

YOUNG WOMEN'S UNDERSTANDING OF CLIMATE CHANGE AND ITS  
EFFECTS ON MATERNAL/PRENATAL HEALTH OUTCOMES IN NIGERIA,  
WEST AFRICA

by

Adebanke L. Adebayo  
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Committee:

*Gary L. Kreps*

Director

Edward Maibach

Digitally signed by Edward  
Maibach  
Date: 2022.05.03 20:32:57 -0400

*Kevin Wright*

*Anne M. Nicotera*

Department Chairperson

*Christopher E. Clarke*

Program Director

*Matthew J. ...*

Dean, College of Humanities  
and Social Sciences

May 5, 2022

Date:

Spring Semester 2022  
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Fairfax, VA

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by

Adebanke L. Adebayo  
Master of Arts  
Southern Illinois University Edwardsville, 2017  
Bachelor of Arts  
Babcock University, 2013

Director: Gary L. Kreps, University Professor  
Department of Communication

Spring Semester 2022  
George Mason University  
Fairfax, VA

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## **DEDICATION**

This research project is dedicated to Proverbs chapter three verses five to six, my family, and the pursuit of peace.

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## LIST OF ABBREVIATIONS

American College of Obstetricians and Gynecologists .....	ACOG
Environmental Protection Agency .....	EPA
Federation of Gynecology and Obstetrics.....	FIGO
Homozygous Genotype.....	AA
Intergovernmental Panel on Climate Change .....	IPCC
Millennium Development Goals.....	MDGs
Nigerian Metrological Agency .....	NiMet
Non-Governmental Organization.....	NGO
Sickle Cell .....	SS
Social Economic Status.....	SES
Sustainable Development Goals .....	SDGs
United Nations .....	UN
United Nations Children's Fund .....	UNICEF
United Nations Framework Convention on Climate Change .....	UNFCCC
World Health Organization.....	WHO

## **ABSTRACT**

### **YOUNG WOMEN'S UNDERSTANDING OF CLIMATE CHANGE AND ITS EFFECTS ON MATERNAL/PRENATAL HEALTH OUTCOMES IN NIGERIA, WEST AFRICA**

Adebanke L. Adebayo, Ph.D.

George Mason University, 2022

Dissertation Director: Dr. Gary L. Kreps

Climate change is one of the biggest 21st-century global health problems. Developing nations like Nigeria are the hardest hit, with pregnant women being the most vulnerable and at-risk populations. Despite the overwhelming evidence linking climate change to adverse maternal and prenatal health outcomes, only a few studies have investigated Nigeria's climate change and maternal health outcomes. Hence, this study seeks to examine the perspectives of young Nigerian women about climate change and maternal and child health, emphasizing the sociocultural nuances that define their experiences. Building on an earlier autoethnography, this study adapted the Delphi technique and in-depth interviews with women in five distinct groups ( $N=50$ ). The study findings show that women across groups are aware of the changing weather and seasonal patterns and their implications on children, elderly, less privilege and farmers. Also, religious beliefs appear to be a socio-cultural factor that transcends income, education,

and employment in influencing women's perceptions of climate change. The findings in this study have value in translating science-based evidence into understandable and accessible information to raise awareness and help guide environmental policy changes that can enhance maternal health outcomes.

## **CHAPTER ONE: INTRODUCTION**

Climate change is arguably biggest global health problems of the 21st century (Watts et al., 2018), contributing adversely to myriad physical and mental health conditions (World Health Organization, 2018; Centers for Disease Control, 2021). Scientific evidence shows that climate change is an all-encompassing severe threat to wellbeing and ecological sustainability of humanity (Intergovernmental Panel on Climate Change, 2022). The public health harms associated with climate change are rapidly-growing, worldwide, with the harms projected to grow considerably worse if left unchecked (Adebayo, 2019).

Over the past several years, major international organizations such as the World Health Organization (WHO), the United Nations (UN), and the World Bank have introduced influential development programs—including the Sustainable Development Goals (SDGs) and the Millennium Development Goals (MDGs)—to spur global discourse, research, and policy to address the negative influences of climate change on public health (World Health Organization, n.d.). These efforts highlight the important influences that climate change is having on health around the globe, as well as the need to study ways to respond to this pervasive health threat. According to the 2017 Intergovernmental Panel on Climate Change (IPCC) report, climate change is resulting in higher temperatures, severe weather events, and rising seas. All these factors are contributing to heat-related

cardiopulmonary illness, respiratory diseases, infectious disease, mental health, and reproductive health issues in women.

Conversely, the effects of climate of climate on health outcomes are inequitably distributed within and between countries; universally, the consequences of climate change exposure are disproportionately borne by people with low incomes (Levy & Patz, 2015; United Nations, 2020). Societal factors such as poverty, socioeconomic disparities, discrimination, limited access to health care, dangerous occupations, and pre-existing health conditions make some populations even more vulnerable (Healthy People 2020, n.d.). The aforementioned factors make African countries especially vulnerable to climate change issues considering the existing challenges facing the healthcare system (Oleribe et al., 2019). For example, African countries are more likely to encounter systemic challenges in mitigating and adapting to climate change effects (Madu, 2012; Nganga, 2006; Nielsen & Reenberg, 2010; Ogbo et al., 2013). Numerous African countries struggle with infectious diseases, food insecurity, contaminated food and water, and waterborne infections, which can all be exacerbated by climate change issues related to temperature, precipitation, floods, and other related environmental changes (Amegah et al., 2013; Bello, 2012; Asiyanbi, 2015; Sayne, 2011)

African countries have been said to contribute the least to global emissions that lead to climate change (Intergovernmental Panel on Climate Change, 2018). Even though the African continent contributes under 6% of emissions, with per capita emissions of only 0.8 tons per year, well below the global mean of 5 tons, and far lower than for other regions such as Europe and Asia (Intergovernmental Panel on Climate Change, 2018),

African nations have been projected to experience serious climate change effects, such as severe environmental threats to the fight against air pollution, hunger, malnutrition, infectious diseases, and other health-related challenges (Akpodigaga-a & Ojugo, 2010; Campbell-Lendrum & Corvalan, 2007; United Nations Framework Convention on Climate Change, 2020; World Meteorological Organization, 2020; Tagbo, 2010). Hathaway and Maibach (2018) have found that among vulnerable people in Asia and Africa, awareness of increasing health harms due to specific changing climatic conditions is high. With a weak health care infrastructure, developing African countries are least able to cope, prepare, and respond to the negative health effects of climate change (World Health Organization, 2021).

Nigeria is listed among the top 10 countries most vulnerable to climate change (Climate Change Vulnerability Index, 2017). With Nigeria having low levels of precipitation in the north to high precipitation levels in the south, climate change problems can lead to drought and desertification in the north, and then flood and erosion in the south. Climate change is likely to have negative influences on several of the nation's key sectors, such as agriculture–fishery, water, forestry, food security–health, economy, and energy (oil and gas).

Climate change studies in Nigeria have shown that with increasing temperature, the country has begun to experience problems with heat stress, vector-borne diseases, poor water quality, air pollution, and compromised immune systems (Akpodigaga-a & Ojugo, 2010; A. A. Idowu et al., 2011; Okafor & Ezegwui, 2010). Similarly, Adepoju (2019) posits that, due to Nigeria's unique population, the consequences of climate

change are likely to include increased water and food shortages, high exposure to heat stress, and dangerous levels of ultraviolet radiation. Also, climate change influences on rainfall and temperature events can lead to increased incidence of diarrhea, malnutrition, and mortality in young children—under five— in Sub-Saharan Africa (Amegah et al., 2013; Wang et al., 2009).

Climate change can also influence the social and environmental determinants of health, including key factors such as clean air, safe drinking water and food security. These climate change effects can seriously harm the health of the Nigerian population. For example, Nwoke and colleagues (2009) have linked climate change to higher temperatures, which enhance production of various secondary pollutants and, thereafter, increase the frequency of allergic and cardio-respiratory disorders and even deaths caused by these air pollutants. Omoruyi and Onafalujo (2011), explained that other direct consequences of climate change in Nigeria include cerebra-spinal meningitis, cardiovascular respiratory disorder of elderly people, skin cancer, high blood pressure, malaria, cholera and child and maternal health issues.

Several studies have focused more specifically on the direct and indirect negative effects of climate change on child and maternal health outcomes (Adebayo, 2019; Bakhtsiyarava et al., 2018; Grace, 2017; Rylander et al., 2013; Sorensen et al., 2018). However, only a few studies have been conducted concerning these climate-related health issues within Nigeria. For example, Okafor and Ezegwui (2010) examined whether there is a seasonal variation in preeclampsia's presentation undergoing cesarean delivery in a tropical rainforest belt in Nigeria showed that there was seasonal variation in the cesarean



delivery required for preeclampsia/eclampsia patients. An older retrospective study of eclampsia in Lagos—the busiest city in Nigeria—found the incidence of the condition varies significantly with weather changes (Agobe et al., 1981).

During pregnancy, women have a unique immunological condition that causes modulation of the immune system at different stages of the pregnancy which can lead to adverse reactions to environmental toxins and microorganisms (Mor & Cardenas, 2011). During pregnancy, women's ability to thermoregulate is compromised, making them particularly susceptible to extreme heat waves and air pollution (Kuehn & McCormick, 2017; Climate and Health Assessment, 2016).

Studies have shown links between prenatal exposure to environmental chemicals and adverse health outcomes that span the life course and include impacts on fertility and pregnancy, neurodevelopment, and cancer (Di Renzo et al., 2015). Warmer/higher temperatures can allow certain chemicals to breakdown into toxic elements, as well as vaporize and easily enter the air, leading to adverse effects on fertility and pregnancy outcomes (EPA, 2020; WHO, 2021; Borgen Project, 2019). Therefore, prenatal and early childhood exposure to air pollution, especially PM<sub>2.5</sub>, contributes to respiratory illness as well as neurological damages (Rylander, Odland & Sandanger, 2013). Climate change affects how chemicals deposited into the environment by factories, car emissions, and congestion in urban areas interact with the air we breathe—air pollution.

The dangers of these environmental exposures have led the American College of Obstetricians and Gynecologists (ACOG) and the International Federation of Gynecology and Obstetrics (FIGO) to alert members of the reproductive and maternal health

community about the far-reaching effects of climate change on maternal and neonatal health outcomes ( DeNicola, 2020; International Federal of Gynecology and Obstetrics, 2015; American College of Obstetricians and Gynecologist, 2013; American College of Obstetricians and Gynecologist, 2016).

Pregnant and postpartum women and their infants are uniquely vulnerable to the health impacts of climate change, due to the many physiologic and social changes that occur as a result of pregnancy (Bekkar et al., 2020; Di Renzo et al., 2015; Grace et al., 2015; MacVicar et al., 2017). Several studies have reported the adverse influences of low temperatures on birth outcomes of preterm birth low birth weight in developing African countries (Bakhsiyarava, et al., 2018; Grace et al., 2015; Zhang et al., 2017). While there is an association between meteorological variation and birth weight, the magnitude of these associations may vary across ethnic groups with differential socioeconomic resources, which has implications for the introduction of interventions to reduce these gradients and offset the health impacts predicted under climate change (Galvao et al., 2008; MacVicar et al., 2017).

Climate and weather can also affect water and food quality in Nigeria, with serious health implications. The International Federation of Gynecology and Obstetrics (FIGO) recommends that reproductive and other health care professionals advocate for policies to prevent exposure to toxic environmental chemicals to ensure a healthy food system for all, to make environmental health part of health care, and to champion environmental justice.

Many of the harmful health effects of climate change are especially severe for women, developing babies, infants, and children. Therefore, it is important to explore Nigerian women's perceptions about climate change, as well as to investigate key sociocultural factors—age, education, employment, income, and religious belief—that influence their understanding and response to climate change. The sociocultural factors that define their perception of climate change are pertinent to translating science-based evidence into understandable, accessible, and culturally sensitive information to raise awareness and help guide environmental policy changes that can enhance maternal health outcomes. Exploring women's perceptions of climate change also has potential to identify ways Nigerian women could mitigate the adverse maternal health-related influences to promote better health outcomes.

## **CHAPTER TWO: CLIMATE CHANGE, NEWS COVERAGE, AND CULTURE IN NIGERIA**

This chapter presents an overview of climate change and health in Nigeria. The chapter is divided into five major sections and begins with a geographic and climate description of Nigeria. The second section covers climate change health implications and its effects on Nigeria's maternal/prenatal health outcomes. This is followed by an overview of the media coverage of climate change in Nigeria. The fourth section presents the cultural factors that influence the perception of climate change in Nigeria. And the last section highlights the theoretical framework that guides this study. Finally, the research questions and hypotheses that this study seeks to investigate are presented.

### **Overview of Nigeria**

Nigeria is in West Africa—bordering Niger in the north, Cameroon in the west, Benin in the west, and Gulf of Guinea in the South. Nigeria is the most populous African country and seventh in the world with over 200million people. She is often considered the giant of Africa because of its population and economy. Nigeria has the largest economy in Sub Saharan Africa and relies heavily on crude oil export. Aside from crude oil being the major source of Nigeria's economy, agriculture plays a pivotal role in the local economy and general sustainability of the population.

Nigeria has a richly diverse culture as reflected in the over 250 ethnic groups and 500 spoken languages/dialects, with English as the official language. She has diverse geography, with climates ranging from arid to humid equatorial—equatorial in south, tropical in center, and arid in north. Nigeria has a tropical climate with variable rainy and dry seasons, depending on location—more rainy days in the south, west, and east, and less precipitation in the north and northeast.

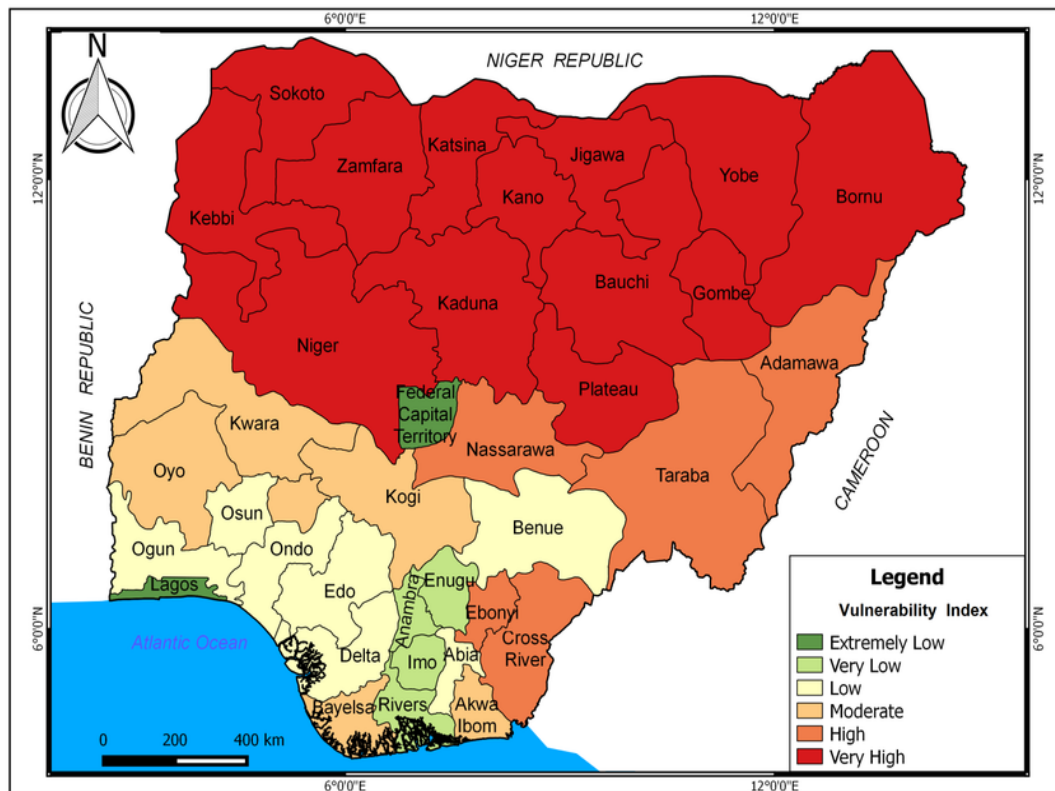


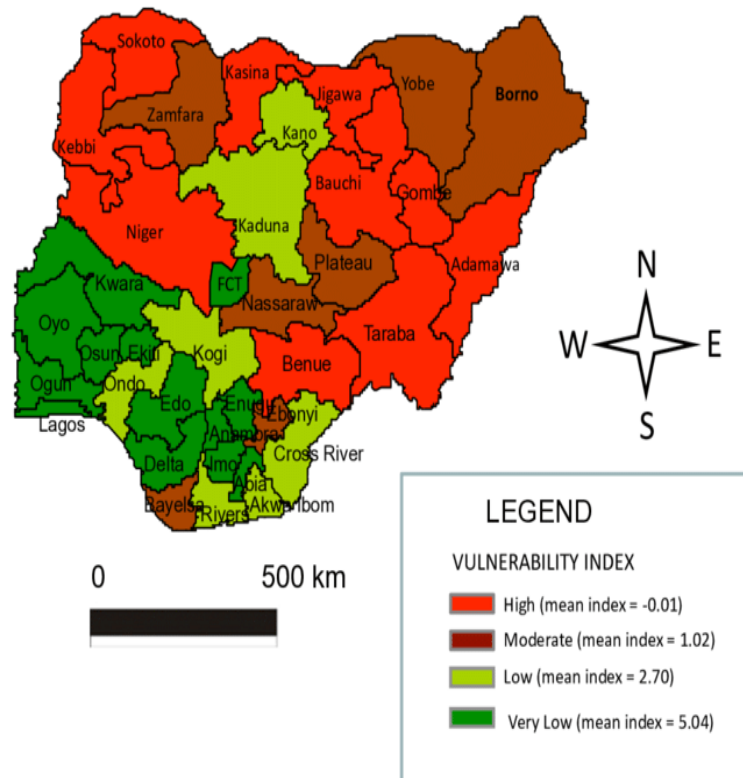
Figure 1: Patterns of Climate Change Vulnerability in Nigeria (Madu, 2016)

With Nigeria having low precipitation in the north to high precipitation in the south, the climate change can lead to drought and desertification in the north, then flood and erosion in the south. Climate change would most likely impact sectors such as agriculture, fisheries, food security, water, forestry, health, economy and energy. Climate change studies in Nigeria have shown that with the increasing temperature, the impact from climate changes would include heat stress, vector species, water quality, air pollution, and immune suppression (Akpodiogaga & Odjugo, 2010; Okafor & Ezegwui, 2010; Idowu, Ayoola, Opele & Ikenweiwe, 2011). Also, there are extreme impacts of rainfall and temperature events on the incidence of diarrhea, malnutrition and mortality in young children—under five— in Sub-Saharan Africa which has raised concerns among international organizations (Wang et al., 2009). Hence, the discourse around climate often revolves around agricultural related issues such as flood and drought and the effect it is having on the country's economy (Barau & Tanko, 2018; Idowu et al., 2011; Ifeanyiobi et al. 2014; Onyeneke, 2018).

### **Climate Change Health Implications in Nigeria**

Health experts posit that climate crisis is a threat multiplier, particularly for communities already suffering from environmental injustice. The 2017 IPCC report highlights, for example, how higher temperatures, severe weather events and rising seas can contribute to heat-related cardiopulmonary illness, respiratory diseases, infectious

disease, mental-health and reproductive health issues. Similarly, societal factors such as poverty, discrimination, access to health care and pre-existing health conditions make some populations even more vulnerable (Barlett, 2008; Davenport et al., 2017; Galvão et al., 2009; McMichael et al., 2008; Nganga, 2006).



*Figure 2: Rural Households Climate Change Vulnerability in Nigeria (Madu, 2012)*

Climate change has serious implications for human health in Nigeria. Direct health impacts stem from extreme events such as heat waves, floods, droughts, windstorms, and wildfires (BNRCC, 2011). Currently, there are numerous news reports of extreme heat waves across the country (The Guardian, 2021). According to the Nigerian Metrological Agency NiMet, the rising heatwave in the month of March is caused by North Western and South Western air masses from the Sahara and Atlantic Ocean which generates so much heat during the transition month period of March-April. According to the agency, these temperatures are said to have been increasing in the last 5 years (NiMet, 2021). In the last five years, the whole country has been experiencing intense heatwave. For example, in the first four months of 2019 the mercury rose up to five degrees higher than average – around 35 degrees Celsius – in the humid commercial capital (BBC, 2019). In 2019, there were recorded incidences of deaths from heatwave in the northeastern part of Nigeria (BBC, 2019; Aljazeera, 2019).

High temperatures can trigger increased incidence of tropical diseases, such as heat cramps, heat strokes, cerebrospinal meningitis, and malaria (Amadi & Udo, 2015; Osuafor & Nnorom, 2014). In the savanna and Sahelian region, drought and high temperatures, reducing freshwater quantity, has increased heat stress, compromised hygiene and raised the risk of diarrhea and other water-borne diseases such as typhoid fever, cholera and river blindness (Amegah et al., 2013; Barau & Tanko, 2018; Building Nigeria's Response to Climate Change, 2011; Hagos et al., 2014; Onah et al., 2016).



Indirect effects of climate change can arise from malnutrition due to food shortages; from the spread of infectious disease and food- and water-borne illness; and from increased air pollution (Abdulkadir et al., 2017; Building Nigeria's Response to Climate Change, 2011). Aside from malnutrition, climate variability and extreme weather and climate events are among the key drivers of the recent increase in global hunger (World Meteorological Organization, 2020). Rising temperatures, rising sea levels, floods and changes in rainfall pattern affect fresh water supply, which can predispose people to infection and other health challenges (Onah et al., 2016). Similarly, rising temperatures and changes in rain fall patterns can climate-induced disasters such as population displacement. For example, 2019 recorded a deteriorating food security situation in sub-Saharan Africa, as well as increased population displacement (see figure 3).

Cases of cerebrospinal meningitis have been found to correlate positively with the highest maximum temperature of the northern dry season (Osuafor & Nnorom, 2014). In the past five years, studies found that meningitis cases in Northwest Nigeria may increase in the future due primarily to warmer temperatures as in the case of the current heatwaves that has typified the country's climate. During the peak of the season, cases could potentially increase because of climate change by 32–38 percent for 2020–35 and by 43–91 percent for 2060–75 (Abdussalam et al., 2014).

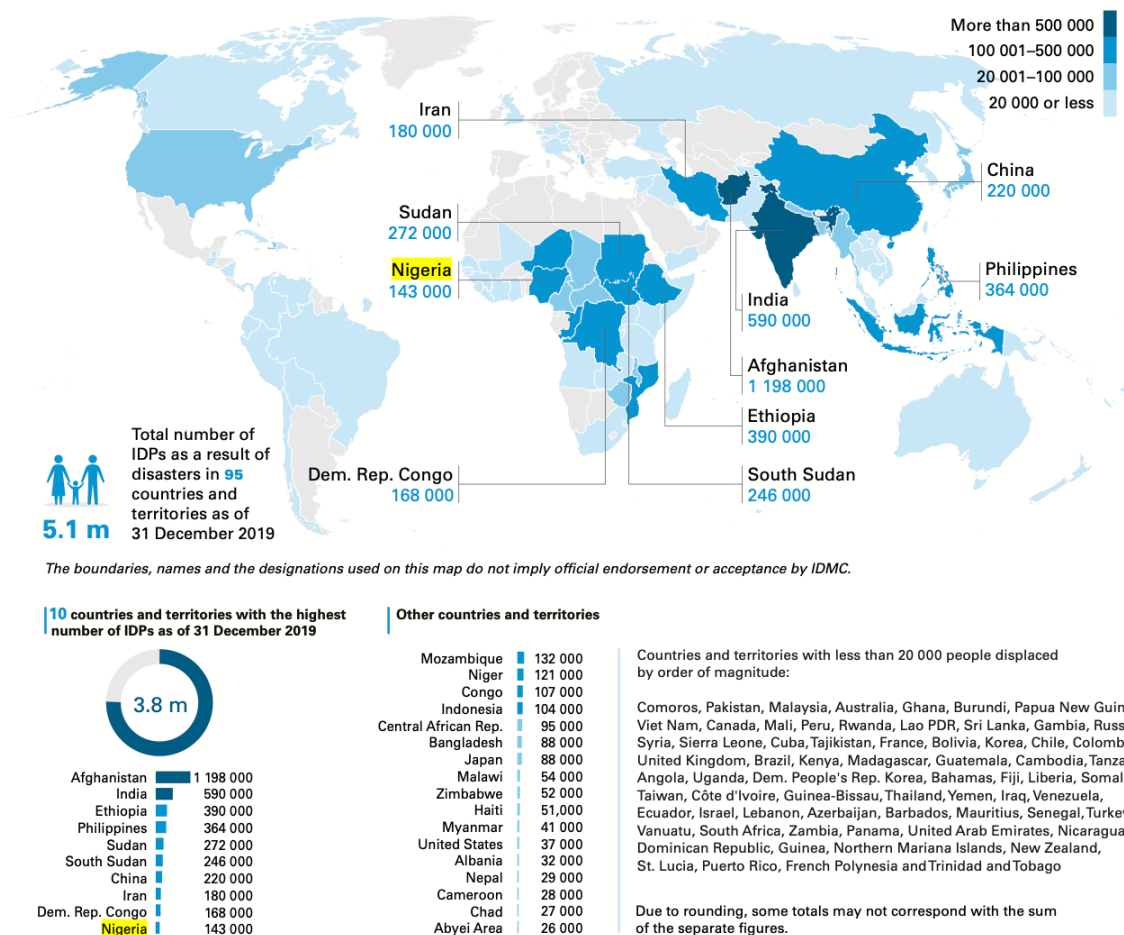


Figure 3: Global Report of Internal Displacement (Internal Displacement Monitoring Center, 2020)

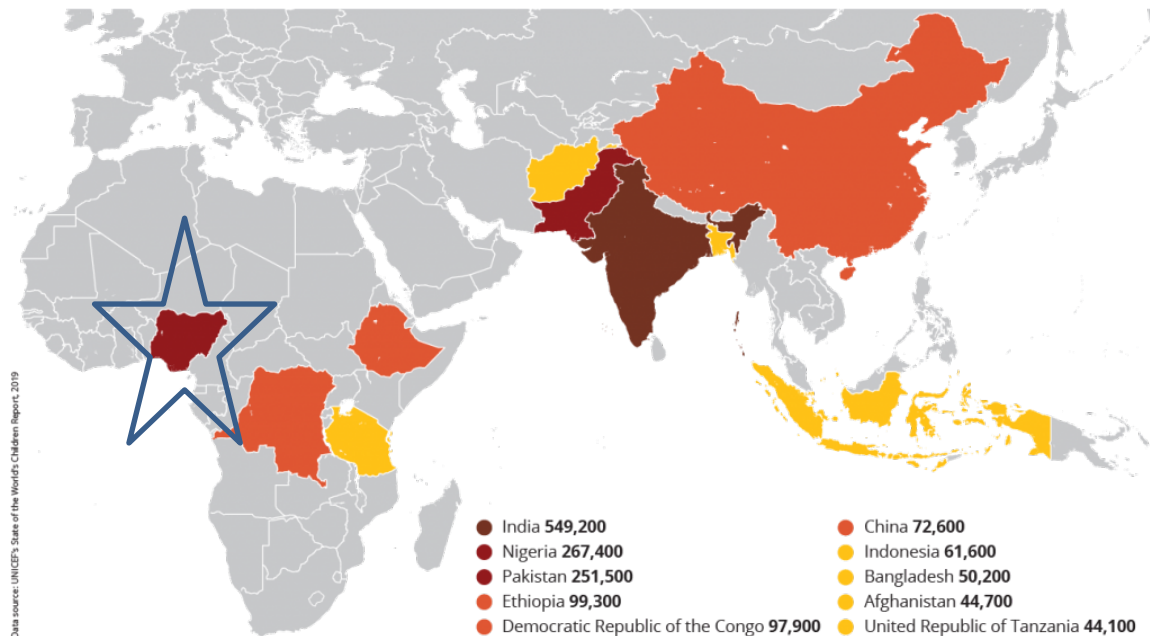
In coastal eco-zones, windstorms and extreme rainfall, rising sea levels and floods can cause injuries, drowning, death, severe physical and mental trauma, particularly for citizens who live along major river deltas, on islands and in low-lying coastal areas (Abdulkadir et al., 2017; Amanchukwu et al., 2015). Increased rainfall intensity,

flooding, stagnated water and polluted ground water increases outbreaks of water-borne diseases and other diseases like hepatitis and malaria commonly experienced in Southern Nigeria (Ebele and Emodi, 2016; Osuafor and Nnorom, 2014; BNRCC, 2011). Heavy rainfall events can also lead to contaminated drinking water from sewage, industrial and chemical waste, which can lead to the outbreak of infections (Ebele and Emodi, 2016; BNRCC, 2011). In parts of Southern Nigeria, for example, flooding from sea level rise has contaminated freshwater aquifers, rivers, and stock-watering points. This has increased salinity in these bodies of water and polluted them with sediment and sewage (Sayne, 2011).

### ***Climate Change Effect on Maternal/Prenatal Health***

According to UNICEF, the first 28 days of life which is referred to, as the neonatal period is the most vulnerable time for a child's survival (UNICEF, 2017). Children are often faced with the highest risk of dying in their first month of life at an average global rate of 18 deaths per 1,000 live births in 2017 (WHO, 2018). Globally, 2.5 million children died in the first month of life in 2017 alone—approximately 7,000 neonatal deaths every single day, most of which occurred in the first week of birth—about 1 million dying on the first day and close to 1 million dying within the next six days (UNICEF, 2018). Most of these neonatal deaths are happening in developing countries such as; India, Pakistan, *Nigeria*, China, Bangladesh, the Democratic Republic of the Congo, Ethiopia, Indonesia, Afghanistan and the United Republic of Tanzania (UNICEF, 2012 & Lancet, 2016). In Nigeria, the number of neonates that still die of

preventable/treatable causes and diseases as at the year 2020 is as high as 38 per 1,000 live births (UN-IGME, 2019; WHO, 2020).



*Figure 4: Global Prenatal and Newborn Deaths, 2018*

Similarly, according to the World Health Organization (WHO) approximately 830 women die every day from pregnancy and child related causes and 99% of all maternal deaths occur in developing nations (WHO, 2018). It is pertinent to note that nearly 20% of all global maternal deaths happen in Nigeria (WHO, 2020). When compared to other

developed countries, Nigerian woman has a 1 in 22 lifetime risk of dying during pregnancy, childbirth or postpartum/post-abortion, whereas in the most developed countries, the lifetime risk is 1 in 4900 (WHO, 2020).

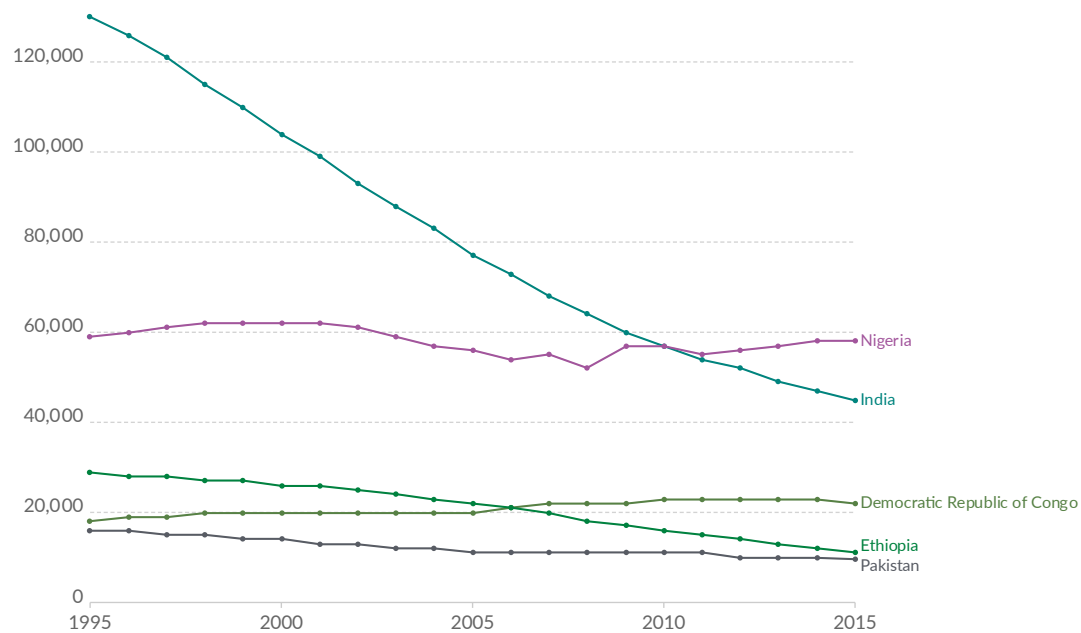
With these alarming statistics and the prevalent health climate change impact on maternal and neonatal health, the mortality numbers might not decrease at the desired pace suggested in the Sustainable Development Goal 3 (SDG) and Millennium Development Goal 5 (MDG) globally and nationally respectively (United Nations, 2016). The issue of climate change has sparked a lot of controversial discussions both in the media and among the public about if and how climate change might be affecting maternal and prenatal health outcomes, especially in developed countries.

The alarming statistics that define problems with maternal and neonatal health in Nigeria will most likely continue to grow as the effect of climate change increases (Orellana, 2021; Sorenson, 2018). There is evidence that temperature extremes lead to negative birth outcomes, including: changes in the length of gestation, birth weight, stillbirth, and neonatal stress from unusually hot temperature exposures (Grace et al., 2015; Lam & Miron, 1996; MacVicar, et al.; Kuehn & McCormick, 2017; Zhang, Yu, & Wang, 2017). According to IPCC, the increasing global temperature and its detrimental influences on neonatal and maternal health has led them to strong concerns about the negative influences of climate change on the growth and development of babies both before (pre-natal) and after (post-natal) birth. However, climate change-related health issues will adversely affect developing nations—like Nigeria— already dealing with an

array of public health issues such as malaria, diarrheal diseases, diabetes, and tuberculosis (Lancet, 2000; & WHO, 2015).

### Number of maternal deaths

The number of women who die from pregnancy-related causes.



Source: World Health Organization (WHO); UNICEF  
 Note: A maternal death refers to the death of a woman while pregnant or within 42 days of termination of pregnancy. Included are deaths from any cause related to or aggravated by the pregnancy but not from accidental or incidental causes.

OurWorldInData.org/maternal-mortality • CC BY

*Figure 5: Maternal Deaths in the Top Five Countries in 2015*

Human health, already compromised by a range of environmental and socioeconomic factors in Nigeria, could be further harmed by climate change and climate variability,

such as from malaria (IPCC, 2014). Human health is predicted to be adversely affected by projected climate change. Temperature rises will extend the habitats of vectors of diseases such as malaria that greatly harms the health of children. Droughts and flooding, where sanitary infrastructure is inadequate, will result in increased frequency of epidemics and enteric diseases with maternal and neonatal health being the most vulnerable in developing nations (Bakhtsiyarava et al., 2018; Intergovernmental Panel Climate Change).

Pregnant and postpartum women and their infants are uniquely vulnerable to the health impacts of climate change, due to the many physiologic and social changes that occur as a result of pregnancy (Anderko et al., 2020; Bick, 2009; Rylander et al., 2013). As mentioned earlier, climate-related exposures may lead to adverse pregnancy and newborn health outcomes, including spontaneous abortion, low birth weight, preterm birth, increased neonatal death, dehydration and associated renal failure, malnutrition, diarrhea, and respiratory disease. According to Balbus and colleagues (2016), pregnant women are vulnerable to temperature extremes and are especially susceptible to dehydration, which releases labor-inducing hormones. Newborns are especially sensitive to ambient temperature extremes because their capacity for regulating body temperature is limited.

Molina and Saldarriaga (2017) have identified five pathways through which climate change temperature can affect the growth and development of a healthy fetus which includes exposure to extreme temperatures, maternal infection by a temperature-sensitive disease (e.g., respiratory infections) or by a biological vector-borne disease,

maternal mental illnesses, and food insecurity brought about by less predictable growing conditions. However, communicating the negative effects due to these pathways to indigenous people might be challenging (Nielsen & Reenberg, 2010). For example, it is easier to describe the need for nutrition as compared to the consequences and responses to being exposed to extreme temperatures, especially to women who are busy co-bread winners of their families and go about their daily hustle to make ends meet for their families. The extreme temperature is least considered when they are hungry mouths to feed.

Furthermore, drought and flood reduce pregnant women's access to safe food and water, resulting in adverse psychological stress and disrupted health care, and increasing their vulnerability to dehydration (leading to pre-term labor) and infectious agents (Bakhtsiyarava et al., 2018; Hagos et al., 2014). The floods places pregnant women at increased risk of exposure to environmental toxins and mold (Balbus et al., 2016; Korten et al., 2017).

Although most of the effects of climate change on health are yet to be foregrounded in climate research in Nigeria, it does not change the population's vulnerability and the current adverse health effects that are yet to be accounted for. Therefore, this study aims to assess the perceptions of climate change in Nigeria, the socio-cultural and economic factors that influences these perceptions, with the eventual aim of increasing climate change awareness and influencing protective health behaviors especially among women.



## **Media Coverage of Climate Change in Nigeria**

Over the past couple of years, international organizations including the World Health Organization (World Health Organization, 2018), the United Nations (UN) and other governmental have conducted considerable research synthesis and instigated considerable media discourse around the public health impacts of climate change. The health concerns raised from the global discourse of climate change has led to the issuance of a global health concern (IPCC, 2017; Healthy People 2020; WHO, 2015).

Within the global context, climate change as a public health issue is prevalent, and the same is often projected to African nations (UNFCCC, 2020; Guardian, 2020). However, within the Nigerian context and Africa at large, there is a different discourse regarding climate change and its effects. For example, the media in Nigeria report climate change issues through the local and national lenses and not the global context as expected because the global report shows increasing climate change threats for human health in the continent (Abdulhamid, 2011; Batta et al., 2013; Nwabueze et al., 2015). These media reports are centered on the negative effects of climate change on agricultural yields, economic strains, and infrastructural damage which will be exacerbated with frequent extreme weather events (Nwabueze & Egbra, 2016; Tagbo, 2010; Ukonu et al., 2012).

Adebayo (in press) conducted a content analysis of climate reporting in the top five Nigerian newspapers, finding a dominant focus on agricultural and economic issues rather than public health. After studying media representation of environmental issues in Nigeria, one study found that overall, the media gives poor coverage to environmental

issues (Nwosu & Uffoh, 2016; Okoro, 2012). Nigeria media reports were almost indifferent about reporting climate change issues (Nwabueze, 2008).

Before Nigeria signed the SDGs, climate change was reported in only a handful of the major agenda-setting news outlets. It is only until recently, after signing the Sustainable Development Goals (SDGs) and Millennium Development Goals (MDGs) in 2015, that Nigeria began to accentuate climate change effects on health because both the MDGs and SDGs highlight the impact of climate change on the environment, agriculture, and health. Even with MDGs and SDGs highlighting climate change threats, the news coverage were lagging in climate change reports, primarily as related to health. And, most of the newsworthy coverages related to climate change were championed by individual efforts and non-governmental organization campaigns (Tagbo, 2010; Ukonu et al., 2012).

In the last decade, there has been increase in news coverage of environmental related issue, especially after signing the MDG and SDG agreements. After 2015, the media started to report climate change issues across boards such as irregular rain fall, flood, health issues, drought, rising ocean levels, submerging riverine communities, vulnerable population and desertification (Emenyeonu, 2017; Nwabueze et al., 2015; Obar et al., 2019). With increased news media coverage of climate change, those in the agricultural sector became more aware of the serious environmental threat, especially its impact on agricultural productivity–food quality and supply (Enete & Amusa, 2010) and economic effects (Abdulhamid, 2011; Anyadike, 2009). The country faces a wide range of environmental challenges. Some of the specific phenomena include climate change,

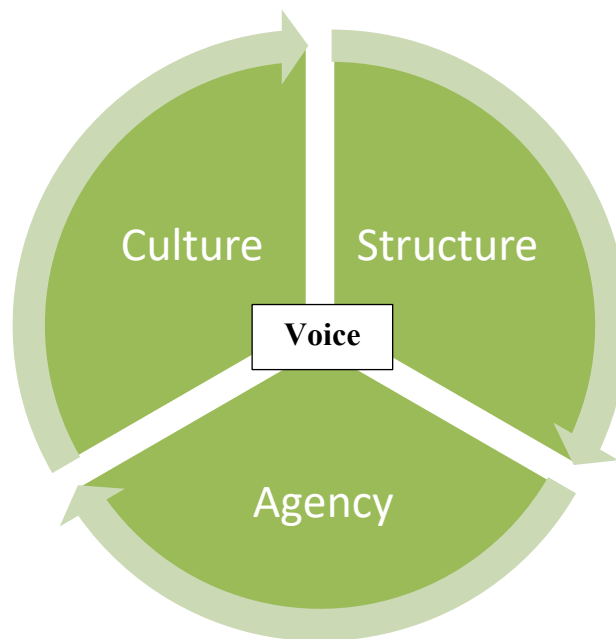
which is negatively affecting every sector of the country's economy, particularly agriculture and water resources (Department of Climate Change, Federal Ministry of Environment, Nigeria, 2021). Hence, it is through these lenses that climate change is mostly viewed because of its apparent and significant impact on agricultural sustainability and economic growth (Department of Climate Change, Federal Ministry of Environment, Nigeria, 2021; World Meteorological Organization, 2020). This supports the notion that “media discourses help shape and set the parameters of discussion and understanding of environmental issues” (Hansen, 1991, p. 500).

### **Culture and Cultural Factors that Influence the Perceptions of Climate Change in Nigeria**

Since people are the victims of the negative impacts of climate change as well the drivers of climate change (Anyanwu & Nwajiuba, 2021), it is important to explore the cultural factors that influence the perceptions of climate change and the responses to these perceptions in Nigeria. Hence, this section briefly presents these cultural factors and influence on climate change perceptions in Nigeria.

Culture is often defined as the way of life of people. This is true but vague. Hofstede (1991) defined culture as the collective programming of the mind which distinguishes the members of one group or category of people from another. While Hofstede defined *culture* as the collective programming of the mind, Dutta (2008) viewed culture as a process that is a continuous state of production and reconfiguration through communication. Dutta's definition foregrounds the dynamic nature of culture and the

interactive piece with other members of the society and the environment. However, to bring the ideas within this discourse into perspective, culture would be defined as the set of attitudes, values, beliefs, and behaviors shared by a group of people, but different for each individual, communicated from one generation to the next (Matsumoto et al., 1996). This definition highlights the richness and individual interpretation of society's interactions and the nuanced differences in a culturally diverse society like Nigeria.



*Figure 6: Dutta, M. J. (2008). Communicating Health: A Culture Centered Approach*

Ignatow (2006) found that national culture can have substantial effects on environmental concern. Hofstede (1984) and Tompenaars (1998) argue that culture exerts a powerful influence on people's behaviors. Culture affects not only the inquisitiveness of the members of society but also their rate of tolerance for change, discovery, and innovation (Wallace, 2001). Consequently, people with the same goals in different cultures will not act the same to achieve their goals. Schultz (2002) noted that very different reasons for different people could drive environmental concerns. This is very important because of the diverse cultures and ethnicities in Nigeria.

Nigeria is generally a collectivist nation. People in Nigeria believe that the group is more important than the individual. In this sense, the group might not be the national group per se, but the different ethnicities and cultures within the national group. The group provides help and safety in exchange for loyalty. The group always comes before the individual. The importance of social relations (the core element of a collectivistic culture) leads people to work harder toward goals that benefit the group rather than the individual. In collectivist nations, people tend to be more influenced by social norms, display a willingness to share resources, and focus on long-term goals to benefit the group (McCarty & Shrum, 2001). Schultz (2002) reflected on his findings of collectivistic cultures concluding that such cultures are more likely to engage in pro-environmental behavior, noting that there are differences in respondents' attitudes even within cultures. Although this is the overarching perception of Nigeria's national culture, it has, in numerous ways, being influenced by western cultures. For example, the extended family is beginning to be pushed to the background, while nuclear families exist

independent of close relational ties to the extended family, as used to be the case.

Therefore, if there was a mid-ground between the collective and individual, that is precisely where the current Nigeria's culture should be situated. This would mean that generalized notions of collectivist cultures would need to be reevaluated to understand how specific cultural norms influence health communication practices.

Any given group's cultural characteristics may be directly or indirectly associated with health-related priorities, decisions, behaviors, and/or with acceptance and adoption of health education and health communication programs and messages (Pasick et al., 1996). This implies that culture presents the local contexts within which health meanings are constituted and negotiated. Culture provides the communicative framework for health meanings such that members of the community come to understand that health and illness are embedded within cultural beliefs, values, and practices. These beliefs are contextual, and the health meanings are localized within such indigenous cultures and dynamics.

According to Slater (1996), in health communication, the process of partitioning large and heterogeneous populations into smaller, more homogeneous subgroups is known as audience segmentation. Audience segmentation is a well-accepted best practice in health communication and is an essential first step in developing health communication programs. Culture has always been used as an essential audience-segmentation variable because it helps contextualize health meaning and information.

Therefore, to understand climate change's discourse and its effects on health, it is essential to engage it through the cultural and environmental framework. Society's response to every dimension of global climate change is mediated by culture and the

environment in which they cohabit. Culture influences the overall perception of risk; factors that impact risk perception include efficacy beliefs (self, collective, outcome), often defined by one's culture or co-culture, personal experience, and social inequality or group diversity. Environmental problems are particularly insidious because they develop slowly. As long as the change occurs slowly, we adapt to the surroundings and are unlikely to detect a change. From one day to the next, we notice little (if any) change in the natural world around us or even changes in our lifestyles. Nevertheless, if we were to jump ten years into the future, we would likely notice a substantial change (Schultz, 2002). However, this might be the case for Nigeria if immediate actions are not taken to mitigate climate change's health risk impact.

Even if the Nigerian framing of climate change becomes more health-centered, structural factors will mitigate appropriate protective actions, especially for women and children. Also, protective actions would differ from one region of the country to another because of the climate variations earlier mentioned. It is pertinent to note that although self-efficacy is an individual belief, social and physical environmental barriers can undermine people's sense of self-efficacy and thereby reduce the likelihood that they will engage in self-protective behaviors. When women are educated about the risk of climate change, structures need to be put in place to enable them to take protective actions. There is a need for fundamental resources in the environment as the structure that surrounds the individual can influence self-efficacy.

Environmental problems are often caused by human behaviors; and solving these problems will require changes in behavior. At the very core of environmental problems is

an individual's understanding of their relationship with the natural environment. All cultures that exist today and throughout history have addressed the relationship between individuals and the natural environment. Just as every culture has a prescribed set of rules for social interaction, culture also frames the relationship between the individual and nature. As environmental problems have become more apparent, our understanding of the problems, and the solutions we develop to address the problems, occur through the filter of culture.

Based on the individual and group factors that impact the environment, we can classify the problems associated with Nigeria's environmental issues into two. First is the consumption of natural resources with little or no sustainability because of the general belief that nature replenishes itself. Aside from the need for educational intervention, this perceived belief might, in some ways, negatively impact the population's perception of environmental health. Secondly, population growth has been a challenge. An increase in population would mean more natural resource consumption, greater demand for resources, and more pollution and waste. The projection of Nigeria's population growth is alarming and disproportionately so in the northern region. Population control is actively part of the nation's health policies to control population growth.

Aside from the general belief around the consumption of natural resources and population growth, corruption and economic challenges cripple the masses' perception of the environment. Most people are more concerned about the end of the day and the end of the month than the distant future, which is not perceived as an imminent threat. Even with the current agricultural framing of climate change, we mostly see farmers lamenting



about the impact of floods, decreased rainfall, and excessive heat (Bello, 2012; Ozor et al., 2010).

Culture is essential for understanding both mitigation of and adaptation to climate change, and of course, plays its part in framing climate change as a phenomenon of concern to society. According to Adger, Barnett, Brown, Marshall, and O'Brien, culture is embedded in the dominant modes of production, consumption, lifestyles, and social organization that gives rise to greenhouse gas emissions. The consequences of these emissions—climate change impacts—are given meaning through cultural interpretations of science and risk (Adger et al., 2013).

Cultural factors shape how people support adaptive interventions and their motivation to respond to them. The attachment that people have to their community may be a significant predictor of how they might adapt, and support strategies designed at higher levels. Culture can be a barrier to adopting healthy behaviors, but it can also be adapted to shift the narrative if studied.

We need to understand how to appropriately communicate the health risk that climate change poses, which should involve the negotiation of shared meanings embedded in the population's socially constructed identities, relationships, and social norms. Recognizing the societal context of many public health problems—and implicitly acknowledging the social nature of solutions—is an essential step toward making real progress in improving health and health outcomes. The narrative of climate change and its effects on health need to be framed into the existing values, beliefs, norms, and structures in society.

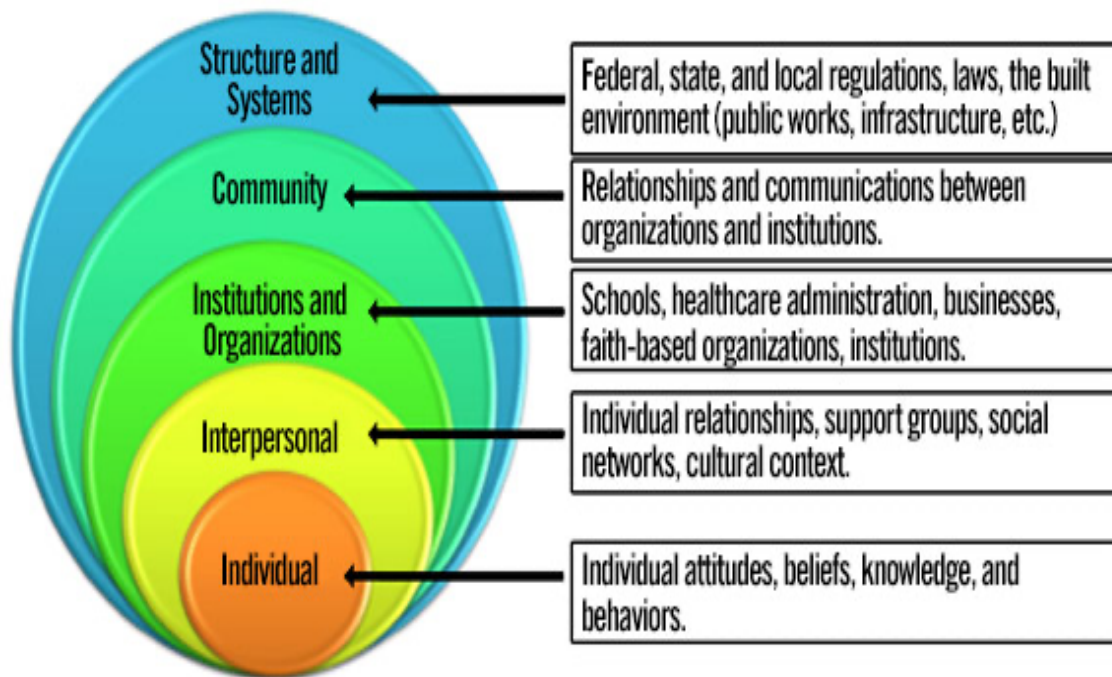
## **Theoretical Framework**

We already know that culture and environment play key roles in major health communication and health behavior theories. For example, in the Health Belief Model, one of the key antecedents of behavioral intention in the model is “perception”—perception of susceptibility, severity, benefit and barriers. However, the model does not adequately account for the cultural situations where the behavior is located within a broader culture, sub-culture, and practices. The perception of a health threat is influenced by our way of life, beliefs, norms, and values. The model does not consider some of the social determinants of health that mitigate individuals from making certain decisions or protective health behaviors. This also applies to Witte’s Extended Parallel Process Model, which emphasizes the individuals’ role and ignores how collective—social reality—is shaping and directing behaviors. Because belief is core to raising awareness or creating messages targeted at changing perceptions or taking protective behaviors, it should be woven into the discourse. Therefore, to understand the perceptions, make recommendations, or create interventions related to health issues, there is need first to address the beliefs, social norms, and cultural values of the target population, to better evaluate how to frame health communication messages that would not have a boomerang effect.

To design interventions that would be effective, we need to take these theoretical gaps into perspective, the collectivist culture, and the nuanced cultural differences within the national culture. Because of Nigeria’s collectivist nature, interventions have to

consider the individual, the society, and the environment. Any intervention should cut across these levels and engagement and impact individual and collective health behaviors. The ecological model/the people and place model lends itself to exploring the perceptions of climate change and its effect among Nigerian women.

To explore the perception of climate change in Nigeria, especially as it relates to maternal and child health outcomes in Nigeria, the following theories and interpersonal concepts would be used; a) people and places model that examines the interaction between individuals and the environment as integral to health outcome b) knowledge gap hypothesis that explores the increasing differences in knowledge due to socioeconomic factors c) the relational self d) social structures and functions that define health awareness, actions and behavior in the community. The interpersonal concepts are fundamental to appropriately foregrounding the socio-cultural issues that typify climate change perception in Nigeria.



*Figure 7: Social Ecological Model*

### ***Ecological Model (People and Places Model)***

The interaction between individuals and the environment has been essential to health outcomes. Healthy behaviors are maximized when the environment and policies encourage healthy decisions alongside the required education and motivation to make those decisions. Therefore, the ecological model combines the individual, environmental, and policy level engagement to achieve sustainable positive changes and maintain healthy behaviors. The ecological model–People and Places Model posits that population health is influenced by the people's attributes, environment, and the interaction between

both (E. W. Maibach et al., 2007). These attributes and their interactions influence health behaviors and, by extension, overall health outcomes.

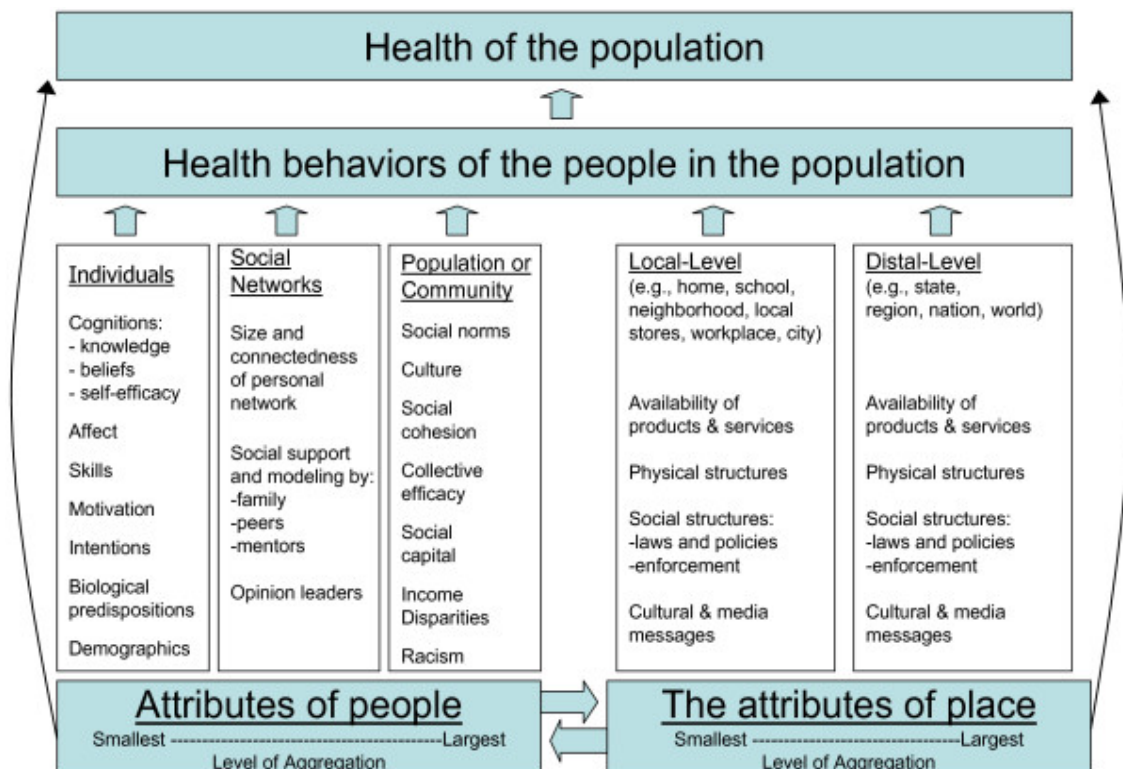


Figure 8: People and Places Model

The People and Places Model can be applied to understand how people take actions and decisions to protect themselves using the people and place attributes.

The *people's field of influence* includes individual, social network, and community factors essential to understanding people's actions to protect themselves. For example, the confidence in women's ability to take actions to protect themselves against specific impacts of climate change on their health during their pregnancy is an essential efficacious act and there are social and physical environmental barriers that can impede their self-efficacy. Hence the need for fundamental environmental resources to positively influence the ability to engage in protective efficacious acts.

Education and health literacy, coupled with their social network, can influence women's decisions towards protective actions. For example, in collectivist cultures like Nigeria, the social network is integral to understanding the community. The potential influence of significant community members is an inherent part of the collectivist culture, which differs across regions in the country. The influence can be from family, friends, peers, religious leaders, and chiefs. The individual and social group's identity affects behaviors. The uptake of health-orientated behaviors can be inhibited or enhanced by personal motivation, intentions, and social networks. Social networks are so essential that one woman–opinion leader–in her network with the correct information can get other women on board even if the others lack “literacy.” If the opinion leader can communicate climate change effects or health benefits from taking protective action, other women would tag along.

Therefore, it is important to engage the local contexts within which health meanings are constituted and negotiated because culture provides the communicative framework for health meanings such that how members of the community come to

understand health and illness are embedded within the cultural beliefs, values, and practices (Adger et al., 2009; Nielsen & Reenberg, 2010). These beliefs are contextual, and the health meanings are localized within such indigenous cultures and are dynamic.

Although people's attributes are determining factors to women's health behaviors in Nigeria, *the place attributes* also pose significant challenges to engaging in health behaviors. We know that people make health decisions based on the context of the social and cultural environment in which they live. Peoples' health is also affected by their physical environment—limiting or enabling factors created by society. *Place attributes* highlight some of the environmental factors that influence making these health decisions. Place attributes are described as the availability of products and services and physical and social structures manifested at the local and distal levels. The place attribute can be synonymous with the social determinants of health, which are conditions—social, physical, and economic—in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks. All these factors can influence perceptions of climate change and its effects.

There is a lot to be done in the aspect of *place* to motivate and maintain protective behaviors among women and pregnant women. For example, the access to health information and services. As mentioned earlier, in Nigeria, climate change is primarily framed as an agricultural and economic issue, which is understandable because the nation's economy relies on it. However, there are many local and distal availability to product and services that need to be put in place, such as a) basic awareness, b) accessible

health information, c) encouraging health care providers to share the imminent climate change health risk with pregnant women, d) encouraging women to call for some policy changes that will positively impact the community and e) implementing nationwide policies. Overall, it is essential to provide women (pregnant women) with the motivation and skills to change their behaviors; however, without enabling environmental factors and policies, it will be challenging to actively engage the motivation and skills to make healthy decisions or pursue healthy behaviors.

### ***Knowledge Gap Hypothesis***

While socio-cultural factors might influence climate change perceptions, it is also essential to understand how these factors can create differences across groups. The knowledge gap hypothesis posits increasing differences in knowledge due to socioeconomic factors (Tichenor et al., 1970). The knowledge gap is defined “as the infusion of mass media information into a social system increases higher socioeconomic status segments tend to acquire this information faster than lower socioeconomic status population segments. Hence the gap in knowledge between the two tends to increase rather than decrease” (Tichenor et al., 1970). Access to information differs across different SES groups and inevitably widens the gap between lower and higher economic status of the population. Hence, as the knowledge gap widens, people of the higher economic class gain the most benefits. Therefore, it is pertinent to explore how unequal distribution of information can influence perception and understanding of climate change and climate change information. As well as acknowledge the cognitive differences in the



ability to process information, level of prior knowledge, and social networks that education strongly influences (Tichenor et al., 1970).

It is essential to consider the basic assumptions of the knowledge gap hypothesis; SES and knowledge are often correlated, and the distribution of new information increases the gap between lower and higher educated groups in society. Moreover, how these assumptions intersect with exploring the socio-cultural factors that might define young Nigerian women's perception of climate change and the understanding of related information. Although the knowledge gap hypothesis was initially centered around mass media, studies dealing with the impact of information infusion via online media channels, various contexts, and types of information provision, as well as content features and modalities, appear to be relevant (Lind & Boomgaarden, 2019).

### ***Interpersonal Constructs***

Besides the enabling environmental factors, interpersonal factors will influence the populace's general perception of climate change. Because this study is centered on perception, several interpersonal constructs and theories will be used as exploratory tools for this study, including relational self, social structure and functions, and social networks. However, all of these concepts will be briefly discussed and contextualized, emphasizing women's unique experiences in the collectivist Nigerian culture(s), mainly because the socio-cultural contexts are often not captured in the original conceptualizations, limiting their application in diverse contexts as this study presents.

According to Adebayo (2018), anything that threatens women's reproductive health in Nigeria becomes a significant and collective problem because, similar to other cultures, women's identity is often framed with the ability to "bear healthy living children." The ability to bear healthy children defines their *relational self within the culture*, that is, self in relation to others and the community, and this relationship evolves throughout their lifetime (Chen et al., 2011). As women transition to womanhood—defined with the birth of a living and healthy child—this transition or attainment of womanhood can be disrupted with miscarriages, stillbirths, and infant loss, causing instability and causing stress to the health and well-being of women. Any form of disruption to women's reproductive health can be physically, socially, or emotionally stressful event in Nigerian women's lives (Adebayo et al., 2019; A. Idowu, 2013; Mboho et al., 2013).

*Social functions and structures* in Nigeria are primarily defined by social relations among family, friends, and relations. These social relationships can be examined via two major social frameworks—*structures and functions* (Burleson, 2009; Burleson et al., 1994; Cohen et al., 1985). Women often function as the gatekeepers in families and are targeted for most health interventions. *Structurally*, women are situated and integrated into the family's social network through the connections between individuals and their relationships, including the size and number of social contacts, which is an essential element in collectivist cultures. The size and number of one's social contact can be a predictive element for adapting certain health behaviors—social integration. This means that the extent of one's engagement in social activities for a sense of belonging and being

identified as a community member is significant. Women will also tag along with their social network to preserve their individual and collective goals, including maternal health issues. Aside from the structural aspect of these relationships, there are also functional factors. *Functional* factors focus on the specific functions the relationship serves and the perceived support from these relationships. The structural and functional aspects of social networks and their support complement each other within the Nigerian society.

Belonging, emotional, and informational support within the structure and function embedded in the community is required to help women adopt behaviors that positively impact their overall maternal health outcomes. Emotional and informational support and belongingness are centered on the social network (Cutrona & Russell, 1990; Sarason & Sarason, 2009). The social network is a determinant of the type and quality of social support one receives. For example, weak-ties and strong-tie networks are integral to the type of support offered to an individual when dealing with life stressors. Weak tie provides individuals with enhanced informational resources and network support (Steinkuehler & Williams, 2006; Wright et al., 2003). Weak ties can provide new and personal examples to encourage others, reducing the feeling of isolation as in most social support online groups. However, strong ties are more bonded to an individual, offering emotional understanding and personal connection (Steinkuehler & Williams, 2006; Trepte et al., 2012). This relational bonding occurs overtime to produce a shared sense of understanding and emotional connection, which defines the type and quality of support women will receive.

To reiterate, currently, in Nigeria and other African nations, climate change is being framed more as an agricultural and economic concern and less of a health concern, as is the case in most developing nations. This agricultural and economic framing is because most of these nations' economies rely on agricultural-related factors. However, this does not change the adverse effects that the changing climate is already having on the nations, especially on the health outcomes of vulnerable and risk populations. Therefore, one of the aims of this study is to evaluate women's perception of climate change and its impact on health. Another aim is to explore women's understanding of helpful mitigation (actions that help to limit climate change) and adaptation (actions that help to protect human health and other resources from changes in the climate) actions, and how these strategies can be implemented. A third aim is to inform, increase awareness, and seek culturally friendly ways to engage women in climate change discourse.

The specific objectives of this study are two-fold: a) explore young women's perception of climate change and its maternal and prenatal health implications b) translate science-based evidence into understandable information. The overarching goal of this research is to a) effectively educate and raise awareness among women about the maternal and child health risks associated with climate change; and b) encourage women to engage in advocacy for policy changes that can protect their and their children's health. The following research questions guides this study.

**RQ1:** How is climate change perceived by Nigerian women?

**RQ2:** What are Nigerian women's perceptions of the influences of climate change on their health and its potential influence on their babies' health?

**RQ3:** What socio-cultural factors are associated with understanding the pregnancy/maternal health risks caused by climate change, and with taking appropriate protective actions?

**RQ4:** How do social determinants of health– SES, income, employment, education– influence the perceptions of climate change among women in Nigeria?

**RQ5:** How do education and income influence feelings of vulnerability to the harmful influences on health from climate change?

Furthermore, the following hypotheses will be tested in the research:

**H1:** The following social determinants of health– SES, income, employment, education– will influence Nigerian women’s understanding of written information about the harmful influences of climate change on health.

**H1a:** Women with higher levels of education will report better understanding of climate change and its effects on maternal and child health than women with lower levels of education.

**H1b:** Women with higher levels of income will report better understanding of climate change and its effects on maternal and child health than women with lower levels of income.

**H1c:** Women with higher levels of education will be less likely to ascribe weather changes to their religious beliefs than women with lower levels of education.

**H1d:** Women with higher levels of income will be less likely to ascribe weather changes to their religious beliefs than women with lower levels of income.

**H1e:** Women with lower levels of education will feel less able to perform recommended climate change protective behaviors than women with higher levels of education.

**H1f:** Women with lower levels of income will feel less able to perform recommended climate change protective behaviors than women with higher levels of income.

### **Brief Overview of the Methodological Approach**

To answer the above research question and hypothesis, this study takes a multi-methodological approach. First, the research incorporates knowledge from an autoethnography, and Delphi technique study as described in the next chapter. This approach allows for the current research project to truly capture the socio-cultural nuances in this formative study. The findings from the field and pilot test informed the study instrument used in this study to answer the research questions and test the hypotheses.

### **CHAPTER THREE: FIELD AND PILOT STUDY**

The following chapter presents a description of the field and pilot study that informs the main study. First, the chapter describes the field work that was conducted—autoethnography—followed by the adapted Delphi technique. Then, it outlines the pilot test and how it informs the methodology—sample and study instrument—used in the main study.

#### **Ethnography and Autoethnography**

This research project builds upon a prior ethnography and autoethnography that I conducted to explore major sociocultural perspectives of women in Nigeria, as well as my own perspective about climate change and health (Adebayo, 2021). Through the ethnography, I was able to examine women's ways of speaking and relating (Ellis et al., 2011; Lindquist, 2002), and investigate uses of space and place (Corey, 1996; Makagon, 2004; Philipsen, 1976) as it relates to climate related events and changes. Then, by being part of the culture and possessing the same cultural identity, I was able to use my personal experience as data to describe, analyze, and understand women's cultural experiences alongside their perception of the changing environmental issues within the community. The autoethnography aspect of this prior research allowed me to place myself within the sociocultural context (Reed-Danahay, 2006), greatly influencing the qualitative approach utilized in this study.

## **Delphi Technique**

Building on the existing autoethnography, this study employs a pilot study alongside a Delphi technique—a group facilitating technique that seeks to obtain consensus on the opinions of experts or individuals knowledgeable on the subject through a series of interviews (Hasson et al., 2000). The Delphi technique is a multistage process designed to combine the different expert opinions into a consensus (Lynn et al., 1998) to best understand a problem, seek solutions, educate, and make informed recommendations to improve health outcomes. It is often used when there is limited or conflicting evidence to develop evidence-based design recommendations and considerations for healthcare-built environments (Taylor, 2020). It has also been extensively used to generate many indicators relevant to health behaviors in communicating public health issues (Vantamay, 2015). According to Turnoff (1970), Delphi is most appropriate to explore information leading to different judgements, seeking out information to generate a consensus, correlate information from diverse discipline, and adequately educate lending itself to this study. Hence, this study adapted the Delphi technique in its message design.

### ***Designing the Test Message Using an Adaptation of the Delphi Technique***

*Step 1: Engaging with experts and rationale.* To design the message that participants were exposed to, experts were purposefully selected to apply their knowledge to the existing research discourse on climate change and its effects on maternal/prenatal health outcomes using a topical interview. These experts were obstetrician-gynecologists

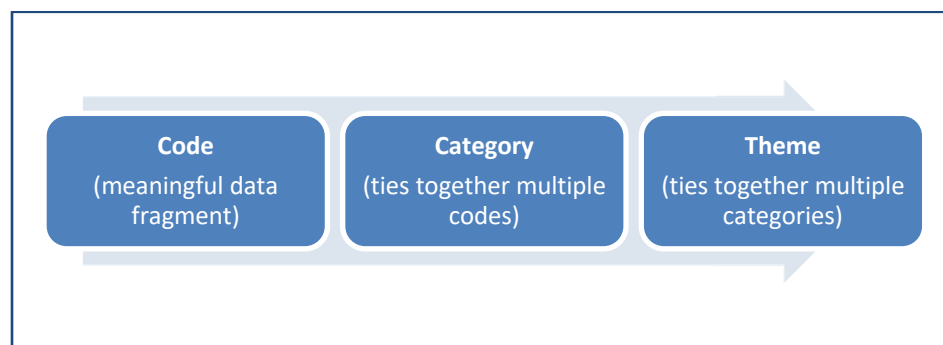


(OBGYN) both in the U.S. and in Nigeria (two from the U.S. and six from Nigeria). The communication with experts provided this study with the nuanced health and scientific prowess to deal with the complex climate change effect on maternal/prenatal health outcomes. The data collected from the interviews explored the various opinions pertaining to climate change effects on health, highlighted the significant areas pertaining to the study objective—especially protective health behaviors, and consolidate their opinions. Examples of the expert interview questions includes.

- a) What do you think women, especially pregnant women need to know about climate change?
- b) How do you think women can protect themselves and their developing babies from the effects of climate change (rising temperatures, air pollution etc)? See expert interview protocol in Appendix B.

Using the knowledge and/or perceptions of experts from both the US and Nigeria guided in drafting appropriate study instruments, especially the interview questions and the test message. The experts in Nigeria provided nuanced contextual information related to the sociocultural and economic effects and how it is intertwined with climate effects on health outcomes. These experts' communication adequately informs the analysis and recommendation of the study.

*Step 2: Analyzing experts' interviews.* The brief topical interviews with experts were thematically analyzed to find recurrent patterns (Charmaz, 2007; Saldaña, 2014). The interviews, findings from the autoethnography and existing literature were used as foundational resources for drafting the test message.



*Figure 9: Thematic Analysis Approach  
(Adapted from Saldana 2014 and Charmaz 2007)*

*Step 3: Drafting the test message.* In drafting the test message, the major themes from the experts' topical interview were used to create the core ideas/knowledge areas for the test message. These core ideas/knowledge areas were centered on the Nigerian experience of climate change and its effects on health within the said geographical setting. The core four areas/sections included in the test message were:

- a) What is climate change?
  - This section included a brief definition of climate change and some of its anthropogenic causes typical to the Nigerian environment.
- b) The effects of climate change on health

- This area includes the effects of climate change on the health as evident in Nigeria.
- c) The effects of climate change on pregnant women's health
- This section highlights how climate change can affects maternal and prenatal health outcomes specifically as it relates to pregnant living in Nigeria.
- d) Protective measures
- This area outlines what women, especially pregnant women in Nigeria can do to actively mitigate the effects of climate change on their health.

*Step 4: Experts' review.* After the core ideas were created and the proposed test message was drafted. The draft test message was shared with some of the experts who participated in the initial topical interview. Sharing the draft test message with the experts was to ensure that the content of the message captures the most essential information and is presented accurately. It also foregrounds the idea of reaching a consensus that is essential in the use of the Delphi method.

*Step 5: Message testing.* The message was tested with ten women, two per each of the five groups of women targeted for the full study to ensure that the message is clear, simple, and understandable to the study demographic. Simple and clear messages have been said to increase understand and is a recipe for successful public communication (E. Maibach, 2019). Additionally, message testing is essential to create a message that is user

centered (Neuhauser & Kreps, 2014). Participants were asked to review the test message based on the following criteria

- a) What part of the message was clear?
- b) What part of the message was unclear, or would you need more information on?
- c) Which of the protective measures is efficacious to you? Why and why not? etc.

Since this is a formative study, the pilot study was incorporated to inform and test both the study instruments and sample where appropriate before the actual investigation was conducted. Hence, below, the pilot test is discussed—the findings and how informed the main study.

### **Pilot Study Rationale**

The rationale for initiating a pilot was based on the need to test the study instrument, sample groups, and to adequately assess the overall feasibility of the main study. Hence, the outcome of this pilot was to make one of the following decisions: *stop*—main study not feasible; *continue* but modify the procedure and/or study instruments—feasible with modifications; *continue* without modifications but monitor closely; *continue* without modifications—feasible as is (Thabane et al., 2010). The objective of this pilot study was to develop study instruments capable of answering the research questions and hypotheses posed for the main study.

## **Pilot Study**

### **Pilot Study Recruitment**

To complete the pilot investigation, participants were recruited using purposive snowball sampling. For each sample group, two women were recruited. The less educated working-class women (no more than secondary/high school) and low-income largely uneducated young women (no more than primary school education, if at all) were recruited from a suburb with proximity to the city capital, Abuja; the college students (who are presumably middle to upper-middle class) from a university campus in the Abuja, Federal Capital City (FCT); the educated working-class women in the same age group (with at least have college education) were recruited from within and outside the city center; and finally, the pregnant women were recruited from the antenatal waiting room of a government owned hospital within the city center.

### **Procedure**

Participants had to read/be read to and agree to an informed consent form to participate, and this consent form and all research procedures were approved by the Institutional Review Board (IRB) at George Mason University. The researcher then shared the research questions with the participants in a conversational semi-structured approach to get their overall perception about the clarity of the survey questions and the test message. Basically, participants were asked to highlight areas of both the interview questionnaire and test message they found confusing, unclear, or generally difficult to understand.

## Participants

Overall, ten women, two per each of the five groups of women targeted for the full study, were recruited for the pilot test. The overall mean age was 27.23 (SD = 4.89). Participants reported working outdoors (50%,  $n = 5$ ) and indoors (50%,  $n = 5$ )—college students responded to this question based on where they spent the most time. Majority of the participants have income lower than the national minimum wage (60%,  $n = 6$ ) and while (40%,  $n = 4$ ) reported earnings above the minimum wage. All the participants in the study reside within or around Abuja metropolis. However, all the participants were all from different states across Nigeria.

*Table 1: Age demographic of women across groups*

Groups	<i>M</i>	<i>SD</i>
Groups 1 (Primary School)	25.5	2.12
Group 2 (Secondary School)	26.5	3.53
Group 3 (College Students)	22.5	2.12
Group 4 (At least college Students)	27	2.83
Group 5 (Pregnant women)	27.5	0.70
N = 10 (Individual groups: $n = 2$ )		

## Findings

This investigative pilot did present great informative guidance instrumental to the main study in the following ways: sample description, demographic questions and the test

message. Based on Thabane and colleagues (2010), the outcome of this informative pilot test was to *continue* but modify the procedure and/or study instruments—feasible with modifications. Below are some of the changes that the pilot study influenced.

*Sample description:* the pilot test did show that the proposed sample groups were not distinct especially groups 1(at least primary school) and group 2(at least secondary school). Therefore, for the main study, the groups were recategorized with clear distinction as see below.

*Table 2: Sample group changes*

	<b>Below Pilot Test</b>	<b>After the pilot test</b>
Group 1	Low-income largely uneducated young women (no more than primary school education, if at all)	Low-income largely uneducated women (no more than primary school education, if at all)
Group 2	Less educated working-class women (no more than secondary/high school)	Less educated working-class women (secondary/high school)
Group 3	College students (who are presumably middle to upper-middle class)	College students
Group 4	Educated working-class women in the same age group (at least have college education)	Educated working-class women in the same age group (at least have college education)
Group 5	Pregnant women (from a government owned hospital)	Pregnant women (from a government owned hospital for a diverse population)

*Test message document:* the pilot did highlight the need for clarity in the definition of climate change. Participants had follow-up questions regarding the initial definition of climate change used in the pilot test. Therefore, the definition was revised based on participants' concerns.

*Scratch note:* During the pilot test the researcher found that participants were distracted and/or felt uneasy with notetaking by the interviewer. Hence, for the main study, scratch notes during in-depth interviews were withdrawn to get participants to feel more relaxed sharing their experiences. Only audio recordings were utilized in the main study.

*Demographic Questions:* Demographic questions such as income, language, and jobs were reframed. Participants were hesitant to share their income range with the researcher. However, using the national “minimum income” as benchmark allowed participants to feel more comfortable sharing.

*Table 3. Demographic questions changes*

	<b>Before Pilot Test</b>	<b>After Pilot Test</b>
1	Do you consider your job an outdoor or indoor job?	Do you consider your job an outdoor, indoor, or a combination?
2	What is your income range?	Would you consider your income the same, lower, or higher than the minimum wage?
3	What language do you speak?	What language do you speak? For this interview, will you prefer speaking to me in English or Pidgin?

*Step 6: Test message.* After the test message was tested and revised, it was then put into an actual infographic format using a doctor-patient scenario. The doctor-patient scenario was selected because doctors are one of the most trusted sources for health-related information. According to Maibach (2019), simple clear messages, repeated often, by a variety of *trusted sources* results in successful public communication.



## **CHAPTER FOUR: METHODOLOGY**

The following chapter presents a description of the methodology used to answer the research questions and hypotheses. This chapter describes rationale used for data collection in this study, participant recruitment and sample. Descriptions of the methods used to analyze the data to answer each research question and hypothesis are presented in the follow-up chapter.

### **Brief Methodological Grounding of the Qualitative Approach**

The qualitative research follows the interpretative research paradigm, which explores phenomena descriptively by seeking information about natural participants' perspectives in specific situations (Lindlof & Taylor, 2011). Interviews and open-ended questionnaire are valuable in acquiring information for participants in a way that helps "clarify the meanings of common concepts and opinions...to determine what influenced a person to form an opinion or to act in a certain way...to understand the interpretations that people attribute to their motivations to act" (Lindlof & Taylor, 2011, p. 179). This research design is appropriate for conducting this study because it is a natural and interpretative approach concerned with exploring a phenomenon from within using the perspectives of the participant as a starting point that should provide useful data for answering the research questions.

## **Brief Methodological Grounding of the Quantitative Approach**

The second phase of this study collected quantitative data to answer the hypothesis. This phase of the study is a follow up of the qualitative method discussed above. Data from this will help answer the hypothesis and it is also useful in a situation as this when we are trying to understand a particular demographic of people to be able to cautiously draw some generalizable inferences that will help better understand the sample population. The ability to draw such generalizations are essential to create interventions and policies where appropriate.

## **Study Procedures**

After responding to the research call, participants had to read/be read to and agree to an informed consent form to participate, and this consent form and all research procedures were approved by the Institutional Review Board (IRB) at George Mason University. Participants who were unable to read were read to and those who did not understand English, the interview process was conducted in Pidgin English. Participants were engaged in a semi-structured in-depth interview—to collect their responses about their beliefs, behaviors, thoughts, or feelings about climate change (see Appendix A).

This form of interview was specifically chosen for the following reasons a) to capture women's perception of climate change in Nigeria, b) to be able to reach the demographic in vivo c) more appropriate for hard-to-reach populations. A semi-structured in-depth interview guide was used to allow flexibility for follow-up/probing questions while also allowing participants to provide feedback. After the interview,

participants were exposed to the test message –also known as “Did You Know” or “Fact Sheet”– about climate change risks on maternal/child health. The test message contained information related to climate change effects on health and protective actions–taking into consideration the contextual nuances of the Nigerian women’s experiences. The sole aim incorporating the test message is to a) educate the participants about climate change, its effects, and protective actions b) evaluate their reaction of the interviews c) clarify any prior and/or current misunderstanding related to climate change and its effects.

After reading the test message, participants were given two pens (green and red) and asked to “use the green pen to underline any sentences that you feel are especially clear and/or helpful and use the red pen to mark any sentences that are particularly confusing or unclear.” Interviews lasted for 45mins–1 hour (all interviews were recorded with an audio device). Participants were offered \$5 (Naira equivalent) as an incentive. Some participants received jewelry as an additional incentive.

## **Participants**

Upon the Institutional Review Board’s (IRB) approval and consulting with the Nigerian National Code of Health Research Ethics to ensure that the research adheres to relevant guidelines (National Health Research Ethics Committee of Nigeria, 2007), participants were recruited. Participants in this study consist of emerging adults. There has been various age range attached to this group. However, for this study, emerging adults will span from about ages 18 to 29 (Arnett, 2000). This age group also captures the age range that the Nigerian society expects women to be married and birth at least their

first child–18.1 and 20.2 years, respectively (National Population Commission of Nigeria, 2013). Therefore, participants were at least 18years of age, had not celebrated their 30<sup>th</sup> birthday at the time of the interview. Participants were all Nigerians who reside in Nigeria at the time that the interviews were conducted.

Because this study is attempting to access women’s risk perception, using Morgan et al. (2002) approach of conducting 10-15 per group, women from the following demographic population were interviewed in Abuja–Nigeria’s capital city;

Group 1: Low-income largely uneducated women (no more than primary school education, if at all)

Group 2: Less educated working women (secondary/high school)

Group 3: College students (who are presumably middle to upper-middle class)

Group 4: Educated working-class women in the same age group (at least have college education)

Group 5: Pregnant women (from a government owned hospital for a diverse population). Participants in this group can be inclusive with other of the above listed groups’ characteristics. However, women in this group would be recruited “exclusively” using being pregnant and the study’s age range as the entry criteria for participation.

## **Participants Sampling**

Similar to the recruitment for the pilot test, participants were recruited using purposive snowball sampling (Etikan, 2016; Tongco, 2007), volunteer and snowball sampling techniques. Convenience sampling was used in this study because the sample also consists of women in the researcher's indigenous social caucus. Also, snowball sampling involves asking for participants referrals to women in their network—age, marital status, worship centers, workplaces, social media etc. Snowball sampling was even more effective among collectivist cultures, where sharing is central. These selected sampling methods provided the best possible access to relevant participants for this research project.

## **Participant Recruitment**

For each sample group, ten women were recruited. The low-income largely uneducated young women (no more than primary school education, if at all) and less educated working-class women (no more than secondary/high school) were recruited from a suburb with close proximity to the city capital, Abuja; the college students (who are presumably middle to upper-middle class) from a university campus in the Abuja, Federal Capital City (FCT); the educated working-class women in the same age group (with at least have college education) were recruited from within and outside the city center; and finally, the pregnant women were recruited from the antenatal waiting room of a government owned hospital within the city center.

## **Analysis**

The study initially attempted to use NVIVO for its transcription, however, the transcriptions were heavily inaccurate because participant spoke both in Standard English and Pidgin. Hence, the study reverted to manually transcribing all interviews.

For the data analysis, each of the interview collected was manually transcribed in the form of text to thematically analyze the in-depth understanding of the experiences transcribed. As the data was being transcribed, the researcher familiarized with the transcripts. After transcribing and reading the text, the process of open coding began (Charmaz, 2007; Saldana, 2014) which entailed considering all aspects of the transcript – line-by-line, paragraphs, segments. Simply put, this implies evaluating all aspects of the data and remaining open to the possibilities of what the data has to say without being restricted by the literature and/or theory. See figure nine for a representation of the coding approach used for the thematic analysis.

This open coding process yielded 287 codes, which were tailored down using axial coding—that is, finding relationships among the codes, then grouping them into categories. Based on the axial 49 categories emerged, then multiple categories were grouped until themes emerged from common patterns in the categories. The themes were decided based on the most prevalent “story line” that describes the interrelationships of the categories (Creswell, 2007; Williams & Moser, 2019) as it relates to the study’s research questions. The thematic analysis yielded several themes and subthemes regarding that were instrumental in answering the research questions and reaching the study objectives.

## CHAPTER FIVE: PARTICIPANTS

First, this chapter gives an overall overview of the participants in the study. Then, followed by a descriptive of each group with their unique socio-economic characteristics such as education and income.

### Participants

To investigate the research questions and hypotheses posed, this study recruited participants ( $N = 50$ ) from five various sample groups with ( $N = 10$ ) for each group. Their mean age was 24.88 ( $SD = 2.91$ ). A plurality of the participants reported working both indoors and outdoors (36%,  $n = 18$ ), indoors (34%,  $n = 17$ ), and outdoors (30%,  $n = 15$ )—college students responded to this question based on where they spend the most time. The majority of the participants have income lower than the national minimum wage (66%,  $n = 33$ ) and while about one-third (34%,  $n = 17$ ) reported earnings above the minimum wage. The minimum wage in Nigeria is ₦30,000 which equals about 77 U.S. dollars. All the participants in the study reside within or around Abuja metropolis with a minimum of 1 year and maximum of 20years. However, they were all from different states across Nigeria and spoke Hausa (40%,  $n = 20$ ), Igbo (28%,  $n = 14$ ), Yoruba (8%,  $n = 4$ ), and others (24%,  $n = 12$ ); and fell into the four main regions of Nigeria – North,

South, West, and East – and they all identified as either being Christians (84%,  $n = 42$ ) or Muslims (16%,  $n = 8$ ).

Group 1: A total of 10 low-income largely uneducated young women (no more than primary school education, if at all) participated in this study. Their mean age was 24.2 ( $SD = 2.57$ ). All the participants in this group worked outdoors and earn less than the minimum wage. Participants had lived in Abuja and its environs for a minimum of 1 year and a maximum of 8 years.

Group 2: A total of 10 less educated working-class women (secondary/high school) participated in this study. Their mean age was 23.5 ( $SD = 3.57$ ). Majority of the participants reported working outdoors (70%,  $n = 7$ ) and others indoors (30%,  $n = 3$ ) with earnings less than the minimum wage (90%,  $n = 9$ ). Participants in this group had lived in Abuja and its environs for a minimum of 1 year and a maximum of 20 years.

Group 3: A total of 10 college students (who are presumably middle to upper-middle class) participated in this study. Their mean age was 22.8 (1.87). Majority of the participants in this group were college seniors (50%,  $n = 5$ ); freshman (20%,  $n = 2$ ); and junior (30% = 3). All participants reported working both outdoors and indoors with earnings less than the minimum wage (college students responded to this question based on where they spent the most time). Participants in this group had lived in Abuja and its environs for a minimum of 1 year and a maximum of 5 years.

Group 4: Educated working-class women in the same age group (at least have college education). Their mean age was 26.5 ( $SD = 1.96$ ). Participants reported working both outdoors and indoors (40%,  $n = 4$ ), indoors (30%,  $n = 3$ ) and outdoors (30%,  $n = 3$ )



with earnings more than the minimum wage (80%,  $n = 8$ ). Participants in this group had lived in Abuja and its environs for a minimum of 1year and a maximum of 10years.

Group 5: Pregnant women (from a government owned hospital for a diverse population). Their mean age was 27.4 (SD = 1.58). Their mean gestational age was 25.91 weeks (SD = 10.11), with a minimum gestational age of 14 weeks and a maximum of 38 weeks. Participants reported working indoors (80%,  $n = 8$ ) and others worked both indoors and outdoors (20%,  $n = 2$ ) with majority earnings more than the minimum wage (80%,  $n = 8$ ). Participants in this group had lived in Abuja and its environs for a minimum of 2years and a maximum of 6 years.

## **CHAPTER SIX: RESULTS**

To reiterate, the objective of this study and rationale for posing the research questions is to explore examine women's perception of climate change as well as to examine key socio-cultural factors that might influence women's understanding and response to climate change changes in Nigeria. In pursuit of these objectives, the chapter covers the findings from the research questions. First, this chapter outlines the qualitative data analysis used in the study to answer the research question. Then followed with the themes that emerged from the thematic analysis.

### **RQ1: How is climate change perceived among Nigerian women?**

The research question sought to understand women's general knowledge and perception of climate change as experienced in their day-to-day life. The thematic analysis showed that climate change was generally likened to weather, weather changes and the seasonal variations.

*Table 4: General knowledge of climate change*

	Have you heard about climate change?		
	Yes	No	Maybe
<b>Group 1</b> (low-income largely uneducated young women—primary school, if at all)	0	9	1
<b>Group 2</b> (less educated working-class women—secondary/high school)	4	2	4
<b>Group 3</b> (College Students)	8	0	2
<b>Group 4</b> (Educated working-class women—college)	10	0	0
<b>Group 5</b> (Pregnant women)	9	0	1

*General Knowledge: When Weather Matters.*

Although majority of the participants ( $n = 31$ ) have heard of “climate change,” they were unable define the term or its causes. However, participants were actively able to respond to their perception of weather and weather changes. One participant said, “I really do not know how to describe climate change, but “climate” indicates you are asking about the weather, correct? [laughter].” Another participant stated that “climate change is the change in weather and everything.” Participants described the weather changes through two lenses which has been categorized into two sub-themes:

Unanticipated *changing patterns and varying seasonal intensity*.



Figure 11: Word Frequency Map Across Groups

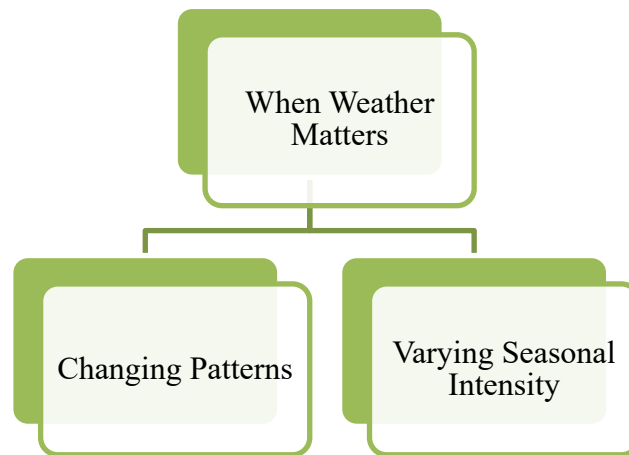
### *Changing Weather Patterns*

The first lens through which described the weather changes was the “weather patterns.” Regarding the changing patterns, 100% of participants who were asked ( $N = 50$ ) mentioned the changing weather patterns as a significant constant in the climate discourse that defines Nigeria. One participant said “we all complain about the weather, and we move on. *Abi* what can we do?” There was consensus among participants that “the seasons are no longer the same” and the sudden irregular seasonal changes are offsetting. One participant laid emphasis “see *ehn!* All the weather timing is just so off.

Sometimes the changes even within the seasons are strange o! As in, you don't even know what to expect each day anymore. It is crazy.” Similarly, all participants voices were echoed in the following participant's statement.

We are used to certain season and periods that we all know of [referring to the regular raining and dry season]. So, these changes are not expected. There is no rain at the appointed time...the patterns are sha different from our expectations. I hear people talking about it a lot too. This is no longer news. It is how different it will be in the coming year that we are not sure of, but we already know it is going to be different.

It is interesting to see how participants across all the groups collectively echoed the same knowledge about the increasingly changing weather patterns. It appears there is almost an unwritten expectation about the changing weather patterns. Although participants silently hope the weather will return to what they are used to, they “know” this is not going to be a reality.



*Figure 10: Climate Change Perception*

*Varying seasonal intensity.*

The second lens through which participants discussed changing weather patterns was through the “varying seasonal intensity.” When talking about varying seasonal intensity, participants referenced specific lived experiences. Participants shared experiences about the varying seasonal intensity were either related to harsh seasonal experiences or fewer/heavy rain falls.

When participants spoke of harsh seasonal experiences, they were all referring to extreme heat or little to heavy rainfall within and around Abuja and its environs. Because some of the participants have lived in the Abuja for a while, they are able to compare years of experience as the participant below described with so much confidence.

For example, ten years back, Abuja wasn’t as hot as it is now, and I don’t see anyone arguing that...the sun is so hot these days. The rain is too much or not

enough. See, the way it rained even three years ago is not the same way it is raining now.

Another participant who grew up in Abuja shared a unique experience related to “ice” which many of the other participants alluded to.

ice [hail stone] used to be frequent when I was going up. Now, it is so rare. I had to video it the last time it happened because it has been a long time, I saw it. I will say that the rain is not falling the way we expect it to fall. Even heat period will just start from nowhere.

The hail stone seem to be a significant part of the lived weather experience of multiple participants. It signifies cold and friendly weather with lots of rain, laughter and narratives. Another participant shared a childhood experience related to hail stones (ice).

When I was younger it rains ice very well but presently, we don’t really get that. I can’t even remember seeing that as an adult. Now, all we get is this very hot sun, like the heat is on steroids. Something must be really off about the current weather.

Aside from the reduced rain and “disappearing ice,” the heat in Abuja and its environs was a collective point of discourse across groups. Participants clearly expressed confusing with the extreme heat and irregular heat seasonal experiences over the years.

It feels like we are receiving the heat directly from the sun or maybe the sun is moving closer to us because this hotness and heat is too much. The sun is so hot...like we have offended the gods and need to appease them [laughter].

The intensity of some of the weather conditions stood out through the interviews. However, participants also highlighted the less intense weather patterns as well, especially in the reduced rain fall. Specifically, one participant said the following with so much conviction.

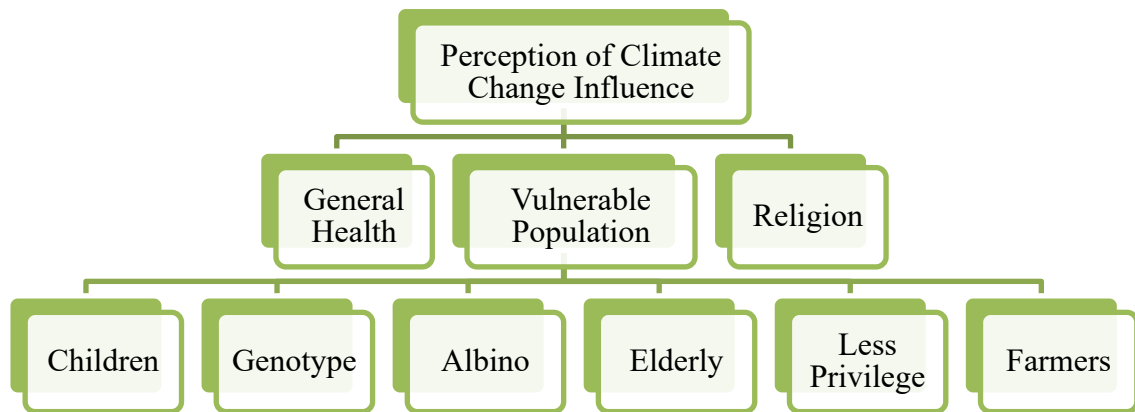
Ask anybody, last year we did not experience rain as we used to...it feels like the rain is reducing each year and it is scary. There was even no rain in the so called august. There was no august rain, can you imagine that? Harmattan was not even dry and harsh as it used to be in the mornings. See, I really do not understand this weather thing...and it is affecting a lot of people.

All the participants in the interview did show some level of worry about the changing and what it might mean for them in the near future. There was also a feeling of helplessness about immediate actions to be taken, if there is any at all.

**RQ2: What are Nigerian women's perceptions of the influences of climate change on their health and its potential influence on their baby's health?**

This research question sought to get an insight into women's perception of the effects of climate change on their general health and the wellbeing of a developing fetus. The thematic analysis yielded two broad themes related to what they perceive as the general effects of the weather on health and vulnerable populations.





*Figure 11: Perception of Climate Change Influence*

*Common Health Symptoms: “We all blamed it on the weather”*

In responding to the effects of climate change on health and its potential influence on baby’s health, participants talked about what is considered “general common health symptoms” from the changing weather and seasonal patterns. One participant said,

Yeah! It affects me. I was really sick and lots of people around me were sick too...and it was because of the weather. We all blamed it on the weather. That was what everyone said. I was having cold, malaria and that was because of the irregular rain. You know if it is not raining season yet and it rains, that type of rain can cause sickness ...and it cause mosquitoes breeding in all those places.

Recurrent headaches and common cold symptoms were very much highlighted throughout the entire interview with the participants. There was an unflinching believe that the symptoms were from the changing and unstable weather patterns, which also

causes the malaria because of the stagnant and stale water bodies from the irregular rain fall.

While common cold and malaria were very common, some other participants identified the effect the blazing sun has on their vision. For example, one college participant said, “the sun is too much. Personally, when the sun is too much it affects my eyes. I get blurry visions and I hear people complain about headaches and all that.” Another college participant shared her how the weather variations and its intensive constantly affects her skin.

See the weather has been harsh in every aspect. When it is raining it rains a lot.

When it is sunny it is extreme. Everything is extreme and harsh, and it is not good for the skin. See me, I am getting so dark. I have to walk in the sun, I am a student and move around a lot. My skin is reacting differently every time due to the harsh weather.

Generally, participants worried about the ability of their bodies to adjust and adapt to the changing weather to prevent health related issues, especially for certain groups such as children, the elderly and folks with certain genotypes.

It gets very hot and not everyone’s system is used to the extreme change and the change is not constant. Your body has to constantly be changing and your body cannot accommodate all these changes all the time. That is my fear and that is why we fall sick.

*Vulnerable Groups: “I am fine. I worry for my parents”*

Aside from the effect it might have on health, most participants mostly projected the effects of the weather changes on others—away from themselves. In projecting the effects of the changing weather on health and the health outcomes of others, a few groups were considered most vulnerable, and they include: children, people with certain genotypes, the elderly, less privilege, and farmers.

### *Children*

Participants in all groups shared their perceptions surrounding the vulnerability of children because their immune system might not be able to adapt to the constant irregular weather changes, and they are less able to protect themselves without the help of other adults. One participant from the low-income and less educated group shared an insight that “too much heat *fit* [can] make measles and meningitis catch children. When *e dey* [it is] cold, *e fit dey* [it can] cause catarrh among small children.”

Although participants did not perceive any direct harm from the weather changes to unborn babies, one participant mentioned how detrimental the weather can be to an unborn baby if the mother is exposed to malaria.

I don't know if it affects the baby but if she is affected then the baby will also be affected. So, I will say she has to stay under a mosquito net because pregnancy and malaria are enemies.

### *Genotype*

Interestingly, many participants did mention that people with certain blood genotype might be more susceptible to the adverse effects of the changing weather patterns and its varying intensity. Majority of the participant ( $n = 41$ ) specifically

mentioned people with “AA” and “SS” genotype to be more affected. One participant said, “I think AA people, those ones [AA genotype] they are always prone to malaria, and you know this weather brings malaria.” Another participant used a personal example, she stated that,

AA genotype group people like myself...most of us will be feeling minor sickness. We will have malaria and start falling sick. It is not all of us o! But plenty of us experience this and because of how the weather is not stable, it makes it worse for us.

Another genotype group that came up as being vulnerable to adverse seasonal changes were the “SS” (Sickle Cell Anemia). Although participants were unable to definitely state the science behind their perception of this group’s susceptibility, they were very assertive with their perception. One participant stated that

I strongly believe it [weather changes] will affect SS even though I don’t know how. I have a friend who is SS and I just know she is very protective of herself when the weather is unstable, too cold, or too dry. So, this constant changing weather is not her friend.

#### *Albino*

Although only few participants ( $n = 5$ ) mentioned albinos as being a vulnerable group, it is worth noting. Albinos were specifically mentioned to be extremely vulnerable extreme heat exposures. All participants who perceived albinos as being susceptible to extreme heat reference the impact it might have on their skin.

You know too much hot weather is not good for Albinos. It affects their skin a lot. They must take extra care of themselves when the sun is too hot. They have to stay away from the sun, so they do not have those black dots you see on some albinos.

Another participant worried about how the extreme heat from the sun might affect the overall wellbeing of people with albinism. This participant said, “*Afin* [Albino in Yoruba] must not stay in this sun o! I *dey* feel for them because this kin hot sun go fit affect their eyes, their skin and plenty other things.”

#### *The elderly*

Participants across groups were quick to mention “older folks” before another other group when asked about vulnerable groups. Many participants used their parents or grandparents as direct examples. One participant said, “when the weather is doing anyhow, I worry for my parents because it affects them. They will just be weak; it affects their bones.” Another participant said

My parents are old [laughter]. They are grandparents and their bodies are not as strong as when they were young. You know, their immune system is not as strong. There are now like big children. And when the weather acts up, it worries me that it might be affecting them. But what can they do?

#### *Less privilege*

Participants continuously highlighted some the challenges that makes the less privilege susceptible. The reasons were not as direct as highlighted in other groups. Participants felt that the less privilege would most likely be unable to take protective

actions or care for themselves when they become ill from the weather changes. One participant said,

People who do not have the adequate facilities to take care of themselves like mosquito nets, no good water around their environment, and no access to good health centers to check themselves will be affected. Generally, all those who cannot afford the basic needs will struggle with the physically adjusting to the weather changes and the consequences.

Also, for populations who work outdoors, participants perceive that the adverse weather might not just be affecting their health but also their livelihood. One participant, who is also a petty trader shared a collective struggle of those who work outdoors like herself and some of the challenges to making ends need.

You see all these welders and hawkers, this weather *wey dey* confuse us like this, *dey* affects them well well. I know because me self *dey* sell market. All of us prefer dry season than raining season because this raining season *wey* no steady *dey* affect our market. If we no sell market how we wan take chop?

#### *Farmers*

Participants who mentioned farmers generally started with basic exposure to the sun, however, they ended up connecting it to the challenges inherent to planting in an ever-changing season. A participant from the working-class group said, “when there is no rain at all. I pity farmers. How do they survive from it?” Another participant also agrees that farmers are a hard hit

“Imagine! We all know that farmer’s plant based on weather patterns and all of a sudden there are changes from nowhere. This will affect the crops. Some seasonal crops like corn will be affected. For example, when rain is expected to fall, and it doesn’t it can affect the agriculture. It can destabilize them [farmers].”

*Religion: The gods are angry with us*

The last theme in women’s perception of climate change is religion. First some women mentioned or agreed that there are anthropogenic factors; however, the supernatural factor supersedes it. One participant said, “even though human activities like industries and improper disposal of waste is something to consider. I believe that cannot change God’s plan for the earth, the weather or the changes we are experiencing.”

Majority of the participants ( $n = 42$ ) believe that a) the weather and the changes are solely in the hands of God, and b) there is really nothing humans can do to affect changes in the weather. Therefore, in responding to the role of a supernatural factor influencing the weather or the changes human can make to positively impact the changing climate, another participant clearly stated the following.

I believe in Allah, but I think we are bringing all these climate change things upon ourselves. Allah makes it happen for some reasons unknown to us humans. The only control we have are those who work with the weather [meteorologists]. God can open their [meteorologists] eyes to see it [weather changes]. Humans can only discover the weather and the changes but not control it.

Similarly, another participant said

I am a believer. I believe in God. There is time and season for everything.

Whatever we are experiencing now is part of the plan of God. Definitely, it is God that created all and everything he made is beautiful. So, God is in control. I don't have any control over the weather because it is supreme. The person that controls it is above [looks up into the sky].

While the perception of a supernatural being controlling the weather was dominant, there were a few participants who believed in both the supernatural being and in the traditional belief that some human with spiritual powers can influence weather outcomes such as “holding” the rain. “Holding” the rain implies the ability to either stop or make the rain fall. One participant shared a personal experience

I will say no [no human can control the weather] but I stay in a place where they worship water. There is a way they say they used to control the rain. Though I don't believe it but sometimes it used to be true...you will see the weather changing and the cloud will be so dark but there will not be any droplet of rain.

So, you'll hear them saying they held the rain. I feel like sometimes it works. It is their belief. You can even see that the rain holding idea was used in Airtel's advert [Airtel is one of the biggest mobile communication companies in Nigeria].

I tell you; it happens.



**RQ3: What socio-cultural factors are associated with understanding the pregnancy/maternal health risks caused by climate change, and with taking appropriate protective actions?**

This research question explores the social cultural factors that participants connected with their understanding of pregnancy/maternal health risks caused by climate change, and with their ability to take appropriate protective actions when necessary. The thematic analysis highlighted to major themes centered around access to information/options and beliefs.

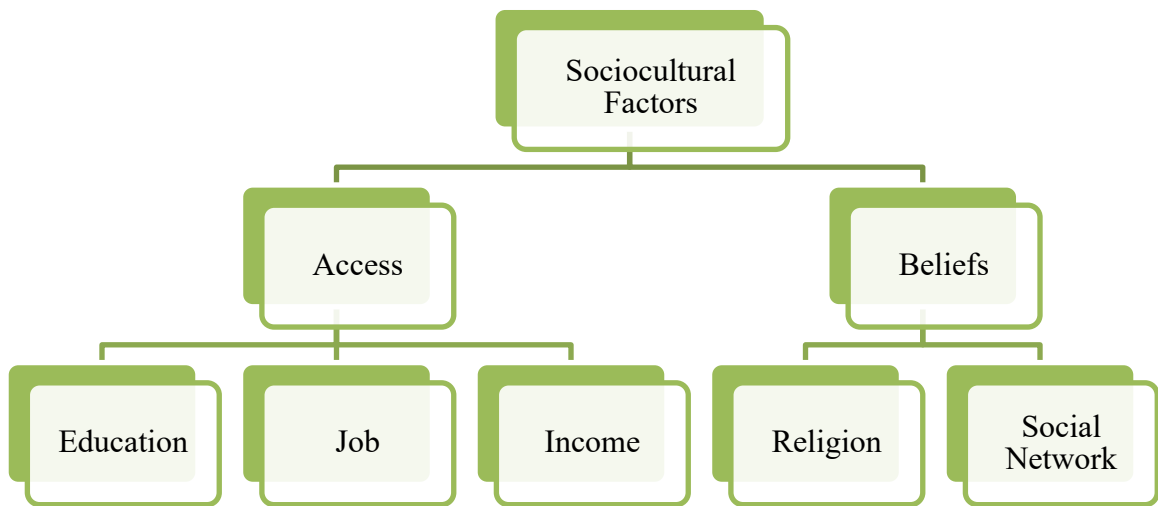
*Access: It is beyond me*

The theme of access is centered around participants' education, income, and job (indoor or outdoor). Many participants understanding of the effects of climate change on pregnancy or maternal health outcomes was based on their education, income, and/or job. However, participants felt this sociocultural trio (education, job and income) will significantly influence their ability to take some protective actions and it will be “beyond” them to actively engage in some of the lifestyle changes required because of their jobs. Those who worked outdoors or in a job that required a significant amount of outdoor exposure showed dismay in the aspect of the protective measure that had to do with avoid. One participant said

I know we should avoid this extreme heatwave. I get it, but how can I avoid when my job is out there. “Avoid” to me means no salary which means no food and no roof over my head. I go like to avoid, especially now that I am planning to get married and have children. And If I decide to use umbrella, it will be obstructive

for my job. See, even me, I know that the way this sun has been getting hot *ehn* is not good for me. But there is really I can do. This interview now, is making me sad because my situation is beyond me.

Another participant said “even people *wey* finish university never see work. My sister, this thing [by this “thing” she meant life] no easy.” Similarly, a participant who is willingly to actively take actions to mitigate the effects of climate change said, “I really cannot have a water bottle around me during work. There is nowhere to place it and it will be obstructive to my job delivery.” While there were different reasons why participants could not engage in some of the active protective behaviors, they were mostly centered around their jobs.



*Figure 12: Sociocultural Factors Associated with the Understanding of Climate Change Health Risks and Taking Protective Actions*

### *Beliefs*

Participants generally understood the effects of climate change maternal health outcomes. They comprehended the protective measures that they were exposed to at the end of their in-depth interview. However, majority of the participants referenced to the “god factor” as the definer of what would eventually happen when it comes to their overall health outcomes. One participant said, “my sister, whether I do all these things abi I no do am, you know say na God get the final say for our body. We need to pray for this weather thing. Make God forgive us, reduce the sun.” Similarly, another participant said,

“I know we need to take steps, but this weather is needs spiritual intervention.” These quotes also connotes that the weather variations or intensity might be because of human’s sin against God.

The “god factor” trait was connected to social network. Participants worried about being singled out if they embark on some of the active protective acts outside of their normal day-to-day lifestyle. The concern about their social network is unique to collectivist cultures. Participants wondered how they might be perceived. For example, one participant said, “if I begin carry umbrella, them go think say person don carry [financially buoyant] or I don turn *Oyinbo* [a word used to refer to Caucasians].” Another participant said, “It is funny, but if I am the only one always carrying water bottle around, people might gossip about it.”

#### **RQ4: How do social determinants of health– age, SES, ethnicity, education– influence the perceptions of climate change among women in Nigeria?**

This research question was posed to explore how age, education, and social economic status influences women’s perception of climate change. To answer this research question, the transcripts in each group were thematically analyzed to see if there were differences across groups based on education, income and perhaps age.

The thematic analysis does show some differences in groups perception to climate change. And because education and income are the main grouping factors, these two factors did appear to influence women’s perception to climate change. Therefore, in

response to the research question, the theme “*Rain or Weather*” will be evaluated as it relates to the education and income across groups.

### *Rain or Weather*

Education does influence women perception of climate change. First, there is an interesting difference in the choice of words used to describe the changing climate between groups (see figures 13 and 14). While women in the lower educational bracket generally used “rain” in their lingual when discussing the changing climate, women in the mid and higher educational bracket used “weather.”

For women in groups 1 and 2, they largely referenced the changing climate to rain—its intensity and unstable patterns (see figure 13). This is especially so because majority of them conduct their day-to-day businesses outdoors and rain is a major defining factor on many days. Hence, when asked about the changing climate, “rain” can singlehandedly define their overall perception. Simply put, changes in the climate that influences the rain were easily noticed because of its effects on their means to an end. One participant said,

(Laughter) How do I make money if I stay indoors? I cannot say because the sun is hot, I will not eat. The children will not eat, or I will not take care of other things? Biko this is Nigeria o! Who thinks about the sun being too hot? As long as it is not raining then it is fine.

Women in these groups (1&2) only referred to other weather conditions or seasons when specifically asked about it in follow-up interview questions.

Women in groups 3-5 framed the changing climate in reference to the general “weather” conditions and seasons (see figure 11). Women in this groups mentioned the difference in both rainy and dry seasons, however, they laid more emphasis and concern on the heat and/or sun.

The weather is changing causing excessive heat or cold. The weather is seriously hot. The heat is so much. Earlier this year, you need to hear how everyone complained about the heat. We were practically burning during the day and marinating in sweat at night. It was too much.

Furthermore, although there were women across groups who earn below the national minimum wage, the narrative among women who earn their living working outdoors and those who don’t. For example, one participant (low education and low income) shared how it was not even foreseeable to stay away from the sun even when she is aware that it is extremely hot.

How I *wan* take run from sun when *be* say life no easy for any man? See, I no fit stay house because I cannot eat myself. And for my work, if I don’t come it will be problem with my boss.

Similarly, another participant (high education and low income) shared relatively the same perception about the sun and earning a livelihood.

I have to go to work. I have to be outside...that is the only way I get paid to get food. It is not debatable. I only wish I can get a better job that I would not have to spend so much time outside. I am still looking for one *sha*.

**RQ5: How do education and income influence feelings of vulnerability to the harmful influences on health from climate change.**

This research question seeks to explore how education and income influences the feeling of vulnerability to the harmful effects of climate change on health. Hence, to answer this question, participants response to the vulnerability questions was thematically analyzed. Two major themes emerged.

*Meeting End Needs*

Basically, across groups, participants were very concerned about making ends need. The end of the day was more important than the perceived distant threat from the changing climate and its effects. Participants were genuinely more concerned about how to fend for their daily and perhaps monthly needs, than the end of the world, which is the idea of climate change. Therefore, this theme cut across groups. One participant said, “you see this mouth [point to her mouth] e must chop. This mouth no know if weather dey change o! Hunger must come.”

Irrespective of how compelled participants felt about the necessity to meet end needs, all participants were openly worried about the adverse effects of the changing weather and its influence, but they did not feel capable of changing how they feel about their vulnerability, which lead to the next theme—helplessness.

*Helplessness*

An interesting perspective to vulnerability is the helplessness that participants in the low education and low-income group displayed. It is a mixture of a) awareness of the vulnerability and b) helpless to make immediate change to mitigate the effect of climate

change on their lives. Hence, access to some basic amenities even makes it more challenging to mitigate the complexity of climate effect on the quality of life.

I have bath, remove my clothes and fan myself if there is no light [laughs]. You know how this light thing can get. I can't go outside and stay for a long time because there are mosquitoes. There are people that cannot afford water to bath or extra bath like me. So, it is even more difficult for them. I cannot even complain.

There are very little participants feel like they can do when exposed to extreme weather conditions. With the lack of basic amenities in many areas of the country, participants highlight that it makes it even more challenging take even the basic protective actions that they are aware of.







## **CHAPTER SEVEN: TESTING THE HYPOTHESES**

As mentioned in the chapter above, the objective of this study is to explore examine women's perception of climate change as well as to examine key socio-cultural factors that might influence women's understanding and response to climate change changes in Nigeria. Thus, to examine which socio-cultural factors influence the women's perception and understanding of climate change, the following hypothesis guided this study.

### **Data Collection and Coding**

As mentioned in the study procedure above, at the end of the interviews, participants were given the test message which was designed to educate and raise awareness. The participants were given a green and a red pen and asked to "use the green pen to underline any sentences that you feel are especially clear and/or helpful and use the red pen to mark any sentences that are particularly confusing or unclear."

As discussed in the message design, the test message was organized into four sections: the first section included a brief definition of climate change and some of its anthropogenic causes typical to the Nigerian environment (four bullet sentences); the second section included the effects of climate change on the health as evident in Nigeria (four bullet sentences); the third section highlighted how climate change can affect

maternal and prenatal health outcomes specifically as it relates to pregnant living in Nigeria (four bullet sentences); and the fourth section outlines what women, especially pregnant women in Nigeria can do to actively mitigate the effects of climate change on their health (four bullet sentences).

To code the participants' reactions to the test message made with the colored pens, bullet sentences marked with the green pen were scored +1 (indicating "clarity/understanding"), sentences marked with the red pen were scored -1 (indicating "unclear"), and sentences with no pen (green or red) markings were scored 0. Using the markings, composite scores were created for all the participants for each of the four sections. The composite scores created was used to test the hypothesis posed.

### **Data Quality Checking**

Prior to conducting any data analyses, responses were examined to ensure the value of data in the sample. The data showed normal distribution (approximately) of the of the composite score for each section for each group and there was also homogeneity of variances (i.e., variances approximately equal across groups). The data did show a balanced design (i.e., same number of subjects in each group) which reduces the possibility of violating normality or assumption of the requirements/assumptions that threatens the validity of the ANOVA *F* test.

## Results

H1: The following social determinants of health– SES, income, employment, education– will influence Nigerian women’s understanding of written information about the harmful influences of climate change on health.

**H1a: Women with higher levels of education will report better understanding of climate change and its effects on maternal and child health than women with lower levels of education.**

To test this hypothesis, a one-way ANOVA was conducted. Results of Levene’s Test of Variances indicated homogeneity of variance between the groups ( $p = .29$ ). The one-way ANOVA indicated significant differences between the groups,  $F(4, 45) = 15.38$ ,  $p < .001$ ,  $\eta^2 = .58$ , power = .89. The follow-up results of Tukey’s HSD post-hoc test indicated significant differences between groups on the understanding of climate change and its effects on maternal and child health. See table below for descriptives and significant differences per group.

*Table 5: Descriptives and significant difference across groups*

Groups	<i>n</i>	<i>M</i>	<i>SD</i>	Tukey's HSD Comparisons				
				1	2	3	4	5
1 (Primary School, if at all)	10	3.7	.69					
2 (Secondary School)	10	3.95	.59	.96				
3 (College Students)	10	5.0	1.0	.007*	.04*			
4 (At least College)	10	5.2	1.1	.003*	.01*	.91		
5 (Pregnant– At least College)	10	6.3	6.4	<.001*	<.001*	.01*	.03*	

Note. \**p* is significant at 0.05. *N* = 50.

Results indicates that there was a significant difference between women with less education (primary and secondary school) and women with more education (those in college and those with at least college degree). Similarly, there was also a statistically significant difference between pregnant women (all of which had at least a college degree) and women from the more educated groups. Thus, H1a was supported.

**H1b: Women with higher levels of income will report better understanding of climate change and its effects on maternal and child health than women with lower levels of income.**

To test this hypothesis a one-way ANOVA was conducted. Results of Levene's Test of Variances indicated homogeneity of variance between the groups ( $p = .67$ ). The one-way ANOVA indicated significant differences between the groups,  $F(1, 48) = 9.07$ ,  $p = .004$ ,  $\eta^2 = .16$ . See table below for descriptives.

*Table 6: Income group descriptives*

Groups	<i>n</i>	<i>M</i>	<i>SD</i>
Below Minimum Wage	33	4.50	1.13
Above Minimum Wage	17	5.54	1.23

Note. N = 50

Results indicates that women's understanding of climate change and its effects on maternal and child health was significantly higher among women with higher income; thus, H1b was supported.

**H1c: Women with higher levels of education will be less likely to ascribe weather changes to their religious beliefs than women with lower levels of education.**

To test this hypothesis, a chi-square was conducted to assess whether women with more education will less likely ascribe weather changes to their religious beliefs than women with lower education. The result for this test was not significant:  $X^2(8, N = 50) = 7.14, p = .52$ . Hence, H1c was not supported. \*

\*There was not enough variation in the data test for this analysis.

**H1d: Women with higher levels of income will be less likely to ascribe weather changes to their religious beliefs than women with lower levels of income.**

To test this hypothesis, a chi-square was conducted to assess whether women with more education will less likely ascribe weather changes to their religious beliefs than

women with lower education. The result for this test was not significant:  $X^2(2, N = 50) = 1.66, p = .44$ . Thus, H1d was not supported. \*

\*There was not enough variation in the data test for this analysis.

**H1e: Women with lower levels of education will feel less able to perform recommended climate change protective behaviors than women with higher levels of education.**

To test this hypothesis a one-way ANOVA was conducted. Results of Levene's Test of Variances indicated homogeneity of variance between the groups ( $p = .29$ ). The one-way ANOVA indicated significant differences between the groups,  $F(4, 45) = 25.72, p < .001, \eta^2 = .69, \text{power} = .97$ . The follow-up results of Tukey's HSD post-hoc test indicated significant differences between groups ability to perform recommended climate change protective behaviors. See table below for descriptives and significant differences per group.



*Table 7: Descriptives and significant difference across groups*

Groups	<i>n</i>	<i>M</i>	<i>SD</i>	Tukey's HSD Comparisons				
				1	2	3	4	5
1 (Primary School, if at all)	10	1.3	2.3					
2 (Secondary School)	10	1.9	2.4	.93				
3 (College Students)	10	5.9	1.5	<.001*	<.001*			
4 (At least College)	10	6.7	1.8	<.001*	<.001*	.90		
5 (Pregnant– At least College)	10	6.8	1.6	<.001*	<.001*	.85	.98	

Note. \**p* is significant at 0.05. *N* = 50.

Results indicates that women's ability to perform recommended protective actions was significantly higher among women with higher levels of education; thus, H1e was supported.

**H1f: Women with lower levels of income will feel less able to perform recommended climate change protective behaviors than women with higher levels of income.**

To test this hypothesis a one-way ANOVA was conducted. Results of Levene's Test of Variances indicated homogeneity of variance between the groups ( $p = .12$ ). The one-way ANOVA indicated significant differences between the groups,  $F(1, 48) = 12.14$ ,  $p = .001$ ,  $\eta^2 = .20$ . See table below for descriptive.

*Table 8: Income group descriptives*

Groups	<i>n</i>	<i>M</i>	<i>SD</i>
Below Minimum Wage	33	3.0	3.46
Above Minimum Wage	17	6.3	2.50

Note. N = 50

Results indicated that women's ability to perform recommended climate change protective behaviors were significantly higher among women with higher income; thus, H1f was supported.

## **CHAPTER EIGHT: DISCUSSION**

This discussion chapter begins with a summary of the results of the study. The summary of the results is followed with an in-depth discussion of the results, especially the results of the hypothesis; how the results fit into theory and literature; how the results contribute to theories—the practical and theoretical implications of the findings. The chapter concludes with a discussion of the limitations of this study and opportunities for further research.

Currently, in Nigeria, climate change is being framed more as an agricultural and economic concern and less of a health concern. However, this does not absolve the fact that Nigeria is listed among the top 10 countries of the world in the climate change vulnerability index (Climate Change Vulnerability Index, 2017) and the climate change has adverse for women, developing babies, infants, and children in developing African countries. Hence, this study is one of the very few and currently the only study to explore the socio-cultural perspective of climate change through the health lenses in Nigeria using a multi-method approach that captures the voices of women.

The primary objective was to explore the sociocultural perception of women about climate change and its effect on maternal and prenatal health outcomes in Nigeria. The finding of research question one shows that women's perception of climate change is a generally associated with weather changes and seasonal variations. Simply put, women are generally unable to describe the term climate change or its causes; however, they do

have a good understanding of the underlying concept of “climate change” as reflected in their numerous references to weather and seasonal patterns. This finding is instrumental to the discourse of climate change and its effects on health in Nigeria and developing countries at large. It is a great start to framing climate change and health in Nigeria. Although most of the women were unable to describe climate change, however, they are very aware of the weather changes and its perceived influence on general health outcomes. Hence, this knowledge is integral to mitigate and adapt to the changing climate.

While women are not particularly able to identify how climate change can be influencing maternal and neonatal health outcomes, this in itself is a significant finding that suggests it is necessary to not only educate, but also to raise awareness and design educational materials to bridge this knowledge gap. Nigerian women’s perception of climate change highlights the need to understand target populations and be able to provide culture centered protective measures based on their current knowledge of climate change.

For example, pregnant women are at particular risk of ‘over-heating’ (too high core body temperature) because of the hormonal situation at all stages of pregnancy which creases the health risks for both mother and fetus. Women are aware of the general adverse heat implications; how then do we educate them on the direct and indirect effect it has on pregnancy? Similarly, the newborn is especially sensitive to too high or too low temperature in the environment because of its limited temperature regulation capacity (Poursafa & Kelishadi, 2011). Women perceive there is a risk but are just unaware of

how this extreme weather affects birth outcomes. Women need to be educated about the effects of varying seasonal patterns of birth outcomes, such as low birth weight, preterm birth, and stillbirth, in relation to ambient temperature. It is evident that extremes of temperature may be a risk factor for poor birth outcome. Awareness of this is important to the discourse taking into consideration the current knowledge and the socio-cultural realities of Nigerian women. Also, it is pertinent to note that the severity of these outcomes will vary by geographical region and socioeconomic status, potentially further increasing health inequalities.

An interesting finding is the general perception that changing weather patterns affects farmers. Women who participated in the study were did not associate climate change influence on maternal and pregnancy health through lack of food, safe drinking water, and proper sanitation; increased frequency of extreme weather events; changing patterns of disease and morbidity; and direct heat exposure. However, all of these factors are closely related and will interact. Increased frequency of extreme weather events will lead to malnutrition, cholera outbreaks, population movements, and spreading of diseases.

The spread of diseases and cholera outbreaks that currently occur have in the Northern part of the country becomes serious risk factors, especially for those with lack of access to adequate health care. Lack of access to proper health care and increased core body temperatures due to hot ambient surroundings will further increase the health risks, especially for pregnant and delivering women. Specifically, the consequences for pregnant women and the unborn child can be substantial. Thus, it is important for global

efforts to reduce the negative health effects of climate change to focus on maternal health.

Similarly, malaria was a prominent health issue raised. Malaria is among the infectious diseases of greatest concern for public health. Malaria in pregnancy can lead to anemia, spontaneous abortion, stillbirth, prematurity, and low birth weight. Generally, women and children are more vulnerable to this disease if they are poor and have less access to health clinics and affordable health care.

Another significant finding is the role religion plays in the general perception of weather and weather changes. Although the hypothesis was not supported, which is in itself a finding—albeit it should be treated with caution—it does suggest that religion appears to be a socio-cultural factor that socio-economic variables like education and income does not define. Women across groups—age, education, and income—were relatively the same in their overall perception of climate change. This finding supports with the theme of religion that emerged from the in-depth interviews.

Furthermore, the findings in this study suggest that social network is an integral aspect in collectivist cultures. Studies have shown that collectivist cultures place emphasis on the gaze of the group and it defines actions and inactions. In this study, participants were consciously aware of the social network while they thought about taking protective action to mitigate the effect of climate change on their health. While there were other factors like the job situations, women valued how they were perceived if they begin to act in a way that is not typical to their environment.

One of the findings in this study is that providing didactic written information fosters the knowledge gap between those with less and more education. Women with more education are better able to understand the test message. This finding is consistent with the knowledge gap hypothesis. The knowledge gap hypothesis posits increasing differences in knowledge due to socioeconomic factors (Tichenor et al., 1970). Studies have shown that providing information like the test message used in this study tends to benefit higher SES audience segments more than lower SES segments (Ettema et al., 1983).

To mitigate the knowledge gap, it may help to incorporate other forms of information that are better able to meet the information needs of less educated and less financially secure women. For example, narrative information has been shown to more effective than didactic information at enhancing pregnant women's understanding of the maternal and child health risks of climate change (Adebayo et al., 2020). Narrative is a universal form of human communication with the potential to blur the knowledge inequality gap. Humans interact daily using storytelling to organize information, create meaning, and shape the world around them (Niles, 2010).

### **Practical Applications**

Because climate change is considered one of the biggest threats to achieving the MDG for maternal health, this clearly emphasizes the need for better and geographically specific knowledge of climate change and maternal health (Homer et al., 2009). This study provides geographically specific knowledge of climate change and maternal health in Nigeria. It also presents an approach to creating and designing targeted messages that

takes into consideration the socio-cultural and social determinants of health.

Significantly, this study serves as a starting point to informing, increasing awareness, and seeking culturally friendly ways to engage women in climate change discourse. With the use of the test message women are better able to take active protective actions to mitigate the impact of climate change on their health and that of their babies.

The study expands on the understanding of climate in developing African countries and creates a platform to further explore the health effects of climate change. Therefore, creating a framework for healthcare providers, health care agencies, and policymakers to begin the dialogue related to the health narrative and climate change with specific consideration of the social, cultural and economic nuances that defines the lived experiences of women in Nigeria.

*For health care professionals and health care agencies:* It is time to reemphasize the need for family planning, including strengthening of women's education, as the only way forward from this point. Empowering women will bring many positive additive effects, such as reduced poverty, reduced maternal and child mortality, and reduced population growth. In addition, it has been shown that the lack of appropriate antenatal care significantly increases the risk of perinatal mortality. Making good quality antenatal care available is beneficial for maternal health outcome. It is also an intervention to reduce the negative health impacts of climate change. Every effort should therefore be made to maintain antenatal care during extreme conditions. An additional effect of climate change is the changed behavior of environmental contaminants and their pathways into the human body through diet, inhalation, and dermal contact.



Also, since there are good indications that the use of insecticide treated bed nets during pregnancy is effective in reducing fetal loss and women are aware that the weather patterns increase the likelihood of being infected with malaria, this suggests that healthcare practitioners need to continually push the agenda towards using mosquito net as a protective behavior especially for pregnant women.

Similarly, public health agencies should specify that their warnings apply to pregnant women with simple and clearly stated reasons that are relatable. Also, there should be uniformity in definition and implications of effects. Likewise, both local and global public health professionals and public health communication expert can adapt the findings from the effective use of culturally centered messages for targeted audiences.

Finally, protective measures to mitigate the effect of climate change on maternal health outcomes should be incorporated into antenatal care. As women attend hospitals, health care centers, and doulas for antenatal care, health care professionals should share protective measures with women. As mentioned earlier, women will listen to trusted sources when it comes taking actions to protect their developing babies.

*To the global public health communication field*, this study adequately provides novel information for exploring the perception of climate change among vulnerable populations; highlighting ways to translate science-based evidence into understandable and accessible; information and foregrounding ways to engage vulnerable populations in the pursuit of better health outcomes through taking protective actions within their socio-cultural niche; and encourage them to call for policy changes that can impact their health outcomes and engage in environmental advocacy.

Generally, there is need to ensure indigenous women's involvement in climate change negotiations and resource management. This also suggests the need to develop policies to address climate change that recognize gender-sensitive impacts, especially maternal and prenatal health impacts. We need to provide women with access to resources and give them opportunities to participate in mitigation and adaptation processes. In addition, we need to ensure that key decision-makers understand how environmental degradation and climate change affect women differently than men, especially reproductive health within a culture where women are often defined by their ability to bear healthy living children.

Thus, including women in creating policies and strategies around environmental protection including disaster response, building resilience, securing land and inheritance rights, food insecurity, and ending energy poverty is central to mitigating and adapting climate change effects. Investing in technologies and initiatives to enhance sustainable and renewable energy sources that reflect women's knowledge, needs, and roles, while incorporating indigenous expertise and traditional practices cannot be overemphasized. Finally, integrating environmental conservation strategies within family planning and women's health programming and vice versa.

Policies that address broader health and climate protection can also work to reduce the significant economic losses from damages to health (Hutton, 2011) and the environment. It is important to prioritize gender policies in response to climate change that protect vulnerable populations, particularly women and children, both now and in the future.

## **Theoretical Implications**

In addition to the practical contributions of this formative study mentioned above, the findings in this study also adds insight to previous research and theorizing regarding the theoretical model that frames this study.

As mentioned in the introductory pages of this study, culture and environment play key roles in major health communication and health behavior theories. This study accounts for the cultural situations where behaviors are located within a broader culture, sub-culture, and practices and its theoretical applications.

The perception of a health threats is often influenced by our way of life, beliefs, norms, and values. While most health models do not consider some of the social determinants of health that mitigate individuals from making certain decisions or protective health behaviors, this study explored the need to address the beliefs, social norms, and cultural values of the target population, to better understand and evaluate how to frame health communication messages that would not have a boomerang effect.

The findings strengthen the intersection between all levels of engagement that influences individual and collective health behaviors through the lens of the socioecological model and the people and place model that frames the exploration of the perceptions of climate change among Nigerian women. Culture provides the communicative framework for health meanings such that how members of the community come to understand health and illness are embedded within the cultural beliefs, values, and practices (Adger et al., 2013; Nielsen & Reenberg, 2010). Beliefs

such as religion are contextual, and the health meanings that are localized within such indigenous cultures and are dynamic.

The findings suggest that religious beliefs are integral to individual perceptions of their environment and its effects on them irrespective of educational status. This finding significantly bears weight on the people and places model (E. W. Maibach et al., 2007), in that it shows the importance to engage the local contexts within which health meanings are constituted and negotiated and how that informs perceptions, behavior and self-efficacy. Simply put, the finding further highlights how the *people attributes* influences behavior.

Similarly, the *people's field of influence* which includes individual, social network, and community factors essential to understanding people's actions to protect themselves does show that the confidence in women's ability to take actions to protect themselves against specific impacts of climate change on their health during their pregnancy is an essential efficacious act. And it is pertinent to note that there are social and physical environmental barriers can hinder people from engaging in self-protective efficacious acts.

Furthermore, the finding bears significant weight for social-cognitive theory (Bandura, 1996) in that it further demonstrates the relationship between self-efficacy and behavior. Based on these findings, perceptions of social contexts are predictive of behavior, but only insofar as they are also predictive of individuals' confidence in their ability to engage in those protective behavioral actions.

Our health is very well affected by our physical environment—limiting or enabling factors created by our society. *Place attributes* highlight some of the environmental factors that influence making these health decisions. Place attributes are described as the availability of products and services and physical and social structures manifested at the local and distal levels. The place attribute can be synonymous with the social determinants of health, which are conditions—social, physical, and economic—in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks. The findings from this formative study support the fact that these factors do influence perceptions of climate change and its effects.

## **Limitations**

Despite the enormous practical and theoretical contributions, the current research as with all qualitative studies, has several key limitations that must be considered, including transferability of the findings to others in the population, the extent to which the final analysis accurately represents participant perspectives, and the extent to which researcher bias may influence findings (Anderson, 2010).

Because this study centers on the social and cultural perspective of women in Nigeria, hence, the transferability of the findings to other groups individuals should be done with caution. Also, it is pertinent to note that recruiting participants using purposive sampling with the intention of gathering insights from specific groups of people. Therefore, because participants volunteered to participate, there is a likelihood that they

are the exceptions. To this end, it is possible that the participants involved might have a strong perspective that do not necessarily represent everyone within the Nigerian society. However, their willingness to share their experience is the strength of this study.

Some may argue that the sample size of ten participants per group might be small. Nevertheless, a previous study found that saturation consistently occurred within the first twelve interviews and basic elements for meta-themes were found in as few as six interviews (Guest et al., 2006). Thus, this study of ten highly specialized interviewees certainly provides valuable insights that can guide future research.

Secondly, to mitigate issues of social desirability from the interviewing process, the researcher built rapport and trust with participants by identifying as part of the larger society and speaking the generally acceptable lingual. All participants were delighted to have participated in the study and were willing to refer members of their social group(s) to me to also participate in the study.

Furthermore, in-depth interview cannot be conducted without reference to the researcher's bias, especially in a single-authored, qualitative study. Because the researcher is member of the Nigerian society, the researcher pilot tested study instrument, including the interview questions.

Finally, there were limitations to the data collected in terms of variations. The sample size was relatively small and could have used more religion variations. However, the data was directional in highlighting the need to consider religion variations when collecting data from collective and religious diverse countries.

## **Directions for Future Research**

While this study explores young Nigerian women's perception of climate change, its implications on maternal health outcomes, and socio-cultural factors that impede the understanding of related information, there is still a need for additional research in raising awareness, advocacy, and individual behavioral change, and application of research findings in developing nations.

*Awareness and understanding:* Considerable research efforts need to be conducted to explore how to adequately fill the knowledge gap among vulnerable populations taking into consideration the intersection between social, cultural, and economic living experiences, using the findings in this study to create accessible protective messages and conduct extensive surveys to gain further knowledge on how to mitigate climate change effects on vulnerable populations. Similarly, a follow-up study should be conducted to further explore the adaptation of the test message into a culturally appropriate infographic message and tested for understanding, simplicity, and clarity across groups. For example, incorporating the findings from the cultural factors in this study to further explore the implications climate change has on the livelihood of at-risk populations. Research around effective ways to communicate science-related information into understandable messages for diverse culturally centered populations is paramount.

*Advocacy and individual behavioral change:* Since this study already provides a framework for creating awareness, it is imperative to investigate measures to best use communication to build public and political will for policies that will influence the social, economic, and environmental infrastructures to impact vulnerable population's ability to

take protective actions. Research needs to explore how to adequately rally at-risk populations to engage in climate change discourse, especially in developing nations like Nigeria, where several socio-economic factors hinder individual abilities to engage in protective actions. Similarly, research on effective adaptive practices and strategies to impact climate change in developing nations taking into consideration their socio-cultural living experiences with an emphasis on the role of communication.

*Application:* Additional research is needed to explore best practices to translate the findings into designing and conducting a national climate change survey in Nigeria. For example, the four core protective measures can be used as practical test instrument for pregnant women and the health outcomes evaluated. The findings did highlight the need for a follow-up study on the health implications of climate change in Nigerian women's health outcome. Research around coordinating efforts to mitigate the negative health consequences of climate change and help women take protective actions is essential.



## CONCLUSION

Exploring young women's perception and understanding of climate change is essential in framing climate change discourse in Nigeria. This current study showed that women already have a good understanding of climate, albeit not so much of the health implications on maternal health outcomes. Similarly, religion plays an integral role in women's perception of climate change and related information.

This study raises several opportunities for understanding Nigerian women's perception of climate change. This understanding will be needed in developing adequate resources to help women mitigate the effect of climate change. It also highlights socio-cultural factors that influence women's perceptions which will be essential in designing culturally centered messages.

Irrespective of the recommendations made, it is essential to highlight that the understanding of the test message and ability to engage in protective actions would differ from one region of the country to another because of the climate variations as well as the social and physical environmental barriers that influence self-efficacy.

In addition, there are several gaps and areas to advance the study of climate change and health in Nigeria, especially in seeking ways to raise awareness, individual and collective advocacy, and individual behavioral change. Furthermore, increase interest in identifying adaptation and mitigation options that are culturally friendly and adapted to

the living experiences of women. Overall, climate change remains a salient factor with adverse effects on women's reproductive health (Adebayo, 2022), and this message is yet to be common knowledge among women, especially the at-risk population.

## **APPENDICES**

### **Appendix A**

#### **Interview Protocol**

##### Preamble

Greetings

Consent form

Consent to record

Any questions before we begin?

##### Demographic Questions

Age

Language

State of residence

State of origin

Religion

Education

Marital status

For Group 5: Length of pregnancy

# of children

# of current pregnancy

Would you consider your job an outdoor, indoor, or a combination?

Would you consider your income the same, lower, or higher than the minimum wage?

What language do you speak? For this interview, will you prefer speaking to me in English or Pidgin?

### Section 1: General Perceptions

- i. Have you heard of climate change?
  - a. If yes, what do you think it means?
  - b. Do you think we might be experiencing climate change in Nigeria?
  - c. In what ways do you think we are experiencing climate change in Nigeria?
- ii. Do you think climate change is influencing the weather in Nigeria? If yes, how so?
  - a. Can you describe to me how you think the weather has changed?
  - b. Other than climate change, what other things/factors are changing the weather here in Nigeria? (That is, what other things/factors do you think is causing the change in weather?
- iii. Have you personally experienced changes in the weather? If yes: What changes in the weather have you personally experienced?
  - a. How have you been responding to these changes [mentioned above]?
    - i. How has the rainy/dry/harmattan season been different?
    - ii. How has the dry/harmattan season been different?

## Section 2: Health

- iv. Do you think the change, including changes in weather, is affecting our wellbeing/health?
  - a. If yes, in what ways?
- v. Do you think the change in weather due to climate change affects your wellbeing/health?
  - a. If yes, in what ways?
- vi. Are some groups of people more likely than other groups to have their health harmed by changes in the weather?
  - a. If yes, what groups?
  - b. In what ways do you think these groups more vulnerable?
- vii. Do you think climate change, including changes in weather, is affecting the health of your developing baby?
  - a. In what ways?
  - b. How does [first harm mentioned] happen?
  - c. Do you think anything can be done to stop that harm? What?
  - d. Repeat B and C for the next harm mentioned etc., until all harms mentioned have been explored.
- viii. What are your general religious beliefs?
- ix. Do you think there are supernatural powers that control the weather (environment)?

- a. Based on your religious beliefs, do you think you have any control over the weather (environment)?

Section 3: Current Actions (From the literature)

- x. What kind of stove do you use?
  - a. Is your kitchen located inside or outside/corridor of your living area?
- xi. Do you own a generator? (If no, skip to xb)
  - a. How often is it powered on?
  - b. Do any of your neighbor(s) own generator?
  - c. Are you ever exposed to fumes from generators? (For example, can you perceive the fume of the generator from your living area?)
    - i. How often are you exposed to these fumes?
    - ii. Where are you exposed to the fumes?
- xii. When the weather is very hot–blazing sun–can you decide to stay indoors?
  - a. Do you have ways to cool the air in your home when it is very hot outside?
    - i. What are those ways?
    - ii. How effective are they?
  - b. Do you work outdoors?
    - i. If yes, how do you deal with the excessive heat during the day while working outdoors?
- xiii. To reduce exposure to air pollution, do you have ways to reduce exposure to the sun on hotter days?

- i. What are those ways?
    - ii. How effective are they?
  - b. Do you work outdoors?
    - i. If yes, how do you deal with the excessive heat during the day while working outdoors?
- xiv. Do you ever talk about climate change/weather changes with your friends, neighbors and/or family members?
  - a. How often do you talk about it?
  - b. When you have these conversations, what do you usually talk about?
- xv. Pregnant women—Do you ever talk to other pregnant women about the dangers of climate change to their and their baby’s health?
  - a. How often do you talk about it?
  - b. When you have these conversations, what do you usually talk about?

#### Section 4: Awareness

- xvi. Where do you get information about how to have a healthy pregnancy?
- xvii. Provide participants with some practical actionable behaviors (test message).  
Then ask if each of the recommended behaviors are something they can do and will do.
  - a. If yes, how so? If no, why not?

## **Appendix B**

### **Topical Interview Protocol with Experts (OBGYNs)**

- What do you think women, especially pregnant women need to know about the changing climate?
  - What do you think Nigerian women need to know about climate change?
- How do you think women (Nigerian women) protect themselves and their developing babies from rising temperatures (extreme weather events)?
- How do you think women (Nigerian women) protect themselves and their developing babies from air pollution?
- How can pregnant women, especially those who work outdoor and less privileged protect themselves from the effects of climate change?
- What will the major takeaway you will give to your patients about protecting themselves from the recurrent extreme weather events and air pollution?



## **Appendix C**

### **Test Message (Did you Know?/Fact Sheet)**

#### **Core Four Test Message Sections**

- What is climate change?
- How does climate change affect people's health?
- How does climate change affect the health of pregnant women and their developing babies?
- What can pregnant women do to protect themselves and their developing babies from climate change?

## **Appendix D**

### **Test Message (Did you Know?/Fact Sheet)**

#### **What is Climate Change?**

- Climate change is a change in the usual weather patterns in an area—for example, Nigeria—that occurs over many years.
- These changes in the weather can include hotter days and nights, heavier rainstorms, more floods, and longer droughts.
- Global climate change is sometimes called global warming because the average air temperature, worldwide, is getting hotter.
- Global climate change is caused by burning fossil fuels such as petroleum and gas, and by cutting down large areas of forest.

#### **How does climate change affect people's health?**

- Hotter days and nights can cause heat-related illnesses and can make air pollution worse.
- Hotter temperatures and changes in rainfall can lead to the spread of many infectious diseases including malaria and other diseases carried by mosquitos, as well as diseases spread by food and water such as cholera.
- Droughts and floods cause food shortages which can lead to malnutrition.

### **How can climate change harm pregnant women and their babies?**

- Exposure to too much heat can lead to dehydration and even kidney failure.
- Dehydration in early in pregnancy can affect the baby's growth and can cause the baby to be born too soon, when it is not yet fully developed.
- Air pollution from climate change can harm the lungs and heart of the mother, the brain of the baby, and can result in the baby being born too soon or too small.

### **What can pregnant women do to protect themselves and their baby?**

- When it is very hot outside:
  - Limit the amount of time you spend outdoors: Stay indoors or in the shade—out of the sun—especially during mid-day.
  - Stay hydrated: Drink a lot of water.
  - Wear light clothing to avoid excessive sweat
  - When outdoors: Use headcovers or umbrella as shade
- Spend as little time as possible in places:
  - Where **outdoor** air pollution is worst, such as busy roadways and industrial plants.
  - Where **indoor** air pollution is worst because of generator fumes or poorly vented indoor gas/biofuel cooking.
- Download an air quality app on your smart phone so that you will know when outdoor air pollution is dangerous
- Ask your doctor about other protective measures for your baby's health from the risks associated with climate change.

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## **BIOGRAPHY**

Adebanke L. Adebayo earned her Bachelor of Arts in English Studies (Literature Emphasis) from Babcock University in 2013. She received her double Master of Arts in Applied Communication Studies and English (American Literature) from Southern Illinois University, Edwardsville. After earning her Doctor of Philosophy in Communication at George Mason University in 2022, Adebanke will begin a position as an Assistant Professor of Communication Studies at Washburn University.