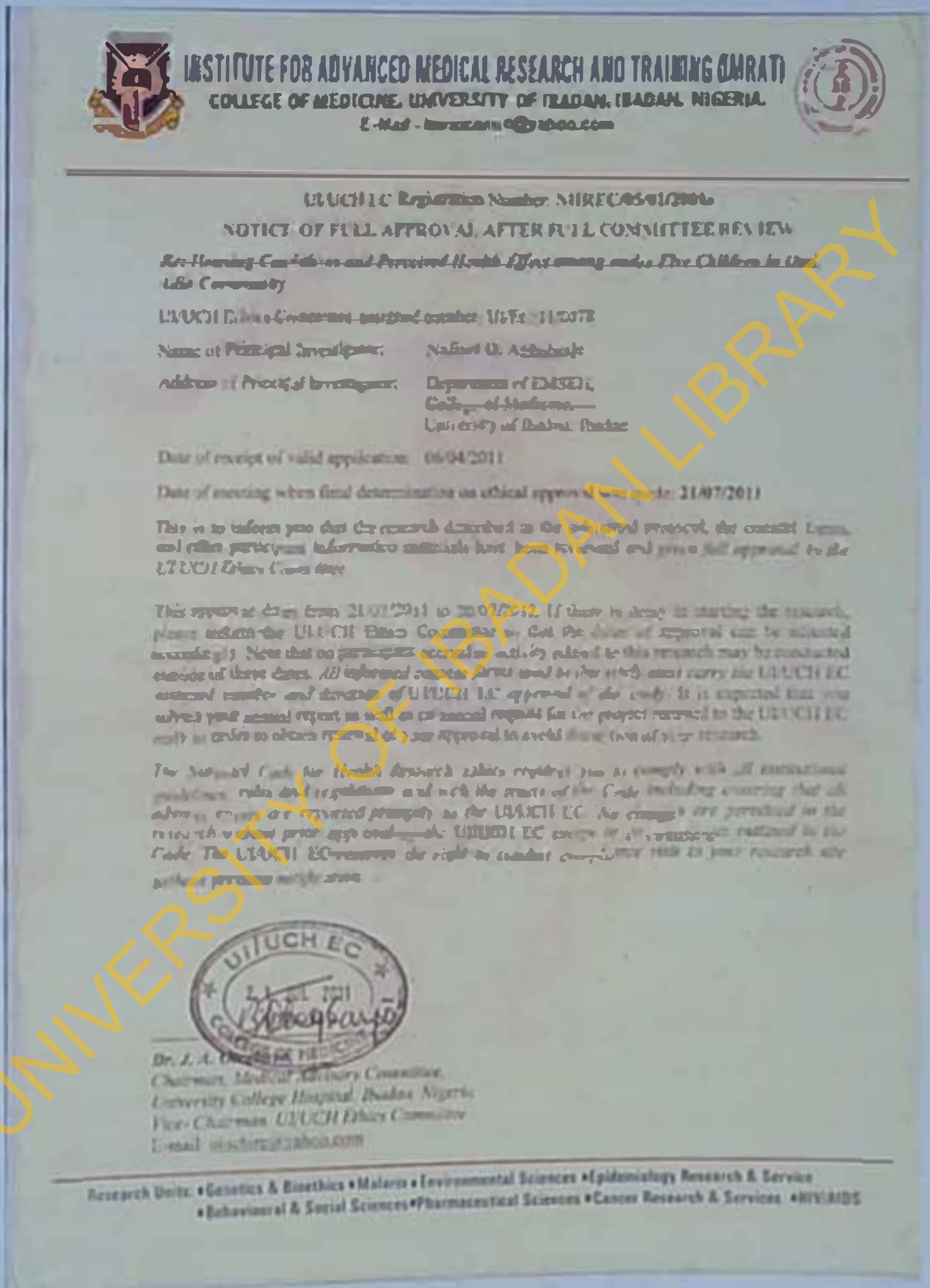
UI/UCH EC
[illegible] JUL 2011
COLLEGE OF MEDICINE

Dr. J. A. [illegible]
Chairman, Medical Advisory Committee
University College Hospital, Ibadan, Nigeria
Vice- Chairman, UI/UCH Ethics Committee
E-mail: [illegible]@yahoo.com

Research Units: •Genetics & Bioethics •Malaria •Environmental Sciences •Epidemiology Research & Service •Behavioural & Social Sciences•Pharmaceutical Sciences •Cancer Research & Services •HIV/AIDS

APPENDIX IX

ETHICAL APPROVAL FROM THE UI/UCH ETHICAL REVIEW COMMITTEE



INSTITUTE FOR ADVANCED MEDICAL RESEARCH AND TRAINING (IMRAT)
COLLEGE OF MEDICINE, UNIVERSITY OF IBADAN, IBADAN, NIGERIA.
E-Mail - [redacted]

UI/UCH EC Registration Number: NHREC/05/01/2008

NOTICE OF FULL APPROVAL AFTER FULL COMMITTEE REVIEW

Re: Hearing Cognition and Perceived Health Effect among male Out Children in the Ido Community

UI/UCH Ethics Committee meeting number: UI/EC/11/2078

Name of Principal Investigator: Nafiu U. Adebanjo

Address of Principal Investigator: Department of EMSEH,
College of Medicine,
University of Ibadan, Ibadan

Date of receipt of valid application: 06/04/2011

Date of meeting when final determination on ethical approval was made: 21/07/2011

This is to inform you that the research described in the referred protocol, the consent form and other participant information materials have received full approval by the UI/UCH Ethics Committee.

This approval is from 21/07/2011 to 20/07/2012. If there is delay in starting the research, please inform the UI/UCH Ethics Committee so that the date of approval can be adjusted accordingly. Note that no participant recruitment and/or data collection for this research may be conducted outside of these dates. All approved consent forms must be the study must carry the UI/UCH EC assigned number and duration of UI/UCH EC approval of the study. It is expected that you advise your annual report as well as on special requests for the project referred to the UI/UCH EC early in order to obtain renewal of the approval to avoid disruption of the research.

The Principal Guide for Human Research ethics requires that you strictly comply with all institutional guidelines, rules and regulations as well as with the tenets of the Code including ensuring that all adverse events are reported promptly to the UI/UCH EC. No changes are permitted in the research without prior approval by the UI/UCH EC except in circumstances outlined in the Code. The UI/UCH EC reserves the right to conduct compliance visits to your research site without previous notice.

UI/UCH EC
21 JUL 2011
CONSULTANT

Dr. J. A. [redacted]
Chairman, Medical Ethics Committee
University College Hospital, Ibadan Nigeria
Vice-Chairman, UI/UCH Ethics Committee
E-mail: [redacted]@yahoo.com

Research Units: •Genetics & Bioethics •Malaria •Environmental Sciences •Epidemiology Research & Service
•Behavioural & Social Sciences •Pharmaceutical Sciences •Cancer Research & Services •HIV/AIDS

APPENDIX X

INFORMED CONSENT FORM

IRB Research approval number:

This approval will elapse on:

Title of the research: Housing conditions and perceived health effect among under-five children in Omi-Adio community, Ido Local Government Area, Oyo State. My name is _____. I am a student of the Department of _____Focully of _____ U.I. Ibadan.

Purpose of research: This research is self sponsored. The purpose of this research is to investigate the impact of Housing conditions and perceived health effect on under-five children in Omi-Adio, Ido Local Government Area, Oyo State.

Procedure: The research will be carried out in Omi-Adio community with about 300 participants to be recruited for this study. If you agree to participate in this study, you will be expected to provide some information on a questionnaire. You will also need to grant us access to your house where organisms in the air will be caught from the bedroom as well as measuring some environmental parameters and assessing your building.

Expected duration: The research is expected to take about 3 months during which we will need you to be available in the event that we need to contact you anytime during these 3 months.

Risks: There are no risks involved for your child in taking part in this study.

Costs to the participant: Your participation in this study will not cost you anything.

Benefits: At the end of the study, specific risk factors in your house will be brought to your notice.

Confidentiality: All information provided by you and/ or collected about you and your child will be treated with the utmost confidentiality and will be used only for research purposes. Codes will be given to questionnaire and other data collected so that information cannot be linked back to you.

Voluntariness: Your participation in this research is entirely voluntary. You will not be paid any fees for participating in this research. At any time if you decide to pull out of this research you may do so without any consequence. Please note that some of the information

that has been obtained about you before you chose to withdraw may have been modified or used in reports and publications. These cannot be removed anymore.

Treatment in case of injury: There is no injury expected in the course of this Project.

After the research: You will be informed about any information that may affect your continued participation or your health. If this research leads to any benefits, the researchers will jointly own it. There is no plan to contact any participant now or in the future about any such benefits.

Conflict of interest: There are no conflicts of interest among the researchers.

Statement of person obtaining informed consent:

I have fully explained this research to _____ and have given sufficient information, including the risks and benefits, to make an informed decision.

Date: _____ Signature _____

Name: _____

Statement of person giving informed consent:

I have read the description of the research or have had it translated into language I understand. I understand that my participation is voluntary. I know enough about the purpose, methods, risks and benefits of the research study to judge that I want to take part in it. I understand that I may freely stop being part of this study at any time. I have received a copy of this consent form and additional information sheet to keep for myself.

Date: _____ Signature _____

Name: _____

Witness' signature (if applicable) _____

Witness' name _____

Contact information:

This research has been approved by the UI/UCH Ethical Review Committee, University of Ibadan. Ibadan and the Chairman of this Committee can be contacted at IMRAT, UCH, Ibadan. In addition, if you have any question about your participation in this research, you can contact the principal investigator Miss. Agbolaje Nafisat O. at the Department of Environmental Health, Faculty of Public Health, UCH Ibadan. The phone number is 08057844317/07030370583.

APPENDIX XI

IWE IFITONILETI

Nomba ifowosi iwadi.

Ifowosi iwadi yi yo dopin ni:

Akole iwadi: ipo ilegbe ati ailera ti eyan lero laarin awon omo ti ko to omo odun marun ni agbegba Omi-Adio. Oruko mi ni Agboluaje Nafisat O. Akeko ni ipele keji eko ti agbon to n bojuto isele ojiji, alakosile eto ilera ati ilera ayika ni eka ilere gbogbo gbo ti ile-iwe giga ilu Ibadan (Department of Environmental Health, Faculty of Public Health, U.I. Ibadan)

Eredi iwadi: iwadi yi je eyi ti a nawo si funra wa. Eredi iwadi yi ni lati sewadi ipa ti ipo ti ile-igbe ati awon ailera ti a lero nko larin awon omo ti won ko ti to omo odun marun ni agbagbe Omi-Adio ti ijoba ibile Ido ti ipinle oyo.

Ona ti a ma gba: a o se iwadi yi ni agbegbe omi-Adio pelu awon akopa ti yo to oodunrun. Ti e ba faramo lati kopa ninu iwadi yi, a n reti pe ki e pese idahun si awon oro inu iwe iwadi yi. E o tun gbawalaye lati wo inu yara yin ki a mu awon kokoro aifojuri ninu afefe ati lati se igba ti a lero; a lero pe iwadi yi yo gba to osu meta ninu eyi ti a o fe ki e wa laroworo nitori a le kan si yin nigbakugba larin osu meta yi.

Ewu : ko si ewu Kankan fun omo yin ninu kikopa ninu iwadi yi nitoripe a ti se ohun gbogbo lati ri dajupe ko si ewu atiwipe a ko ni gba nkank an to se foju ri.

Iye owo ti akopa yo san: kikopa omo yin ninu iwadi yi ko ni nayin ni nkankan.

Anfani : Ni eyin iwadi yi, awon nkan to le fa ewu ni ile yin ni a o mu wa si etigbo yin.

iforapamo: gbo awon oro ti e ba so fun wa pelu awon eyi ti a ba gba nipa yin ati omo yin ni a o pamo dara dara atiwipe a o lo fun eredi iwadi yi nikan. A o fi ami si iwe iwadi ookankan ati awon oro ti a ba gba ti yo fi je pe ko ni si bi a se ma le mo oro pato ti a gba lenu yin.

ifara-eni jin: kikopa omo ninu iwadi yi ko pa dan-dan tara ra. A ko ni san owo kankan fun yin nikoripe e kopa ninu iwadi yi. Igbakugba ti e ba fe ki omo yin fa seyin ninu ki kopa re ni o le faseyin laisi abayori kankan. E jowo e mo pe awon oro ti a ti gba ki e to fa seyin ninu kikopa yin ni a le se atunse re ki a si lo fun akosile ati ipolongo iwadi yi. E ko ni le gba pada mo.

Itoju ti ipalara ba wa: ko si ipalara Kankan ti a n reti ninu ise iwadi yi.

Leyin iwadi: a o fi awon oro to ba le se akoba fun ilera tabi titesiwaju yin ni kikopa yin ninu iwadi yi to yin leti.

Ti iwadi yi ba yori si anfani Kankan, awon oluwadi ni won pawopo fun. Ko si ipinnu lati sawari akopa Kankan nisinsin yi tabi lojowaju lori iru anfani bee.

Ede aiyede lori isepataki: ko si ede-aiyede kankan larin awon oluwadi fun iwadi yi.

Oro eni ti ahun gba ise oro ifitonileti

Mo ti se alaye oro iwadi yi ni kikun fun_____ mo si ti so oro toto loni ewu ati anfani ti o ye lati se ipinnu

Docti: _____ ifiwosi_____

Oruko: _____

Oro eni ti a forotaleti:

Mo ti ka akosile oro iwadi yi tabi ti ri ni ede ede ti o yemi dada. Mo loye pe kikopa mi ko pon dandan. Mo mo ohun to po lori eredi, ona, ewu ati anfani iwadi yilati le sepinnu kikopa ninu re. mo loye pe mo ni anfani lati dekun kikopa mi nigbakugba. Mo ti gba eda iwe ifitonileti ati iwe to ni oro afikun lati fi pamo fun ara mi

Docti: _____ ifiwosi_____

oruko: _____

ifowosi ajeri (nibi to ba ye) _____

oruko ajeri _____

aro idaniloju ibapade:

awon igbimo to wa ni igbaju eto ilera lori iwadi ni ile-iwe giga fasity ti ilu Ibadan ti fi owo si iwadi yi atiwipe le ri asoju fun igbimo yi ni ori-oke kerin ni IMRAT ti o wa ni inu ogba ile-iwosan nla (UCH) ni Ibadan. Ni alikun, ti e ba ni ibere kankan lori kikopa yin ninu iwadi yi e le pe alakoso iwadi yi Miss. Agboluaje Nafisat O.ti agbon to n bojuto isele ojiji, alakosile eto ilera ati ilera nyika ni eka ilera gbogbo gbo ti ile-iwe giga ilu Ibadan. Ero alagbeka ni 08057814317/07030370583.