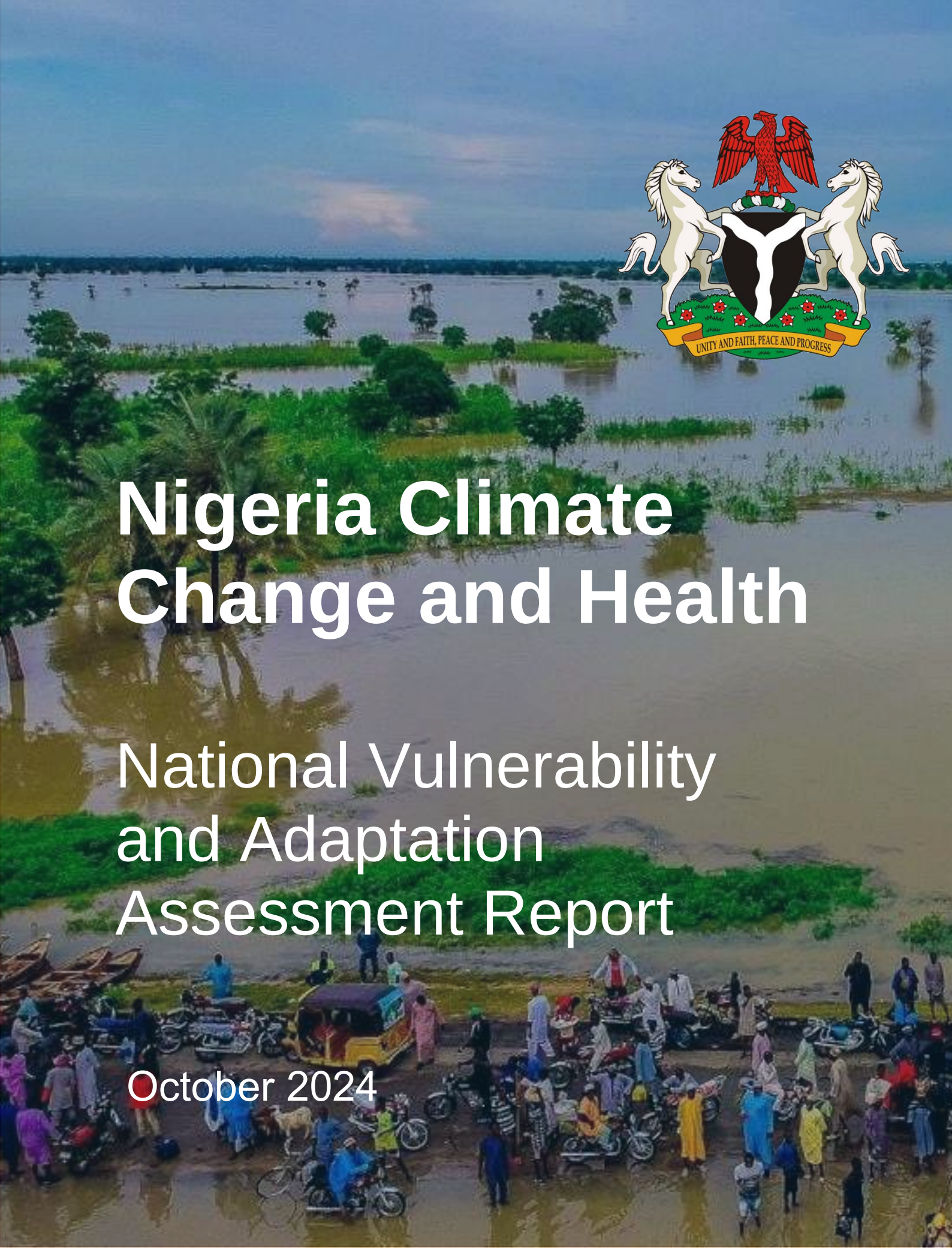

Nigeria Climate Change and Health

National Vulnerability and Adaptation Assessment Report

October 2024

Foreword

At COP26, Nigeria made a clear commitment to build a climate resilient and sustainable (low carbon) health system. This is the first firm and substantial step towards delivering that commitment and marks a significant milestone. This report aligns the Minister of Health's blueprint and the priorities within the health Sector Wide Approach (SWAp).

The nexus between climate change and health is apparent in Nigeria. The effects of climate change have intensified the impacts of extreme weather events, changed the environmental suitability for infectious disease transmission, altered population movements, and undermined people's livelihoods, well-being, as well as physical and mental health. Besides exacerbating current health problems in Nigeria, climate change is expected to undermine health services, water and food supplies, infrastructure, and social protection systems. The resulting strain on health and social systems will disproportionately affect the vulnerable and the most disadvantaged - such as women and children, the elderly, people with disabilities, and the extremely poor – with climate change amplifying inequities.

Nigeria's Climate Change and Health Vulnerability and Adaptation (V&A) Assessment Report is the output of a broad national participation and consultations with stakeholders. The assessment will help to strengthen the national health system to deliver effective, efficient and resilient health services that foster the improved health status of Nigerians and accelerate sustainable development. The V&A highlights areas outside of the health system where climate change will have devastating impacts on health outcomes; it helps to identify important cross sector partnerships which we must establish to protect the health and livelihoods of our people in the face of a more unpredictable climate. The results from the V&A provide a baseline that will be updated at key intervals and will be used to develop Nigeria's Health National Adaptation Plan (HNAP) which will serve as a national roadmap for building a climate resilient health system.

I present this V&A assessment report to partners and stakeholders in all government sectors, policy makers, development partners, civil society, scholars and practitioners in climate change and health – and, crucially, the communities of Nigeria. This report will be highly useful in setting the policy direction and vision of President Tinubu's regime on climate change and health.

Prof. Muhammad Ali Pate
Co-ordinating Minister for Health and Social Welfare

Preface

Nigeria is part of the global system that is under increasing threat of notable and sometimes rapid changes in climatic conditions. The effects of climate change are already evident in Nigeria. The health consequences from climate change - both in terms of the health outcomes such as mortality and healthy life years lost and the economic costs to the health system - will create significant additional burdens on an already-strained health infrastructure and medical and human resources.

The Vulnerability and Adaptation (V&A) assessment supports the delivery of the health programme commitments made at COP26 in Glasgow in the UK in 2021 to build climate-resilient and sustainable low-carbon health systems. The V&A assessment will assist Nigeria to strengthen its support to different populations across the geographic zones to better respond to climate health impacts and interventions.

The assessment was carried out following the WHO's guidance and assesses the vulnerabilities, the capacities, future risks and potential adaptations to Nigeria's health systems, policies, and programmes that will increase the climate resilience of peoples' health, the delivery of services and health facilities across Nigeria.

The V&A assessment was designed with a focus on health equity, recognising that the impacts of climate change affect everyone, but disproportionately harm individuals in low-income and disadvantaged communities. Priority was given to those facing greater risks of diseases linked to climate change impacts, including communities along coastlines and in desert areas, as well as specific groups including but not limited to women and girls, internally displaced persons, persons living with HIV, individuals with albinism, farmer groups, and the elderly.

The V&A has laid the foundation for the Health National Adaptation Plan (HNAP) by providing a strategic overview of order-of-magnitude costs of implementing the recommended adaptation interventions.

Finally, it is anticipated that the V&A will be a useful resource for policy maker, programmers, scholars and researchers with an interest in the nexus of climate change and health. I also encourage stakeholders in the health and non-health sectors to use the V&A assessment in their climate actions to protect and promote the health and wellbeing of Nigerians.

Ms Daju, Kachollom S. mni
Permanent Secretary
Federal Ministry of Health and Social Welfare

Acknowledgements

This assessment was made possible through the valuable contribution and collaboration of the Federal Ministry of Health and Social Welfare with stakeholders including FCDO, World Health Organisation (WHO), members of Academia, Technical Working Group (TWG) and relevant line ministries. The financial and technical support of FCDO and WHO is highly appreciated.

We are equally grateful to all the individuals, corporate entities, Federal-level institutions, the six geopolitical zones including government health actors, government Ministries, Departments, and Agencies, climate scientists, enumerators, climate and meteorological institutions, media, civil society, faith-based groups, labour organisations, international multi-laterals, affected populations including vulnerable groups, traditional leaders and other stakeholders who participated in the assessment and provided consistent support that contributed to the final production of the report.

Finally, we are grateful for the commitment of the staff of the Department of Public Health, especially the staff of the Climate Change and Environmental Health team; and indeed, the whole FMoH for their contributions and support in one way and another.

Dr Chukwuma Anyaike
Director Public Health
Federal Ministry of Health and Social Welfare

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Abbreviations

AF	UNFCCC's Adaptation Fund	**NAP**	National Adaptation Plan
AMR	Anti-Microbial Resistance	**NASCP**	National Aids, Viral Hepatitis and STIs Control Programme
AMSL	Above Mean Sea Level	**NASPA**	National Adaptation Strategy and Plan of Action
AR4	IPCC's 4th Assessment Report	**NASPA-CCN**	National Adaptation Strategy and Plan of Action on Climate Change for Nigeria
AR5	IPCC's 5th Assessment Report	**NBS**	National Bureau of Statistics
AR6	IPCC's 6th Assessment Report	**NCCP**	National Climate Change Policy
ARF	Agricultural Resilient Framework	**NCCC**	National Council on Climate Change
BAU	Business as Usual	**NCDC**	National Centre for Disease Control
BHCPF	Basic Health Care Provision Fund	**NDC**	Nationally Determined Contributions
BMPHS	Basic Minimum Package of Health Services	**ND-GAIN**	Notre Dame Global Adaptation Initiative
BUR	Biennial Update Report	**NEMA**	National Emergency Management Agency
CCKP	Climate Change Knowledge Portal	**NGO**	Non-Governmental Organisation
CDS	Climate Data Score	**NHA**	National Health Act
CHVA	Climate Change and Health Vulnerability and Adaptation Assessment	**NHIA**	National Health Insurance Authority
CMIP	Coupled model intercomparison project	**NHIS**	National Health Insurance Scheme
COPD	Chronic Obstructive Pulmonary Disease	**NHMIS**	National Health Management Information System
CRF	Consolidated Revenue Fund	**NICS**	National Immunisation Coverage Survey
CSO	Civil Society Organisation	**NIMET**	Nigeria Meteorological Agency
DHIS2	District Health Information System v2	**NMEP**	National Malaria Elimination Programme
DHS	Demographic and Health Survey	**NPHCDA**	National Primary Health Care Development Agency
DRF	Drug Revolving Fund	**NPI**	National Programme on Immunisation
DRR	Disaster Risk Reduction	**NSHDP**	National Strategic Health Development Plan
DTP	Diphtheria Tetanus Pertussis	**NSRDA**	National Space Research and Development Agency
ESRI	Environmental Systems Research Institute	**NSITF**	National Social Insurance Trust Fund
FBO	Faith Based Organisation	**NSPHP**	National Strategic Plan for Health Promotion
FCDO	UK' Foreign, Commonwealth and Development Office	**NTLCP**	National Tuberculosis and Leprosy Control Programme
FCT	Federal Capital Territory	**NTD**	Neglected Tropical Disease
FGD	Focus Group Discussion	**OCHA**	United Nations Office for the Coordination of Humanitarian Affairs
FMoE	Federal Ministry of Environment	**OOPE**	Out of Pocket Expenditure
FMoH	Federal Ministry of Health	**PLWD**	People Living With Disability

FMHDM	Federal Ministry of Humanitarian and Disaster Management	**PLWHIV**	People Living with HIV/AIDS
FMoWR	Federal Ministry of Water Resources	**PNC**	Post-Natal Care
GAI	Global Adaptation Index	**PTSD**	Post-Traumatic Stress Disorder
GCF	UNFCCC's Green Climate Fund	**RMNCAH**	Reproductive, Maternal, Neonatal, Child and Adolescent Health
GEF	Global Environment Facility	**RUWASA**	Rural Water and Sanitation Agency
GESI	Gender Equality and Social Inclusion	**SEMA**	State Emergency Management Agency
GDP	Gross Domestic Product	**SLCP**	Short Lived Climate Pollutants
GHG	Greenhouse Gas	**SPHCDA**	State Primary Health Care Development Agency
GIS	Geographical Information System	**SMoH**	State Ministry of Health
GNI	Gross National Income	**SSP**	Shared Socioeconomic Pathway
GoN	Government of Nigeria	**TB**	Tuberculosis
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome	**THE**	Total Health Expenditure
HNAP	Health National Adaptation Plan	**TNC**	Third National Communication
HRH	Human Resources for Health	**TWG**	Technical Working Group
IDP	Internally Displaced Person	**UHC**	Universal Health Coverage
IMR	Infant Mortality Rate	**UNFCCC**	United Nations Framework Convention on Climate Change
IPCC	Intergovernmental Panel on Climate Change	**UNEP**	United Nations environment programme
JONAPWD	Joint National Association of PLWD	**UNFPA**	United Nations Population Fund
KII	Key Informant Interview	**UNICEF**	United Nations Children's Fund
LGA	Local Government Area	**USAID**	USA Agency for International Development
LTV	Long-Term Vision	**UTACS**	United Nations Conditional Target Ambition Climate Scenario
M&E	Monitoring and Evaluation	**V&A**	Vulnerability and Adaptation
MDA	Ministries, Departments and Agencies	**VBD**	Vector Borne Disease
MHPSS	Mental Health and Psychosocial Support	**VPD**	Vaccine Preventable Diseases
MICS	Multiple Indicator Cluster Survey	**WB**	World Bank
MTNDP	Medium-term National Development Plan	**WGS84**	World Geodetic System 1984
NAF	National Adaptation Framework	**WHO**	World Health Organisation
NAFDAC	National Agency for Food and Drugs Administration	**WMO**	World Meteorological Organisation
NAMA	Nationally Appropriate Mitigation Actions	**ZRI**	Zoonoses Risk Index

Glossary

Adaptation	Adjustment to actual or expected climate change and its effects	**Harmattan**	Coastal dry dusty wind
Anthropogenic	Caused by human activity	**Hazard**	The potential of a natural or human-induced physical event to cause harm
Anticipatory action	A set of actions to prevent or reduce potential disaster impacts prior to a shock or acute impacts	**Health risk**	The potential for consequences where something of value is at stake and where the outcome is uncertain. Risk results from the interaction of vulnerability, exposure, and hazard. Higher hazards, exposures, and/or vulnerabilities will lead to higher risk
Attribution	Establishing the most likely cause for a change or impact	**Loss and damage**	Negative climate change impacts occurring despite, or in the absence of, mitigation and adaptation
Capacity	The combination of strengths, attributes and resources available to achieve goals	**Malnutrition**	Deficiencies or excesses in nutrient intake
Climate change	Human caused changes in the earth's climate	**Mitigation**	Technology or practice to reduce GHG emissions
Climate hazard	Refers to climate-related physical events or trends or their physical impacts, such as changes in extreme precipitation and heat waves that may compromise systems in the future.	**Nephropathy**	Deterioration of kidney function
Community vulnerability	Comprised of socio-economic, ecological, livelihood and topographical factors or circumstances that may render an area more susceptible to various health impacts	**Population exposure**	Exposure is the presence of systems, people, and assets that may be at risk due to a particular hazard
Compound hazards	Multiple hazards with concurrent impacts such as heavy rainfall, extreme wind and storm surge	**Resilience**	The capacity to respond, reorganize, learn, adapt or transform to cope with hazards
Cyanotoxins	Toxins from cyanobacteria	**Risk**	The potential for a hazard to cause harm
Development pathways	Socioeconomic futures in different climate emissions scenarios	**Sensitivity**	Amount of warming from a given amount of carbon emissions
Ecosystem	A unit of living organisms interacting with each other and their non-living environment	**Stationarity**	Assumption that the underlying characteristics of a system do not change over time.
Emissions	GHGs released into the atmosphere	**Systemic**	Systems interacting with each other such as climate, food, planning and economic systems

Epidemiological	Incidence, distribution and control of diseases	**Vulnerability**	The propensity or predisposition to be adversely affected
Exposure	The act of being proximate to any risk due to a specific hazard	**Zoonoses**	Disease transmissible from vertebrate animals to humans
Evapotrans-piration	Transfer of water from land and plants to the atmosphere		

*Most definitions are abbreviated from IPCC definitions which can be found here.

1. Summary for policymakers

Headline messages from the report

1. **The overall trend – across all scenarios - is that the risks and impacts from climate change to the health sector are projected to worsen** in terms of severity, duration and magnitude across all geographic areas of Nigeria
2. **Under all scenarios and despite any efforts on behalf of Nigeria, the country's risk to climate change is increasing and will continue to increase.** These increased risks will create a situation that will impact health care capacity, increase the vulnerability of communities and create conditions more conducive to disease growth, with some geopolitical zones and states being more at risk that others
3. **Based on analysis, Nigeria will experience an additional 21% burden of disease** due to climate change
4. **Temperatures will continue to rise across the country** by approximately 1.0-1.1 °C between 2020 and 2050 under mild climatic scenarios. Under more extreme scenarios it is expected to rise by at least +3.0 °C
5. **The population exposed annually to increased heat events is projected to quadruple** from 6% in 2000 to 19-22% by 2080. The population exposed to heat waves each year will quadruple from 6% in 2000 to 19 - 22% by 2080. Deaths from heat are expected to double, increasing from 2.5 to 5 per 100,000 people per year by 2080
6. **Nigeria will be exposed to increased rainfall that will be experienced across much of the country.** Most of the country will experience an additional 110mm to more than 200mm rain each year, building on a current national average of 1,165mm per year. A total of 800,000 individuals are at risk from riverine flooding by 2030 and approximately 550,000 individuals could be affected annually by flooding from sea levels by 2070
7. **Under the most severe scenarios, sea level is predicted to rise between 0.5 and 1.0 meters by the end of the century** which will have a significant impact and permanently alter shorelines, increasing the risk of flooding for coastal towns and ecosystems, and which will alter patterns of infectious and vector-borne disease transmission
8. **Many waterborne diseases will increase due to climate change**. Some Neglected Tropical Diseases are expected to increase– e.g. Buruli ulcers, Guinea worm, Trypanosomiasis. Diarrhoea related deaths in children under 15 resulting from climate change will account for around 9.8% of the total diarrhoea related mortalities
9. **Non-communicable diseases will increase.** Cardiovascular disease will increase by 10% to over 4.5m cases in 2030. Diabetes is predicted to increase to almost 450,000 in 2030 due to rising temperatures. High blood pressure is also expected to increase significantly from almost 900,000 cases in 2020 to over 1.6m in 2030
10. **Mental health conditions will rise due to the stresses of climate change.** Mental disorders will rise from 2.6m in 2020 to more than 3.1m by 2030. Interpersonal violence will increase from 900,000 in 2020 to 1.05m in 2030 and neurological disorders and self-harm will increase
11. **Respiratory disease, severe acute respiratory illness and asthma will see marginal increases.** Tuberculosis (TB) is forecast to increase from over 41,000 cases in 2020 to more than 52,000 in 2030
12. **Regarding vector-borne diseases**, malaria is expected to increase significantly. There will be increase in yellow fever cases

1.1 Vulnerability & Adaptation assessment overview

Nigeria's V&A assessment has been carried out against the WHO's guide "Climate Change and Health: V&A Assessment". Developed in 2021, this provides guidance on conducting assessments of current and future vulnerability to the health risks of climate change, and of policies and programmes that could increase resilience, considering the multiple determinants of climate-sensitive health outcomes. The guidance has been successfully applied to more than 50 countries and settings, and has helped countries to prepare their health contributions to United Nations Framework Convention on Climate Change (UNFCCC) national adaptation plans. The operational framework for Nigeria's V&A is built on the WHO's six building blocks of the health system and the 10 building blocks of climate resilient health systems.

WHO's six building blocks of the health system and ten building blocks for climate resilient health systems

1.2 Assessment objectives

The overarching objective of the V&A assessment is to provide both baseline and future projections of the vulnerability, capacity and future risk of Nigeria's health sector and health system to climate change - and to use these findings to inform recommendations that will support adaptations to climate change. The objectives were met by identifying Nigeria's climate-sensitive health risks and exploring the current burden and vulnerabilities, including for at-risk communities and groups, of climate change on health in Nigeria. Existing health policies and programmes were reviewed to understand where climate change is included, and the preparedness and capacity of the health system at the national and sub-national levels has also been carried out in order for the future risks from climate change to be reviewed and adaptation recommendations made.

1.3 Methods and processes

The V&A assessment is national in scope, with as much primary and secondary data collected, analysed and synthesised as possible from across the country and from multiple sources. As per the WHO V&A guidance, the primary data gathering is illustrative, not representative.

The majority of the evidence and conclusions in Nigeria's V&A is drawn from analysis and synthesis of existing data, literature and expert opinions. Primary data was sourced to provide

local illustrated findings, providing examples to verify overarching findings and to fill in gaps from secondary data. Secondary data was drawn from a number of available sources from within and outside Nigeria and was analysed and synthesised through a literature and policy review and modelling of climate and health data.

Methods and processes used to carry out Nigeria's V&A assessment

Primary/ secondary data	Method and process
Primary data	• Key informant interviews (in-person and remotely) with stakeholders at the Federal, state and local government authority (LGA) levels • Focus group discussions with communities, including with vulnerable groups • Health facility assessments (30 in total, including public and private sector facilities at primary, secondary and tertiary levels) • National stakeholder workshops • Modelling
Secondary data	• Literature review • Policy review • Modelling • Data sourcing

1.3.1 Samples of states

The V&A assessment covers Nigeria's Federal level and six geographical zones. One state was selected for primary data gathering within each geographical zone, using selection criteria including vulnerability to climate change impacts; representation of vulnerable groups; access, security and proximity to transport hubs.

States and LGAs selected for primary data collection

No.	Geo-political zone	State/capital	LGAs selected (urban and rural)
1.	**North-East**	Adamawa - Yola	Yola South and Demsa
2.	**North-West**	Kano - Kano	Ungogo and Gezawa
3.	**North-Central**	Kwara - Ilorin	Ilorin West and Asa
4.	**South-West**	Lagos - Lagos	Ikeja and Ikorodu
5.	**South-East**	Enugu - Enugu	Enugu East and Aninri
6.	**South-South**	Akwa Ibom - Uyo	Uyo and Ikono

1.3.2 Stakeholder engagement

In total, more than 300 stakeholders were interviewed and engaged across at the Federal, state and LGA levels. Consultations involved all relevant stakeholders across various categories of relevance and importance to climate change and health, including:

- Federal and state health agencies
- Other Federal and state agencies, such as the National Council on Climate Change (NCCC)
- Multilateral agencies, such as WHO and UNICEF
- Financiers
- Climate and health researchers and specialists
- Community representatives, such as LGA chairpersons

1.3.3 Climate change and health TWG

Prior to the start of the V&A assessment, a national climate change and health TWG was established to provide an oversight function for the entire process, to ensure that relevant stakeholder groups were engaged and to enable key expert inputs to be solicited as needed. The TWG had a central coordinating role in advising, informing, reviewing, and validating the V&A assessment approach through meeting, discussing, proposing any changes and validating the Nigeria's V&A assessment.

1.3.4 Modelling Nigeria's health risks from climate change

The climate health risk assessment used for Nigeria's V&A assessment incorporates definitions to align with the WHO health outcomes methodology. The modelled data used for the assessment included large-scale climate modelling efforts aimed at providing the most up-to-date and reliable projections of future climate change. This V&A used the "middle of the road" scenario which assumes emissions fall mid-century, but do not reach net-zero by 2100. This is a realistic scenario, adopted by many other V&As and by donors. The 30-year time frame of 2020-2050 with a mid-point of 2035 is used for the V&A assessment of the near future climate changes in Nigeria. The baseline of the current climate used is 1990-2020 unless otherwise stipulated.

WHO identifies nine critical health outcomes that are most at risk from climate change

1. Injury and mortality from extreme weather events
2. Heat-related illness
3. Waterborne diseases
4. Vector-borne diseases
5. Malnutrition and food-borne diseases
6. Respiratory illness
7. Zoonoses
8. Noncommunicable diseases
9. Mental and psychosocial health

1.4 Climate change and health in Nigeria

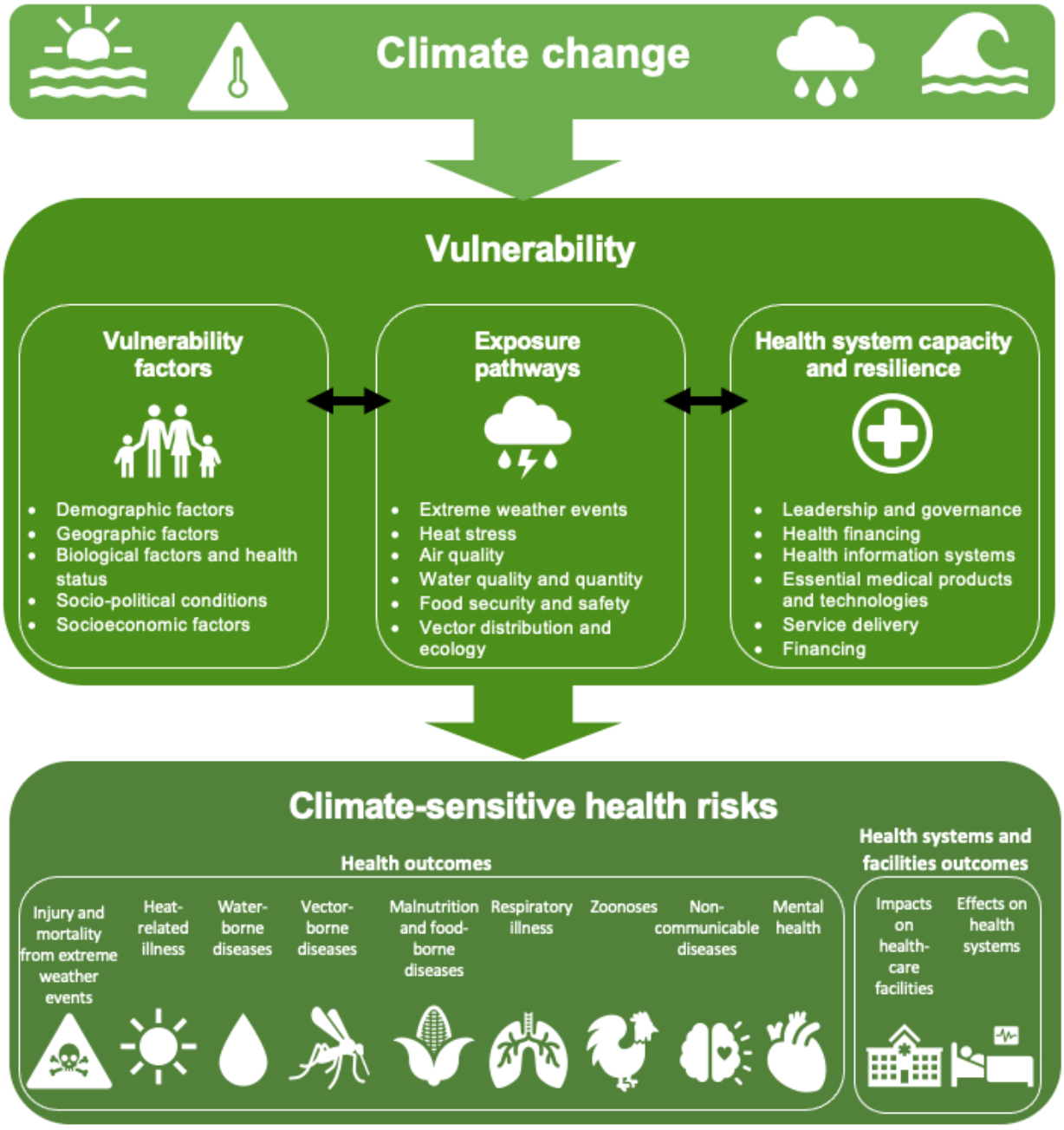
Climate change encompasses long-term alterations in temperature and weather patterns, predominantly attributed to human activities, particularly the combustion of fossil fuels.[1] This phenomenon acts as a risk multiplier, transcending sectors and geographies, and intensifying pre-existing developmental challenges. Notably, climate change poses significant threats to human health and wellbeing by impacting weather conditions, ecosystems, and societal systems.[2]

Climate change exacerbates the impacts of extreme events, alters the environmental dynamics of the transmission of infectious diseases, influences population movements, and erodes the foundations of livelihoods, wellbeing, and both physical and mental health.[3] In Nigeria, climate change not only exacerbates existing health issues but also jeopardises health services, water and food security, infrastructure, and social protection frameworks.[4] The health consequences associated with climate change, both in terms of health outcomes (mortality and

[1] IPCC AR6 assessment report here: https://www.ipcc.ch/assessment-report/ar6/
[2] WHO Exec Board. Climate change and health, WHO, 2023. Here: https://apps.who.int/gb/ebwha/pdf_files/EB154/B154_25-en.pdf
[3] N. Watts et al. The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. 2019. Here: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)32596-6/abstract
[4] IPCC. 6th Assessment Report. Chapter 9: Africa. Here: https://www.ipcc.ch/report/ar6/wg2/chapter/chapter-9/

healthy lives lost) and the degradation of healthcare, place a substantial additional burden on already overstretched infrastructure and medical and human resources.[5] These nine health outcomes are presented below and are assessed in detail throughout Nigeria's V&A assessment.

Risk relationship between climate change and health outcomes expressed through exposure pathways, vulnerabilities and capacities.[6]



[5] EHP publishing. https://ehp.niehs.nih.gov/
[6] Quality criteria for health national adaptation plans. Geneva: World Health Organization; 2021

Climate and health exposure pathways

Health outcomes	Climate exposure pathway	Climate impacts
Injury and mortality from extreme events	• Extreme single-day rainfall • Number of days above 20mm of rainfall • Peak monthly precipitation • Flood risk	• Extreme weather and climate events, such as floods, droughts, and wildfires, have profound and direct impacts on human health and safety • These impacts can range from immediate injury and loss of life to longer-term public health challenges
Heat-related illness	• Days over 35°C • Heatwaves • Monthly temperature peak • Average maximum temperature	• Health impacts include heat exhaustion, heatstroke, and, in severe cases, death • Other impacts include heat rash, cramps, heat exhaustion from a loss of water and salt in the body, excessive sweating without adequate fluid and salt replacement and heat stroke when the body's heat-regulating system is overwhelmed • Heat stress reduces capacity for physical work and increases the risk of occupational health problems
Waterborne disease	• Changes in rainfall seasonality • Average temperature increases • Maximum temperature increases	• Cholera which can cause severe diarrhoea, vomiting and dehydration • Typhoid fever caused by the salmonella typhi bacteria • Other diarrhoeal diseases such as giardiasis, dysentery, rotavirus, hepatitis A, and e-coli contamination
Vector-borne diseases	• Increased peak precipitation • Annual rainfall • Average and peak temperature increases • Aridity	• Malaria, dengue fever, yellow fever, Lyme disease, and zika virus, among others
Malnutrition and food-borne diseases	• Annual rainfall • Aridity • Seasonality index	• Malnutrition • Iodine deficiency, selenium deficiency, iron deficiency, norovirus infection, and shigellosis
Respiratory illness	• Extreme rainfall which can create mould which causes lung complications	• Pulmonary TB • Asthma

	• Rainfall variability - during dry years, respiratory illnesses can increase • Heatwaves which can cause respiratory problems making breathing more difficult in hot, humid air and increased levels of ozone and pollen	
Zoonoses	• Increased rainfall - can lead to runoff that contaminates water sources with pathogens, nutrients, and toxins • Increased temperature – can lead to more parasites and bacteria	• Lassa fever • Yellow fever
Mental and psychosocial health	• Climate stresses lead to cause trauma, mental illness and distress •	• Depression • Anxiety • Chronic stress and anxiety
Non-communicable diseases	• Heatwaves and reduced rainfall are linked to higher rates of morbidity and mortality from NCDs	• Cardiovascular diseases • Hypertension • Arthritis • Cancers • Diabetes

1.5 Climate impacts on Nigeria's health system

Due to the increasing prevalence and incidence of direct and indirect climate-sensitive health risks resulting from extreme weather events - rising sea levels, drought, excessive heat, air pollution, and floods, among others – Nigeria's health system is often overburdened by changing climate conditions.[7] Primary and secondary data collected from across the six geopolitical zones to inform the V&A indicates a number of concerns on how the effects of climate change impacts on an already underperforming health system.

[7] Schrage, Pia & Adeyanju, Gbadebo. (2024). Building Climate Resilient Health Systems: Panacea for Mitigating Climate Change Effects in Nigeria. DOI:10.21203/rs.3.rs-4387784/v1.

Summary of climate change implications on Nigeria's health system

Climate resilient building block	Climate change impacts
Leadership and governance	• Difficulties in planning, disruptions to operations, and increased costs, due to unpredictability of weather patterns • Multi-sectoral coordination efforts are required to mitigate the impacts of climate change
Climate and health financing	• Effects of climate change undercuts financial resources budgeted for health service provision – needing re-allocation of funds to treat new disease burden or re-design of healthcare structures, programmes, and services
Health workforce	• Safety of health workers carrying out duties under extreme weather conditions compromised • Increased workload - overstretched health workers who besides providing routine services have to cope with increased demand from climate health risks • Increasing occurrence of medical errors, due to the unsuitable working environment (e.g., very high temperatures) and excessive workload
Vulnerability, capacity and adaptation assessment Integrated risk monitoring and early warning Health and climate research	• Increased prevalence and incidence of climate health risks places new demand on the already week HMIS to analyse disease impacts • Increased amount of health information needed to be gathered and reported overwhelm the HMIS and data availability for decision making
Climate resilient and sustainable technologies and infrastructure	• Disruption to transport facilities/services from climate extreme events leading to shortages of essential medicines and supplies • Changes in temperature affecting storage conditions for vaccines and drugs – integrity of medical supplies compromised due to high temperatures which causes many problems with the safety of drug use • Flood water destroy medical equipment, drugs, and supplies
Management of environmental determinants of health Climate-informed health programmes Emergency preparedness and management	• Damage to health care facilities due to extreme weather and decreasing access to water during droughts • Reduced access to water during floods and extreme weather events as water sources compromised and no longer 'safe' • Facilities built in flood prone areas damages health centre building - makes it to deteriorate faster and become very unstable for continuous use • Presence of flood water in facilities makes it difficult for the staff to render services and the need to relocate to other places/premises. • Disruption to power and energy sources impacts the operation of primary health care and hospital key services such as immunisation, surgical operations etc. • Losing access to health services - patients and care givers cannot access health services during heavy rainfall • Disruption for patients for routine health service delivery due to extreme weather events that restrict the ability to travel to health facilities

Climate resilient building block	Climate change impacts
	• Health services struggle to maintain normal services while also trying to meet increased demand for services resulting from climate-sensitive health risks

1.6 Vulnerability assessment

Due to a combination of political, geographic, and social factors, Nigeria is categorised as acutely vulnerable to climate change impacts with comparatively low levels of readiness. Nigeria is ranked 154 out of 181 countries in the 2021 Notre Dame Global Adaptation Initiative (ND-GAIN) Index[8]. Despite a positive trend between 2005 and 2013 where the highest score of 46 was attained, little progress has been made over a 25-year period between 1995 and 2021.

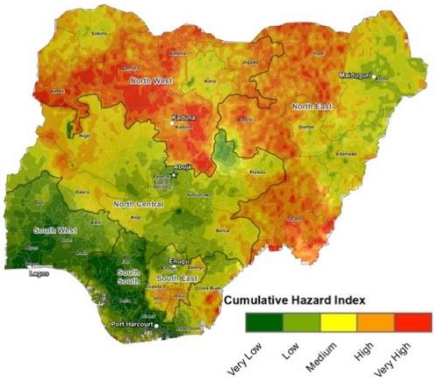
Climate change vulnerability is multisectoral. Failures in water and sanitation, energy availability, waste management and food systems will exacerbate the impact of health-related climate stress. Cross-sectoral approaches to climate change adaptation are therefore critical. Regarding cross-sectoral approaches to climate-health governance and leadership in Nigeria, data shows that the most relevant sectors to consider as part of the climate-health nexus are agriculture, food security, forestry, biodiversity conservation, water and sanitation, energy, and transport. Primary data from stakeholder engagement adds to this list the waste, construction, mining, and manufacturing sectors. Reducing health risks and improving equity in a way that realises co-benefits requires wide-ranging cross-sectoral stakeholder engagement.

Climate change affects different population groups disproportionately, causing and exacerbating socioeconomic and health inequality. In Nigeria, health sector stakeholder perceptions are that women, especially pregnant mothers and those in their reproductive age group; children; the elderly; persons with disabilities (in particular those with albinism); people with psychosocial disorders; and individuals with pre-existing and chronic health conditions are the most vulnerable to climate change impacts. It is noted that poor women who bear the unpaid burden of childcare, family health and children's schooling, for example, are more likely to be vulnerable to these impacts. Geographically, people residing in poor living conditions and indigent communities (particularly those who are multidimensionally poor), urban slums, unsecured settlements, overcrowded communities, and places prone to the impacts of extreme weather are also disproportionately vulnerable to climate change.

1.6.1 General health system vulnerability

In its current state, the health system in Nigeria is unlikely to withstand the shocks from climate impacts and ensure uninterrupted healthcare services to the population. Nigeria's heath system has varied vulnerabilities to climate change:

- **Highest vulnerabilities:** Health systems in most states in the North West and North East zones, especially the states in the central and southern parts of North Western – Kebbi, Zamfara, Katsina, Kaduna and Jigawa – and the western states in North East – Taraba, Bauchi and Yobe



[8] University of Notre Dame Global Adaptation Initiative. (2024). *ND-GAIN Country Index*. [Online]. Available: https://gain.nd.edu/our-work/country-index/rankings/

- **High vulnerabilities:** Health systems in the eastern parts of Niger and Kwara state in North Central zone, south parts of Cross Rivers state in South zone and Imo and Abia states in South East zone
- **Medium vulnerabilities:** Health systems in states in North East and North Central zones
- **Lower vulnerabilities:** Health systems in South West and South zones

1.6.2 Vulnerability of the health systems building blocks

Primary and secondary data indicates that Nigeria's health system remains largely weak and is vulnerable to climate change.

Nigeria's health system vulnerabilities to climate change

Climate resilient building block	Vulnerabilities to climate change
Leadership and governance	• **Leadership and governance capacity for climate change and health is limited** within the MoH at the Federal, state and LGA levels • **Lack of awareness among policymakers** or what some stakeholders referred to as 'policymaker ignorance' regarding the importance of climate change on Nigeria's health sector • **The climate and health units in the FMoH and the state MoHs are not fully functionally** administratively to perform their basic functions • **The impacts of climate change on health is not widely or fully appreciated** across the leadership and governance of the health sector • **Coordination between the FMoH and other Ministries, Departments and Agencies (MDAs) is weak**, and bureaucracy is very high • **Bureaucracy and apparent power struggles** between Federal and state ministries, according to interviews with key stakeholders • **Climate change and the nexus with health is not a significant enough feature in national development policies and plans**, including health policy and plans. Other "more pressing" healthcare challenges are given priority. Only a small number of national policies including the 2021 National Policy on Climate Change, the 2021 Climate Change programme, the 2050 Long-Term Vision for Nigeria, the Nigeria National Action Plan (NAP), and the Agricultural Resilient Framework address the climate-health nexus in part • **Nigeria does not have a National Adaptation Plan** • **Climate change and health coordination forums are nascent** – and only exist at the Federal level • **A lack of synergy between health and non-health sectors**, including the increasing risk of climate change has also been noted by stakeholders
Climate and health financing	• **Low budgetary allocations** to support the routine and essential functions of the health sector • **No costed plan in place for climate and health** • **No specific funding for climate and health** priorities • **No clear and defined budget for emergency preparedness and response** to extreme weather events, as part of overall health budget
Health workforce	• **The current number, availability and distribution of health professionals is already insufficient**, especially in the northern and many rural parts of the country • **Deploying and retaining health workers in rural, remote, and underserved areas continues to be a major challenge**. This is exacerbated by factors like the 'Japa syndrome' (migration of professionals) which further vulnerabilities to dealing with climate-sensitive health conditions

Climate resilient building block	Vulnerabilities to climate change
	• **Low capacity and limited knowledge and understanding of health workers on the impacts of climate change** on the health system and populations' health. • **Very limited/no training of current health professionals that equips them on how to deal with the increasing demands of climate change** risks, including emergency preparedness • **No capacity to predict and act on climate change projections** • **No assessment of health workforce capacities** to respond to climate risks
Vulnerability, capacity and adaptation assessment **Integrated risk monitoring and early warning** **Health and climate research**	• **Knowledge of the climate-health nexus is low for civil society**, with several stakeholders directly demonstrating this is especially low at the community level. Statista (2022) equally reported that over 60% of Nigerians were not aware of the changing climate. As of 2020, more than six Nigerians out of 10 never heard about climate change. Only 30 percent of respondents declared to have heard about this topic. Awareness of the topic resulted to be higher in urban Nigeria than in rural areas. • **The health information systems are not aligned with weather and disaster early warning systems** to support effective anticipatory action and improved service delivery and coverage • **The current health information systems do not capture any climate change and health nexus information** • **The lack of climate and health information throughout the system** limits the overall awareness and appreciation of the impacts on climate change – and data is not incorporated into climate-sensitive health policies and plans • **Nigeria's research capacity and research experience on climate change and health** is limited • **The availability of climate change and health data is limited** at the Federal level, and very limited in the states and Local Government Areas (LGAs) • **Weak Health Management Information Systems (HMISs) that provides limited availability of health information required** for planning, resource allocation, and informs service delivery
Climate resilient and sustainable technologies and infrastructure	• **The current procurement and distribution system is unable to anticipate potential disruptions** to the supply chain from climate change • **Logistic management information systems are not linked to other early warning systems** in order to ensure that sufficient quantities of essential medicines are available and provided in advance of climate-related disasters • **Nigeria's supply chain does not have a master plan to mitigate the risks** from climate change • **Alternative and innovative modes of distributing essential medical supplies are not available**. There is an over-reliance on traditional means of distributing via roads • **There is no back-up supply chains available** for use during extreme weather events caused by climate change
Management of environmental determinants of health	• **Many existing health facilities are insufficiently equipped** to meet the general health needs of Nigerians • **The majority of health facilities infrastructure are not specifically adapted to effectively deal with the projected changes due to climate change** and to adequately cope with extreme weather events

Climate resilient building block	Vulnerabilities to climate change
Climate-informed health programmes	• **Health facilities do not have sufficient equipment** to deal with increased numbers of clients due to the changes in climate • **Laboratory capacities do not track current needs nor model future burdens** of climate-sensitive diseases • **Healthcare facilities lack emergency plans** for providing essential health services to higher demands created by extreme weather events (floods, heatwaves, storms etc) • **Climate not mainstreamed into core health system and infrastructure planning** • **Limited disaster contingency plans**, especially at community level • **Several key health programmes have limited or no inclusion of climate-health nexus issues**, such as the National AIDS and STDs Control programme, National Malaria Elimination programme, National Tuberculosis and Leprosy Control programme, National Health Insurance Scheme, and; Nigerian government's Midwife Service Scheme.
Emergency preparedness and management	

Summary of vulnerabilities in Nigeria to the nine health outcomes

Health outcome	Vulnerability summary
 **Injury and mortality from extreme events**	**Highest vulnerabilities:** • Much of Nigeria's health system shows very high vulnerabilities to being able to adequately respond to extreme events caused by climate change • The coastal states in the South geopolitical zone are most vulnerable, followed by the southern states in South East geopolitical zone due to risk of flooding and sea level rises
	Medium vulnerabilities: • Central higher elevated areas have a medium flood hazard rating
	Lower vulnerabilities: • Other zones and states have lower vulnerabilities due to their limited rainfall
 **Heat-related illness**	**Highest vulnerabilities:** • Health systems in the most north-westerly and north-easterly regions, as well as in the states in southern North East zone and most of North Central zone are at high-to-very high vulnerabilities to temperature stress
	Medium vulnerabilities: • Elevated states in central and northern central Nigeria are exempt from this high heat hazard index • Health systems in southern Nigerian states show a low-to-medium vulnerability to temperature stress due in part to their proximity to the ocean
 **Waterborne disease**	**Highest vulnerabilities:** • Health systems in states in the north, north-west, north-east, west and coastal areas in the South West and South zones have the highest vulnerabilities
	Lower vulnerabilities: • Health systems in several states in the south have lower vulnerabilities
 **Vector-borne diseases**	**Highest vulnerabilities:** • Vector-borne disease vulnerability peaks in states in the far southern delta area in South zone
	Medium vulnerabilities: • Medium-high vulnerability exists in states in the North West and North Eastern zones
	Lower vulnerabilities: • States in the South West zone, as well states immediately around this zone, as show lower vulnerability scores
 **Malnutrition and food-borne diseases**	**Highest vulnerabilities:** • States in northern Nigeria
	Medium vulnerabilities: • States in the middle band of the country show medium vulnerability
	Lower vulnerabilities: • States in the southern areas of Nigeria have the lowest vulnerability levels
 **Respiratory illness**	**Highest vulnerabilities:** • Health systems in states in the north, north-west, north-east, west and coastal areas in the South West and South zones have the highest vulnerabilities
	Lower vulnerabilities: • Health systems in several states in the south have lower vulnerabilities
 **Zoonoses**	**Highest vulnerabilities:** • Vulnerability is high in northern states
	Medium vulnerabilities: • Medium in the states in the middle of Nigeria

Health outcome	Vulnerability summary
	Lower vulnerabilities: • Lower vulnerability in the southern states
Mental and psycho-social health	**Highest vulnerabilities:** • Mental and psychological health vulnerability is highest in the southern states. This is predominantly driven by the impact of severe rainfall
	Lower vulnerabilities: • States in the majority of the central and north west regions have low vulnerability while north-central and north-eastern areas have the lowest vulnerability
Non-communicable diseases	**Highest vulnerabilities:** • Vulnerability is high in northern states
	Medium vulnerabilities: • Medium in the states in the middle of Nigeria
	Lower vulnerabilities: • Lower vulnerability in the southern states

1.7 Future risk assessment

Nigeria faces significant health vulnerabilities associated with anticipated future climatic conditions. These conditions include rising temperatures and enhanced frequency and intensity of extreme weather phenomena such as heavy rainfall along with prolonged and more severe periods of heat, drought and aridity. Such climatic shifts are expected to exacerbate water and food scarcity, increase susceptibility to heat stress and ultraviolet radiation, and alter the transmission dynamics of infectious and vector-borne diseases. Disruptions to existing agricultural practices may lead to food shortages, disproportionately affecting the health of women, children, and other vulnerable groups. These potential effects pose a significant threat to the long-term health of the Nigerian population and the resilience of the national health system. [9] [10]

[9] Climate Risk Profile: Nigeria (2021): The World Bank Group.
[10] Short- and Long-Term Impacts of Climate Extremes (SLICE), Climate risk profile: Nigeria, https://www.climate-impact-economics.org/en/news/climate-risk-profiles

Key messages on the future risk of climate change on health in Nigeria

1. **The overall trend – across all scenarios - is that the risks and impacts from climate change to the health sector are projected to worsen in terms of severity, duration and magnitude across all geographic areas of Nigeria**
   a. Areas which were previously classified as medium to medium-high risk are expected to escalate to high risk
   b. Low and medium-risk zones will transition to medium and medium-high-risk categories
   c. Locations that were previously considered low-risk in the south will escalate to medium-risk

2. **Under all scenarios and despite any efforts on behalf of Nigeria, the country's risk to climate change is increasing and will continue to increase.** These increased risks will create a situation that will impact health care capacity, increase the vulnerability of communities and create conditions more conducive to disease growth, with some geopolitical zones and states being more at risk that others

3. **Based on analysis, Nigeria will experience an additional 21% burden of disease** due to climate change

4. **Temperatures will continue to rise across the country** by approximately 1.0-1.1 °C between 2020 and 2050 under mild climatic scenarios. Under more extreme scenarios it is expected to rise by at least +3.0 °C. The health of people and animals, agriculture and ecosystems will be significantly impacted by increased heat

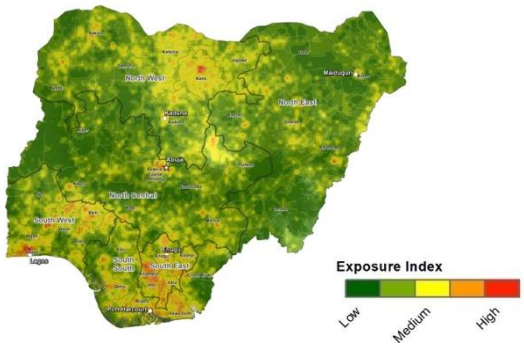
5. **The percentage of the population exposed annually to increased heat events is projected to quadruple** from 6% in 2000 to 19-22% by 2080. With the anticipated increased population growth in Nigeria, these changes will affect a larger number of people in absolute terms

6. **Nigeria will be exposed to increased rainfall.** Except for the most northerly areas, as well as the states in South West and South zones, most of the country will experience an additional 110mm to more than 200mm rain each year compared to a current national average of 1,165mm per year

7. **Under the most severe scenarios, sea level is predicted to rise between 0.5 and 1.0 meters by the end of the century** which will have a significant impact and permanently alter shorelines, increasing the risk of flooding for coastal towns and ecosystems, and which will alter patterns of infectious and vector-borne disease transmission

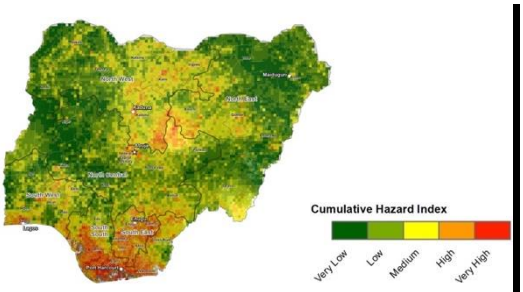
Future exposures to climate change – by 2030

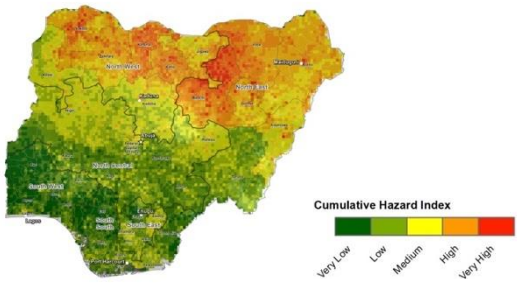
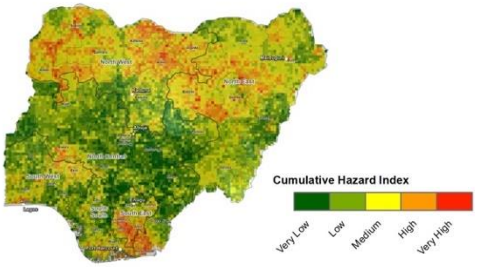
Cumulative exposure to climate change by 2030 ("middle of the road" scenario)

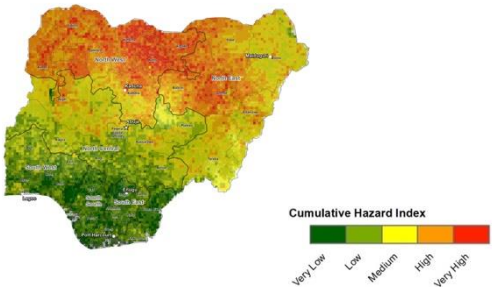
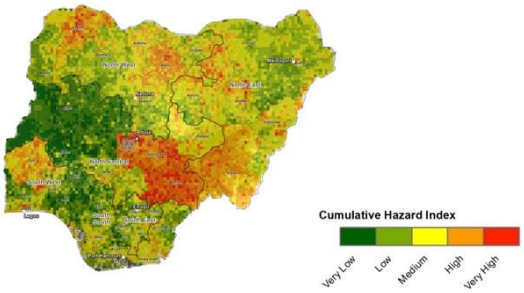
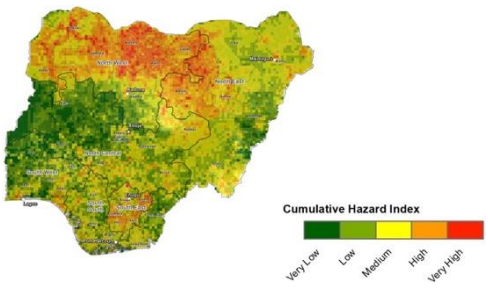


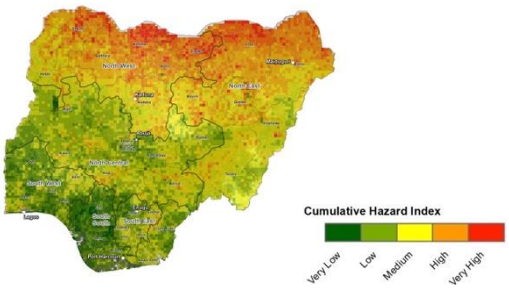
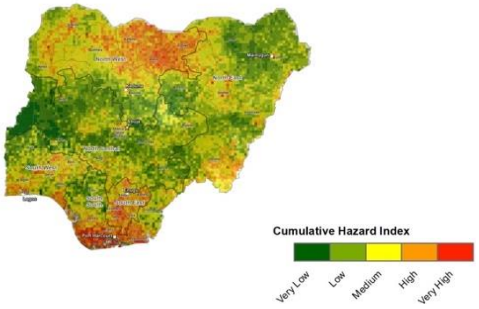
By 2030, the future changes in the exposure to climate change will be highest in the north-central states in the North West zone, especially in Kano and Katsina states, as well as the capitals in Kaduna and Sokoto states. Abuja also has a high future exposure to climate change. In the south of the country, Lagos has a very high future exposure, and several states in South West, South and South East zones also have high future exposures to climate change

Future risks assessed against the health outcome

Health outcome	Selected specific cumulative changes	Future risks ("middle of the road" - SSP2 scenario)
Injury and mortality from extreme events	Exposure to forces of nature will increase A total of 800,000 individuals are at risk from riverine flooding by 2030 Approximately 550,000 individuals could be affected annually by flooding from sea levels by 2070	 • States in the far south of Nigeria, including around Lagos, have very high future vulnerability to injury and mortality from extreme events caused by climate change • Some states in the central and south-central areas have a medium future risk • Other states have a low risk with the lowest future risk being in the most northerly regions and the most westerly states in South West zone
Heat-related illness	The population exposed to heat waves each year will quadruple from 6% in 2000 to 19 - 22% by 2080 Deaths from heat are expected to double, increasing from 2.5 to 5 per 100,000 people per year by 2080	 • States in the further North West and North East zones have the highest future vulnerabilities to heat-related illnesses

Health outcome	Selected specific cumulative changes	Future risks ("middle of the road" - SSP2 scenario)
	↑ Heat-related deaths among the elderly are projected to surge	• However, states immediately north of Abuja, including Kaduna, have lower future vulnerabilities, as do other states in the lower, coastal regions of the country • All other states are at medium to high risk
Waterborne disease	↑ Some Neglected Tropical Diseases (NTDs) are expected to increase– e.g. Buruli ulcers, Guinea worm, Trypanosomiasis Diarrhoea related deaths in children under 15 resulting from climate change will account for around 9.8% of the total diarrhoea related mortalities Polio cases will increase ↓ Cholera cases are expected to decrease	 • States in the far northern band of Nigeria face the greatest future vulnerabilities • The middle band of Nigeria has a medium future vulnerability risk, and states in southern Nigeria, especially South West zone, have the lowest future vulnerability
Vector-borne diseases	↑ Malaria is expected to increase significantly Increase in yellow fever cases ↓ Dengue fever is forecast to drop significantly from 274,000 in 2020 to less than 70,000 in 2030	 • States in the north of Nigeria will face high-to-very high future risks from vector-borne diseases, as well as the coastal states in South zone • States in the middle band of Nigeria face a medium future vulnerability • States in the south west region will be the least vulnerable

Health outcome	Selected specific cumulative changes	Future risks ("middle of the road" - SSP2 scenario)
Malnutrition and food-borne diseases	Malnutrition deficiencies will increase from almost 2.6m in 2020 to almost 2.85m by 2030	 • States in most of North West zone will be at high-to very high future risk, as will the westerly states in North East zone • States in the far north-east and middle band regions of Nigeria will be at medium future risk • States in the south will be least at risk
Respiratory illness	Chronic respiratory disease, severe acute respiratory illness and asthma will see marginal increases Tuberculosis (TB) is forecast to increase from over 41,000 cases in 2020 to more than 52,000 in 2030 Respiratory infections will decrease from almost 17m cases in 2020 to almost 16m in 2030	 • Hotspots of highest future risk in the north-west, south west, southern-central and southern-eastern areas
Zoonoses	Yellow fever is expected to increase significantly from 16,000 cases in 2020 to almost 23,000 cases in 2030 Lassa fever will increase	

Health outcome	Selected specific cumulative changes	Future risks ("middle of the road" - SSP2 scenario)
		• States in the North West zone and the west of the North East zone will be most vulnerable, as well as around Lagos and northern parts of South and South East zones
Mental and psychosocial health	Mental health conditions will increase Mental disorders will rise from 2.6m in 2020 to more than 3.1m by 2030 Interpersonal violence will increase from 900, 000 in 2020 to 1.05m in 2030 Neurological disorders and self-harm will increase	 • States across northern Nigeria will be more at risk • States in the middle band of the country show a low to medium risk
Non-communicable diseases	Non-communicable diseases (NCDs) will increase Cardiovascular disease will increase by 10% to over 4.5m cases in 2030 Diabetes is predicted to increase significantly to almost 450,000 in 2030 due to rising temperatures High blood pressure is also expected to increase significantly from almost 900,000 cases in 2020 to	 • There will be a pronounced south-to-north gradient, with southern states regions exhibiting a higher future risk • States in the middle band and the north will have a low-very-low future risk • There will be hotspots of highest future risk in the north-central part of North West zone, the southern and coastal parts of South zone, followed by areas around Lagos and South West zone

Health outcome	Selected specific cumulative changes	Future risks ("middle of the road" - SSP2 scenario)
	over 1.6m in 2030	

1.8 Adaptation recommendations

Based on the findings from all sections of the V&A assessment, a number of recommendations and actions are made. These will support Nigeria's health sector and health system at all levels – Federal, state and LGA – to better adapt to the risks that climate change will present across Nigeria.

Proposed adaptations against the health system building blocks

Climate resilient building block	Proposed adaptations
Leadership and governance	**Disseminate the Vulnerability & Assessment (V&A) findings and evidence base** to policy makers and health and climate leaders across Nigeria
	Develop costed HNAP and consider state level adaptation plans in future
	Develop a national climate-health education and awareness raising action plan
	Build general capacity, awareness and appreciation for climate change health risks and impacts for leaders and managers within the Federal Ministry of Health and state Ministries of Health as well as Local Government Areas
	Develop and support performance and accountability measures for health leaders' commitments on climate and health
	Develop a cross-sectoral climate-adaptation framework
	Orient other Ministries Departments and Agencies on the impacts of climate change on health
	Support multi-sectoral coordination between the Federal Ministry of Health and state Ministry of Health and other sector Ministries Departments and Agencies
	Provide office support to the climate and health units in the Federal Ministry of Health and the state Ministries of Health
	Support health sector policy makers to use climate information in programs and policy design
	Support the future development of climate-informed health policies and plans, with a focus on the most at-risk states and most vulnerable groups
	Develop a fully-costed Health National Adaptation Plan which is aligned with a National Adaptation Plan, which should also be developed and implemented
	Strengthen Federal, State and Local Government Agency level climate-health leadership by appointing/training leaders at every level to develop relevant expertise, and integrating into professional development plans and leadership objectives
	Develop a domestic resource mobilisation strategy to fund the Health National Adaptation Plan and mitigation ambitions

Climate resilient building block	Proposed adaptations
Climate and health financing	**Mainstream climate-health nexus into funding plans**
	Identify cross-government co-funding opportunities
	Define and cost plans for climate-related emergency preparedness
	Support strategies to secure domestic and external funding to support costed climate and health adaptation plans
	Access global climate-health funds from health and climate multilateral funding sources
Health workforce	**Support national assessment on health workforce capacity** to respond to climate risks
	Support awareness/education campaign for the health workforce to increase knowledge and buy-in on the impact of climate change on the health sector
	Inform health workers on climate change impacts on health
Vulnerability, capacity and adaptation assessment	**Support strategy to enable health information systems at the Federal level and states to be integrated** with other existing meteorological and climate-relevant early warning systems (EWSs)
	Support interoperability and integration of health information systems (HISs) at Federal, state and LGA levels in order to monitor and identify climate-related health risks and disease prevalence
Integrated risk monitoring and early warning	**Assess feasibility of informing logistics management information systems** (MIS) with early warning systems for impacts of climate change
	Integrate logistics management information systems at Federal and state levels with climate and health related early warning systems
Health and climate research	**Build a cadre of climate-health researchers**
	Support research on climate-health priorities identified in this V&A
Climate resilient and sustainable technologies and infrastructure	**Assess health supply chain climate resilience**
	Build climate resilience of health commodity procurement
	Strengthen climate resilience of health commodity warehouses
	Improve laboratory capabilities on climate impacts on health
Management of environmental determinants of health	**Develop a standard climate-resilient health infrastructure assessment tool**
	Strengthen health facility climate resilience based on assessed vulnerabilities and corresponding evidence-based interventions
	Support national assessment on health facilities' capacity to respond to climate change, especially in states that are highlighted to be more at risk
	Support changes within high-risk and prioritised health facilities, by using the assessment on health infrastructure capacities to
Climate-informed health programmes	**Strengthen environmental public health surveillance** and environmental public health programmes
Emergency preparedness and	**Support health service delivery modalities** that can offer essential services during extreme weather events

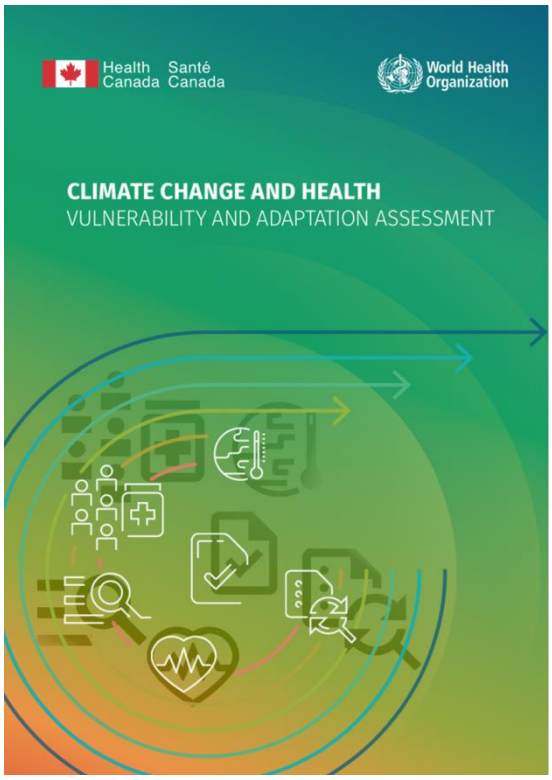
Climate resilient building block	Proposed adaptations
management	**Enhance health service contingency planning** to ensure populations groups most at-risk from climate change are not left behind
	Develop health service delivery contingency plans in response to extreme weather

2. Assessment overview

2.1 Overview

This chapter provides a summary overview of the V&A assessment framework and the methodology and processes used to undertake the assessment, including primary and secondary data collection.

Figure 1. WHO's guide "Climate Change and Health: V&A Assessment"



Nigeria's V&A assessment was developed between January and July 2024. It has been carried out against the WHO's guide "Climate Change and Health: V&A Assessment". The methods and processes used to develop the V&A assessment were validated by the FMoH and the national Climate Change and Health TWG in early 2024. The framework seeks to increase the climate resilience of health systems and to protect and improve the population's health outcomes faced with the increasing impacts of climate change, through providing guidance on how to systematically and effectively address the challenges that are increasingly presented by climate change.

The operational framework is built on the WHO's six building blocks of the health system:

1. Leadership and governance
2. Health workforce
3. Health information systems
4. Essential medical products and technologies
5. Service delivery
6. Health system financing.

The adaptation recommendations from this V&A are aligned with the WHO's updated ten building blocks for climate resilient health systems, 2023, as shown in Figure 2 and detailed in Box 1.

Figure 2. WHO's six building blocks of the health system and 10 building blocks for climate resilient health systems

Box 1. The 10 building blocks of climate resilient health systems

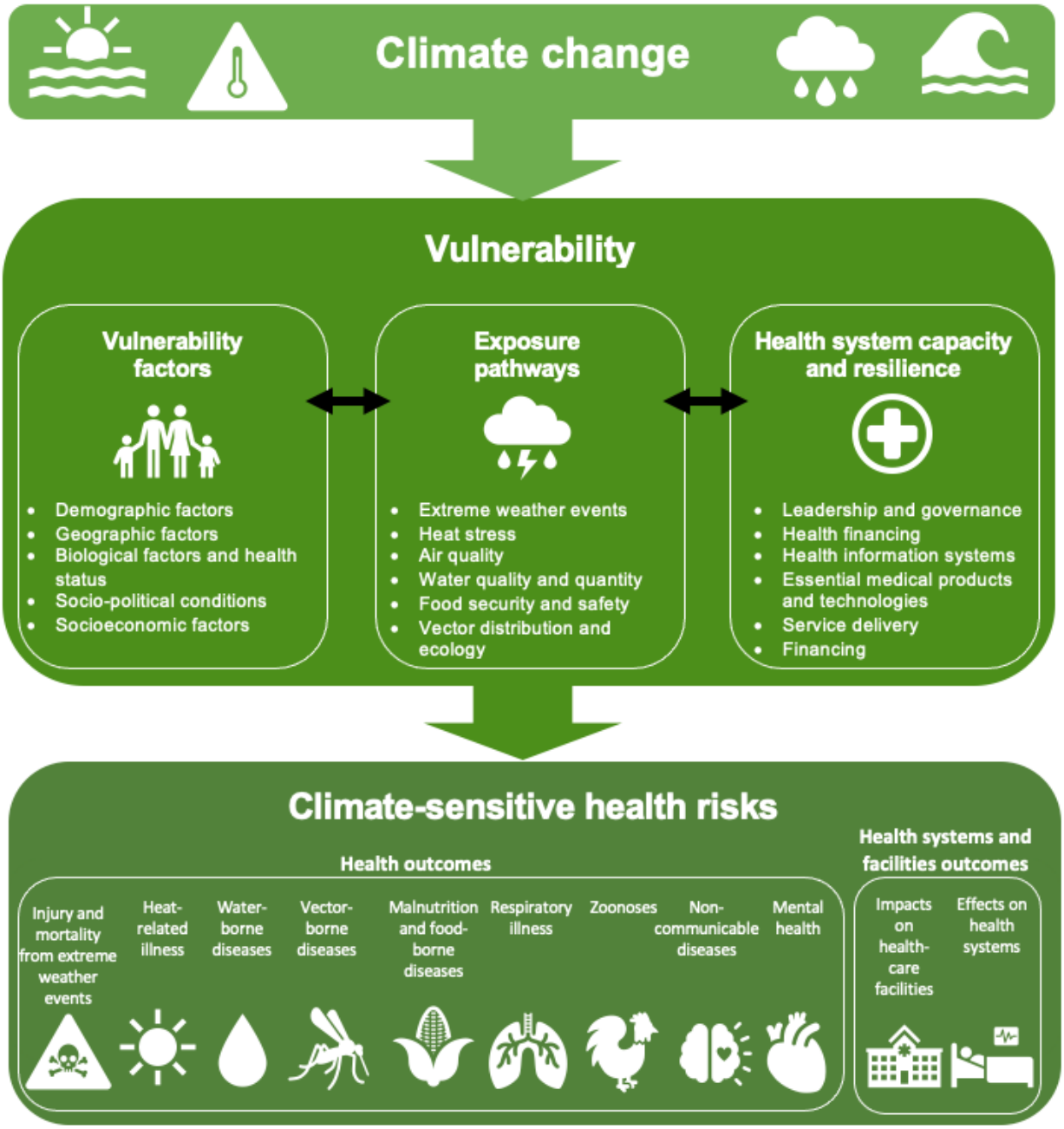
1. **Leadership and governance** that ensures political commitment and effective leadership to build climate resilience through policy prioritisation and planning to address climate risks, including through partnerships and accountability
2. **Climate and health financing** which supports countries in identifying and accessing sustainable financing to support climate change and health interventions, including climate change funding streams and funding allocated for health-determining sectors
3. **Health workforce** that ensures sufficient recruitment, training of staff to ensure health resilience planning. Using climate information for health decision making.
4. **Vulnerability, capacity and adaptation assessment that** establishes a baseline of the health systems' vulnerability and capacity together with future risk and adaptation assessments in a form to enable their regular update
5. **Integrated risk monitoring and early warning** to strengthen climate change and health integrated disease surveillance and climate-informed early warning systems
6. **Health and climate research** to develop an evidence base for policy, and innovative solutions for climate change and health
7. **Climate resilient and sustainable technology and infrastructure** adaptation across infrastructure, technologies and supply chains
8. **Management of environmental determinants of health** to step up efforts to respond to environmental risks to health by strengthening monitoring and management of environmental determinants of health; developing and implementing regulatory instruments and mechanisms; and promoting coordinated intersectoral management including air, water, soil, food, housing, waste
9. **Climate informed health programmes** using the information gathered from health information systems from assessments, research and monitoring, to inform the way specific climate sensitive health programmes deliver them
10. **Emergency preparedness and management** to build preparedness, response capacity and health security in health systems and communities by implementing climate related risks management for emergencies and disasters, through climate-smart policies and protocols and establishing climate-informed health emergency and disaster risk management and supporting community empowerment

2.2 Climate change and health outcomes

The relationship between climate conditions and health outcomes is complex since attribution to a single factor is often highly uncertain. However, what is clear is that under future climate conditions, most health risks will be increased either directly (e.g. heat, flooding and injury) or indirectly (e.g. drought, crop yields, population displacement). Similarly, findings from the Intergovernmental Panel on Climate Change's Sixth Assessment Report (AR6) conclude that all weather-related events are exacerbated by climate change, compounding shocks from non-climate drivers and causing cascading impact throughout food, nutrition, health, and other sectors.

The climate-sensitive health outcomes identified in Nigeria aligned well with the nine health risks identified globally by the WHO: injury and mortality from extreme weather events; heat-related illness; waterborne disease; vector-borne diseases; malnutrition and food-borne diseases; respiratory illness; zoonoses; noncommunicable diseases; and mental and psychosocial health.

Figure 3. Risk relationship between climate change and health outcomes expressed through exposure pathways, vulnerabilities and capacities.[11]



[11] Quality criteria for health national adaptation plans. Geneva: World Health Organization; 2021

2.3 V&A assessment objectives

The overarching objective of this V&A assessment is to provide both baseline and future projections of the vulnerability, capacity and future risk of Nigeria's health system and to provide evidence based information about the current and future risks to health, vulnerable populations, and effective adaptation options, and to use this to inform a supporting adaptation assessment. The methodology for achieving this was validated by the Nigeria Climate and Health Technical Working Group and based on the WHO's guidance for climate change health vulnerability and adaptation assessments.[1]

Box 2. Summary of V&A assessment objectives

1. **Identification of climate-sensitive health risks**: Determine which health risks and outcomes are most sensitive to weather and climate variabilities, emphasising those of greater concern to stakeholders and the public
2. **Current burden and vulnerability analysis**: Assess the current burden of climate-sensitive vs. non-climate-sensitive health outcomes, identifying subnational areas and populations most vulnerable to climate variability and change
3. **Drivers of vulnerability beyond climate**: Analyse major non-climatic factors affecting the vulnerability of populations and health systems, including socioeconomic and environmental determinants
4. **Evaluation of existing health policies and programmes**: Review the effectiveness of current policies, programmes, and activities in managing climate-sensitive health risks, including the integration of Indigenous and informal health systems
5. **Health system preparedness**: Evaluate the health system's current impact and preparedness for climate change, particularly in terms of demand changes due to shifts in the geographical distribution, incidence, or timing for different health outcomes
6. **Projection of future health impacts**: Forecast how climate-sensitive health outcomes are expected to change in the coming decades due to climate change and other development factors and assess the health impacts
7. **Assessment of health equity and vulnerable groups**: Assess how climate change may affect health equity, paying special attention to the vulnerabilities of groups like Indigenous Peoples, pregnant women, and poor rural communities
8. **Capacity and future risk assessment**: Determine the capacity of health and relevant systems to manage current and future health outcomes, evaluate how proposed changes to health programmes might affect their efficacy, and project future health risks under various development scenarios by 2030
9. **Identification of required public health interventions**: Identify additional public health interventions needed for effective risk management, including the costs and benefits of top-priority adaptation measures and examples of interventions in other sectors to protect public health
10. **Adaptation strategies and integration into policy**: Recommend health and adaptation policies and programmes to reduce projected health burdens, exploring opportunities for improved integration of climate change adaptation into health policy and legislation, including the potential for nature-based solutions

2.4 V&A assessment oversight

Prior to the start of the V&A assessment, a national climate change and health TWG was established in January 2024 to provide an oversight function for the entire process, to ensure that relevant stakeholder groups were engaged and to enable key expert inputs to be solicited as needed. The TWG had a central coordinating role in advising, informing, reviewing, and validating the V&A assessment approach through meeting, discussing, endorsing, and proposing any changes. The membership of the TWG is provided in annexe 3.

2.5 V&A methods and process

The V&A assessment is national in scope, with primary and secondary data collected, analysed and synthesised from across the country and from multiple sources. In summary, the main methods used – and which are covered in this section – are outlined in Table 1.

Table 1. Methods and processes used to carry out Nigeria's V&A assessment

Primary/ secondary data	Method and process
Primary data	• Key informant interviews (in-person and remotely) with stakeholders at the Federal, state and LGA levels • Focus group discussions with communities, including with vulnerable groups • Health facility assessments (30 in total, including public and private sector facilities at primary, secondary and tertiary levels) • National stakeholder workshops • Modelling
Secondary data	• Literature review • Policy review • Data sourcing
Analysis and synthesis of all primary and secondary data	

2.5.1 Primary data

As outlined in the WHO guidance on vulnerability and adaptation assessments, the collection and analysis data are illustrative. The majority of the evidence and conclusions is drawn from analysis and synthesis of existing data, literature and policy review and expert opinions, as well as extensive geospatial analysis, mapping and modelling for current and future scenarios. Primary data was collected to provide local illustrated findings, providing examples to verify overarching findings and to fill in gaps from secondary data. This was collected between February and April 2024. Please note that primary data gathering tools that were used to conduct the V&A assessment are too large and numerous to include in an annex, but are available from the FMoH climate change and health desk.

2.5.2 Samples of states

Nigeria is divided into six geographical zones. One state was selected for primary data gathering within each geographical zone, using selection criteria including vulnerability to climate change impacts; representation of vulnerable groups; access, security and proximity to transport hubs, which were all agreed by the national Climate Change and Health TWG. The sample of the states, capital and rural and urban LGAs are provided in Table 2.

Table 2. Sampled states and urban and rural LGAs selected for primary data collection

No.	Geo-political zone	State/ capital	LGAs
1.	**North-East** 	Adamawa - Yola	Yola South and Demsa
2.	**North-West** 	Kano - Kano	Ungogo and Gezawa
3.	**North-Central** 	Kwara - Ilorin	Ilorin West and Asa
4.	**South-West** 	Lagos - Lagos	Ikeja and Ikorodu
5.	**South-East** 	Enugu - Enugu	Enugu East and Aninri
6.	**South-South** 	Akwa Ibom - Uyo	Uyo and Ikono

2.5.3 Stakeholder engagement

More than 300 stakeholders were interviewed and engaged across at the Federal, state and LGA levels. Consultations involved all relevant stakeholders across various categories of relevance and importance to climate change and health, including:

- Federal and state health agencies, such as the MoH
- Other Federal and state agencies, such as the National Council on Climate Change and the Ministry of Environment
- Multilateral agencies, such as WHO and UNICEF
- Climate financiers
- Climate and health researchers and specialists
- Community representatives, such as LGA Chairpersons

A full list of all stakeholders that participated in the V&A assessment is provided in annex 3.

2.5.4 Secondary data

Secondary data was drawn from a number of available sources from within and outside Nigeria – including existing data, literature and policy review, as well as extensive geospatial analysis, mapping and modelling for current and future scenarios. Secondary data was analysed and synthesised through a literature and policy review and modelling of climate and health data which are provided in the annexes.

2.5.5 Modelling climate health risks

Climate modelling is the assessment of the long-term anticipated changes in the climate system. The climate health risk assessment uses an update of the IPCC AR5 (2014) definitions to align with the WHO health outcomes methodology. The risk methodology uses current and projected population, community vulnerability, health system capacity, disease prevalence, and current and future climate exposure pathways to calculate health risks for each of the health outcomes.

2.5.6 Climate scenario used for the assessment

The modelled data used for the assessment was Coupled Model Intercomparison Project Phase 6 (CMIP6). CMIP6 is a large-scale climate modelling effort aimed at providing the most up-to-date and reliable projections of future climate change. It is a collaborative project involving climate modelling groups from all over the world, and it is intended to help the Intergovernmental Panel on Climate Change (IPCC) in its assessments of the state of the climate system.[12]

Nigeria's V&A used the SSP2-4.5 "middle of the road" emissions pathway, which assumes emissions fall mid-century, but do not reach net-zero by 2100. This is a realistic scenario, adopted by many other V&A assessment and by donors. The sensitivity analysis shows that although other emissions pathways may result in higher or lower temperatures and more extreme or stable weather patterns, the overall risks to health and health systems are not significantly affected by using this pathway compared to other emission pathways.

2.5.7 Timeframe used for the analysis

The 30-year time frame of 2020-2050 with a mid-point of 2035 is used for the assessment of the near future climate changes in Nigeria. Long-term anticipated changes in the climate system are normally done for 30 years at the mid-century (2040-2069) and late-century (2070-2099) time intervals. However, the need for interventions to adapt to climate change requires the development of intervention actions in the short term. The baseline of the current climate used is 1990-2020 unless otherwise stipulated.

2.6 Contextualisation and limitations

Nigeria's V&A assessment has been carried out against some key contextual considerations and some minor limitations.

1. **Health outcomes.** WHO standard health outcomes are included in the assessment:
    a. Injury and mortality from extreme weather events
    b. Heat-related illness
    c. Waterborne disease
    d. Vector-borne diseases
    e. Malnutrition and food-borne diseases
    f. Respiratory illness
    g. Zoonoses
    h. Noncommunicable diseases
    i. Mental and psychosocial health

[12] Eyring, V., et al. (2016). Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organisation. Geoscientific Model Development, 9(5), 1937-1958.

A list of Nigeria's priority health risks was not available for the V&A assessment; however, priority health risks were assessed through a combination of health data analysis, key informant interviews, and external actors' assessments and the WHO standard health outcomes are used throughout

2. **Assessment of health facilities.** It was not possible to cover a genuinely representative number of health facilities in the V&A assessment, within the available timeline and budget. A representative sample was therefore selected to provide a means of illustrating findings from GIS modelling and literature review, as well as to seek to fill gaps where data was not available.

3. **Development pathways.** Development pathways have been selected to align with Nigeria's Nationally Determined Contributions (NDCs) and United Nations Framework Convention on Climate Change (UNFCCC) national climate change documents. These have included assessment of demographic change, economic growth, urbanisation trends, as well as access to services, deforestation/ afforestation and nutritional status linked to agricultural yields.

4. **United Nations Framework Convention on Climate Change (UNFCCC) national climate documents.** The V&A data sourcing, modelling, synthesis, findings and recommendations were aligned with UNFCCC national climate change documents including Nigeria's National Adaptation Plan (NAP) which is currently being developed.

5. **No readily available baseline data on climate and health vulnerability to build on.** This is the first attempt to create a climate change and health baseline for Nigeria – and is therefore something to be built on in the future on an ongoing basis. As a result, determining the most appropriate baseline data and information for monitoring vulnerability, capacity, and risk was challenging at times and due to factors such as the short timeframes for data collection and assessment, the scarcity of formal inter-ministerial and cross-sectoral working groups, the delays in securing permission for data sharing in the public sector, and inconsistent curation of data and information between public entities.

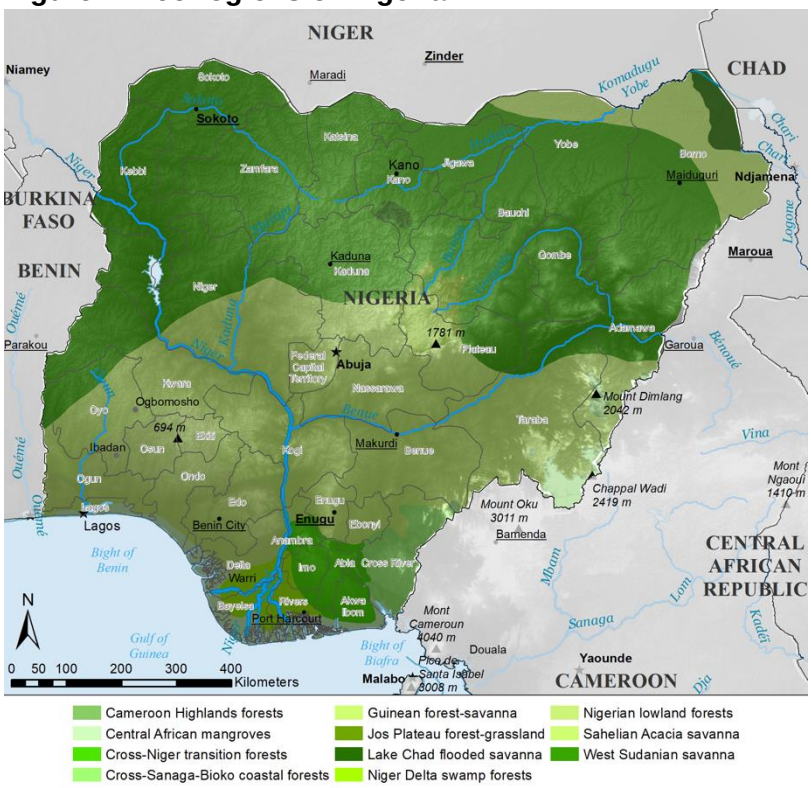
3. Summary of health and climate change in Nigeria

3.1 Overview

This chapter provides a summary overview of the current health and climate change in Nigeria, including the nexus of climate change and health and the current impact of climate change of Nigeria's health system and the nine health outcomes. Evidence and conclusions are drawn from analysis and synthesis of existing data, literature and policy review and expert opinions, as well as geospatial analysis, mapping and modelling.

3.2 Nigeria's environment and climate

Figure 4. Eco regions of Nigeria[13]



Nigeria's varied climate can be described across nine different ecological zones, as shown in Figure 4, which stretch from a tropical south to an arid north that include both lowlands and a plateau. Nigeria is home to three different climatic zones: a tropical savannah climate in the majority of the country's core areas, a tropical monsoon climate in the south, and a hot, semi-arid Sahelian climate in the north.

Nigeria is facing numerous environmental challenges that have a detrimental impact on all sectors of the economy, most notably on agriculture and water resources. Some of these issues are visibly exacerbated by climate change. Environmental issues that are not directly climate related include extensive deforestation and the loss of vegetation cover, which combine to reduce biodiversity and degrade soil. Floods, erosion, drought, and desertification further degrade the environment, particularly in the semi-arid regions of the country. Conflict, waste production, air, water, land, and noise pollution are widespread. Mineral exploration and exploitation indiscriminately scar the landscape. Restricted access to clean water and inadequate provision of sanitation contribute to further environmental degradation.

Nigeria is vulnerable to numerous climate-related disasters, including storms, floods, ocean surges, droughts, and wildfires. The frequency and intensity of extreme events in Nigeria will increase due to climate change. According to climate forecasts, there will likely be a slight increase in the number of days with extremely high rainfall and a significant increase in days with extremely high heat, as well as increased risk to coastal areas from sea level rise and heat stress.

[13] Bioscience, An Ecoregions-Based Approach to Protecting Half the Terrestrial Realm doi:10.1093/biosci/bix014

Like many African countries, Nigeria is acutely vulnerable to climate change's impacts. This vulnerability is due to the country's baseline climate conditions, combined with observed and projected changes to the baseline and contextualised within its capacity to implement adaptation strategies effectively.

Due to a combination of political, geographic, and social factors, Nigeria is categorised as acutely vulnerable to climate change impacts with comparatively low levels of readiness. The ND-GAIN Index[14] ranks 181 countries using a score that calculates a country's vulnerability to climate change and other global challenges and their readiness to adapt and improve resilience. Nigeria is ranked 154 out of 181 countries in the 2021 ND-GAIN Index[15]. Despite a positive trend between 2005 and 2013 where the highest score of 46 was attained, little progress has been made over a 25-year period between 1995 and 2021.

Figure 7. ND-GAIN score for Nigeria score between 1995 and 2021[16]

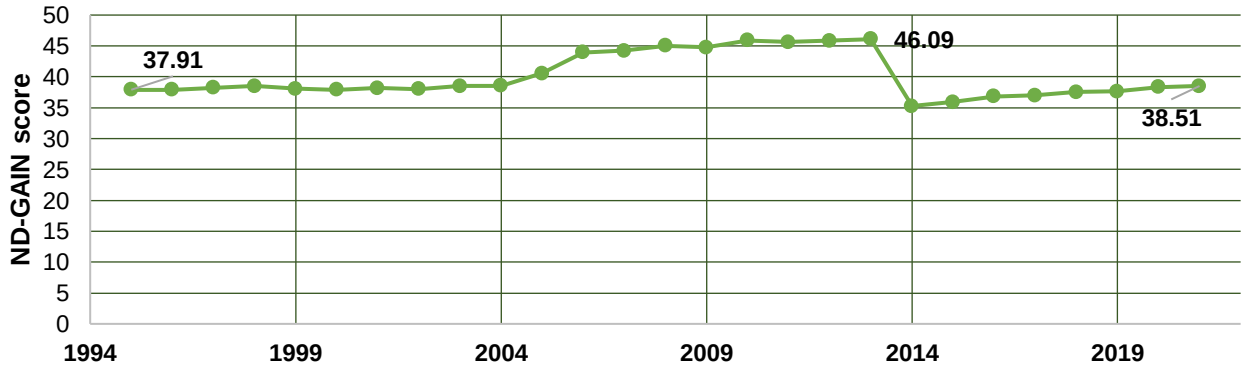
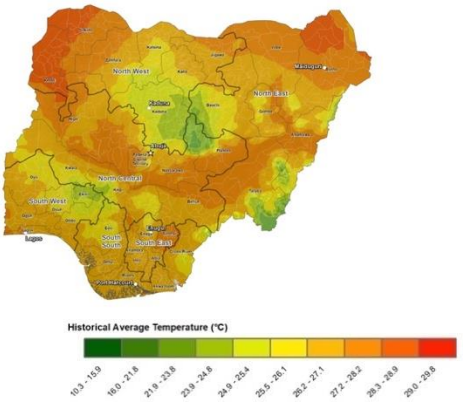


Table 3. Nigeria's current temperature, precipitation and population trends

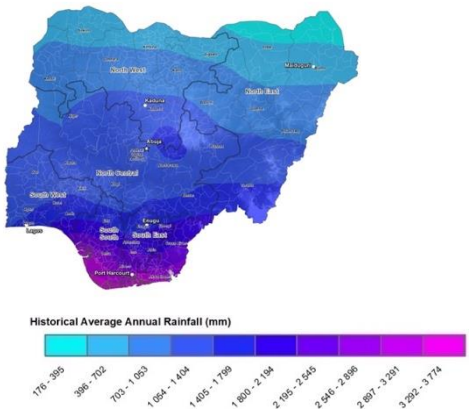
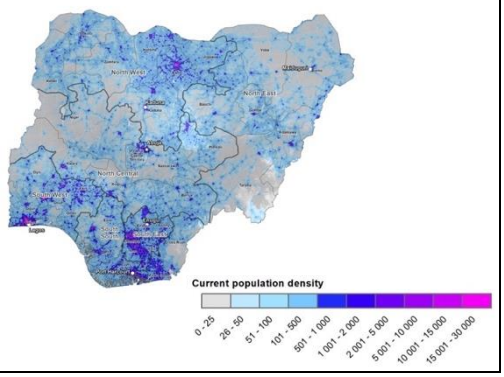
Current temperature[17] • Nigeria's relative humidity falls from south to north, with an annual mean of 88% in the vicinity of Lagos. Annual temperatures range from 12°C to 45°C in the north and from 17°C to 37°C in the south • Temperatures vary by season - lowest in April and highest in October. July to September are more temperate due to the wet season • Average yearly temperature of 26.9°C, with monthly averages ranging from 24°C in December and January to 30°C in April • Nigeria's coastal regions, the interior, plateau and lowlands see the greatest temperature ranges	

[14] University of Notre Dame Research Environmental Change Initiative. (2024*). Helping countries and cities counter the risks of a changing climate*. [Online]. Available: https://gain.nd.edu/

[15] University of Notre Dame Global Adaptation Initiative. (2024). *ND-GAIN Country Index*. [Online]. Available: https://gain.nd.edu/our-work/country-index/rankings/

[16] Source data: University of Notre Dame Global Adaptation Initiative. (2024). *ND-GAIN Index.* [Online]. Available: https://gain.nd.edu/our-work/country-index/download-data/

[17] Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high-resolution interpolated climate surfaces for global land areas. International Journal of Climatology 25: 1965-1978

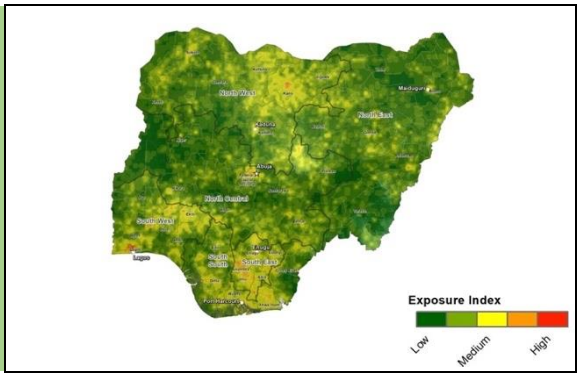
• Nigeria has seen temperature rises of 0.03°C each decade between 1901 and 2016. However, since the 1960s, southern Nigeria has experienced higher temperature increases than the north, with increases of 0.19°C per decade over the last 30 years	
Current precipitation[18] • Nigeria experiences rain every month of the year, with April to October receiving the most substantial quantities. • There is a gradient of decreasing precipitation from the south to the north, averaging 1,165mm rainfall per year. However, precipitation patterns are highly variable • The northeast receives around 500mm of rain annually • The south receives rainfall for most of the year and experiences heavy rainfall events during the rainy season. Annual rainfall in the south typically exceeds 2,000mm, sometimes exceeding 4,000mm in the Niger Delta • Annual precipitation amounts have dropped since the 1960s by about 3.5 mm per month every decade between 1960 and 2006	
2020 population density[19] • The population density highlights the urban hubs around the country. It also shows the distribution of populations in the lower density areas. These densities are consistent with census data, with estimates as required.	

[18] Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high-resolution interpolated climate surfaces for global land areas. International Journal of Climatology 25: 1965-1978

[19] Wang, X., Meng, X., & Long, Y. (2022). Projecting 1 km-grid population distributions from 2020 to 2100 globally under shared socioeconomic pathways. Scientific Data, 9(1), 1-13. https://doi.org/10.1038/s41597-022-01675-x

2020 population exposure to climate change[20]

- This is an index representing the severity of the exposure of the population to possible future climate changes. This index is rated from low (green) to red (high) based on population density.



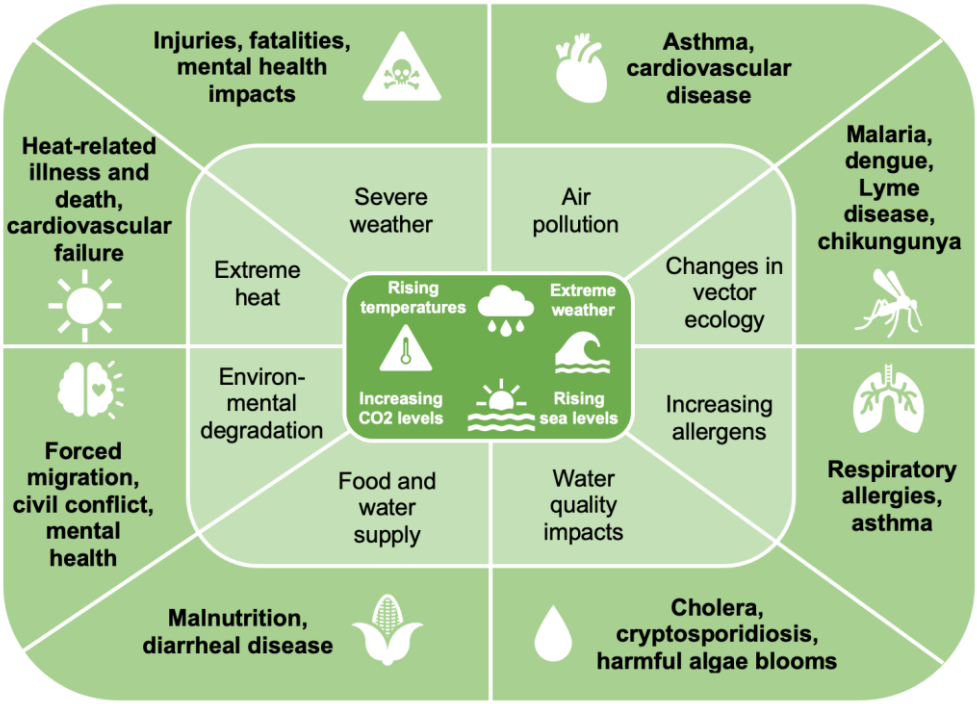
3.3 Climate impacts on health outcomes

Climate change encompasses long-term alterations in temperature and weather patterns, predominantly attributed to human activities, particularly the combustion of fossil fuels.[21] This phenomenon acts as a risk multiplier, transcending sectors and geographies, and intensifying pre-existing developmental challenges. Notably, climate change poses significant threats to human health and wellbeing by impacting weather conditions, ecosystems, and societal systems.[22]

Climate change exacerbates the impacts of extreme events, alters the environmental dynamics of the transmission of infectious diseases, influences population movements, and erodes the foundations of livelihoods, wellbeing, and both physical and mental health. [23] In Nigeria, climate change not only exacerbates existing health issues but also jeopardises health services, water and food security, infrastructure, and social protection frameworks.[24] The health consequences associated with climate change, both in terms of health outcomes (mortality and healthy lives lost) and the degradation of health services and infrastructure, place a substantial additional burden on already overstretched infrastructure and medical and human resources.[25]

[20] Wang, X., Meng, X., & Long, Y. (2022). Projecting 1 km-grid population distributions from 2020 to 2100 globally under shared socioeconomic pathways. Scientific Data, 9(1), 1-13. https://doi.org/10.1038/s41597-022-01675-x
[21] IPCC AR6 assessment report here: https://www.ipcc.ch/assessment-report/ar6/
[22] WHO Exec Board. Climate change and health, WHO, 2023. Here: https://apps.who.int/gb/ebwha/pdf_files/EB154/B154_25-en.pdf
[23] N. Watts et al. The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. 2019. Here: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)32596-6/abstract
[24] IPCC. 6th Assessment Report. Chapter 9: Africa. Here: https://www.ipcc.ch/report/ar6/wg2/chapter/chapter-9/
[25] EHP publishing. https://ehp.niehs.nih.gov/

Figure 5. Links between climate change and impacts on human health[26]

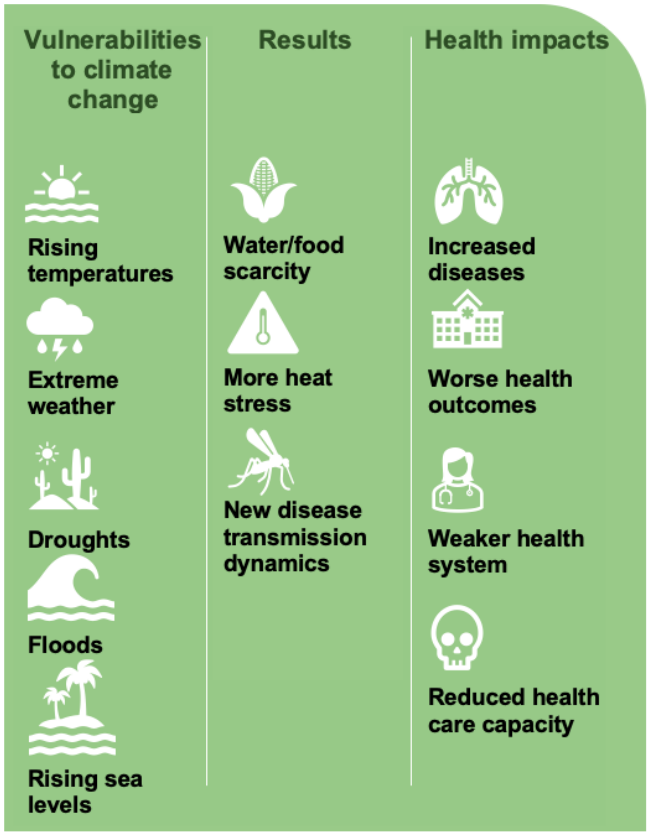


[26] US Centers for Disease Control and Prevention. www.toolkit.climate.gov

The COVID-19 pandemic raised global awareness about how human activities in one region can lead to severe health outcomes worldwide.[27] The escalating frequency and severity of extreme weather events globally have made the implications of a warming planet increasingly palpable.[28] However, establishing direct causal relationships between climate change and specific health outcomes remains challenging.

The 2022 IPCC Working Group II report of its 6th assessment stressed that while the direct health effects of extreme weather events lead to increased morbidity and mortality, climate change also harms human health indirectly through ecosystem changes that negatively impact the livelihoods of those most vulnerable and with the least capacity to adapt. This complex bidirectional linkage between climate change and other biophysical systems emphasises the need for multi sector partnerships in tackling the climate change-induced health consequences.

Figure 6. Climate change impacts on health



The World Meteorological Organisation (WMO), in its 2019 State of the Climate in Africa Report, indicated that increases in temperature and changes in rainfall patterns had significantly affected peoples' health across the continent, including in Nigeria, with warmer temperatures and higher rainfall increasing habitat suitability for biting insects and the transmission of vector-borne diseases such as dengue fever, malaria and yellow fever. The report also indicated that new diseases are emerging in regions where they were previously not present.

The global consensus for the 2023 IPCC synthesis is that climate change is impacting health in a myriad of ways, including by leading to death and illness from increasingly frequent extreme weather events, such as heatwaves, storms and floods, the disruption of food systems, increases in zoonoses and food-, water- and vector-borne diseases, and mental health issues. To-date, some sources have provided some information on climate change-health nexus in Nigeria, albeit in a general manner, to indicate that there is evidence to show that climate change-induced increase in temperature, rainfall, sea level rise and extreme weather events increase health risks such as cerebral-spinal meningitis, cardiovascular respiratory disorder of elderly, skin cancer, malaria, high blood pressure and increased morbidity and mortality from a range of health impacts.

[27] WHO. Conflict, climate crisis and COVID-19 pose great threats to the health of women and children. Here: https://www.who.int/news/item/25-09-2020-conflict-climate-crisis-and-covid-19-pose-great-threats-to-the-health-of-women-and-children

[28] Science direct. The journal of climate change and health. Here: https://www.sciencedirect.com/journal/the-journal-of-climate-change-and-health/vol/10/suppl/C

Table 4. Climate and health exposure pathways

Health outcomes	Climate exposure pathway	Climate impacts
 **Injury and mortality from extreme events**	• Extreme single-day rainfall • Number of days above 20mm of rainfall • Peak monthly precipitation • Flood risk	• Extreme weather and climate events, such as floods, droughts, and wildfires, have profound and direct impacts on human health and safety • These impacts can range from immediate injury and loss of life to longer-term public health challenges
 **Heat-related illness**	• Days over 35°C • Heatwaves • Monthly temperature peak • Average maximum temperature	• Health impacts include heat exhaustion, heatstroke, and, in severe cases, death • Other impacts include heat rash, cramps, heat exhaustion from a loss of water and salt in the body, excessive sweating without adequate fluid and salt replacement and heat stroke when the body's heat-regulating system is overwhelmed • Heat stress reduces capacity for physical work and increases the risk of occupational health problems
 **Waterborne disease**	• Changes in rainfall seasonality • Average temperature increases • Maximum temperature increases	• Cholera which can cause severe diarrhoea, vomiting and dehydration • Typhoid fever caused by the salmonella typhi bacteria • Other diarrhoeal diseases such as giardiasis, dysentery, rotavirus, hepatitis A, and e-coli contamination
 **Vector-borne diseases**	• Increased peak precipitation • Annual rainfall • Average and peak temperature increases • Aridity	• Malaria, dengue fever, yellow fever, Lyme disease, and zika virus, among others
 **Malnutrition and food-borne diseases**	• Annual rainfall • Aridity • Seasonality index	• Malnutrition • Iodine deficiency, selenium deficiency, iron deficiency, norovirus infection, and shigellosis

Health outcomes	Climate exposure pathway	Climate impacts
 **Respiratory illness**	• Extreme rainfall which can create mould which causes lung complications • Rainfall variability - during dry years, respiratory illnesses can increase • Heatwaves which can cause respiratory problems making breathing more difficult in hot, humid air and increased levels of ozone and pollen	• Pulmonary tuberculosis on the basis that climate change affects tuberculosis through diverse pathways: changes in climatic factors like temperature, humidity, and precipitation influence host response through alterations in vitamin D distribution, ultraviolet radiation, malnutrition, and other risk factors[29]. • Asthma
 **Zoonoses**	• Increased rainfall - can lead to runoff that contaminates water sources with pathogens, nutrients, and toxins • Increased temperature – can lead to more parasites and bacteria	• Lassa fever • Yellow fever
 **Mental and psychosocial health**	• Climate stresses lead to trauma, mental illness and distress	• Depression • Anxiety • Chronic stress and anxiety
 **Non-communicable diseases**	• Heatwaves and reduced rainfall are linked to higher rates of morbidity and mortality from, for example, non-communicable diseases	• Cardiovascular diseases • Hypertension • Cancers • Diabetes

29 https://pubmed.ncbi.nlm.nih.gov/33728507/#:~:text=Climate%20change%20affects%20tuberculosis%20through,malnutrition%2C%20and%20other%20risk%20factors.

3.4 Climate impacts on Nigeria's health system

"There have been times when we had immunization campaigns and people could not get to their locations to receive the vaccinations because of flooding. We had instances of flooding and people started having diarrhoea and cholera. In my last position in the government, we accessed affected flooded areas with canoes and my colleagues had to hold my hands as we were all afraid because we had no life jackets".
Government Health Official, North-Central Zone

Due to the increasing prevalence and incidence of direct and indirect climate-sensitive health risks resulting from extreme weather events - rising sea levels, drought, excessive heat, air pollution, and floods, among others – Nigeria's health system is often overburdened by changing climate conditions. [30] Though climate impacts on the health system in Nigeria have not been well documented, one media report notes "healthcare workers endure mental exhaustion from adverse conditions, limited supplies, overwhelming patient loads, and exposure to air pollution. Disruptions in power and discomfort from protective gear compromise safety standards, highlighting the need for comprehensive strategies to address the intricate health implications of climate change".[31]

More than 300 stakeholders that were interviewed across the six geopolitical zones to inform the V&A assessment raised a number of concerns on how the effects of climate change impacts on an already underperforming health system. Besides damage to infrastructure, shortages of essential health commodities and impacts on healthcare workers, extreme weather events repeatedly reduce further the capacity of the health system to deliver quality and timely healthcare to clients. This strain on the system can lead to decreased quality of care and contribute to burnout among healthcare workers, some stakeholders noted.

"Recently, when the rooftop of the health facility was blown off by a wind storm, the health centre could not provide the full range of services, including deliveries, so they had to refer pregnant women to other facilities. This caused a lot of problems to many people. And there is issue of flooding where the facility is built. When there is flooding, it enters the facility and makes it difficult for the staff to provide services. Most times health workers have to relocate to another place. Sometimes, the flood will destroy the medical equipment and drugs."
Member of women's group, North-East zone

Additionally, others also mentioned that healthcare workers themselves are not immune to the effects of climate change and may face challenges in providing care under such conditions. Some asserted that the unpredictability of weather patterns can lead to increased costs, difficulties in planning, and disruptions to operations, such as vaccination programmes.

Others noted that climate change can directly impact infrastructure and resources needed for service provision, such as changes in temperature affecting storage conditions for vaccines. Lastly, the overarching challenge is the escalating nature of climate

[30] Schrage, Pia & Adeyanju, Gbadebo. (2024). Building Climate Resilient Health Systems: Panacea for Mitigating Climate Change Effects in Nigeria. DOI:10.21203/rs.3.rs-4387784/v1.
[31] Business Day, 2023. Adapting Nigeria's health system to climate change: Building resilience for the future. 26th December. https://businessday.ng/opinion/article/adapting-nigerias-health-system-to-climate-change-building-resilience-for-the-future/

change, which exacerbates existing difficulties and necessitates constant adaptation to evolving conditions. A summary of the key climate change impacts on the Nigeria health system is presented in Table 5, and is drawn from analysis and synthesis of existing data, expert opinions, literature and policy review, as well as extensive geospatial analysis, mapping and modelling.

Table 5. Summary of climate change implications on Nigeria's health system

Climate resilient building block	Implications from climate change
 **Leadership and governance**	• Difficulties in planning, disruptions to operations, and increased costs, due to unpredictability of weather patterns • New multi-sectoral coordination efforts are required to mitigate the impacts of climate change
 **Climate and health financing**	• Effects of climate change undercuts financial resources budgeted for health service provision – needing re-allocation of funds to treat new disease burden or re-design of healthcare structures, programmes, and services
 **Health workforce**	• Safety of health workers carrying out duties under extreme weather conditions compromised • Increased workload - overstretched health workers who besides providing routine services have to cope with increased demand from climate health risks • Increasing occurrence of medical errors, due to the unsuitable working environment (e.g., very high temperatures) and excessive workload
 **Vulnerability, capacity and adaptation assessment**	• Increased prevalence and incidence of climate health risks places new demand on the already week HMIS to analyse disease impacts • Increased amount of health information needed to be gathered and reported overwhelm the HMIS and data availability for decision making
 **Integrated risk monitoring and early warning**	
 **Health and climate research**	

Climate resilient building block	Implications from climate change
 **Climate resilient and sustainable technologies and infrastructure**	• Disruption to transport facilities/services from climate extreme events leading to shortages of essential medicines and supplies • Changes in temperature affecting storage conditions for vaccines and drugs – integrity of medical supplies compromised due to high temperatures …raising many problems with the safety of drug use • Flood water destroy medical equipment, drugs, and supplies
 **Management of environmental determinants of health**	• Damage to health care facilities due to extreme weather, decreasing access to water for use in health care facilities during droughts • Facilities built in flood prone areas damages health centre building – causes buildings to deteriorate faster and become very unstable for continuous use • Presence of flood water in facilities makes it difficult for the staff to render services and the need to relocate to other places/premises. • Disruption to power and energy sources impacts the operation of primary health care and hospital key services such as immunisation, surgical operations etc. • Losing access to health services - patients and care givers cannot access health services during heavy rainfall • Disruption for patients for routine health service delivery due to extreme weather events that restrict the ability to travel to health facilities • Health services struggle to maintain normal services while also trying to meet increased demand for services resulting from climate-sensitive health risks
 **Climate-informed health programmes**	
 **Emergency preparedness and management**	

4.Vulnerability assessment

4.1 Overview

This chapter explores the current vulnerability of Nigeria's health system and health outcomes that are currently adversely affected by the impacts of climate change. Evidence and conclusions are pulled together from analysis and synthesis of data, literature and policy review and expert opinions, as well as geospatial analysis, mapping and modelling.

As we noted in section 3.2 of this report, Nigeria is categorised as acutely vulnerable to climate change impacts with comparatively low levels of readiness.

4.2 Multi-sectoral vulnerability

Climate change vulnerability is multisectoral. Failures in water and sanitation, energy availability, waste management and food systems will exacerbate the impact of health-related climate stress. Cross-sectoral approaches to climate change adaptation are therefore critical. Regarding cross-sectoral approaches to climate-health governance and leadership in Nigeria, analysis of secondary data tells us that the most relevant sectors to consider – in addition to the health sector - as part of the climate-health nexus are: agriculture, food security, forestry, biodiversity conservation, water and sanitation, energy, and transport. Primary data from stakeholder engagement adds to this list the waste, construction, mining, and manufacturing sectors. Reducing health risks and improving health equity in a way that realises co-benefits in other sectors requires, among others, wide-ranging vertical and horizontal cross-sectoral stakeholder engagement. Lack of awareness of the climate-health nexus is a key cognitive barrier to this kind of approach. Stakeholders identified a suite of actions and inactions in non-health sectors that increase the risk of climate-sensitive health outcomes, including water capture and storage (particularly in the north), improved management of surface water resources (particularly in the south); robust sanitation and recycling services; reforestation; climate-resilient agriculture; uptake of renewable energy; and air pollution controls.

4.3 Assessment of health equity and vulnerable groups

Climate change is a risk multiplier and affects different population groups disproportionately, causing and exacerbating socioeconomic and health inequality. In Nigeria, the analysis and synthesis of existing data, literature and policy review and expert opinions indicate that women, especially pregnant mothers and those in their reproductive age group; children; the elderly; persons with disabilities (in particular those with albinism); people with psychosocial disorders; and individuals with pre-existing and chronic health conditions are the most vulnerable to climate change impacts. It is noted that poor women who bear the unpaid burden of childcare, family health and children's schooling, for example, are more likely to be vulnerable to these impacts. Geographically, people residing in poor living conditions and indigent communities (particularly those who are multidimensionally poor), urban slums, unsecured settlements, overcrowded communities, and places prone to the impacts of extreme weather are also disproportionately vulnerable to climate change. The global consensus is that climate change impacts and risks affect women and men disproportionately and often to the disadvantage of women and girls.

There are perceived gendered differences in how climate change affects populations in Nigeria, according to stakeholders in the climate and health sectors. Climate change impacts women's and girls' health differently from men's and boys' health due to biological differences, and social norms. For instance, women's health is impacted by their roles and

responsibilities, which often involve exposure to adverse conditions such as excessive heatwaves or water collection during droughts resulting in disrupted menstrual cycles, early menopause, heat rashes, diseases such as diarrhoea, cholera and fungal diseases. Nigerian children in particular are often the first and most severely impacted by climate shocks due to (a) their dependence on others; (b) their physiology that make them more susceptible to disease and malnutrition; and (c) their higher exposure to diseases, among others (UNICEF, 2023). While specific studies are difficult to find in Nigeria, it is generally agreed that people who already experience multidimensional poverty with the disparity in social, political, economic, historical, and environmental contexts are more vulnerable to the impacts of climate change.

The health effects of climate change are furthermore profoundly interconnected with social systems. For example, past heatwaves, increased prevalence of vector-borne diseases, and food shortages due to extreme weather events have highlighted the health vulnerabilities certain populations face. These events disproportionately affect those least able to adapt or recover due to systemic inequalities. Similarly, the intersection of gender, social roles, and climate impacts is critical. Women, who often serve as primary caregivers and resource managers in many cultures, experience unique challenges and pressures during climate crises. Historical evidence suggests that in many disaster scenarios, women face higher risks of violence, health insecurity, and economic loss. Climate change, through higher temperatures, land and water scarcity, flooding, drought and displacement, negatively impacts agricultural production and disrupts food systems. These impacts will disproportionately affect those most vulnerable to hunger and can lead to food insecurity, further worsening the health conditions of the already vulnerable groups and risk further deterioration into extreme weather events-induced food and nutrition crises.

Box 3. The National Action Plan on Gender and Climate Change for Nigeria is the most comprehensive document for climate change impact of gender in the country.

Some of its policy measures, with respect to health, include:

- Mainstreaming adaptation to climate change as central part of public health services;
- Undertaking short, medium and long research on the adverse effects of climate change on women health;
- Raising public awareness programmes on climate change impacts on women health; and
- Development of an advanced preparedness plan to promote gender-neutral adaptation measures for a climate-resilient health system in order to safeguard and enhance national public health security.

Relevant measures proposed in this national plan provide useful inputs into a future gender-responsive climate-resilient health system in Nigeria..

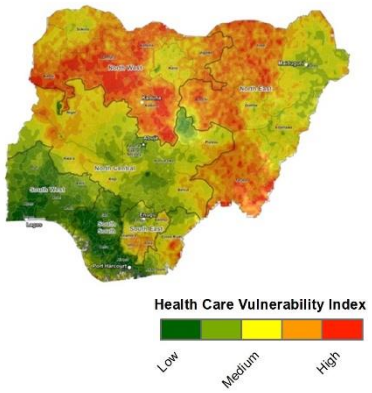
4.4 Health system vulnerability

Characterised by low budgetary allocations, poorly paid and unmotivated health professionals, workforce emigration, fake and poor quality medicines, infrastructural inadequacy, weak health information system to monitor risk and exposure, citizens' lack of trust and confidence, and ongoing battles against deadly diseases such, Nigeria's health system faces enormous challenges amid the need to provide routine healthcare

services for a growing population[32] **as the COVID-19 pandemic demonstrated.**[33] The analysis and synthesis of existing data, literature and policy review and expert opinions, as well as extensive geospatial analysis, mapping and modelling shows that in its current state, **the health system in Nigeria is unlikely to withstand the shocks from climate impacts and ensure uninterrupted healthcare services to the population.**

In terms of general health system vulnerabilities, Nigeria's geopolitical zones are affected to different extents, as described in Table 6. Health systems in most states in the North West and North East zones demonstrate the highest vulnerabilities, states in North East and North Central zones show a medium cumulative vulnerability and systems in South West and South zones have a lower cumulative risk.

Table 6. Nigeria's general health system vulnerabilities

Analysis of sources such as baseline medical facility density access to insurance, skilled birth assistance, mother and child heath index, Infant mortality rate, drive/walk time to health care, health care facility ratios, and public heath index cumulatively show that Nigeria's heath system has varied vulnerabilities to climate change. • **Health systems in most states in the North West and North East zones demonstrate the highest vulnerabilities**, especially the states in the central and southern parts of North Western – Kebbi, Zamfara, Katsina, Kaduna and Jigawa – and the western states in North East – Taraba, Bauchi and Yobe • **Health systems in the eastern parts of Niger and Kwara state in North Central zone, south parts of Cross Rivers state in South zone and Imo and Abia states in South East zone also show high cumulative vulnerabilities** to climate change • **Health systems in states in North East and North Central zones show a medium cumulative vulnerability** to climate change • **Health systems in South West and South zones have a lower cumulative risk** to climate change	

This assessment has also examined specific health system vulnerabilities that contribute to the health of the Nigerian population, as well as health sensitivity and adaptive capacity of the health system to climate change. These consider factors such as baseline health conditions, health insurance coverage, proximity to health facilities as well as the capacity of the health system to provide various health services. These are presented in Table 7. While there is some variation across Nigeria - some of the health system vulnerabilities, such as access to health insurance, show high vulnerability across the country whereas others, such as skilled birth attendance, demonstrate different vulnerabilities between northern and southern regions.

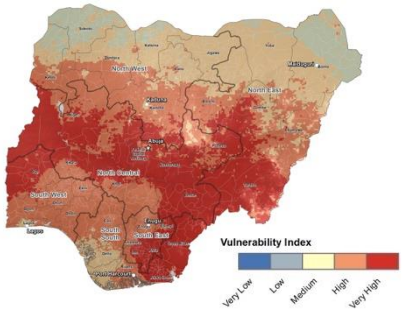
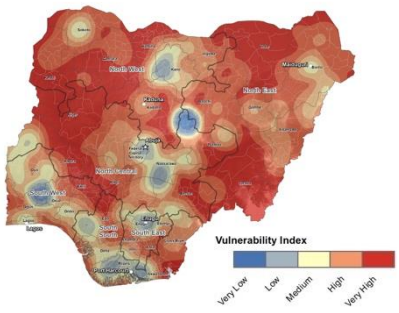
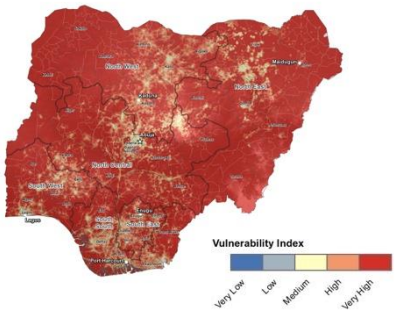
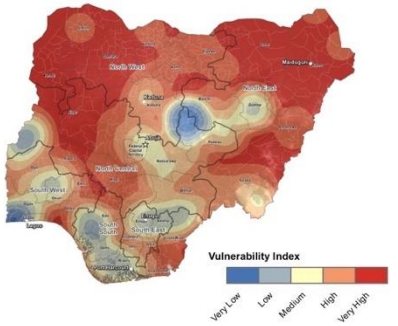
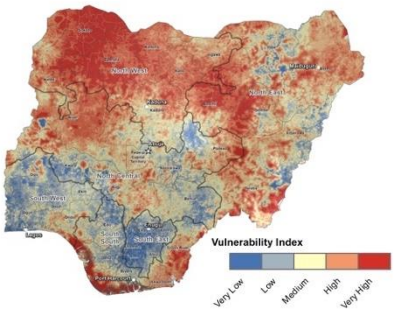
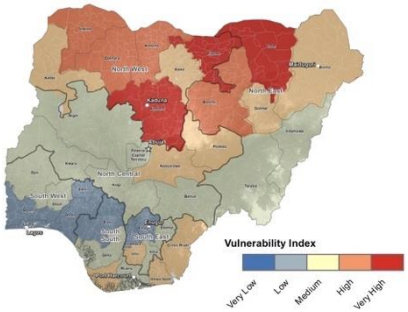
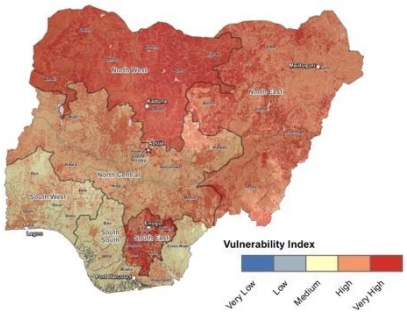
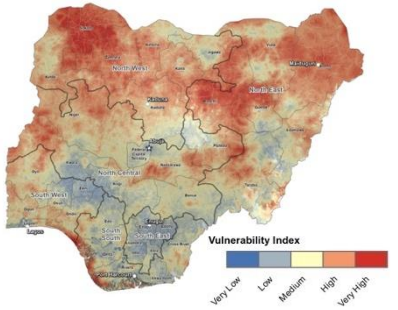
- **Medical facility density:** Most of Nigeria is very vulnerable, except for the major urban areas

[32] Ibid NSHDP II

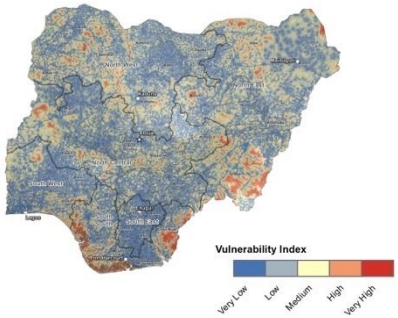
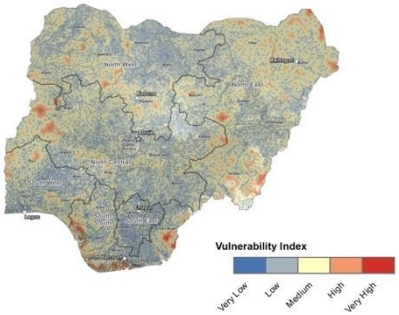
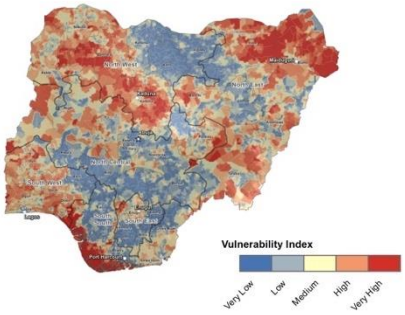
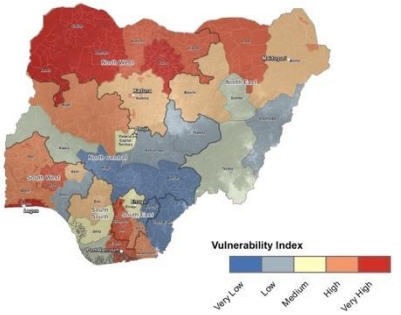
[33] Business Day, 2023. Adapting Nigeria's health system to climate change: Building resilience for the future. 26th December. https://businessday.ng/opinion/article/adapting-nigerias-health-system-to-climate-change-building-resilience-for-the-future/

- **Health facility access:** States in the north east and north west, as south and south-west have the greatest vulnerabilities although the drive time and walk time to heath facilities in most of Nigeria is low-to-very-low
- **Access to health insurance:** Almost all of Nigeria is very vulnerable due to the very low health insurance rates
- **First responder density:** Most of Nigeria is very vulnerable, except for the major urban areas
- **General vaccination coverage:** States in northern Nigeria and the coastal areas of the South West and South zone have very high vulnerabilities
- **Infant mortality rate:** Most of Nigeria has very high vulnerabilities
- **Skilled birth attendance:** States in northern Nigeria and the coastal areas of the South West and South zone have very high vulnerabilities

Table 7. Specific health system vulnerabilities

General health index[34]	Medical facility density [35]	Access to health insurance[36]	First responder density[37]
			
Skilled birth attendance[38]	**Maternal and child health**	**Infant mortality rate**[39]	**General vaccination coverage**[40] –
			

[34] FAO map catalogue, ClimAfrica Work Package 4. https://www.fao.org/home/en
[35] FAO map catalogue, ClimAfrica Work Package 4. https://www.fao.org/home/en
[36] Bosco, C.; Alegana, V.; Bird, T.; Pezzulo, C.; Bengtsson, L.; Sorichetta, A.; Steele, J.; Hornby, G.; Ruktanonchai, C.; Ruktanonchai, N.; Wetter, E.; Tatem, A. J. (2017): Exploring the high-resolution mapping of gender disaggregated development indicators. Journal of the Royal Society Interface, 14(129). DOI: 10.1098/rsif.2016.0825.
[37] Map data copyrighted OpenStreetMap contributors and available from https://www.openstreetmap.org
[38] Bosco, C.; Alegana, V.; Bird, T.; Pezzulo, C.; Bengtsson, L.; Sorichetta, A.; Steele, J.; Hornby, G.; Ruktanonchai, C.; Ruktanonchai, N.; Wetter, E.; Tatem, A. J. (2017): Exploring the high-resolution mapping of gender disaggregated development indicators. Journal of the Royal Society Interface, 14(129). DOI: 10.1098/rsif.2016.0825.
[39] The Malaria Atlas Project, https://malariaatlas.org/about-map/
[40] Bosco, C.; Alegana, V.; Bird, T.; Pezzulo, C.; Bengtsson, L.; Sorichetta, A.; Steele, J.; Hornby, G.; Ruktanonchai, C.; Ruktanonchai, N.; Wetter, E.; Tatem, A. J. (2017): Exploring the high-resolution mapping of gender disaggregated development indicators. Journal of the Royal Society Interface, 14(129). DOI: 10.1098/rsif.2016.0825.

Drive time to health care[41]	Walk time to health care[42]	Health facility access risk	Antimalarial treatment
			

[41] The Malaria Atlas Project, https://malariaatlas.org/about-map/
[42] Ibid.

4.5 Vulnerability of the health systems building blocks

"Our unpreparedness extends to the scarcity of resources; we're still in the process of sourcing funds from international organisations. The health sector urgently need funds to tackle climate change"
Government Health Official, North-East zone

"The lack of health workers is one of our major challenges. For more than a decade now health personnel have been retiring without enough recruitment to fill the gaps. Even the few that are employed lack the basic training to perform their duties effectively and efficiently. We have a handful of volunteers but they also lack basic training."
LGA Health Team Member, North-East zone

In terms of six building blocks, Nigeria's health system remains largely weak.

Stakeholders interviewed to inform this assessment mentioned several inherent deficiencies of the Nigeria health system that undermine its ability to identify and address higher demand created by extreme weather events. These include: (i) weak procurement and distribution system that is not able to anticipate potential disruptions to the supply chain, and proactively plan to ensure the availability of essential supplies and their timely delivery to beneficiaries; (ii) weak HMIS that provides limited availability of health information required for planning, resource allocation, and informs service delivery; (iii) poor health infrastructure that cannot withstand the effects of climate change or extreme weather; and (iv) lack of prominence given to service delivery that can respond to changes in demand, disease patterns or population locations.

Additional vulnerabilities captured through primary and secondary data collection and analysis are presented in Table 8.

Table 8. Nigeria's health system vulnerabilities to climate change

Climate resilient building block	Vulnerabilities to climate change
Leadership and governance	• **Leadership and governance capacity for climate change and health is limited** within the MoH at the Federal, state and LGA levels • **Lack of awareness among policymakers** or what some stakeholders referred to as 'policymaker ignorance' regarding the importance of climate change on Nigeria's health sector • **The climate and health units in the FMoH and the state MoHs are not fully functionally** administratively to perform their basic functions • **The impacts of climate change on health is not widely fully appreciated** across the leadership and governance of the health sector • **Coordination between the MoH and other MDAs is weak**, and bureaucracy is very high • **Bureaucracy and apparent power struggles** between Federal and state ministries, according to interviews with key stakeholders • **Climate change and the nexus with health is not a significant enough feature in national development policies and plans**, including health policy and plans. Other "more pressing" healthcare challenges are given priority. Only a small number of national policies

Climate resilient building block	Vulnerabilities to climate change
	including the 2021 National Policy on Climate Change, the 2021 Climate Change programme, the 2050 Long-Term Vision for Nigeria, and the Agricultural Resilient Framework address the climate-health nexus in part • **Nigeria's does not have a Health National Adaptation Plan** • **Climate change and health coordination forums are nascent** – and only exist at the Federal level • **A lack of synergy between health and non-health sectors**, including the increasing risk of climate change has also been noted by stakeholders
Climate and health financing	• **Low budgetary allocations** to support the routine and essential functions of the health sector • **No costed plan in place for climate and health** • **No specific funding for climate and health** priorities • **No clear and defined budget for emergency preparedness and response** to extreme weather events, as part of overall health budget
Health workforce	• **The current number, availability and distribution of health professionals is already insufficient**, especially in the northern and many rural parts of the country • **Deploying and retaining health workers in rural, remote, and underserved areas continues to be a major challenge**. This is exacerbated by factors like the 'Japa syndrome' (migration of professionals) which further vulnerabilities to dealing with climate-sensitive health conditions • **Low capacity and limited knowledge and understanding of health workers on the impacts of climate change** on the health system and populations' health. • **Very limited/no training of current health professionals that equips them on how to deal with the increasing demands of climate change** risks, including emergency preparedness • **No capacity to predict and act on climate change projections** • **No assessment of health workforce capacities** to respond to climate risks
Vulnerability, capacityand adaptation assessment	• **Knowledge of the climate-health nexus is low for civil society**, with several stakeholders directly demonstrating this is especially low at the community level. Statista (2022) equally reported that over 60% of Nigerians were not aware of the changing climate. As of 2020, more than six Nigerians out of 10 never heard about climate change. Only 30 percent of respondents declared to have heard about this topic. Awareness of the topic resulted to be higher in urban Nigeria than in rural areas. • **The health information systems are not aligned with weather and disaster early warning systems** to support effective anticipatory action and improved service delivery and coverage • **The current health information systems do not capture any climate change and health nexus information**
Integrated risk monitoring and early warning	

Climate resilient building block	Vulnerabilities to climate change
 **Health and climate research**	• **The lack of climate and health information throughout the system** limits the overall awareness and appreciation of the impacts on climate change – and data is not incorporated into climate-sensitive health policies and plans • **Nigeria's research capacity and research experience on climate change and health** is limited • **The availability of climate change and health data is limited** at the Federal level, and very limited in the states and LGAs • **Weak HMIS that provides limited availability of health information required** for planning, resource allocation, and informs service delivery
 **Climate resilient and sustainable technologies and infrastructure**	• **The current procurement and distribution system is unable to anticipate potential disruptions** to the supply chain from climate change • **Logistic management information systems are not linked to other early warning systems** in order to ensure that sufficient quantities of essential medicines are available and provided in advance of climate-related disasters • **Nigeria's supply chain does not have a master plan to mitigate the risks** from climate change • **Alternative and innovative modes of distributing essential medical supplies are not available**. There is an over-reliance on traditional means of distributing via roads • **There is no back-up supply chains available** for use during extreme weather events caused by climate change
 **Management of environmental determinants of health**	• **Many existing health facilities are insufficiently equipped** to meet the general health needs of Nigerians • **The majority of health facilities infrastructure are not specifically adapted to effectively deal with the projected changes due to climate change** and to adequately cope with extreme weather events • **Health facilities do not have sufficient equipment** to deal with increased numbers of clients due to the changes in climate • **Laboratory capacities do not track current needs nor model future burdens** of climate-sensitive diseases • **Healthcare facilities lack emergency plans** for providing essential health services to higher demands created by extreme weather events (floods, heatwaves, storms etc) • **Climate not mainstreamed into core health system and infrastructure planning** • **Limited disaster contingency plans**, especially at community level • **Several key health programmes have limited or no inclusion of climate-health nexus issues**, such as the National AIDS and STDs Control programme, National Malaria Elimination programme, National Tuberculosis and Leprosy Control Programme (NTBLCP), National Health Insurance Scheme, and; Nigerian government's Midwife Service Scheme.
 **Climate-informed health programmes**	
 **Emergency preparedness and management**	

4.6 Cumulative and community vulnerability indices for health outcomes

The sub-section explores individual historical climate hazard indicators, their degree of severity, and cumulative climate hazard index, for each health outcome. A hazard index is a summation of mean average hazards for a location. Table 9 highlights the locations in Nigeria that are most at risk, and key findings are presented here:

- **Injury and mortality from extreme events:** Southern coastal areas in Nigeria are most vulnerable to injury and mortality from extreme events. As well as the coastal states in the South West, South and North East zones, states in the far North East and North West zones show the greatest community vulnerability
- **Heat-related illnesses:** The highest heat hazard index is in the lower-altitude far North East and North West zones of the country that generally have the warmest temperatures. States in north-west and north-east Nigeria show the highest community vulnerability
- **Waterborne diseases:** States in north-west and north-east Nigeria show the highest cumulative vulnerability. States in northern Nigeria, the southern states in South zone and southern states in North East show the highest community vulnerability to waterborne diseases
- **Vector-borne diseases:** Vector-borne disease vulnerability peaks in states in the far southern delta area in South zone**.** Far northern states show the highest community vulnerability to vector-borne diseases
- **Malnutrition and food-borne diseases:** The malnutrition vulnerability index demonstrates a clear north-to-south gradient related to lower rainfall, higher variability, aridity and consecutive dry days in northern area, meaning that states in northern Nigeria are most vulnerable. A similar north-to-south gradient is seen for community vulnerability to malnutrition and food-borne diseases
- **Respiratory illness:** Due to poor air quality, respiratory vulnerability is highest in the southern states, with the exception of the coastal states in South zone which show medium-to-high vulnerability. States in North West, North East and North Central show high community vulnerability to respiratory illnesses
- **Zoonoses:** Vulnerability to zoonoses shows a strong north-to-south gradient, with vulnerability highest in northern states. Community vulnerability to zoonoses is highest in the southern and coastal states, as well as the northern states in North West zone
- **Mental and psychological health:** Vulnerability is highest in the southern states. This is predominantly driven by the impact of severe rainfall. Community vulnerability to mental and psychological health is highest in the southern states and in the far north, especially the northerly states in North West Zone
- **Non-communicable diseases:** There is increased vulnerability to NCDs the far northern states, medium vulnerability in central states, and a lower vulnerability in the southern state

Box 4. Notes on cumulative and community vulnerability to climate change which is covered in Table 9

The climate health risk assessment uses an update of the IPCC AR5 (2014) definitions to align with the WHO health outcomes methodology. The risk methodology uses current and projected population, community vulnerability, health care capacity, priority health risks, and current and projected future climate hazard exposure pathways to calculate health risks for each of the health outcomes

Climate hazard exposure pathway: These are the current and projected climate impacts related to the various different health outcomes. There is no single climate exposure pathway that is common to all the health outcomes and therefore Each health outcome is assessed individually for the current and future periods. The climate scenarios are as follows:

- **Current climate** - the historical climate assessment considers the baseline annual and monthly variables of temperature and precipitation and how they've changed over time as well as considering derived climate parameters that may link to the different health outcomes. The current climate hazards are calculated from 1990-2020
- **The future climate state will be based on the global pathway, rather than any pathway that is set by Nigeria** - the same parameters assessed in the historical climate are assessed again in the future scenario and presented both in absolute and anomaly terms. The projected future covers the ranges of 2021-2040 with a mid-point of 2030. The scenario used is the SSP2-4.5 as the most likely global climate future

Population: This is the population that will be subject to the current and future climate impacts. 'The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.' This is the presence of systems, people, and assets that may be at risk due to a particular hazard. In the AR4 methodology, this was incorporated into the sensitivity index but its relationship with the risk necessitates the need to be distinctively defined. The exposure scenarios are defined as follows:

- The current scenario looks at the current population distribution as a first-order expression of exposure
- The unconditional target ambition climate scenario is the future population based on the SSP2 scenario as moving towards a middle-of-the-road development scenario with medium challenges to mitigation and adaptation. This scenario also is not conditional on international support and is therefore within the capacity of Nigeria to achieve
- The Business-as-usual scenario presents a future population based on the SSP5 scenario as a projection of the current practices within the Nigerian economy and represents the standard Fossil-fuelled development pathway

Vulnerability: This is the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. Different from the AR4 definition, vulnerability is the merging of all factors that may render an area predisposed to heightened impact or having resilience to a climate hazard. Vulnerability comprises both sensitivity (factors that affect the impact severity of a hazard) and capacity (factors that allow areas to prepare and recover from a hazard). The vulnerabilities consider the current state as of 2020 as well as a linear forecast future in 2030. There are three different vulnerabilities utilised. these are:

- **General community vulnerability:** These are factors or circumstances that may render an area more susceptible to various health impacts. There are several factors that are common between the different health outcomes. Additionally, there are some factors unique to individual health outcomes

- **General health system vulnerability:** These are the noted health vulnerabilities and capacities within communities as well as in medical facilities and will act to limit the duration or severity of the impacts of the health outcomes. There are several factors that are common between the different health outcomes. Additionally, there are some factors unique to individual health outcomes
- **Priority health risks:** These are the noted spatial distributions of several diseases or conditions that have been noted in the country. There however is limited subnational data available so several health outcomes are assessed based on national indicators

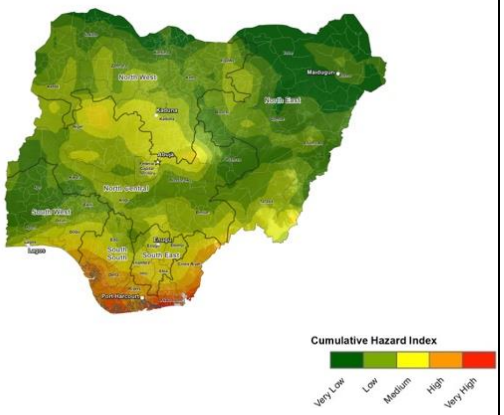
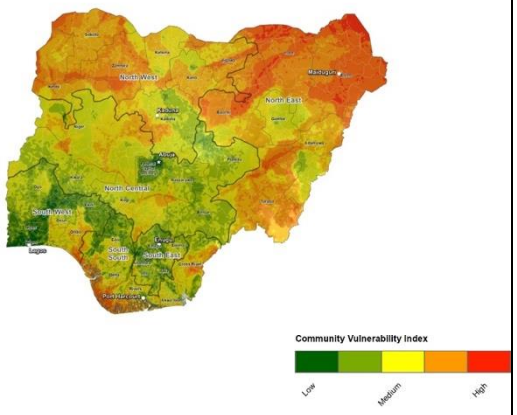
Risk: 'The potential for consequences where something of value is at stake and where the outcome is uncertain. Risk results from the interaction of vulnerability, population, and climate hazard.' Higher hazard, population, and/or vulnerability will lead to higher risk. These are classified along the nine health outcome pathways as well as cumulative current and future risk indexes.

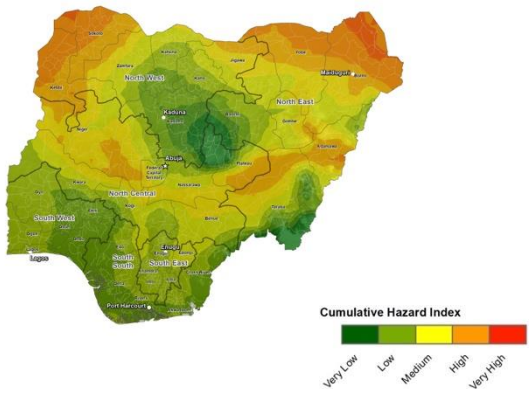
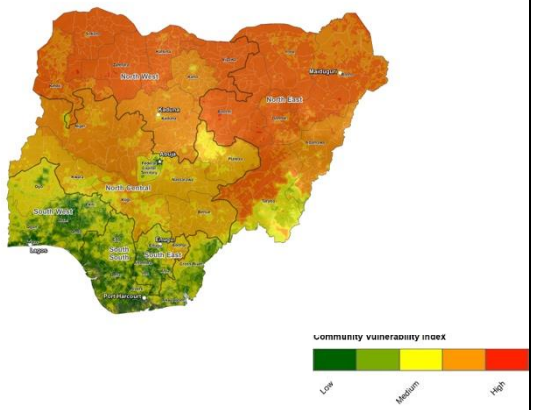
The calculation of the hazard, exposure, vulnerability and risk scores are based on full range of scenarios within Nigeria from areas of low risk or the best performing areas with little to no climate change hazard, low population exposure, and negligible vulnerability to the areas of higher risk consisting of the worst performing areas with significant impacts from current and future climate, highly exposed populations, and very high community and health system vulnerability. Areas where there are only moderate climate hazards, averagely exposed populations and normal vulnerabilities will be classified as medium risk.

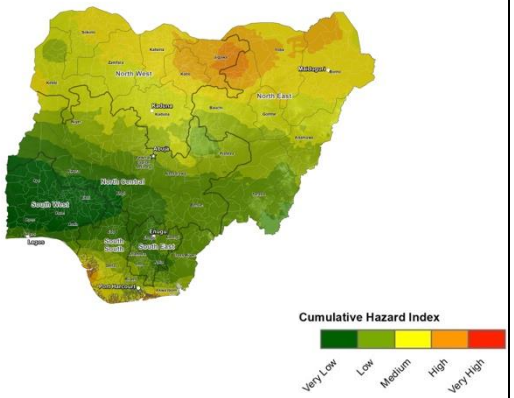
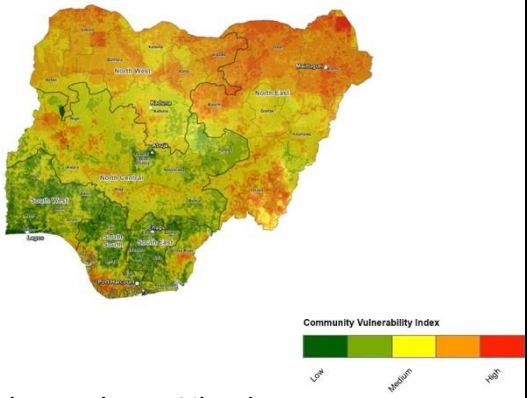
The classification of the scores is done with Jenks natural breaks optimization which seeks to group areas that score similarly into the same category and to assign different categories to areas that have significantly different scores. This is used to highlight areas that are significantly different from the mean and present clearly distinguishable changes in the data.[43]

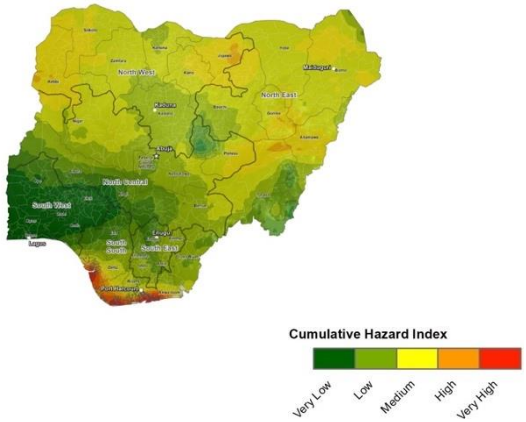
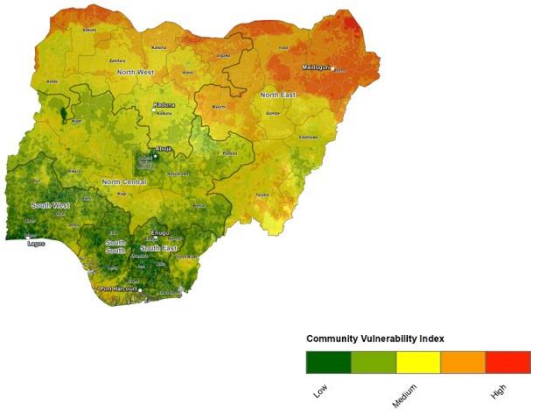
[43] Data classification methods. https://pro.arcgis.com/en/pro-app/latest/help/mapping/layer-properties/data-classification-methods.htm

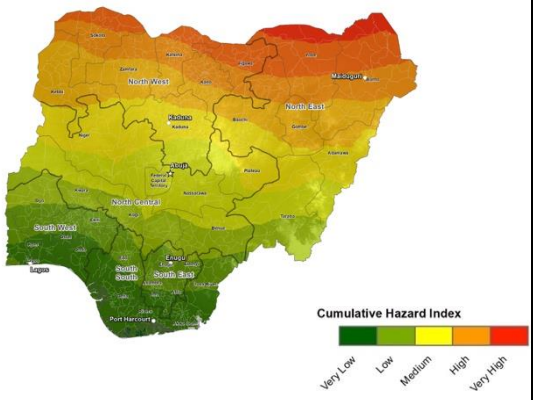
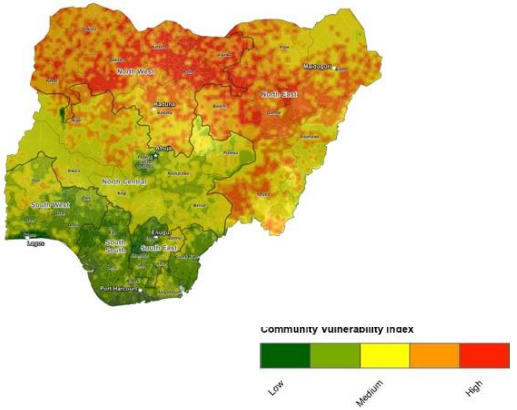
Table 9. Cumulative and community vulnerability from climate change against the health outcomes

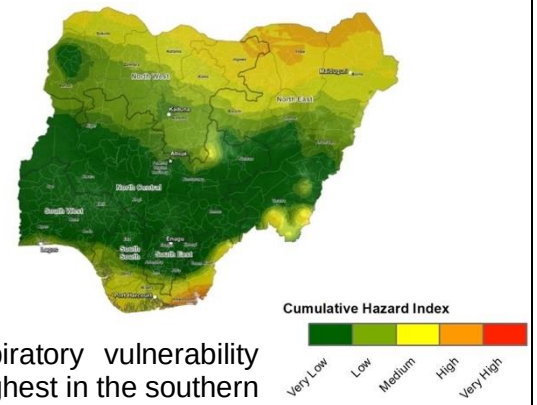
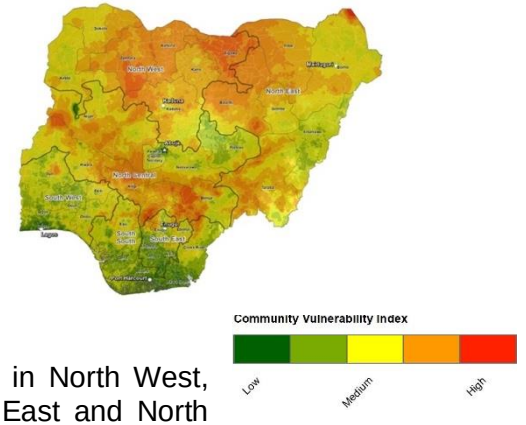
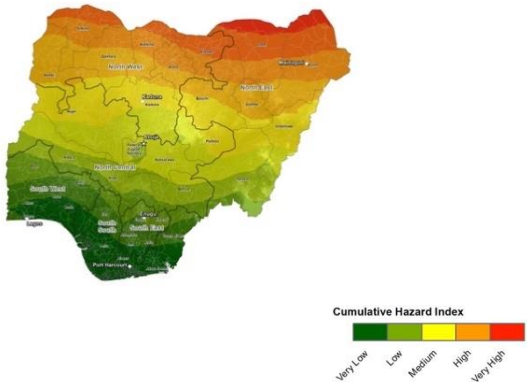
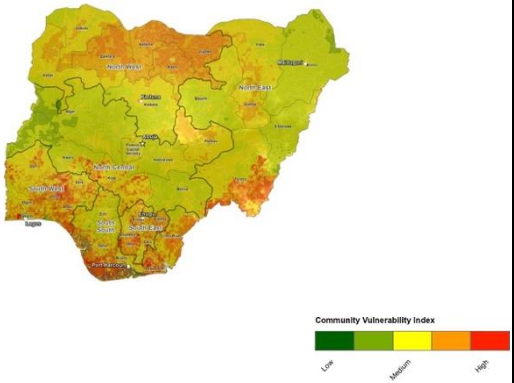
Health outcome	Definition	Climate change hazards	Community vulnerability
Injury and mortality from extreme events	This hazard index relates to single-day maximum rainfall, days of 20mm rainfall and peak monthly rainfall for longer-term events. It also relates to coastal risk from storm surges and severe tidal events. Events are all acute in nature and may impact people unable to get to safety or who do not receive advanced warnings and preparation or response advice and support	 ● Southern coastal areas in Nigeria are most vulnerable to injury and mortality from extreme events ● The coastal states in the South geopolitical zone are most vulnerable, followed by the southern states in South East geopolitical zone ● Southern coastal states in South West geopolitical zone, southern coastal states in North East and the northern states in North Central geopolitical zone and southern states in North West zone all have medium vulnerability ● South coastal areas have the highest flooding hazard index from both the high volume of +20mm days, sea level rise and increased exposure from higher coastal floods	 ● As well as the coastal states in the South West, South and North East zones, states in the far North East and North West zones show the greatest community vulnerability ● Other states in North East and North West zones are also highly vulnerable, as states in the south of the North East zone. ● Community vulnerability to injury and mortality from extreme events in the other states across the country indicate a medium to low status

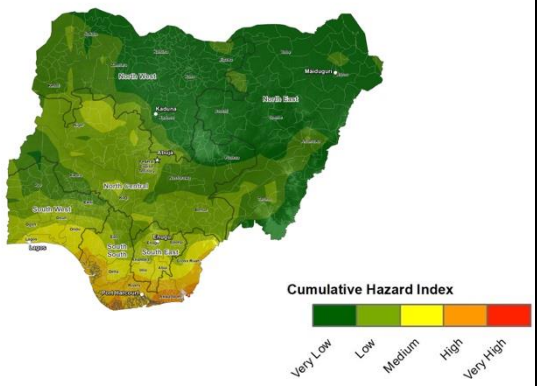
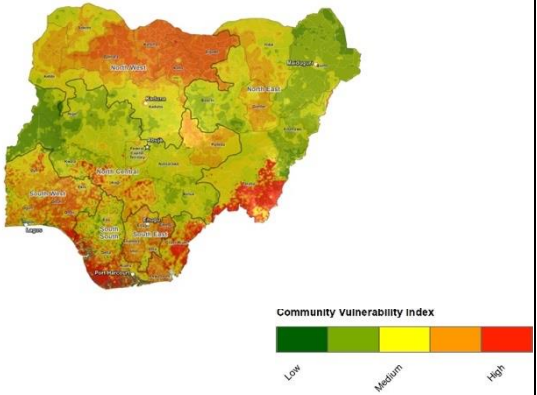
Health outcome	Definition	Climate change hazards	Community vulnerability
		• Central higher elevated areas have a medium flood hazard rating • The hazard score is low elsewhere due to their limited rainfall • Elsewhere in the country, the hazard score is low due to limited rainfall in these areas	
Heat-related illnesses	Heat-related illnesses relate to acute temperature-related hazards including average maximum temperatures, warm spell duration, peak maximum temperature, hot days >35°C and warm nights with temperatures above 20°C. These heat-related factors will result in severe temperature exposure for outdoor workers and people unable to access air conditioning and/or fans.	 • The highest heat hazard index is in the lower-altitude far North East and North West zones of the country that generally have the warmest temperatures • The elevated states in central and northern central Nigeria are exempt from this high heat hazard index • However, immediately surrounding these areas are areas of medium to high heat hazard index • Southern areas have lower maximum temperature peaks due in part to their	 • States in north-west and north-east Nigeria show the highest community vulnerability • Other states in North Central zone and central Nigeria show high community vulnerability • States in southern Nigeria show the lowest community vulnerability, although many demonstrate medium levels of vulnerability

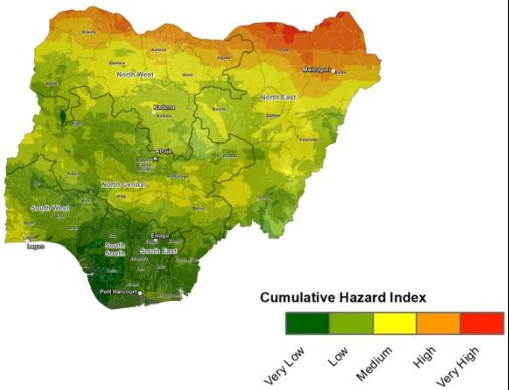
Health outcome	Definition	Climate change hazards	Community vulnerability
		proximity to the ocean and therefore have a lower heat hazard index	
Waterborne diseases	Waterborne diseases are impacted by changes in rainfall limiting water sources as well as influencing hygiene practices and water storage. Temperatures change the rate of pathogens' growth. Climate factors considered are therefore monthly peak rainfall as a proxy for significant and prolonged flooding events, year-on-year variability altering water stress and average maximum temperature associated with prolonged growth rates.	 • States in north-west and north-east Nigeria show the highest cumulative vulnerability • Other states in North Central zone and central Nigeria show high vulnerability • States in southern Nigeria show the lowest community vulnerability, although many demonstrate medium levels of vulnerability	 • States in northern Nigeria, the southern states in South zone and southern states in North East show the highest community vulnerability to waterborne diseases • The rest of Nigeria's community vulnerability is classified as medium with the exception of some states in South West, South and South East zones

Health outcome	Definition	Climate change hazards	Community vulnerability
Vector-borne diseases	Vector-borne diseases have multiple climate drivers and relate to total rainfall volumes, peak monthly rainfall as well as aridity that may force the clustering of vectors and populations into closer proximity. Additionally, temperature maximums and extremes are considered drivers of vector growth and development.	 • Vector-borne disease vulnerability peaks in states in the far southern delta area in South zone • Medium-high vulnerability exists in states in the North West and North Eastern zones • States in the South West zone, as well states immediately around this zone, as show lower vulnerability scores	 • Far northern states show the highest community vulnerability to vector-borne diseases • Medium-high vulnerability exists in the other states in the North West and North Eastern zones • North Central zones and the delta states in the South geographic zone show medium community vulnerability • Other states in South West, South and South East have low community vulnerability

Health outcome	Definition	Climate change hazards	Community vulnerability
Malnutrition and food-borne diseases	Malnutrition and food-borne diseases are heavily driven by agricultural factors. Climate indicators are therefore annual rainfall and year-on-year variability making crop forecasting challenging. A severe drought index, higher aridity and more consecutive dry days also impacts agriculture.	 • The malnutrition vulnerability index demonstrates a clear north-to-south gradient related to lower rainfall, higher variability, aridity and consecutive dry days in northern areas • States in northern Nigeria are most vulnerable, states in the middle band of the country show medium vulnerability and states in the southern areas of Nigeria have the lowest vulnerability levels	 • A similar north-to-south gradient is seen for community vulnerability to malnutrition and food-borne diseases • States in northern Nigeria are most vulnerable, states in the middle band of the country show medium vulnerability and states in the southern areas of Nigeria have the lowest vulnerability levels

Health outcome	Definition	Climate change hazards	Community vulnerability
Respiratory illnesses	Respiratory illnesses can be driven by heat waves where atmospheric inversions trap pollution close to the ground, increasing wildfire risk. Precipitation variability also influences the prevalence of respiratory pathogens, as does excessive rainfall and floods which create damp conditions where mould can thrive which aggravates respiratory condition such as asthma, and respiratory tract infections	 • Respiratory vulnerability is highest in the southern states, with the exception of the coastal states in South zone which show medium-to-high vulnerability • Many northern states have medium-high vulnerabilities, moving to high vulnerability in the north-east	 • States in North West, North East and North Central show high community vulnerability to respiratory illnesses • States in the rest of Nigeria have medium community vulnerability, except for coastal areas which have low vulnerability
Zoonoses	The zoonoses hazard index relates to humans and wildlife proximity. This tends to relate to water availability. Year-on-year variability, drought index, aridity and consecutive dry days are assessed		

Health outcome	Definition	Climate change hazards	Community vulnerability
		• Vulnerability to zoonoses shows a strong north-to-south gradient • Vulnerability is high in northern states, medium in the states in the middle of Nigeria and lower in southern states	• Community vulnerability to zoonoses is highest in the southern and coastal states, as well as the northern states in North West zone • The rest of the country demonstrates medium community vulnerability except for some states in the far west that indicate lower vulnerability
Mental and psychological health	The mental and psychosocial health index links most closely with acute one-day peak rainfall and days over 20mm that could result in flood risk and associated trauma, and with prolonged droughts may cause health and nutrition related psychological stress whilst increased heat waves and warm nights may cause anxiety.	 • Mental and psychological health vulnerability is highest in the southern states. This is predominantly driven by the impact of severe rainfall • States in the majority of the central and north west regions have low vulnerability while north-central and north-eastern areas have the lowest vulnerability	 • Community vulnerability to mental and psychological health is highest in the southern states and in the far north, especially the northerly states in North West Zone • With the exception of states in the far north-east and west of Nigeria, the rest of the country shows medium community vulnerability

Health outcome	Definition	Climate change hazards	Community vulnerability
Non-communicable diseases	NCDs are highly varied and may be affected indirectly by multiple climate factors. They are mostly not caused by specific climate drivers. However, climate conditions can indirectly influence the prevalence, distribution, and severity of NCDs. These include changes in air quality, heat waves and increased stress from extreme events. Changing climate conditions are effectively exacerbating these. As such, the climate stress index is utilised as the climate driver.	 • There is increased vulnerability to NCDs the far northern states, medium vulnerability in central states, and a lower vulnerability in the southern states	No data available for NCDs and community vulnerability

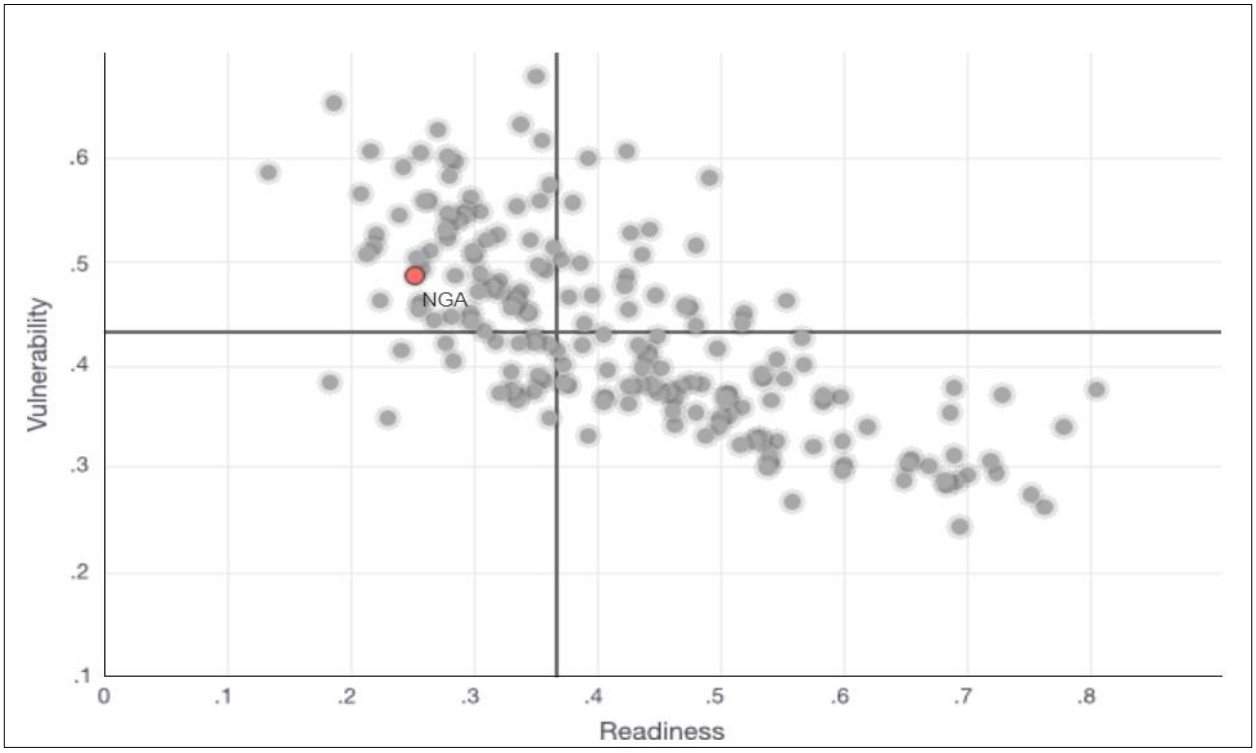
5. Capacity assessment

5.1 Overview

This chapter presents the current capacity of Nigeria's health system to be resilient to the impacts of climate change. The health system is examined against the analysis and synthesis of existing climate change and health system data, literature and policy review and expert opinions, geospatial analysis, mapping and modelling.

Coupled with its economic and social challenges, Nigeria's capacity to adapt and respond effectively to the challenges and vulnerabilities of climate change remain very limited, so much so that Nigeria is one of the least-ready countries in the world to adapt to climate change (placing Nigeria at 154 out of 182 countries ~ ND-GAIN Index is 38.5). In general, Nigeria's high vulnerability score and low readiness score climate change place it in the upper-left quadrant of the ND-GAIN matrix[44] which contextualises a country's vulnerability and readiness.

Figure 8. Nigeria's position on the ND-GAIN matrix in 2021



5.2 Health system capacities

Nigeria's health system's capacity is insufficient to cope with the additional burdens brought about by acute and chronic climate shocks. Several of the findings from the multiple analysed primary and secondary data sources highlight the immense challenge of protecting the health and well-being of the population from increasing climate hazards and risks in Nigeria – as summarised in Table 10.

[44] University of Notre Dame Global Adaptation Initiative. (2024). *ND-GAIN Matrix*. [Online] Available: https://gain-new.crc.nd.edu/country/south-africa

Table 10. Nigeria's health system capacities

Climate resilient building block	Health system capacities
 **Leadership and governance**	• **Awareness and knowledge of climate change and health in the FMoH, state MoHs and LGAs is low.** As a result, the impacts of climate change on health is not fully appreciated across the leadership of the health sector, and it is therefore not prioritised sufficiently • **Leadership and governance capacity for climate change and health is limited** within the Federal and state MoHs and LGAs • **Coordination between the MoH and other MDAs at the Federal level is weak and it is strained between the Federal level and the states**. This reduces harmonisation between the programmes, decreases the overall impact of multi-sectoral climate adaptation measures and increases the duplication of efforts, including financing for climate change adaptation measures • **Bureaucracy is also very high on all levels**, all of which restricts multi-sectoral collaboration on climate adaptations. • **The climate and health units in the FMoH and the state MoHs are not fully functionally** administratively to perform their basic functions and staff have low capacities regarding climate change and health • **Climate change and the nexus with health is not afforded a significant enough feature in existing Federal and state policies and plans**, including health policy and plans - only a small number of national policies including the 2021 National Policy on Climate Change, the 2021 Climate Change programme, the 2050 Long-Term Vision for Nigeria feature climate change and health to a very small extent • **Nigeria lacks a Health National Adaptation Plan** • **Climate change and health coordination forums are nascent** – and only exist at the Federal level but not in the states or LGAs
 **Climate and health financing**	• **Low health sector budget allocations for climate and health exist generally at the Federal** and state levels. No budgets are available at the LGA level. • **Reliance on overseas aid to support climate change impacts** - Nigeria relies on foreign loans, aid and grants to finance more than 50% of its climate adaptation and mitigation activities[45]. Climate adaptation projects in Nigeria have historically been funded mostly by international organisations, though implemented at national and sub-national levels, without budgetary responsibility being owned at national and local level. • **While there are some mitigation projects in Nigeria, there are as yet no national-level projects focused on health sector adaptation.** Nigeria has a portfolio of adaptation projects that have been funded by prominent climate funds such as the Global Environment Facility (GEF) and the Green Climate Fund (GCF), but as yet, no Adaptation Fund (AF) projects, readiness, learning, or innovation grants have been submitted for the country. In terms of the GCF, Nigeria is part of several regional adaptation projects funded by the GCF. Regarding Nigeria's GEF portfolio, the most recent allocation of funds assigns approximately USD

[45] Butu, H., M., Okeke, C., U., and Okereke, C. (2022). *Climate Change Adaptation in Nigeria: Strategies, Initiatives, and Practices*. Working Paper No. 3. APRI: Berlin, Germany. [Online]. Available: https://afripoli.org/climate-change-adaptation-in-nigeria-strategies-initiatives-and-practices

Climate resilient building block	Health system capacities
	8.3 million (38% of the national total) to the climate change focal area, although this is not disaggregated between adaptation and mitigation. • **No clear and defined and budget for emergency preparedness and response to extreme weather events**, as part of overall health budget at the Federal, state and LGA levels (except for the Basic Health Care Provision Fund, which is not explicitly aligned with disasters caused by climate change) • **No specific national or state-level costed plan for climate and health adaptation** in place • **No specific climate and health financing in place** at the Federal or state levels to mitigate and adapt against climate change
 **Health workforce**	• **The current number, availability and distribution of health professionals across the country is already insufficient** to meet the present needs, especially in many remote, rural areas. Climate change will only weaken this capacity more. • **Deploying and retaining health workers** in rural, remote, and underserved areas continues to be a major challenge. As more health workers are recruited, they will need to be trained to be more climate-resilient. • **No assessment of health workforce capacities to respond to climate risks.** Capacity, knowledge and understanding of health workers at all levels of the health system on the impacts of climate change health is generally very limited • **Very limited/no training of current health professionals that equips them on how to deal with the increasing demands of climate health risks** and to serve as frontline climate-informed health workers. Climate change is not integrated into existing health training curriculums • **Health workers have no capacity or tools to predict and act on climate change projections**, which essentially leaves them incapable of knowing when a disaster may occur or how to deal with them
 **Vulnerability, capacityand adaptation assessment**	• **Awareness of climate-health nexus is low** for civil society. • **Health information systems are not aligned with weather and disaster** early warning systems to support effective anticipatory action and improved service delivery coverage. • **Climate and health information is lacking throughout the system**. This limits the awareness and understanding of the impacts on climate change – and data is not incorporated into health policies and plans.
 **Integrated risk monitoring and early warning**	• **Nigeria's health information system, does however, have existing capacity that can be strengthened** with regards to quantity, quality and effective analysis and use of health data, enabling health surveillance to be aligned with weather and disaster early warnings to support effective anticipatory action and improved service delivery and coverage. • **Climate-informed health indicators do not exist within information systems** at the Federal and state levels
	• **Nigeria's research capacity and experience is limited** on climate change and health • **The availability of climate change and health data is limited** at the Federal level, and very limited in the states

Climate resilient building block	Health system capacities
Health and climate research	
 **Climate resilient and sustainable technologies and infrastructure**	• **Current procurement and distribution systems at the Federal and state levels are unable to anticipate potential disruptions** to the supply chain from climate change • **All logistic management information systems are not linked to other early warning systems** in order to ensure that sufficient quantities of essential medicines are available and provided in advance of climate-related disasters • **Laboratory capacities do not track current needs nor model future burdens** of climate-sensitive diseases • **Nigeria's supply chain does not have a master plan to mitigate the risks** from climate change • **Alternative and innovative modes of distributing essential medical supplies are not in place**. There is an over-reliance on traditional means of distributing via roads • **There is no back-up supply chains available for use during extreme weather events** caused by climate change
 **Management of environmental determinants of health**	• **Many existing health facilities are insufficiently built and equipped to meet the general health needs** of Nigerians. Nigeria's National Strategic Health Development Plan (NSHDP II) reports that around 80% of health facilities are dysfunctional,[15] with significant need to upgrade public health facilities and infrastructure. Health facilities surveyed to inform this V&A assessment demonstrated poor-to-very poor functionalities. Climate change will only exacerbate this weak capacity. • **Tools and assessments on health infrastructure capacities to adapt to climate change have been developed under the FCDO Climate Resilient Infrastructure for Basic Services: Health and Education (CRIBS).** Partners include, FCDO, UNICEF, WHO and Crown Agents. These are now being carried out in Kano and Jigawa. • **Majority of health facility infrastructure is not specifically adapted** to effectively deal with climate change. • **Health facilities do not have sufficient equipment and resources to deal with increased numbers of clients** due to the changes in climate, especially in rural areas. • **Service delivery capacity in most is already low.** Climate change will only exacerbate this weak capacity. • **Climate change adaptation not mainstreamed into planning for different levels of service delivery** within the health system. • **Health facilities and communities lack emergency plans and protocols for responding to higher demands** created by extreme weather events (e.g. floods, heatwaves, storms). • **Limited disaster contingency plans**, especially at community level. • **Healthcare facilities lack emergency plans for providing essential health services** to higher demands created by extreme weather events (floods, heatwaves, storms etc). • **Several national health programmes have limited or no inclusion of climate-health nexus** issues
 **Climate-informed health programmes**	
 **Emergency preparedness and management**	

5.3 Health facility capacities

To inform this assessment, health facilities were assessed in each of the six geopolitical zones. It was not possible to cover a representative number of health facilities, within the available timeline and budget. A representative sample was therefore selected to provide a means of illustrating findings from GIS modelling and literature review, as well as to seek to fill gaps where data was not available. 30 health facilities were assessed including public and private sector facilities at primary, secondary and tertiary levels. Findings from these assessments are presented below.

Table 12 shows scores for synthesised findings. In summary, these show:

- **Health service delivery** was reported as the worst-performing health system building block in almost all areas, with the only exception being Kano where it ranked five out of seven
- **Health infrastructure** was ranked sixth whilst **availability of medicine, vaccinations, and supplies** was fifth. These are consistently noted as among the lower capacities in most states.
- **Governance and leadership** and **health workforce** are equal as the fourth and third ranked metrics with mostly middle and good rankings and only one lower ranking in Lagos for the health workforce
- The best-performing metrics are **health information systems** and **health financing** which received generally high rankings in all states.

Table 12. Synthesises scores for the health system building blocks by state

Health system building block	Average rank	Lagos	Akwa Ibom	Enugu	Kwara	Adamawa	Kano
Governance and leadership	**3.33**	2	3	4	4	4	4
Health workforce	**3.33**	6	4	2	3	3	2
Health financing	**2.17**	3	1	4	1	1	4
Health information system	**1.50**	1	2	1	2	2	1
Health infrastructure	**5.83**	5	6	6	6	5	7
Medicines, vaccines, technologies and supplies	**5.17**	4	5	5	5	6	6
Health service delivery	**6.67**	7	7	7	7	7	5

Table 13 shows each of the state's scores of health system capacities relative to each other:

- **Kano scores lowest of the six states** as it has the lowest ranking for metrics other than health service delivery, governance and leadership, and health workforce
- **The best-performing state is Akwa Ibom** which tops the ranking in several metrics including health workforce, health infrastructure, medicines, vaccines, technologies and supplies, and health service delivery
- **The worst performing metric was the Health Management Information System (HMIS)**
- **The remaining states of Lagos, Enugu, Kwara, and Adamawa** all scored very similarly overall with middling rankings.

Table 13. States' health system capacities relative to each other

Health system building block	Lagos	Akwa Ibom	Enugu	Kwara	Adamawa	Kano
Governance and leadership	2	2	4	4	6	5
Health workforce	6	1	3	2	5	4
Health financing	5	2	5	3	1	6
Health information system	2	3	4	5	1	6
Health infrastructure	2	1	5	5	3	6
Medicines, vaccines, technologies and supplies	2	1	4	3	5	6
Health service delivery	6	1	4	3	5	2
Average rank (state-specific)	**3.43**	**1.50**	**3.93**	**3.43**	**3.71**	**5.00**

5.4 Stakeholder feedback on Nigeria's health system capacity

Overall, stakeholders expressed mixed views regarding the preparedness of Nigeria's health system to cope with the anticipated increase in climate-sensitive health outcomes. Political office holders tended to present a positive outlook of the health system; other public sector health officials, including health sector managers, healthcare workers, and community groups do not share this enthusiasm and cite several factors that indicate limited readiness of the health system to respond to climate change impacts. A key knowledge gap in this regard is detailed data and information on the nature of anticipated changes by geographical distribution, incidence or timing of climate-sensitive health outcomes under different warming scenarios for Nigeria.

Stakeholders identified several key challenges which detract from the climate-resilience of Nigeria's health system. Lack of knowledge, lack of political will or collaboration and commitment, and lack of funding featured most prominently among the challenges mentioned, along with ineffective planning and implementation and weak intersectoral collaboration. Besides these, some also identified competing development priorities, lack of awareness among policymakers, as well as poor understanding among the general public, deficiency in comprehensive planning for climate-related emergencies, and poor implementation of government programmes. Similarly, the cognitive barrier (lack of understanding or perception) that the climate-health nexus can cause, according to the analysis of literature and national policy, also challenges the effective implementation of climate adaptation measures in the health sector. For example, a lack of knowledge and clear perception of the issues involved in the climate-health nexus may hinder the ability to act on information about climate change, including perceptions of how urgent the adaptation needs are. The complexities and weaknesses of Nigeria's health system were critically identified as a major challenge in coping with the scale of climate-health impacts.

Stakeholders expressed uncertainty when asked if climate change adaptation is adequately integrated into health policy and legislation. On the one hand, climate change policy per se was perceived as adequate, but no health linkages were referred to.

Concerning the vulnerability to climate change impacts on healthcare supply chains, health sector stakeholders noted that a policy-driven approach is an important first step to improve supply chain resilience. This approach should include a comprehensive review of the current national healthcare supply chains and their vulnerability to climate change to identify gaps and develop appropriate adaptation measures. Once the needs of specific parts of the overall supply chain are thoroughly understood relative to observed and projected climate change impacts, refinement or harmonisation of existing healthcare supply chain policies should be undertaken, promoting local sourcing of high-quality goods to transition away from over-reliance on cost-ineffective imports.

Stakeholders pointed out the extremely low density of the health workforce serving Nigeria's population, combined with insufficient climate-related technical training of health workers. These constraints are related to insufficient finance, poor governance, limited health information services and disease surveillance, and inadequate early-warning systems. Even with the existing inadequate human resources in the country's health sector, there is a serious problem of deploying and retaining health workers in rural, remote, and underserved areas.

Health sector stakeholders reported that while basic health surveillance is in place, record-keeping is largely paper-based and not robustly analysed or shared for decision-making purposes. Several respondents stated that new health information systems (HISs) are required.

Health sector stakeholders reported a high degree of uncertainty regarding the impact of anticipated changes to Nigeria's health programme in the next decade. Specifically, in terms of whether changes to the health sector may improve the country's ability to address climate-sensitive health outcomes, respondents indicated that **the priorities of bilateral and multilateral donors will likely play the most significant role and that these priorities are as yet unknown**. Respondents were convinced that building resilience to the additional challenge of climate change will not be possible without addressing the existing weaknesses of poor governance, outdated technology, inadequate service coverage, under-resourced health facilities, chronic underfunding, and inadequate training of the health workforce.

6. Future risk assessment

6.1 Overview

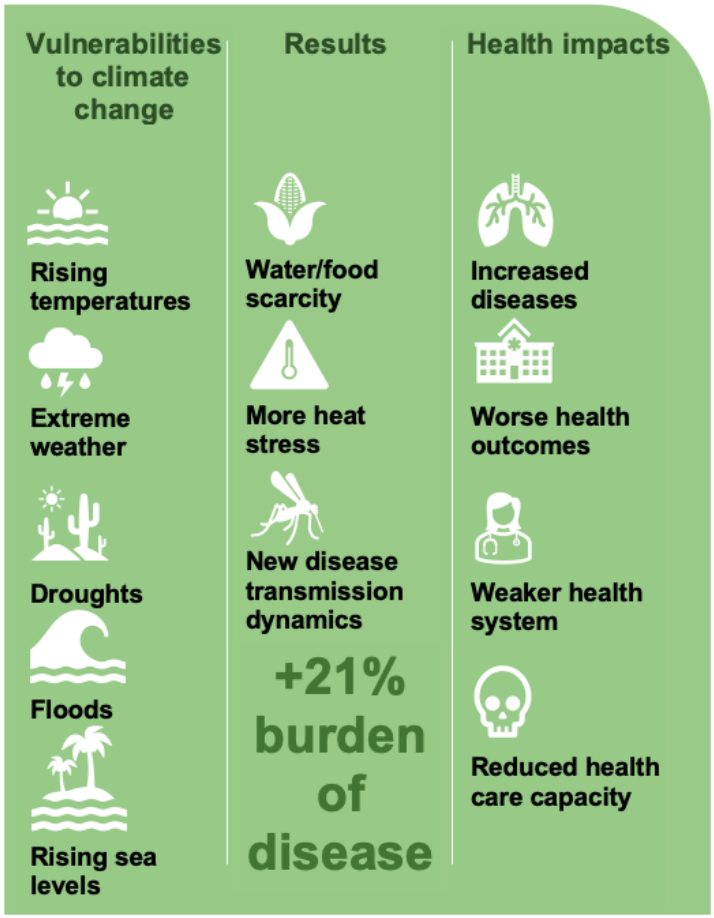
This chapter examines the future risks of climate change on Nigeria's health outcomes across the country. Evidence and conclusions are drawn from analysis and synthesis of existing data, literature and policy review and expert opinions, as well as geospatial analysis, mapping and future modelling.

Box 5. WHO identifies nine critical health outcomes that are most at risk from climate change

1. Injury and mortality from extreme weather events
2. Heat-related illness
3. Waterborne diseases
4. Vector-borne diseases
5. Malnutrition and food-borne diseases
6. Respiratory illness
7. Zoonoses
8. Noncommunicable diseases
9. Mental and psychosocial health

Under all scenarios, Nigeria's risk to climate change is increasing and are expected to increase further. These increased risks from climate change will impact on the country's overall health system, with some geopolitical zones and states being more at risk that others. Changes in Nigeria's climate will also impact on the nine major health outcomes that are assessed throughout this report and presented in Box 9.

Figure 9. Climate change impacts on Nigeria's burden of disease



Nigeria faces significant vulnerability to realising poor health outcomes associated with anticipated future climatic conditions. These conditions include rising temperatures and enhanced frequency and intensity of extreme weather phenomena such as heavy rainfall along with prolonged and more severe periods of drought and aridity. Such climatic shifts are expected to exacerbate water and food scarcity, increase susceptibility to heat stress and ultraviolet radiation, and alter the transmission dynamics of infectious and vector-borne diseases. Disruptions to existing agricultural practices may lead to food shortages, disproportionately affecting the health of women, children, and other vulnerable groups. These potential effects pose a significant threat to the long-term health of the Nigerian

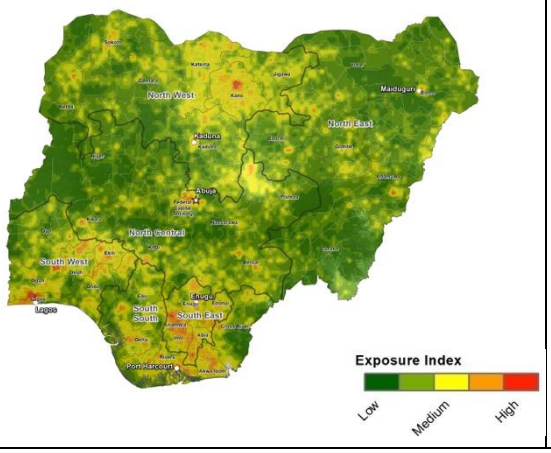
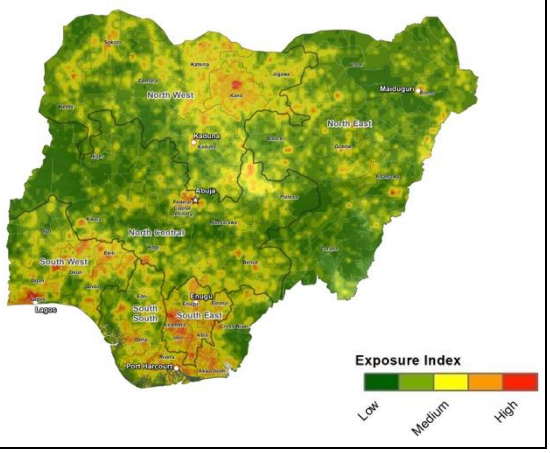
population and the resilience of the national health system. [46] [47]

The future disease prevalence is highly uncertain and very difficult to model but, based on only linear forecasts of current diseases and impact trends, there is an anticipated +21% burden of disease.[48] There is not sufficient validated subnational data in Nigeria to extrapolate the direct relationship between historical climate changes and disease outbreaks and from there to project this into the future under the future climate change scenarios. It was therefore not possible to attribute different disease outbreaks to individual changes in historical climate events. It was assumed that the relationship between the current climate and the current disease prevalence and incidence would remain the same into the future under climate change. For example, if there was an increase in drought, that there would be a proportional increase in malnutrition.

The future exposure to climate change will vary across Nigeria, as shown in Table 11. By 2030, the future changes in the exposure to climate change will be highest in the north-central states in the North West zone, especially in Kano and Katsina states, as well as the capitals in Kaduna and Sokoto states. Abuja also has a high future exposure to climate change. In the south of the country, Lagos has a very high future exposure, and several states in South West, South and South East zones also have high future exposures to climate

Nigeria will face changes to its rainfall and temperatures, which will have significant consequences across the country, as detailed in Table 12. Rainfall and temperatures will rise, affecting communities, their livelihoods and health, and increasing mortality rates.

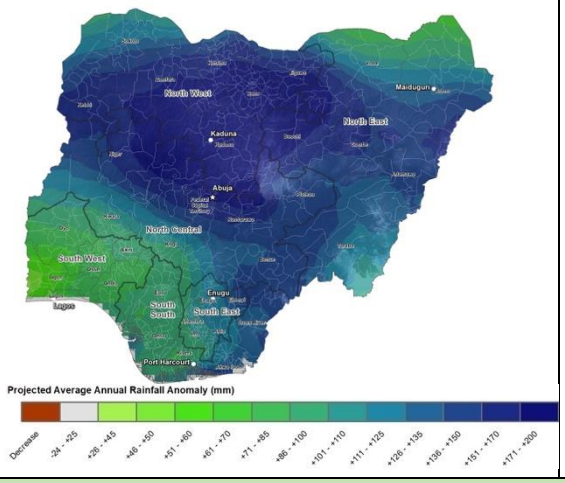
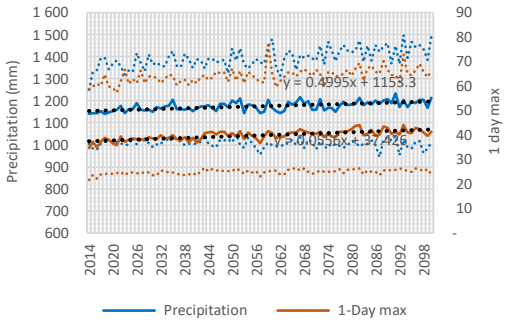
Table 11. Future exposures to climate change – by 2030 and including "avoid at all costs" scenario[49]

"Middle of the road" cumulative exposure to climate change by 2030 (SSP2)	"Avoid at all costs" cumulative exposure to climate change by 2030 (SSP5)
	

[46] Climate Risk Profile: Nigeria (2021): The World Bank Group.
[47] Short- and Long-Term Impacts of Climate Extremes (SLICE), Climate risk profile: Nigeria, https://www.climate-impact-economics.org/en/news/climate-risk-profiles

[49] Wang, X., Meng, X., & Long, Y. (2022). Projecting 1 km-grid population distributions from 2020 to 2100 globally under shared socioeconomic pathways. Scientific Data, 9(1), 1-13. https://doi.org/10.1038/s41597-022-01675-x

Table 12. Future exposure to increased rainfall and temperature [50]

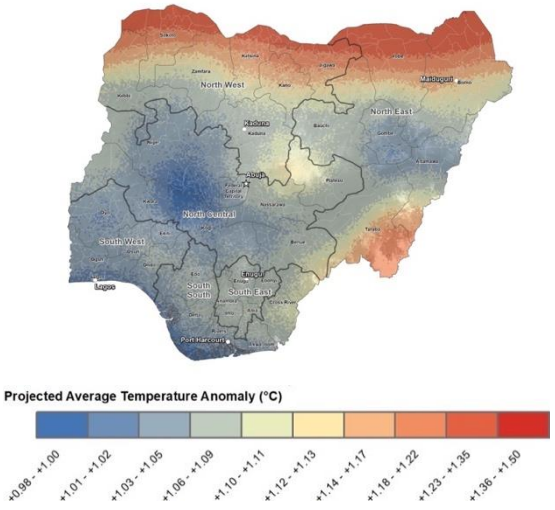
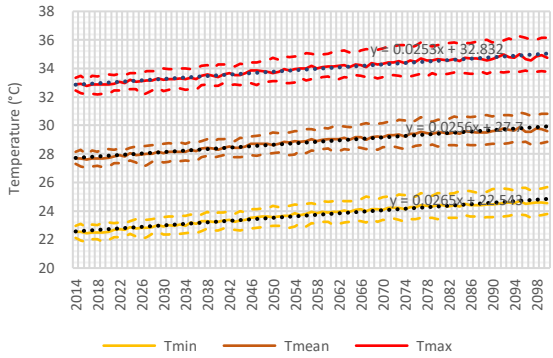
Future rainfall anomaly 2030	Nigeria's projected precipitation to 2100[51]
	

- **Nigeria will be exposed to increased rainfall that will be experienced across much of the country.** With the exception of the most northerly areas, as well as the states in South West and South zones, most of the country will experience between 110mm to more than 200mm rain each year. Models indicate that higher precipitation will be observed from the end of the rainy season through to the start of the dry season, September to December. In addition, it is anticipated that periods of heavy rainfall will become more frequent
- **In contrast to long-term trends, the SSP2-4.5 scenario indicates that annual precipitation will tend to rise.** This trend is however indicative of changes noted from the early 2000s. Future trends suggest increases in the central regions ranging from +120 to +180 mm and in the northeast and south-east from +50 mm[52]
- **Under the most severe scenarios, sea level is predicted to rise between 0.5 and 1.0 meters by the end of the century.** This may lead to seawater intrusion into coastal groundwater reservoirs. Sea level rises, even modest ones, will have a significant impact and permanently alter shorelines, increasing the risk of flooding for coastal towns and ecosystems.
- **Between 2070 and 2100, an average of 550,000 people are expected to experience flooding as a result of sea level rise** under a high emissions scenario, without significant investments in adaptation. Altered patterns of infectious and vector-borne disease transmission, exacerbated by increased food and water insecurity, will have both an immediate and indirect effect on the health of the Nigerian populace.

[50] Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high-resolution interpolated climate surfaces for global land areas. International Journal of Climatology 25: 1965-1978

[51] Ibid.

[52] However, there is significant ambiguity regarding the expected direction and size of future changes, with disagreement across models. Although the amounts vary, the mean ensembles of all the climate scenarios show this increase. Models indicate that higher precipitation will be observed from the end of the rainy season through to the start of the dry season, September to December.

Future temperature projections by 2030	Nigeria projected mean temperature to 2100 [53]
	

- **Temperatures are expected to rise across the country by approximately 1.0-1.1 °C between 2020 and 2050 under mild climatic scenarios. Under more extreme scenarios it is expected to rise by at least +3.0 °C.** Temperature rises are anticipated across the entire year, with most future months showing similar anomalies. Night-time lows, single day extreme highs, and protracted highs are all projected to follow this baseline average temperature shift. Nationwide average maximum temperatures are projected to be approximately 34°C. The health of people and animals, agriculture, and ecosystems will all be significantly impacted by increased and extreme heat.
- **The percentage of the population exposed annually to these events is projected to quadruple from 6% in 2000 to 19-22% by 2080** under low to moderate climate change scenarios. With the anticipated increased population growth in Nigeria, these changes will affect a larger number of people in absolute terms. Concurrent with the increase in heat exposure, there is a projected rise in heat-related mortality.
- **Climate projections indicate that the loss of water from the soil both by evaporation from the soil surface and by transpiration from the leaves of the plants growing on it will increase between 4.1% to 6.6%, in line with the anticipated rise in temperature.** This will increase the amount of soil that dries out, raising the risk of drought, reducing agricultural output, and increasing the susceptibility of sealed soils to flash floods in the event of heavy precipitation

6.2 Future risks to health outcomes

Based on the current trends, there is a likely increase in negative health outcomes in 2030. Despite any efforts on behalf of Nigeria, the climate is anticipated to worsen and create a situation that will impact health care capacity, increase the vulnerability of communities and create conditions more conducive to greater disease incidence and prevalence. It is therefore critical that adaptation measures are urgently put into place to address climate change's expected impacts on health outcomes.

[53] World Bank Group, Climate Change Knowledge Portal (2024). URL: https://climateknowledgeportal.worldbank.org/

It is challenging to assess potential future changes to health outcomes, given the sometimes unpredictable climatic changes and the interconnectedness of the climate-health nexus. However, assuming there were no climate changes, there would still be an increase in health outcome risks as this is based on changes in non-climate factors like inflation and the rising cost of living, conflict, migration, increased population, as well as changes in baseline community vulnerability and medical capacity. While there are improvements being made in several aspects of the health system, the increased future population will likely offset any gains and result in increased risk. When the likely climate changes are factored in, these risks will be exacerbated and enhanced as they will not only change disease profiles but likely also compromise communities' resilience and, in some instances, healthcare capacity.

With specific regard to the climate-health nexus, Nigeria likely faces a slow process of 'epidemiological transition' in the coming decades even without climate change, as seen from experiences of similar middle-income countries. With climate change, climate-related deaths, injuries and diseases will produce an additional burden on the existing dual burden of communicable and noncommunicable diseases.

6.3 Cumulative health outcome risk

General cumulative health sector risks to health impacts can be estimated as factors that are very consistent among the health sector generally rather than specifically for any one health outcome. This means that the combination of medical facility density, access to insurance, skilled birth assistance, mother and child heath index, infant mortality rate, drive/walk time to health care, heath-care facility ratios to local population, and public heath indexes are used as measures of general health care capacity for all health outcomes rather than just a single health outcome, such as heat-related illness or zoonoses, for instance. These factors present the general resilience of diseases, direct and indirect health impacts and both acute and chronic effects. They are factors that contribute to general well-being as well as health sensitivity and adaptive capacity. Therefore, this is a general health care vulnerability index which can serve as Nigeria's baseline, in order to

Box 6. Cumulative health outcome risks

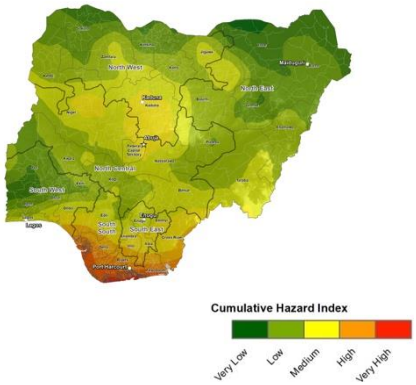
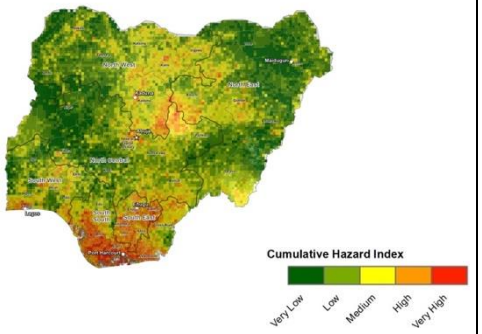
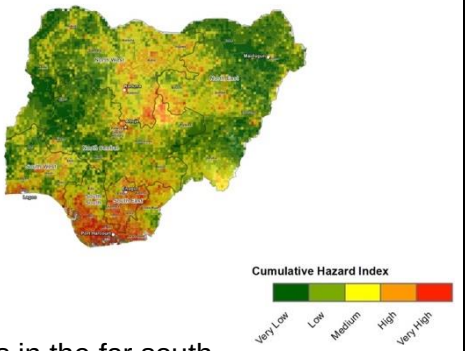
1. **The future SSP5 risk index scenario sees a greater risk in all areas, particularly in the northern areas** and there are increased risks noted in the southern areas
2. **The anomaly of the SSP5 risk also suggests a clustering of high to very high risks for large urban areas with the largest changes in population density**
3. **The current (2020) risk index indicates that there is an increased risk in the northern areas of the country** and some areas of the southern delta areas have moderate risk. The areas to the southwest have the lowest risk and the areas to the far east have low to moderate health risk
4. **The future (2030) SSP2 risk index (the ambition scenario) maintains a similar risk distribution to the current risk**, it does however have an increased risk overall
5. **The areas to the north are projected to have a higher risk than is noted previously** and the areas that were previously noted as low or low-medium are now classified as mostly medium.
6. **There is therefore a very likely increase in the severity, duration and magnitude of future climate impacts in Nigeria** which will exacerbate future health risks

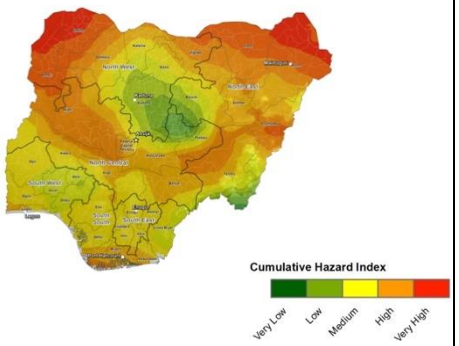
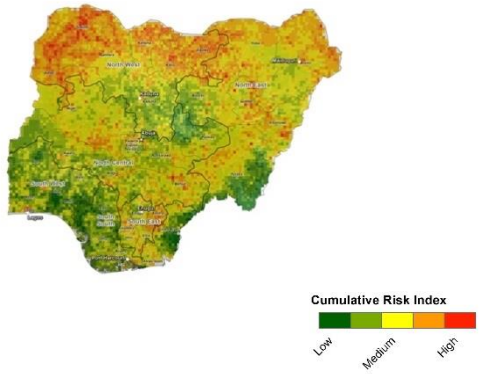
support adaptation planning. With these considerations in mind, Nigeria's cumulative health sector risks are summarised in Table 16 and Table 17.

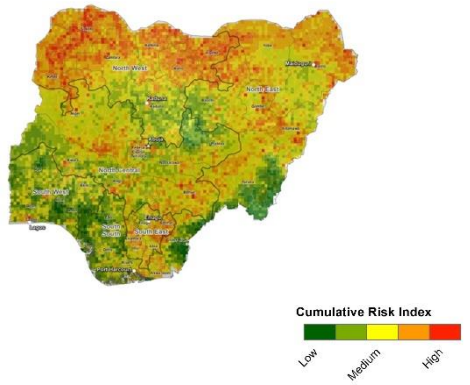
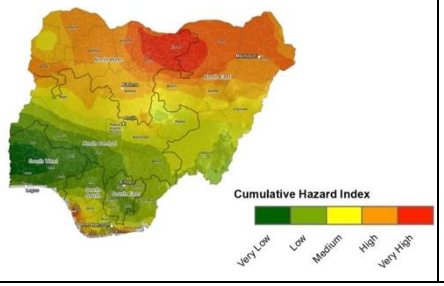
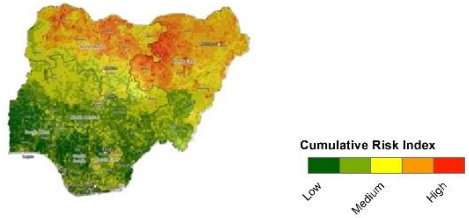
Box 7. The overall trend – across all scenarios - is that the risks and impacts from climate change to the health sector are projected to worsen

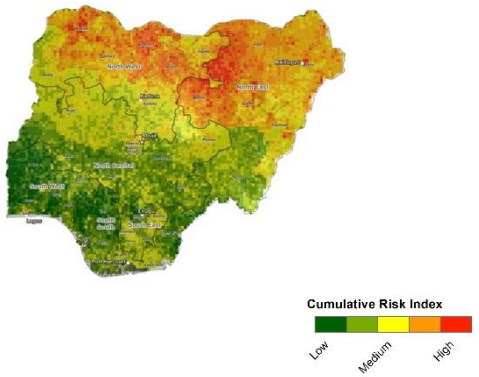
1. **Areas in the north which were previously classified as medium to medium-high risk are expected to escalate to high risk**, and across a broader geographic region
2. **As increased risk intensifies further it causes a transition from low and medium-risk zones to medium and medium-high-risk categories.** Notably, the risk gradient persists, stretching from the central north towards the southwest
3. **Locations that were previously considered low-risk in the south are escalated to medium-risk**

Table 13. Future risks assessed against the health outcomes

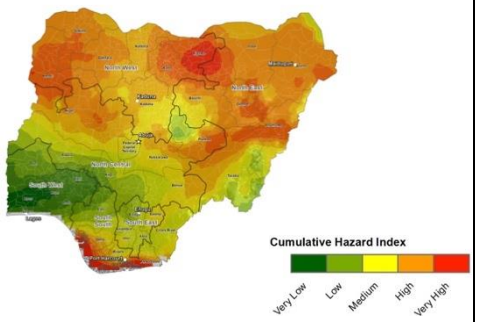
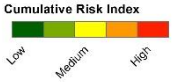
Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
Injury and mortality from extreme events	Exposure to forces of nature will increase, such as: A total of 800,000 individuals are at risk from riverine flooding by 2030 Approximately 550,000 individuals could be affected annually by flooding from sea levels by 2070	 • States in the far south of Nigeria have very high future vulnerability to injury and mortality from extreme events caused by climate change • States in the central and south-central areas have a medium future risk • Other states have a low risk with the lowest future risk being in the most northerly regions and the most westerly states in South West zone	**"Middle of the road" (SSP2)**  **"Avoid at all costs" (SSP5)**  • States in the far south of Nigeria, including around Lagos,

Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
			have very high future vulnerability to injury and mortality from extreme events caused by climate change • Some central areas also demonstrate high future vulnerability
Heat-related illness	The absolute number of people affected will increase significantly due to high population growth The population exposed to heat waves each year will quadruple from 6% in 2000 to 19 - 22% by 2080 Deaths from heat are expected to double, increasing from 2.5 to 5 per 100,000 people per year by 2080, and potentially up to 10 deaths per 100,000 people per year by 2080		**"Middle of the road" (SSP2)** 

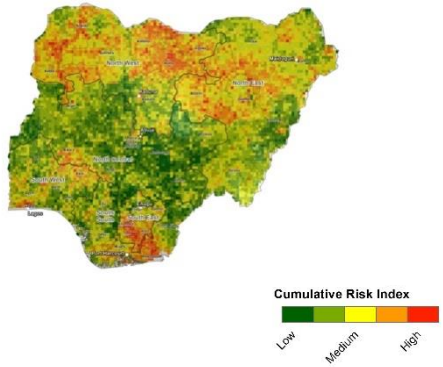
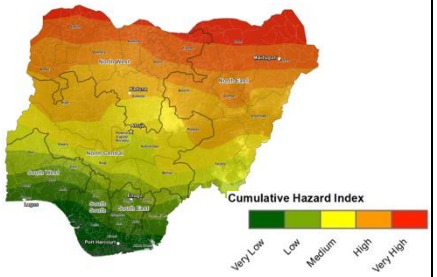
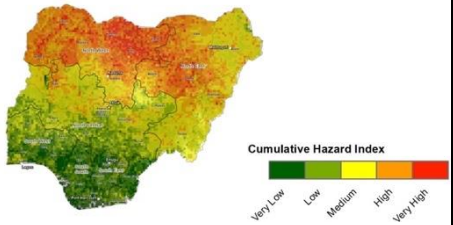
Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
	Heat-related deaths among the elderly are projected to surge to nearly 80 deaths per 100,000 by 2080 up from an estimated baseline of about 3 deaths per -100,000 annually recorded between 1961 and 1990.	• States in the further North West and North East zones have the highest future vulnerabilities to heat-related illnesses • The other states in North West and North East zones as well as in the delta region also have high future vulnerabilities • However, states immediately north of Abuja, including Kaduna, have lower future vulnerabilities • The rest of Nigeria has a medium future vulnerability	**"Avoid at all costs" (SSP5)**  • Similar future vulnerability trends are seen under both scenarios to the cumulative vulnerability, and both scenarios predict increased future vulnerability in the far northern states in North West zone
Waterborne disease	Some NTDs are expected to increase– e.g. Buruli ulcers, Guinea worm, Trypanosomiasis Diarrhoea related deaths in children		**"Middle of the road" (SSP2)** 

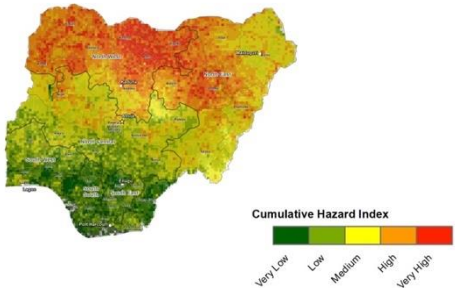
Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
	under 15 resulting from climate change will account for around 9.8% of the total diarrhoea related mortalities predicted for 2030. While the number of fatalities from diarrhoeal disease is expected to drop to about 43,500 by 2050, the percentage of deaths linked to climate change is expected to increase to about 14.2%[54, 55, 56] Based on data from 1990 – 2015, cholera cases are expected to continue to decrease	• States in the far northern band of Nigeria face the greater future vulnerabilities, along with coastal areas in South zone • The middle band of Nigeria has a medium future vulnerability risk, and states in southern Nigeria, especially South West zone, have the lowest future vulnerability	**"Avoid at all costs" (SSP5)**  • Similar trends can be seen for both scenarios as outlined under the cumulative future scenario

[54] World Bank Group, Climate change knowledge Portal, https://climateknowledgeportal.worldbank.org/country/nigeria
[55] Climate Risk Profile: Nigeria (2021): The World Bank Group.
[56] USAID, Nigeria Climate Vulnerability Profile, https://www.usaid.gov/climate/country-profiles

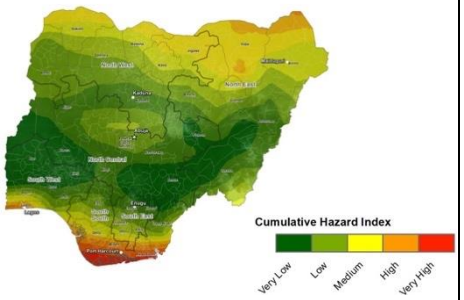
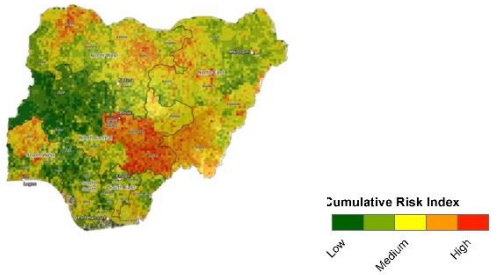
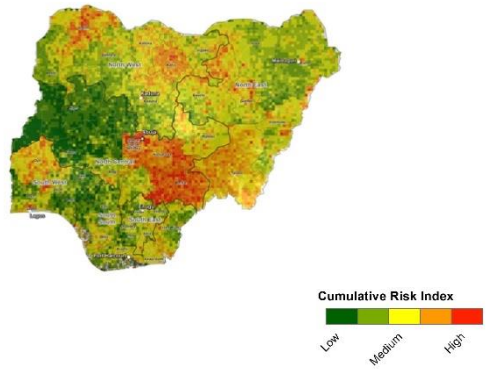
Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
	Some NTDs will decrease – e.g. Filariasis, Lymphatic Filariasis and leprosy		
Vector-borne diseases	Malaria is expected to increase significantly Future forecast zoonoses indicate an increase in yellow fever cases in 2030 based on current trends Dengue fever is forecast to drop significantly from 274,000 in 2020 to less than 70,000 in 2030[57]	 • States in the north of Nigeria will face high-to-very high future risks from vector-borne diseases, as well as the coastal states in South zone • States in the middle band of Nigeria face a medium future vulnerability • States in the south west region will be the least vulnerable	**"Middle of the road" (SSP2)**  **"Avoid at all costs" (SSP5)** 

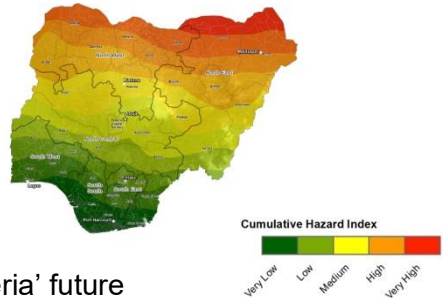
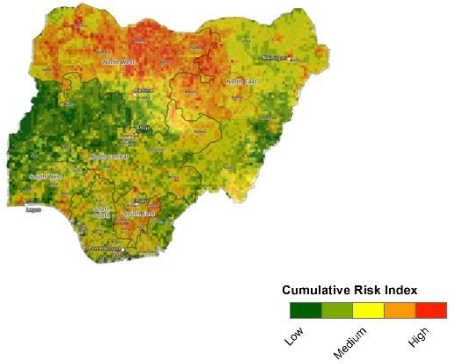
[57] This is based on linear regression of national annual level statistics that showed a decrease in reported cases. It is worth noting that this is based on a limited dataset from 2012-2015 and should not therefore be considered as perfectly robust

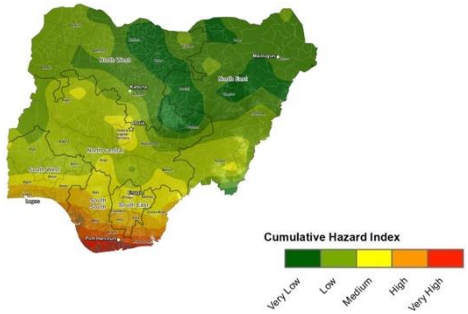
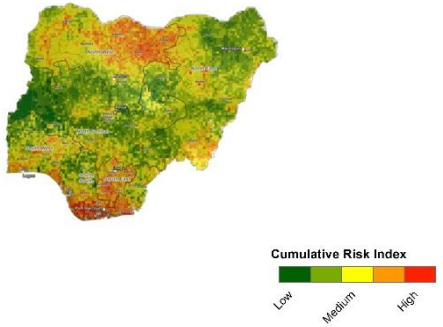
Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
			 • Similar trends can be seen for both scenarios as outlined under the cumulative future scenario, except that the most southerly states in South East zone are predicted to face very high future vulnerabilities to vector-borne diseases
Malnutrition and food-borne diseases	Digestive diseases and nutritional deficiencies will see notable increases The implications for diarrhoea related deaths in children		**"Middle of the road" (SSP2)** 

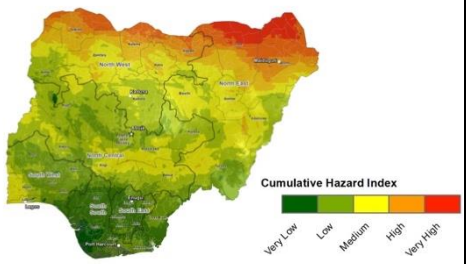
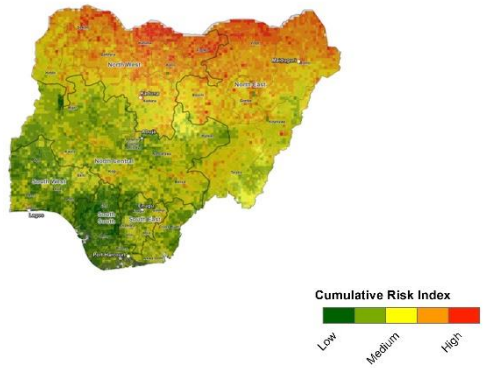
Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
	under 15 years old outlined in Waterborne diseases above apply similarly here. Typhoid fever will increase significantly from slightly more than 1m cases in 2020 to almost 2m cases in 2030 Malnutrition will increase from almost 2.6m in 2020 to almost 2.85m by 2030 Malnutrition is forecasted to decrease slightly[58] Stunting, underweight children and wasting	• States in most of North West zone will be at high-to very high future risk, as will the westerly states in North East zone • States in the far north-east and middle band regions of Nigeria will be at medium future risk • States in the south will be least at risk	**"Avoid at all costs" (SSP5)**  • Similar trends can be seen for both scenarios as outlined under the cumulative future scenario

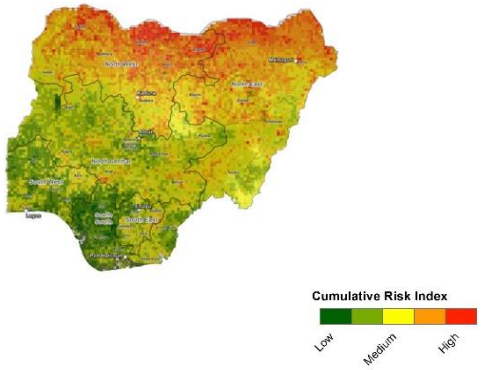
[58] This covers only four data points in 2003, 2008, 2013, and 2018. This is from the Demographic and Health Surveys Program, Nigeria: Standard DHS, 2024, https://dhsprogram.com/methodology/survey/survey-display-609.cfm Assuming the linear trend of how current medical interventions have changed over time in current climate changes continue into the future, this should be an estimate of where the future status may be as this is a function of both future climates but also possible continued intervention.

Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
	are forecast to decrease slightly		
Respiratory illness	Chronic respiratory disease, severe acute respiratory illness and asthma will see marginal increases Major respiratory infections such as Severe Acute Respiratory Syndrome will decrease from almost 17m cases in 2020 to almost 16m in 2030 TB is forecast to increase from over 41,000 cases in 2020 to more than 52,000 in 2030	 • Coastal states face the greatest future risk, especially those in the far south in South zone and around Lagos • The far north has a medium future risk vulnerability • All other states have a low-to-lower future risk	**"Middle of the road" (SSP2)**  **"Avoid at all costs" (SSP5)**  • Both scenarios indicate higher future risks than in the cumulative scenario,

Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
			with hotspots of highest future risk in the north-west, south west, southern-central and southern-eastern areas
Zoonoses	Yellow fever is expected to increase significantly from almost 16,000 cases in 2020 to almost 23,000 cases in 2030 Lassa fever will increase by around 50 cases per month – an increase of 1,600 on current figures by 2030	 • Nigeria' future vulnerability risk to zoonoses will increase through a strong north-to-south gradient • States in far north will face very high future vulnerabilities, states in the middle band of the country will face medium vulnerabilities and those in the south and far south will face low vulnerabilities	**"Middle of the road" (SSP2)**  **"Avoid at all costs" (SSP5)**  • Under both future scenarios, states in the North West zone and the west of the

Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
			North East zone will be most vulnerable, as well as around Lagos and northern parts of South and South East zones • The most north-easterly states will face a medium vulnerability risk and states in the west will be least at risk
Non-communicable diseases	NCDs will increase Cardiovascular disease will increase by 10% to over 4.5m cases in 2030 Diabetes is predicted to increase significantly from 235,000 in 2020 to almost 450,000 in 2030 High blood pressure is also expected to increase significantly from almost 900,000 cases in 2020 to over 1.6m in 2030	 • There will be a pronounced south-to-north gradient, with southern states regions exhibiting a higher future risk • States in the middle band and the north will have a low-very-low future risk	**"Middle of the road" (SSP2)**  **"Avoid at all costs" (SSP5)** 

Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	"Middle of the road" (SSP2) and "avoid at all costs" (SSP5) future risks - 2030
			• Both scenarios indicate higher future risks than in the cumulative scenario, with hotspots of highest future risk in the north-central part of North West zone, the southern and coastal parts of South zone, followed by areas around Lagos and South West zone
9. Mental and psychosocial health	Mental health conditions will increase Mental health disorders will rise from 2.6m in 2020 to more than 3.1m by 2030 Interpersonal violence will increase from 900, 000 in 2020 to 1.05m in 2030 Neurological disorders and self-harm will increase		**"Middle of the road" (SSP2)** 

Health outcome	Selected specific cumulative changes	Future risks	
		Cumulative future hazards - 2030	“Middle of the road” (SSP2) and “avoid at all costs” (SSP5) future risks - 2030
			“Avoid at all costs” (SSP5) 

7.Adaptation recommendations

7.1 Overview

This chapter presents recommended adaptation interventions that Nigeria should consider in order to reduce the impacts of climate change on the health sector and on people's health – as identified in the preceding chapters. The adaptation recommendations have been developed based on recommendations made by key informants at Federal, state, LGA and community level, reinforced by the GIS modelling data, primary data gathering and recommendations made in the literature review and policy review. These recommendations were developed from an initial list of more than 100 recommendations, which were aligned and synthesised to develop these strategic high-level recommendations.

In line with global guidance and best practice, the recommendations should be discussed, prioritised and then validated for action by the FMoH and the TWG. These actions will form the basis for further refinement and agreement during the early stages of the Health National Adaptation Plan (HNAP) process. When finalised, this will then serve as the costed climate change and health adaptation plan for Nigeria.

In line with how findings have been presented throughout this report, the recommendations are presented against the climate resilient building blocks. All recommendations have been evaluated against key criteria to determine their impact, measurability, complexity and cost – each of which was ranked as high, medium, low or very low as shown in Table 17.

Table 14. Evaluation criteria

Criterion	High	Medium	Low	Very low
Impact	Positive effects are obvious, cut across several sectors, and directly or indirectly address most aspects of the climate-health nexus	Positive effects are evident, cut across more than one sector, and directly or indirectly address some aspects of the climate-health nexus	Positive effects are somewhat evident, confined to the health sector, and directly or indirectly address one aspect of the climate-health nexus	Positive effects are unknown or limited, confined to the health sector, and expected to only indirectly address aspects of the climate-health nexus
Measurability	Easily measurable	Measurable	Somewhat measurable	Unmeasurable
Complexity	Simple	Somewhat complex	Complex	Highly complex
Cost	< USD 1 million	USD 1 million – 50 million	USD 50 million – 250 million	> USD 250 million

The full list of recommendations and actions are provided in Table 15.

Table 15. Adaptation recommendations in full

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
 **Leadership and governance**	Awareness and knowledge of climate change impacts on health is low in the health system at all levels	Dissemination of the V&A findings and evidence base to policy makers and health and climate leaders across Nigeria	● The national launch of the V&A will provide a good starting point, which will utilise media channels and bring some state health and climate leaders to Abuja ● Communication materials will be produced as an output of this assessment to be disseminated widely at Federal, state and LGA levels ● FMoH should orient senior state health leaders on the V&A findings – nationally and specifically to each state - during subsequent meetings. State MoHs should organise the same for LGAs ● The development and launch of the HNAP will provide another good opportunity to raise awareness on climate and health at all leadership levels in the health sector	FMoH Consultant then FMoH FMoH SMoHs Consultant	2024 2024 then 2025 2025
		Develop a national climate-health education and awareness raising action plan	● Assess needs at Federal and state levels ● Define channels to increase awareness, specific to the unique needs of states ● Roll out awareness raising plan to Federal and state MoHs as well as LGAs	FMoH & SMoHs	2025 onwards
	Leadership and governance capacity for climate change-health nexus is limited within the Federal and state MoH, and very limited in LGAs	Build general capacity, awareness and appreciation for climate change related health risks and impacts within leaders and managers within the FMoH and state MoHs	● Develop and roll-out climate change and health training for the Federal and state MoH leaders and managers ● Support a cascading roll-out of training to develop a next generation of climate and health leaders across Federal and state MoHs and LGAs ● Embed technical experts in the climate and health units in the Federal and state MoHs to enhance capacities on climate change and health	FMoH & SMoHs, development partners	2024 onwards

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
			● Support Federal and state MoHs,at a range of levels, to attend key conferences on climate change and health ● Develop a culture of climate and health awareness and knowledge in the Federal and state MoHs and LGAs by incorporating climate-informed health data into routine management and planning meetings		
		Develop and support performance and accountability measures for health leaders' commitments on climate and health	● Develop and use HNAP M&E indicators to identify climate and health metrics to be included into Federal and state MoHs leaders performance contracts ● Ensure annual performance reviews of the HNAP (and other related key programmes) to assess delivery performance ● Publish government commitments widely to create upwards accountability from civil society	FMoH with NCCC	2025
	Activities of other sectors impact climate sensitive health outcomes	Develop a cross-sectoral climate-adaptation framework	● Strengthen climate-health resilience across all sectors, making sure that the framework identifies opportunities to incorporate co-benefits from climate actions provided in the national policies on waste and other related sectors (such as energy, agriculture, transport, and food) into the HNAP. ● Convene regular, at least quarterly, cross sectoral climate resilient health collaboration and knowledge exchange for action working group meetings	TWG TWG	2025 - within 12 months of HNAP launch 2024/5 - Within 6 months of HNAP launch

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
	Coordination between the MoH and other MDAs at the Federal level is weak and it is strained between the Federal level and the states.	Orient MDAs on the impacts of climate change on health	● Integrate the HNAP commitments into the NAP ● Communicate health-related NAP updates across government at all levels ● Facilitate knowledge and learning exchange	NCCC, FMoH	at next NAP update
		Support multi-sectoral coordination between the MoH and other sector MDAs	● Support coordination between Federal and state levels through a cross-sectoral health system resilience action and collaboration plan ● Develop formal agreements to form a whole-of-government response	NCCC	2025
	The climate and health units in the FMoH and the state MoHs are not fully functional	Provide office support to the climate and health units in the FMoH and the state MoHs	● Review climate and health unit capacities and provide adequate budgets, supplies and training to enable them to perform their planned functions	FMoH budgeting team	2025
	The climate change -health nexus is not featured sufficiently in Federal and state policies and plans	Health sector policy makers use climate information in programs and policy design	● Train health sector policy makers and planners to use climate information to inform design of health sector programs and policies ● Train FMoH and SMoH trainers so that skills can be transferred widely across the MoH at the Federal, state and LGA levels	FMoH HR training team	2025
		Support the future development of climate-informed health policies and plans, with a focus on the most at-risk states and most vulnerable groups	● Building on the policy review within this V&A assessment, develop a climate and health policy action plan that maps and dates which health - and other key sector – policies and plans are due for review and updating with climate- health evidence and priority interventions ● Update the V&A against the baseline and fill identified gaps. Gaps in data and research such as disease incidence, health outcomes, health facility condition, service quality, should be filled with planned further assessments	FMoH policy makers	2025

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
	Nigeria lacks a Health National Adaptation Plan	Develop a fully-costed HNAP which is aligned with the National Adaptation Plan	● Provides the opportunity for a government-led climate and health adaptation implementation strategy, and include actions to strengthen policy, programme delivery and health system sustainability. The HNAP will cover Federal, state and LGA levels, and other MDAs, to catalyse a 'whole-of-government' approach to climate health adaptation. HNAP will maintain a focus on health equity and vulnerable groups. Costings and resource mobilisation plans will support future financing strategies. Agreed indicators and targets in the HNAP M&E plan can be used to support leadership, governance and accountability.	FMoH	2025
	Climate change and health coordination forums are nascent	Strengthen Federal, state and LGA level climate-health leadership	● Support and maintain the functionality of the national Climate Change and Health TWG through capacity building, funding, agreeing joint commitments and public communication of plans and achievements ● Support the establishment and maintain the functionality of climate change-health nexus TWGs at the state level	Donors Donors and FMoH	2025 2025-26
$ **Climate and health financing**	Low health sector budget allocations exist at the Federal and state levels, particularly for climate-health priorities	Develop a domestic resource mobilisation strategy to increase finances for climate and health Mainstream climate-health nexus into funding plans	● Use V&A findings and adaptation recommendations to develop resource mobilisation strategy within the HNAP process, including options for greater efficiencies such as restructuring existing budgets, joint activities with other health impacting sectors and developing aligned funding plans with donors ● Use evidence and recommendations from the V&A to integrate climate-informed approaches and financial support into all current health sector	FMoH, development partners, FCDO / consultant	2024 2025

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
		Identify cross-government co-funding opportunities	funding modalities, including all new health programmes that are to be designed and initiated ● Plan with other relevant government sectors for the efficient co-funding of activities that lead to climate resilient co-benefits such as clean water, sanitation, medical waste, improved nutrition, clean energy infrastructure and behaviour change campaigns		2025
	No clear and defined budget for emergency preparedness and response to extreme weather events	Define and cost plans for emergency preparedness Support strategies to secure domestic and external funding to support the costed plans	● Identify and supporting new donor funding opportunities, including through project pipeline development and supporting effective project implementation ● The government of Nigeria to invest finances to strengthen infrastructure, including the renovation of health facilities and availability of advanced medical devices, to support health service delivery during extreme weather events	HNAP consultant and TWG, health development partners	2024
	No specific national and state-level costed plans for climate and health adaptation	Develop costed HNAP and consider state level adaptation plans in future Support strategies to secure domestic and external funding to support the costed plans	● Resource mobilisation strategy will be developed under the HNAP process, and will examine options for greater efficiencies such as restructuring existing budgets, identifying co-benefits of joint activities with other sectors and working with donors to develop aligned funding plans ● HDP to set out joined up concept note/plan on how they will support the HNAP delivery in Nigeria as per the SWAp	HNAP consultant and TWG, health development partners	2024
	No specific climate and health financing in place at the Federal, state or LGA levels	Develop climate and health financing strategy that goes beyond the costed HNAP Access multilateral climate change and health funds	● Review existing funding allocations and national health budget to ensure ongoing health system climate-health nexus funding ● Develop capacity for proposals to be developed for global climate and health financing and hire in expertise as needed	FMoH FCDO, health development partners	2025 2025

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
 **Health workforce**	No assessment of health workforce capacities to respond to climate risks	Support national assessment on health workforce capacity to respond to climate risks	• Develop HR health workforce capacity surveys and train MoH staff to administer the surveys • Conduct annual HR health workforce capacity surveys, starting in the most vulnerable states, and then disseminate findings widely to influence actions • Update FMoH HR database records on capacities and training needs to reflect the capacity of staffs' abilities to respond to climate risks • Use the findings from the health workforce capacity surveys to develop appropriate workforce professional development trainings • Develop and pilot climate-heath resilience course modules with an appropriate training institution	FMoH HR team	2025
	The current number, availability and distribution of health professionals is already insufficient to meet the present needs	Strengthen recruitment and retention Support awareness/education campaign for the health workforce to increase knowledge and buy-in on the impact of climate change on the health sector	• Assess climate impacts on workforce working conditions and workload • Develop a training strategy and plan, including capacity building and mitigation measures • Develop climate-health resilience university course modules • Develop integrated climate and health mitigation and adaptation into pre-service training modules for all new health workers. Integrate into existing health training curriculums and in-service trainings • Orient and train all new health workers on integrated climate and health modules	FMoH HR team	2025
	Very limited/no training of health professionals that equips them on how to deal with the demands of climate health risks				

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
	Health workers have no capacity or tools to predict and act on climate change projections	Inform health workers on climate change impacts on health	• Determine skill and labor capacities in Nigeria across key agencies and data systems at Federal and state level • Develop a plan to develop an early warning system (EWS) and an implementation plan across Federal and state level • Develop alerts from the HIS integration with Nigeria Meteorological Agency (NiMET), National Drought Management Agency (NDMA), and other EWSs • Assess which tools are effectively used in other countries (including outside of the health sector) that could be adapted for use in Nigeria. Integrate this within the national assessment on health workforce capacity to respond to climate risks	FMoH HIS team	2025-6
Vulnerability, capacityand adaptation assessment	Climate-health nexus information is lacking throughout the system	Strengthen HIS indicators on climate-impacts Develop climate-informed health indicators in DHIS2 Support climate-informed decision making Promote civil society health service delivery monitoring	• Conduct a review of relevant health indicators in DHIS2 that are relevant to the climate and health nexus • Plan for periodic updates to this vulnerability, capacity and adaptation assessment	FMoH	Every 5 years
Integrated risk monitoring	Climate-informed health indicators do not exist within information systems		• Develop climate-informed health indicators for inclusion in DHIS2 and train health workers and health information teams • Train and orient staff on the new indicators and DHIS2 use	FMoH HIS team FMoH and state HMIS teams	2025

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
and early warning			• Encourage civil society actors to monitor and report health service delivery interruptions due to climate shocks and stresses. Develop mechanism to integrate reports into the HIS		
	Health information systems are not aligned with weather and disaster early warning systems	Support strategy to enable health information systems at the Federal level and states to be integrated with other existing meteorological and climate-relevant EWSs. Ensure interoperability and integration of HISs at different levels	• Assess the extent to which health information systems are aligned with weather and disaster EWSs • Develop a funded plan to address the findings from the assessment • FMoH to develop formal agreements with other government agencies to ensure the integration of their early warning approaches into its health system surveillance – especially NIMET, the Nigerian Hydrological Agency, Federal Ministry of Environment (FMoE) Flood and Erosion Control Department, National Space Research and Development Agency, the Federal Ministry of Humanitarian and Disaster Management, the Federal Ministry of Water Resources, Irrigation and Drainage Department and NEMA • Ensure integrated analysis and reporting of weather, disaster, health and other data to inform cross government department plans and action • Agree climate / weather and disease reporting thresholds that when passed automatically trigger pre agreed anticipatory actions such as scaling up of health services, redeployment of workforce and medical supplies, health awareness and vaccination campaigns etc	FMoH HMIS team, NiMET	2025 - 2027

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
Health and climate research	Climate and health research and knowledge capacity is very limited	Support research on climate-health priorities identified in this V&A, Build a cadre of climate-health researchers	• Fund further research on the climate vulnerability of specific diseases such as MNCH, malaria, dengue, TB, meningitis, NTD, NCDs • Fund research on effective contextualised adaptations to strengthen health outcomes • Support further tertiary education and research on the climate-health nexus to build up a cadre of Nigerian research experts	FMoH and SMoHs	Within 5 years
Climate resilient and sustainable technologies and infrastructure	Current procurement and distribution systems at the Federal and state levels are unable to anticipate potential disruptions to the supply chain from climate change	Supply chain climate resilience assessment Feasibility assessment of informing logistics management information systems with early warning systems Build climate resilience of procurement distribution Strengthen climate resilience of warehouses	• Undertake a review of the supply chain to assess its resilience to climate change • Develop funded plan to address the issues highlighted in the supply chain assessment • Conduct feasibility assessment to determine how the logistics management information systems at Federal and state levels can be integrated with other EWSs • Update procurement distribution and storage plans to ensure they are climate-resilient and adapted to respond to the forecasted climate shocks • Incorporate health supply warehouses and stores in the health infrastructure assessment to understand capacity to respond to climate change	FMoH and SMoHs	2025
	Logistic management information systems are not linked to other early warning systems	Integrate logistics management information systems at Federal and state levels with EWSs	• Conduct feasibility assessment to determine how the logistics management information systems at Federal and state levels can be integrated with other EWSs • Develop funded plan to address the issues highlighted in the feasibility assessment • Plan for early warnings to trigger early procurement and prepositioning of supplies	FMoH and SMoHs	2025 - 26

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
	Laboratory capacities do not track current needs nor model future burdens of climate-sensitive diseases	Improve laboratory capabilities on climate impacts on health	• Model the potential impact of climate change on disease incidence and prevalence and necessary capacity adaptations of lab services	FMoH and SMoHs	2027
	Climate and health research and knowledge capacity is very limited	Support research on climate-health priorities identified in this V&A, Build a cadre of climate-health researchers	• Fund further research on the climate vulnerability of specific diseases such as MNCH, malaria, dengue, TB, meningitis, NTD, NCDs • Fund research on effective contextualised adaptations to strengthen health outcomes • Support further tertiary education and research on the climate-health nexus to build up a cadre of Nigerian research experts	FMoH and SMoHs	Within 5 years
Management of environmental determinants of health	Comprehensive assessments on health infrastructure capacities to adapt to climate change have not been carried out at scale	Support national assessment on health facilities' capacity to respond to climate change, especially in states that are highlighted to be more at risk	• Develop a standard health infrastructure assessment tool and approach • Roll out a standard country wide health infrastructure assessment process • Develop a plan to strengthen the resilience of health system infrastructure	FMoH	2024-27
Climate-informed health programmes	Majority of health facilities infrastructure is not specifically adapted to effectively deal with climate change impacts	Continue work to strengthen health facility climate resilience Develop a standard climate-resilient health infrastructure assessment tool	• Support infrastructure modifications are made in the highest risk facilities, including to retrofitting, refurbishing, and maintaining existing health infrastructure • Develop standard climate-resilient health infrastructure blueprints by type/health system level of infrastructure and vulnerabilities that will be faced (i.e. more flooding, increased heat)	FMoH and SMoHs	2024 and beyond

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
 **Emergency preparedness and management**	Health facilities are not sufficiently equipped to deal with increased numbers of clients due climate change	Using the assessment on health infrastructure capacities to adapt to climate change, support changes within high-risk and prioritised health facilities to improve their capacities to handle additional clients due to climate change and during public health emergencies	● Build additional capacities to specific climate-health impacts in identified hotspots ● Develop system between health facilities to support effective referrals of increased numbers of clients	FMoH and SMoHs	2027 and beyond
	Healthcare facilities are under-staffed for climate change and extreme weather events		● Develop state climate-health task force and surge teams to be deployed during extreme weather events	FMoH and SMoHs	2027 and beyond
	Climate change is exacerbating poor air quality, increasing respiratory and vector borne disease and disasters	Strengthen environmental public health surveillance and environmental public health programmes	● Design environmental public health programmes to understand and address environmental determinants of health including from climate related poor air quality, respiratory disease, increased vector borne disease, and environmental disasters	FMoE	2026 onwards

Climate resilient building block	Adaptive capacity – Federal, states and LGAs	Proposed adaptations (subject to country prioritisation and validation)	Details	Lead	Years
	Health inequities reduce service access for vulnerable people	Strengthen health service awareness Strengthen accountability for health service delivery	● Educate civil society on the climate and health nexus, to help them understand their role in holding government to account on their responsibilities to deliver climate resilient health systems	FMoE	2026 onwards
	Existing fragile health services will be weakened further by climate change impacts	Support service delivery modalities that can offer essential services during extreme weather events Enhance health service contingency planning to ensure population groups most at-risk from climate change are not left behind	● Ensure health programme design and implementation is informed by climate / weather related health surveillance and early warnings ● Conduct seasonal nutritional screening	MoH and SMoHs	2026 onwards
	Climate change adaptation not mainstreamed into planning for different levels of service delivery	Build capacity to enable health service contingency planning for climate events at all levels, including for population groups most at-risk from climate change	● Develop a national health facility and health service climate-health resilience monitoring database ● Develop mechanisms to gather local community / civil society feedback and for accountability to communities ● Support development of health service delivery contingency plans, especially in states that face greater and more immediate risks ● Develop climate resilient medicine and medical supply prepositioning plans ● Train health workforce in advance for climate emergency response ● Develop climate disaster continuity of service plans	FMoH and state HMIS teams	2026 - 2027

7.2 Evaluation matrix

The evaluation of the proposed recommendations is grounded in the concept of cost-effectiveness, where overall cost-effectiveness is a function of impact, measurability, complexity, and illustrative cost factors. The recommendation evaluation criteria are defined in Table 16 below, followed by a graphical summary of the evaluated recommendations and potential prioritisation pathways.

Table 16. Evaluation matrix criterion and definitions

Criterion	Definition
Impact	The extent to which the recommendation is expected to directly or indirectly generate significant positive effects
Measurability	The extent to which the recommendation can be quantitatively measured for monitoring, evaluation, and learning purposes
Complexity	The extent to which the recommendation is technically or administratively complex
Cost	The estimated cost of implementing the recommendation over a five-year period

Table 17 below shows the application of the evaluation criteria, using four qualitative categories: high, medium, low, and very low.

Table 17. Application of the evaluation criteria

Criterion	High	Medium	Low	Very low
Impact	Positive effects are obvious, cut across several sectors, and directly or indirectly address most aspects of the climate-health nexus	Positive effects are evident, cut across more than one sector, and directly or indirectly address some aspects of the climate-health nexus	Positive effects are somewhat evident, confined to the health sector, and directly or indirectly address one aspect of the climate-health nexus	Positive effects are unknown or limited, confined to the health sector, and expected to only indirectly address aspects of the climate-health nexus
Measurability	Easily measurable	Measurable	Somewhat measurable	Unmeasurable
Complexity	Simple	Somewhat complex	Complex	Highly complex
Cost	< USD 1 million	USD 1 million – 50 million	USD 50 million – 250 million	> USD 250 million

The evaluation was based on the V&A assessment's key findings and the project team's expert opinion and reviewed and validated by the TWG. The recommendations are shown in Table 18 below, but the evaluation was undertaken based on the detailed list of proposed actions under each recommendation, with the assumption that at least 50% of the suggested activities would be implemented.

Table 18. Adaptation recommendations against the evaluation criteria

#	Recommendation/intervention	Impact	Measurability	Complexity	Cost
1	Disseminate the V&A findings to policymakers and health and climate leaders across Nigeria, including states and LGAs	High impact	Easily measurable	Simple	Low (< USD 1 million)
2	Develop a national climate-health education and awareness-raising action plan to be rolled out across all states and LGAs	High impact	Measurable	Complex	Medium (USD 1 million - USD 50 million)
3	Build general capacity, awareness knowledge of climate change-related health risks and impacts within the FMoH, state MoHs and LGA leaders and managers	High impact	Measurable	Somewhat complex	Medium (USD 1 million - USD 50 million)
4	Develop and support performance and accountability measures for FMoH, state MoHs and LGA leaders' commitments to climate and health	Medium impact	Easily measurable	Somewhat complex	Low (< USD 1 million)
5	Orient MDAs on the impacts of climate change on health to encourage cross-government and multi-sectoral coordination	Medium impact	Easily measurable	Simple	Low (< USD 1 million)
6	Provide office support to the climate and health units in the FMoH and the state MoHs to ensure their functionality	High impact	Measurable	Somewhat complex	Medium (USD 1 million - USD 50 million)
7	Strengthen Federal, state and LGA level climate-health leadership to ensure greater support and buy-in for climate change and health priorities	High impact	Somewhat measurable	Complex	Medium (USD 1 million - USD 50 million)
8	Support health sector leaders and managers to use climate information to design new health policies and programs that are climate-informed – and with a focus on the most at-risk states and most vulnerable groups	High impact	Easily measurable	Somewhat complex	Medium (USD 1 million - USD 50 million)
9	Develop a fully costed HNAP which is aligned and integrated with the National Adaptation Plan and consider state-level adaptation plans in future and support strategies to secure domestic and external funding to support the costed plans	High impact	Easily measurable	Complex	Medium (USD 1 million - USD 50 million)
10	Support multi-sectoral, national adaptation coordination meetings between the MoH and other sector MDAs	High impact	Measurable	Somewhat complex	Low (< USD 1 million)
11	Develop a domestic resource mobilisation strategy to increase finances for climate and health - and mainstream climate-health nexus into funding plans and identify cross-government co-funding opportunities	High impact	Easily measurable	Somewhat complex	Medium (USD 1 million - USD 50 million)

#	Recommendation/intervention	Impact	Measurability	Complexity	Cost
12	Define and cost plans for health sector emergency preparedness due to extreme weather events	High impact	Easily measurable	Somewhat complex	Medium (USD 1 million - USD 50 million)
13	Support national assessment on health workforce capacity to respond to climate risks	High impact	Measurable	Complex	Medium (USD 1 million - USD 50 million)
14	Support awareness/education campaign for the health workforce to increase knowledge and buy-in on the impact of climate change on the health sector	High impact	Measurable	Complex	Medium (USD 1 million - USD 50 million)
15	Inform health workers on climate change impacts on health	Medium impact	Easily measurable	Simple	Low (< USD 1 million)
16	Develop a standard climate-resilient health infrastructure assessment tool	High impact	Easily measurable	Somewhat complex	Low (< USD 1 million)
17	Conduct health infrastructure assessment for climate change	High impact	Easily measurable	Somewhat complex	Medium (USD 1 million - USD 50 million)
18	Support national assessment on health facilities' capacity to respond to climate change, especially in states that are highlighted to be more at risk	High impact	Easily measurable	Complex	Medium (USD 1 million - USD 50 million)
19	Strengthen health facility climate resilience, including adapting health facilities to be more resilient to climate change	High impact	Easily measurable	Complex	Medium (USD 1 million - USD 50 million)
20	Support changes within high-risk and prioritised health facilities to improve their capacities to handle additional clients	High impact	Easily measurable	Somewhat complex	Medium (USD 1 million - USD 50 million)
21	Assess resilience of the health supply chain at the Federal, state and LGA levels	High impact	Easily measurable	Complex	Medium (USD 1 million - USD 50 million)
22	Integrate logistics management information systems at Federal, state and LGA levels with early warning systems	High impact	Easily measurable	Complex	Medium (USD 1 million - USD 50 million)
23	Build climate resilience of the distribution systems for health supplies and products at the Federal, state and LGA levels	High impact	Easily measurable	Somewhat complex	Medium (USD 1 million - USD 50 million)

#	Recommendation/intervention	Impact	Measurability	Complexity	Cost
24	Strengthen climate resilience of warehouses at the Federal and state levels	Medium impact	Easily measurable	Somewhat complex	Medium (USD 1 million - USD 50 million)
25	Assess the feasibility of informing logistics MIS with other EWS	High impact	Easily measurable	Somewhat complex	Low (< USD 1 million)
26	Improve laboratory capabilities on climate impacts on health	Medium impact	Easily measurable	Complex	Medium (USD 1 million - USD 50 million)
27	Develop climate-informed health indicators in DHIS2 and include in DHIS2	High impact	Easily measurable	Somewhat complex	Low (< USD 1 million)
28	Train HMIS staff on new climate-informed health indicators in DHIS2	Medium impact	Measurable	Simple	Medium (USD 1 million - USD 50 million)
29	Support strategy to enable health information systems at the Federal level and states to be integrated with other existing meteorological and climate-relevant EWSs	High impact	Easily measurable	Somewhat complex	Low (< USD 1 million)
30	Support the interoperability and integration of HISs at different levels	High impact	Easily measurable	Somewhat complex	Low (< USD 1 million)
31	Support research on climate-health nexus by training a new cadre of Nigerian researches	High impact	Easily measurable	Complex	Medium (USD 1 million - USD 50 million)
32	Enhance health service planning to ensure population groups most at risk from climate change are not left further behind	High impact	Easily measurable	Somewhat complex	Low (< USD 1 million)
33	Develop health contingency plans to ensure service delivery continues at the state and LGA levels during extreme weather events	High impact	Easily measurable	Somewhat complex	Low (< USD 1 million)

8. Annexes

Annex 1. Data used to inform Nigeria's V&A assessment

Climate hazard exposure pathway data

Climate data was based on the CMIP6 SSP2-4.5 climate scenario. The CMIP6 project expands on previous phases of the Coupled Model Intercomparison Project (CMIP), which have provided valuable information on the past and future evolution of the Earth's climate system. This analysis is based on CMIP6 data, which includes 134 models from 53 modelling centres. The publication of CMIP6 data began in 2019, with the majority of the data by 2022, with CMIP6 scientific analyses used in the IPCC's 6th Assessment Report (AR6).[59]

- **WorldClim:** WorldClim data is a set of bias-corrected, high-resolution, downscaled climate models that can be used for detailed spatial analysis of an area's climate changes. The data used has a downscaled resolution of ~10km and presents a temporal average of the climate from 2021-2040 representing the near-term projection.[60]

- **The Climate Change Knowledge Portal (CCKP):** the CCKP is a hub for climate-related information, data, and tools which provides an online platform from which to access and analyse comprehensive data related to climate change and development. The data used has a downscaled resolution of ~50km and presents a temporal average of the climate from 2020-2039 representing the near-term projection.[61]

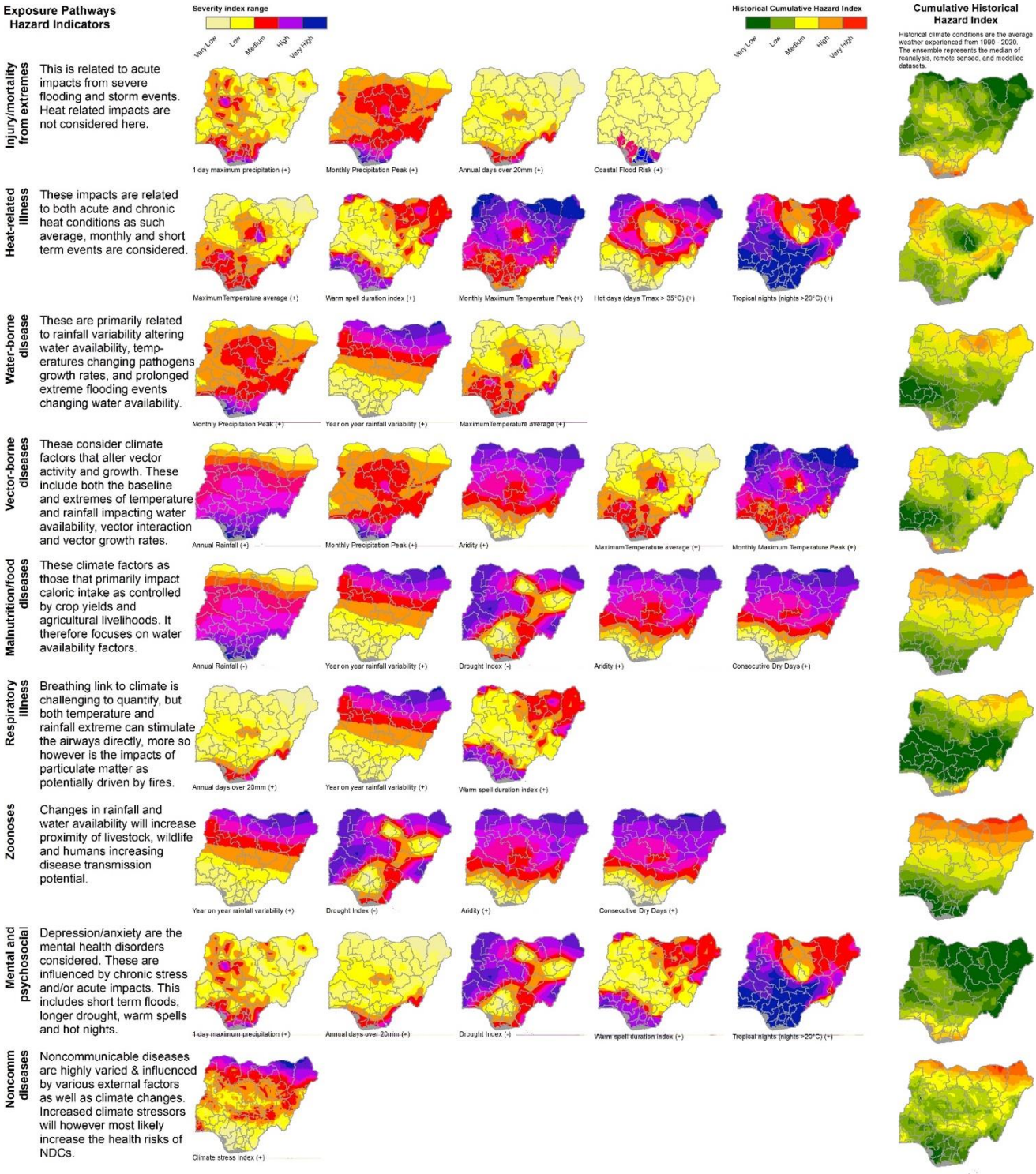
- **Copernicus Climate Change Service (C3S):** This dataset provides aridity indicators useful for climate and vegetation interaction assessment.[62]

- **Köppen-Geiger climate classification:** Maps present global maps of the Köppen-Geiger climate classification at a high resolution for historical and future climate conditions. The data used has a downscaled resolution of 1km and presents a temporal AVERAGE of the climate from 2041-2070 representing the medium-term projection.[63]

- **Climate research unit (CRU) data 4.06 release:** The CRU TS dataset was developed and has been subsequently updated, improved, and maintained with support from several funders, principally the UK's Natural Environment Research Council (NERC) and the US Department of Energy. Long-term support is currently provided by the UK National Centre for Atmospheric Science (NCAS), a NERC collaborative centre.[64]

[59] ECMWF, CMIP6 climate projections and information.
[60] Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high-resolution interpolated climate surfaces for global land areas. International Journal of Climatology 25: 1965-1978
[61] World Bank Group, Climate Change Knowledge Portal (2024). URL: https://climateknowledgeportal.worldbank.org/
[62] Nobakht, M., Beavis, P., O'Hara, S., Hutjes, R., Supit, I., (2019): Agroclimatic indicators from 1951 to 2099 derived from climate projections. Copernicus Climate Change Service (C3S) Climate Data Store (CDS). DOI: 10.24381/cds.dad6e055
[63] Beck, H.E., T.R. McVicar, N. Vergopolan, A. Berg, N.J. Lutsko, A. Dufour, Z. Zeng, X. Jiang, A.I.J.M. van Dijk, D.G. Miralles. High-resolution (1 km) Köppen-Geiger maps for 1901–2099 based on constrained CMIP6 projections. Scientific Data 10, 724, doi:10.1038/s41597-023–02549-6 (2023)
[64] Harris, I., Osborn, T.J., Jones, P. et al. Version 4 of the CRU TS monthly high-resolution gridded multivariate climate dataset. Sci Data 7, 109 (2020). https://doi.org/10.1038/s41597-020-0453-3

Figure 9. Individual historical climate hazard exposure pathway indicators degree of severity and cumulative climate hazard index for each health outcome

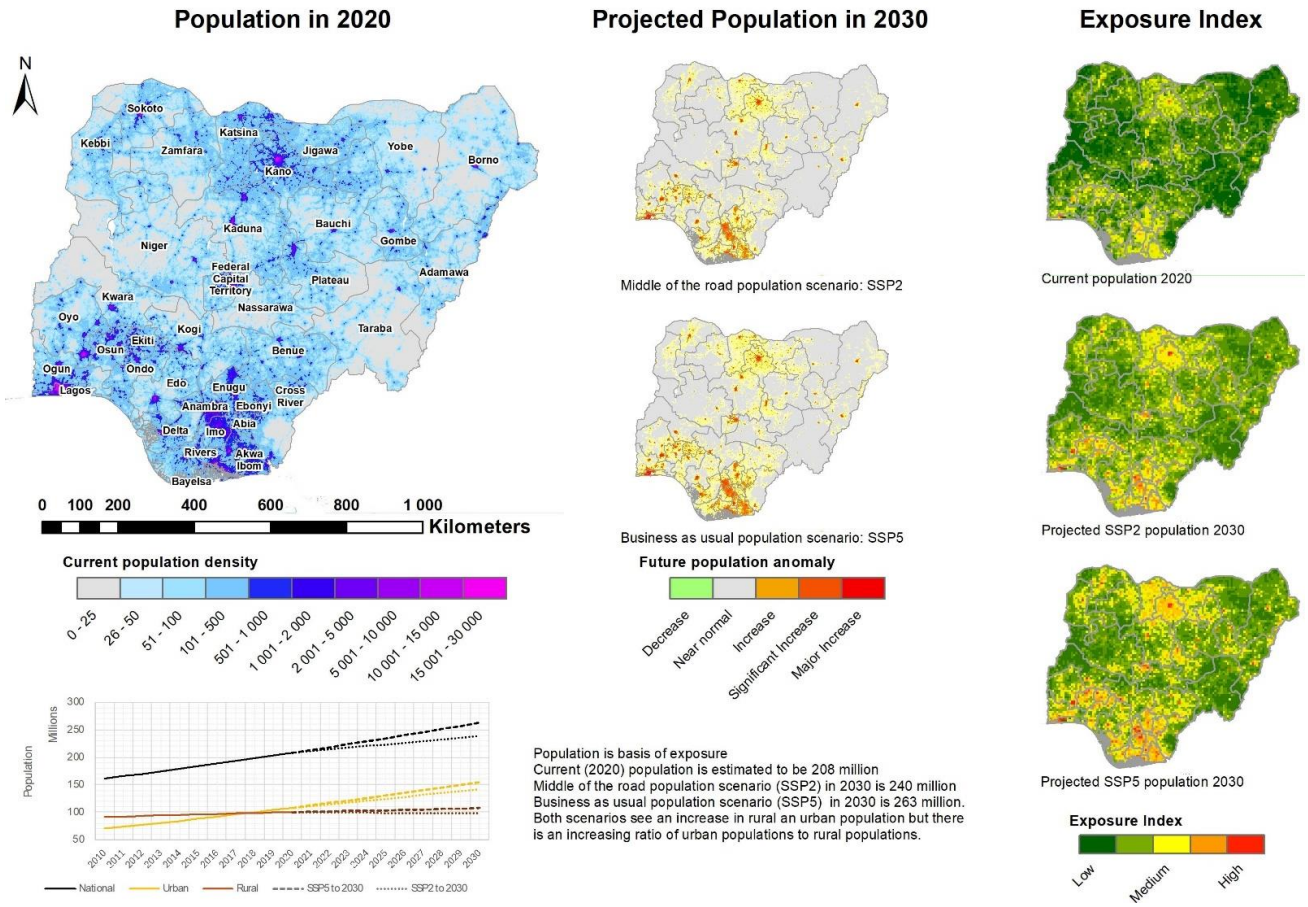


Population data

The population exposure scenarios are defined as the current 2020 population scenario which considers the current population distribution as a first-order expression of exposure; the ambition climate scenario is the future population based on the SSP2 scenario and the business-as-usual scenario presents a future population based on the SSP5 scenario.

- **1 km-grid population distributions:** The data source is based on the WorldPop dataset, SSPs population projection and other related covariates, to provide a range of future population projections from 2020 to 2100 at a 5-year interval. Each projection product has the spatial distribution of population at an approximately 1 km (30 arc-seconds) spatial resolution.[65]

Figure 10. Population index - current (2020) population density (left), projected population density to SSP2 (middle top) and SSP5 (middle bottom), and the population indices (right)



Vulnerability data - community

Community vulnerability is comprised of socio-economic, ecological, livelihood, and/or topographical factors or circumstances that may render an area more susceptible to various health impacts. These factors are the general considerations for baseline disaster risk vulnerability assessments as well as some factors that are relevant directly to individual health outcomes.

- The Food and Agriculture Organisation (FAO) ClimAfrica data is designed to assess many factors of vulnerability in Africa and covers basic services, agriculture and water stress, conflict and

[65] Wang, X., Meng, X., & Long, Y. (2022). Projecting 1 km-grid population distributions from 2020 to 2100 globally under shared socioeconomic pathways. Scientific Data, 9(1), 1-13. https://doi.org/10.1038/s41597-022-01675-x

several combined indices. These data presented the Baseline adaptive capacity and sensitivity, Media access in the form of the technological capital index, Basic services access in the form of the household technology index, Water stress, Malnourishment, Reliance on agriculture, Livestock density, and Conflict index. This dataset has been produced in the framework of the "Climate change predictions in Sub-Saharan Africa: impacts and adaptations (ClimAfrica)" project, Work Package 4 (WP4).[66]

- WorldPop presents high-resolution population density and demographic information. The poverty index is derived from the persons living on under $2/day[67] and the gender gap is based on differences in literacy rates.[68]

- Socioeconomic Data and Applications Center (SEDAC) covers data such as the Relative Deprivation Index that incorporates the Human Development Index, Child dependency ratio, and nightlight and electricity access.[69]

- 2015 World Accessibility Map indicates the proximity of populations to various community hubs and potential services.[70]

- Flood sensitivity was a combination of GAR 2017 Atlas Risk Data presents the Flood sensitivity[71] and Aquaduct Floods Hazard Maps.[72]

- Ecosystem integrity is used to assess forest integrity and wild area proximity.[73]

- Aquaduct sensitivity maps present the drought sensitivity.[74]

- Rainfed agriculture presents areas that are sensitive to climate variations for agriculture yields.[75]

- Particulate matter presents possible sources of respiratory illnesses.[76]

- Fire density is presented through the UNEP / GRID data.[77]

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[66] FAO map catalogue, ClimAfrica Work Package 4. https://www.fao.org/home/en

[67] Tatem AJ, Gething PW, Bhatt S, Weiss D and Pezzulo C (2013) Pilot high resolution poverty maps, University of Southampton/Oxford

[68] Bosco, C.; Alegana, V.; Bird, T.; Pezzulo, C.; Bengtsson, L.; Sorichetta, A.; Steele, J.; Hornby, G.; Ruktanonchai, C.; Ruktanonchai, N.; Wetter, E.; Tatem, A. J. (2017): Exploring the high-resolution mapping of gender disaggregated development indicators. Journal of the Royal Society Interface, 14(129). DOI: 10.1098/rsif.2016.0825.

[69] Center for International Earth Science Information Network (CIESIN), Columbia University. 2022. Global Gridded Relative Deprivation Index (GRDI), Version 1. Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC). https://doi.org/10.7927/3xxe-ap97

[70] Weiss, D. J., Nelson, A., Gibson, H. S., Temperley, W., Peedell, S., Lieber, A., Hancher, M., Poyart, E., Belchior, S., Fullman, N., Mappin, B., Dalrymple, U., Rozier, J., Lucas, T. C., Howes, R. E., Tusting, L. S., Kang, S. Y., Cameron, E., Bisanzio, D., . . . Gething, P. W. (2017). A global map of travel time to cities to assess inequalities in accessibility in 2015. Nature, 553(7688), 333-336. https://doi.org/10.1038/nature25181

[71] PrevnetionWeb. Global Risk Analysis and Reporting (GRAR), UN Office for Disaster Risk Reduction (UNDRR), 7 avenue de la Paix, CH-1211 Geneva 2, Switzerland, https://www.preventionweb.net/understanding-disaster-risk/graf

[72] Aqueduct Global Maps 3.0 Data, https://www.wri.org/aqueduct/data

[73] Grantham, H. S., Duncan, A., Evans, T. D., Jones, K. R., Beyer, H. L., Schuster, R., Walston, J., Ray, J. C., Robinson, J. G., Callow, M., Clements, T., Costa, H. M., DeGemmis, A., Elsen, P. R., Ervin, J., Franco, P., Goldman, E., Goetz, S., Hansen, A., . . . Watson, J. E. (2020). Anthropogenic modification of forests means only 40% of remaining forests have high ecosystem integrity. Nature Communications, 11(1), 1-10. https://doi.org/10.1038/s41467-020-19493-3

[74] Aqueduct Global Maps 3.0 Data, https://www.wri.org/aqueduct/data

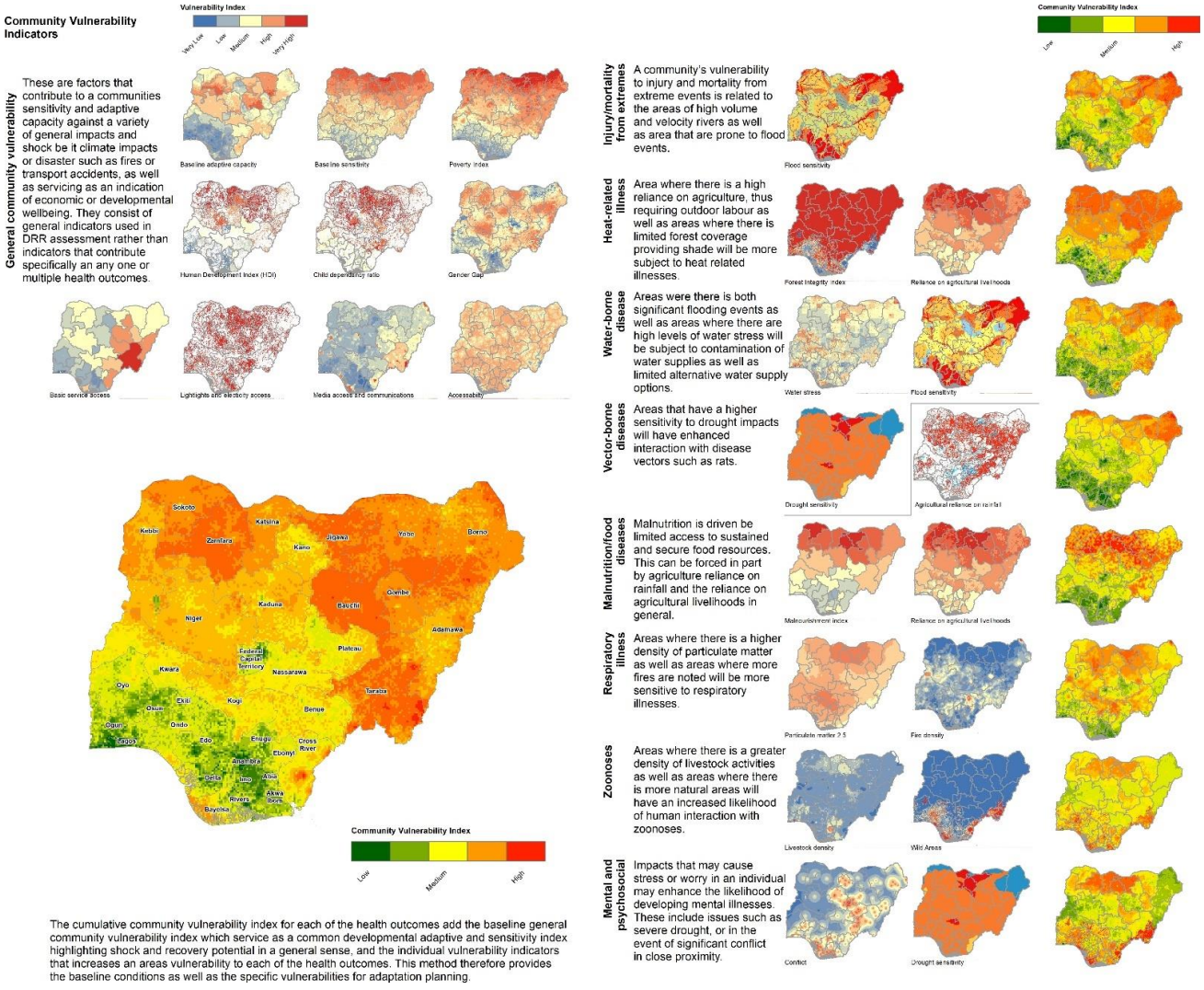
[75] International Water Management Institute (IWMI), Irrigated area mapping http://www.iwmi.cgiar.org/2018/06/irrigated-area-mapping-asia-and-africa/

[76] NASA Socioeconomic Data and Applications Center (SEDAC), Documentation for the Global (GL) Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD), v4.03 (1998–2019)

[77] GeoNetwork, OSGeo project, https://geonetwork-opensource.org/

- Forecast changes in factors contributing to community vulnerability. Service access, education and livelihoods, diet, and childhood mortality[78] [79]

Figure 11. Community Vulnerability index for the health outcomes - general community vulnerability and contributing indicators (left), and the individual heath outcome-specific vulnerability indicators and resulting health outcome-specific vulnerabilities (right)



Medical capacity

Healthcare capacities are factors specifically measurable for the healthcare sector. These health matrices within communities and in medical facilities will act to limit the duration or severity of the acute impacts and chronic conditions for each of the different health outcomes. Many of the factors are common between the different health outcomes. Those that differ are interventions or activities targeted at different particular health outcomes.

- The FAO provides detailed indicators of health including the General Health Index and the Mother and Child Health Index.[80]

[78] Our World in Data, Nigeria, https://ourworldindata.org/country/nigeria

[79]The Demographic and Health Survey, Nigeria: Standard DHS, 2024, https://dhsprogram.com/methodology/survey/survey-display-609.cfm

[80] FAO map catalogue, ClimAfrica Work Package 4. https://www.fao.org/home/en

- Open street maps provide information on the locations of specialised facilities including Medical facilities and first responder institutions.[81]

- WorldPop provides specific health capacity information including Access to health insurance, skilled birth attendant density, Measles and Diphtheria vaccination coverage and Contraception access.[82]

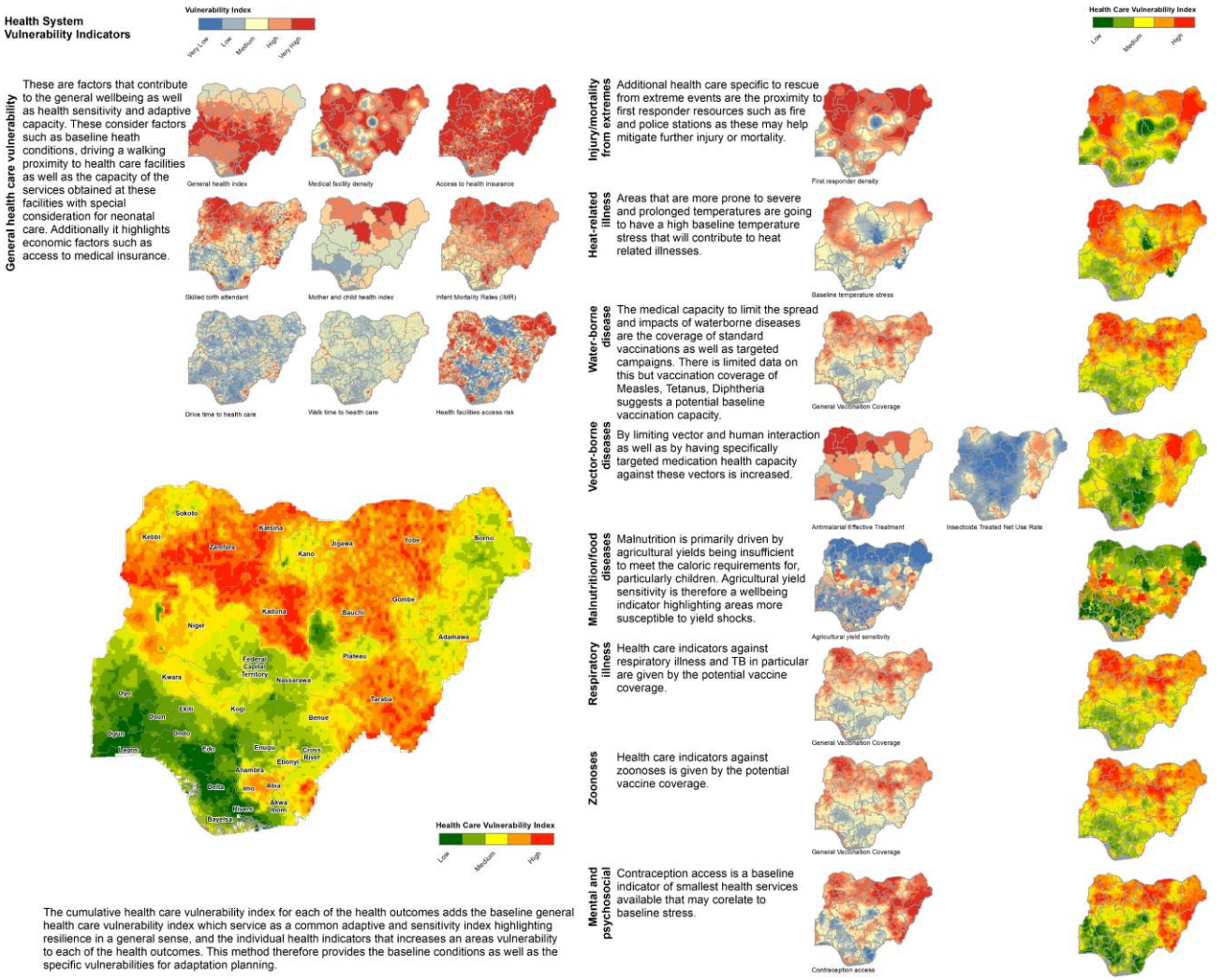
- Several health capacity indicators are given by the Malaria Atlas Project and include Drive time to health care, Walk time to health care, Antimalarial effective treatment, and Insecticide-treated net use rates.[83]

- Forecast changes in factors contributing to health care capacity. Vaccines and medicine coverage and specialist medical treatment, medical staffing capacity, health care outcomes and health metrics[84] [85]

- Other data sources include:
  - Infant mortality rate.[86]
  - Health facility access risk.[87]
  - Baseline temperature stress.[88]
  - Agricultural yield sensitivity.[89]

[81] Map data copyrighted OpenStreetMap contributors and available from https://www.openstreetmap.org
[82] Bosco, C.; Alegana, V.; Bird, T.; Pezzulo, C.; Bengtsson, L.; Sorichetta, A.; Steele, J.; Hornby, G.; Ruktanonchai, C.; Ruktanonchai, N.; Wetter, E.; Tatem, A. J. (2017): Exploring the high-resolution mapping of gender disaggregated development indicators. Journal of the Royal Society Interface, 14(129). DOI: 10.1098/rsif.2016.0825.
[83] The Malaria Atlas Project, https://malariaatlas.org/about-map/
[84] Our world in data, Nigeria, https://ourworldindata.org/country/nigeria
[85] The Demographic and Health surveys Program, Nigeria: Standard DHS, 2024, https://dhsprogram.com/methodology/survey/survey-display-609.cfm
[86] Center for International Earth Science Information Network (CIESIN), Columbia University. 2022. Global Gridded Relative Deprivation Index (GRDI), Version 1. Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC). https://doi.org/10.7927/3xxe-ap97
[87] Fraym, Health Facilities Access Risk Score per Ward, https://data.grid3.org/datasets/GRID3::grid3-nga-health-facilities-access-risk-score-per-ward/about
[88] SolarGIS. Solar resource maps and GIS data for 200+ countries
[89] FAO - Agricultural Stress Index System (ASIS), https://www.fao.org/giews/earthobservation/

Figure 12. Health system vulnerability index for the health outcomes. General health system vulnerability and contributing indicators (left), and the individual heath outcome-specific vulnerability indicators and resulting health outcome-specific vulnerabilities (right) [90] [91] [92] [93] [94] [95] [96] [97] [98] [99]



[90] FAO map catalogue, ClimAfrica Work Package 4. https://www.fao.org/home/en
[91] Map data copyrighted OpenStreetMap contributors and available from https://www.openstreetmap.org
[92] Bosco, C.; Alegana, V.; Bird, T.; Pezzulo, C.; Bengtsson, L.; Sorichetta, A.; Steele, J.; Hornby, G.; Ruktanonchai, C.; Ruktanonchai, N.; Wetter, E.; Tatem, A. J. (2017): Exploring the high-resolution mapping of gender disaggregated development indicators. Journal of the Royal Society Interface, 14(129). DOI: 10.1098/rsif.2016.0825.
[93] The Malaria Atlas Project, https://malariaatlas.org/about-map/
[94] Our world in data, Nigeria, https://ourworldindata.org/country/nigeria
[95] The Demographic and Health Survey, Nigeria: Standard DHS, 2024, https://dhsprogram.com/methodology/survey/survey-display-609.cfm
[96] Center for International Earth Science Information Network (CIESIN), Columbia University. 2022. Global Gridded Relative Deprivation Index (GRDI), Version 1. Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC). https://doi.org/10.7927/3xxe-ap97
[97] Fraym, Health Facilities Access Risk Score per Ward, https://data.grid3.org/datasets/GRID3::grid3-nga-health-facilities-access-risk-score-per-ward/about
[98] SolarGIS. Solar resource maps and GIS data for 200+ countries
[99] FAO - Agricultural Stress Index System (ASIS), https://www.fao.org/giews/earthobservation/

Priority health risks

Priority health risks will give a status of disease prevalence and suggest linkages between disease and current climate parameters. The forecasting of diseases is based on the relationship between disease and climate but under the future altered climate as a driver and the disease as a dependant result. The data used for the baseline disease prevalence is not always available and outputs from reports were used in some cases rather than the raw data sets. The following diseases were assessed:

- Cholera cases.[100]
- Diarrhoea prevalence.[101]
- Ebola potential.[102]
- Lassa cases.[103]
- Yellow fever hotspots.[104]
- Pulmonary tuberculosis distribution.[105]
- Tsetse fly hotspots[106]
- Malaria prevalence: Plasmodium falciparum cases per 1000 people.[107]
- Stunting.[108]
- Children underweight.[109]
- Future 2030 linear forecast change in disease/injury burden and absolute case numbers based on historical trends[110] [111]

[100] Elimian, K. O., Musah, A., Mezue, S., Oyebanji, O., Yennan, S., Jinadu, A., Williams, N., Ogunleye, A., Fall, I. S., Yao, M., Eteng, E., Abok, P., Popoola, M., Chukwuji, M., Omar, L. H., Ekeng, E., Balde, T., Mamadu, I., Adeyemo, A., Ihekweazu, C. (2019). Descriptive epidemiology of cholera outbreak in Nigeria, January–November 2018: Implications for the global roadmap strategy. BMC Public Health, 19. https://doi.org/10.1186/s12889-019-7559-6

[101] Bolarinwa, O. A., Tadesse Tessema, Z., Frimpong, J. B., Seidu, A., & Opoku Ahinkorah, B. (2021). Multi-Level Analysis and Spatial Interpolation of Distributions and Predictors of Childhood Diarrhea in Nigeria. Environmental Health Insights. https://doi.org/10.1177/11786302211045286

[102] Predicting Ebola outbreaks by understanding how ecosystems influence human health. https://www.ucl.ac.uk/news/2019/oct/predicting-ebola-outbreaks-understanding-how-ecosystems-influence-human-health#:~:text=Predicting%20Ebola%20outbreaks%20by%20understanding%20how%20ecosystems%20influence%20human%20health,-15%20October%202019&text=The%20next%20Ebola%20outbreak%20could,of%20the%20deadly%20infectious%20disease

[103] Dalhat, M. M., Olayinka, A., Meremikwu, M. M., Dan-Nwafor, C., Iniobong, A., Ntoimo, L. F., Onoh, I., Mba, S., Ohonsi, C., Arinze, C., Esu, E. B., Nwafor, O., Oladipupo, I., Onoja, M., Ilori, E., Okonofua, F., Ochu, C. L., Igumbor, E. U., & Adetifa, I. (2022). Epidemiological trends of Lassa fever in Nigeria, 2018–2021. PLOS ONE, 17(12), e0279467. https://doi.org/10.1371/journal.pone.0279467

[104] Nomhwange, T., Jean Baptiste, A.E., Ezebilo, O. et al. The resurgence of yellow fever outbreaks in Nigeria: a 2-year review 2017–2019. BMC Infect Dis 21, 1054 (2021). https://doi.org/10.1186/s12879-021-06727-y

[105] Daniel, Olusoji & Adejumo, Olusola & Jo, Bamidele & Alabi, Adekunle & Gbadebo, Ayisat & Oritogun, Kolawole. (2023). Social determinants of tuberculosis in Nigeria: an ecological approach. Journal of Public Health in Africa. 14. 10.4081/jphia.2022.2215.

[106] FAO map catalogue, Predicted areas of suitability for tsetse fly groups and species . https://www.fao.org/home/en

[107] The Malaria Atlas Project, https://malariaatlas.org/about-map/

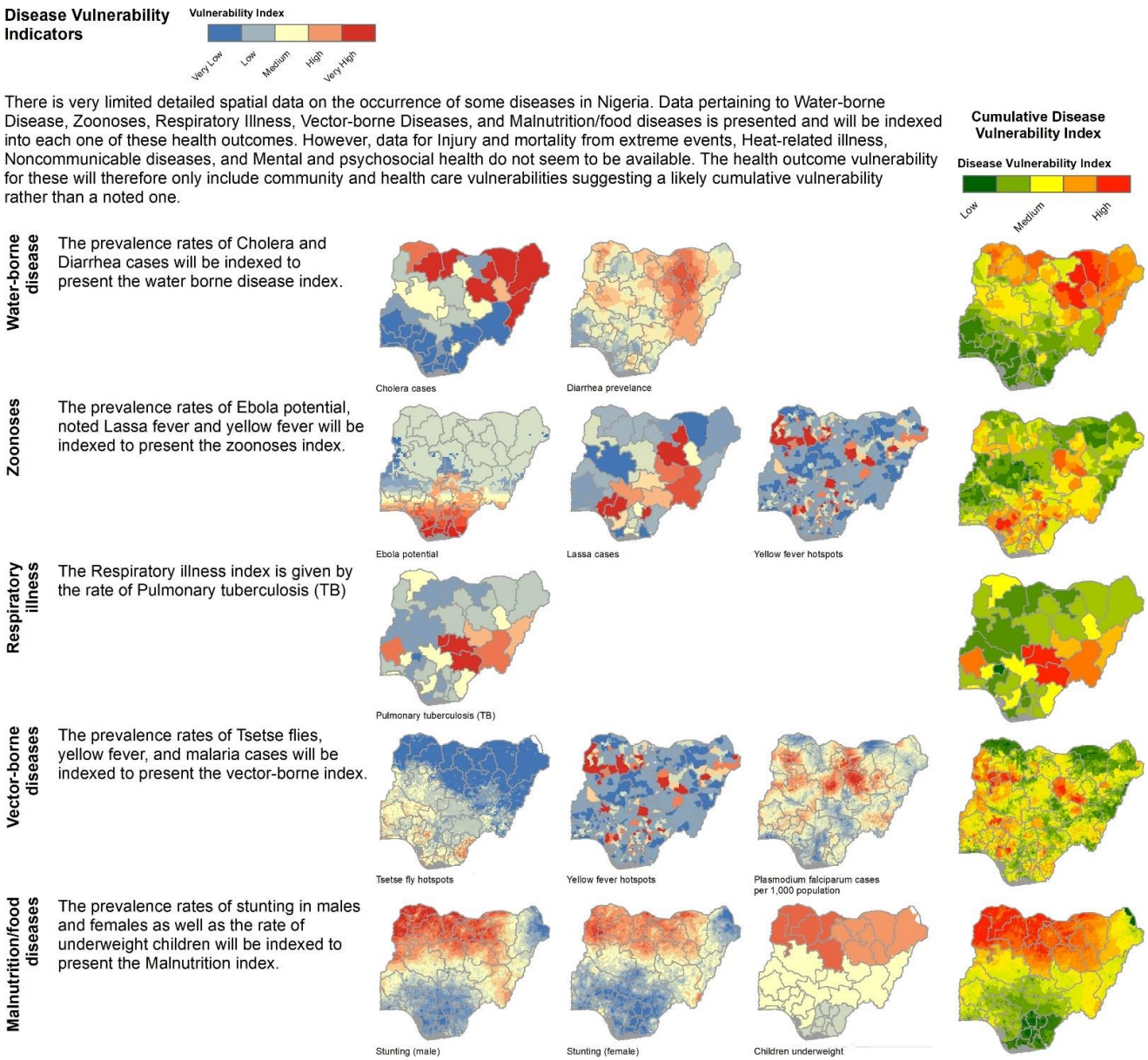
[108] Bosco, C.; Alegana, V.; Bird, T.; Pezzulo, C.; Bengtsson, L.; Sorichetta, A.; Steele, J.; Hornby, G.; Ruktanonchai, C.; Ruktanonchai, N.; Wetter, E.; Tatem, A. J. (2017): Exploring the high-resolution mapping of gender disaggregated development indicators. Journal of the Royal Society Interface, 14(129). DOI: 10.1098/rsif.2016.0825.

[109] Center for International Earth Science Information Network (CIESIN), Columbia University; 2005 Global subnational rates of child underweight status [dataset]. CIESIN, Palisades, NY, USA. Available at: http://www.ciesin.columbia.edu/povmap/ds_global.htm

[110] Our world in data, Nigeria, https://ourworldindata.org/country/nigeria

[111] The Demographic and Health surveys Program, Nigeria: Standard DHS, 2024, https://dhsprogram.com/methodology/survey/survey-display-609.cfm

Figure 13. Priority health risks index for the health outcomes. Individual disease indicators and resulting health outcome-specific vulnerabilities



Annex 2. Reviewed health policies and policies in other related sectors

Table 19. Reviewed health policies and policies in other related sectors

Sector	Policies
Health	• The National Strategic Health Development Plan Framework (2009-2015) • National Health Policy 2016 • National Health Promotion Policy 2019 • National Policy on the Health and Development of Adolescents and Young People In Nigeria: 2020-2024 • National Gender in Health Policy 2021 – 2025 • National Malaria Strategic Plan 2014 – 2020 • National Action Plan for Health Security Federal Republic of Nigeria (2018-2022 • National Child Health Policy 2022 • National Health Product Supply Chain Strategy and Implementation Plan 2021 - 2025 • National Healthcare Waste Management Policy • National Policy and Strategic Plan of Action on Prevention and Control of Non-Communicable Diseases (NCDs) 2013 • National Policy on the Health and Development of Adolescents and Young People in Nigeria: 2021-2025 • National Strategic Plan of Action for Nutrition (2021 – 2025) • National Adolescent Health Policy Revised 2019 • Nigeria Health Information System Policy 2014 • Nigeria-Health-Financing-Policy-Strategy_2017-2021 • Nigerian Health System Organization and Delivery Structure • Nigeria-National-Health-Act-2014 • One Health Strategic Plan 2019 – 2023 • Second National Strategic Health Development Plan 2018 - 2022 • REVISED Second National Strategic Health Development Plan (NSHDP II Revised) 2023 – 2025 • National Health ICT Framework 2015 – 2020 • National Policy for Non-Communicable Diseases (NCDs), Prevention and Control 2013 – revised 2021 • National Health Research Policy and Priorities 2014 • Nigeria Health Financing Policy and Strategy 2017 • 2022 National Health Workforce Profile • National Public Health Multi-Hazard Emergency Preparedness and Response Plan
Agriculture and food security	• National Policy on Food and Nutrition in Nigeria (2016) • National Health Promotion Policy (2019) • National Multi-Sectoral Plan of Action for Food and Nutrition 2021 – 2025 • National Policy on Maternal, Infant, & Young Child Nutrition (MICYN) in Nigeria, 2021 • National Agricultural Technology and Innovation Policy • The Agriculture Promotion Policy (2016 -2020) • National Agricultural Resilience Framework 2014
Biodiversity and forestry	• National Biodiversity Strategy and Action Plan 2016 • National Strategy for Nigeria REDD+ programme 2019 • National Forestry Policy 2020

Climate change	• National Climate Change Policy 2020 • National Climate Change programme 2020 • National Adaptation Strategy and Plan of Action (NASPA) 2011
Energy	• Energy Transition Plan • Long-Term Strategy for Low-Carbon Development • Nigeria Renewable Energy Master Plan • Nationally Determined Contribution Update 2021
Environment	• National Policy on Environment • National Drought Plan • National Environmental (Soil Erosion and Flood Control) Regulations 2011
Waste/ pollution	• National Policy on Solid Waste Management • National Policy on Plastic Waste Management • National Policy on Waste Battery Management in Nigeria • Nigeria's Action Plan (NAP) to Reduce Short-Lived Climate Pollutants (SLCPs)
Water	• National Water Sanitation Policy 2004 • National Climate-Resilient Water Management Plan 2021 - 2025
Disaster management	• National Disaster Management Framework • National Disaster Risk Management 2018
Gender	• National Action Plan on Gender and Climate Change for Nigeria
National development	• Agenda 2050

Annex 3. Stakeholder engagement

Primary data for the Nigeria V&A assessment was gathered through three main sources: KIIs; FGDs and through consultations with the Climate Change and Health TWG. More than 300 people were interviewed at the Federal level and across the six states visited in six geopolitical zones and at the federal/national level. Primary data gathering tools are too long to include in an annex and are available from the FMoH climate desk. Participants were drawn from the following key stakeholder groups with interest and influence in climate change and health in Nigeria:

Climate Change and Health TWG members/engagements

1. Honourable Minister, Federal Ministry of Helath and Social Welfare – Dr Muhammad Ali Pati
2. Honourable Minister, Federal Ministry of Agriculture and Rural Development – Mustapha Iyabo
3. Honourable Minister, Federal Ministry of Water Resources & Sanitation – Umezulike Robert A.
4. Honourable Minister, Federal Ministry of Budget and National Planning – Obikaonu U. Louis
5. Honourable Minister, Federal Ministry of Environment – Ezeude Uchenna
6. Federal Ministry of Health, Director Public Health – Dr Chukuma Anyaike
7. Federal Ministry of Health, Director/Focal Point, Climate Change and Health – Mr Brooks Godwin
8. National Centre for Disease Control (NCDC), Director General – Dr. Jide Idris
9. Federal Ministry of Health, National Coordinator NCDs – Dr Ahmad Ozi
10. Federal Ministry of Health, National Coordinator, Mental Health – Dr. Tunde Ojo
11. Federal Ministry of Health, National Coordinator, National Malaria Control Programme – Dr.Godwin Ntadom
12. Federal Ministry of Health, National Coordinator, Neglected Tropical Diseases – Mr Fatai Oyediran
13. Federal Ministry of Health, Dr. Muyi DG – NPHCDA
14. Federal Ministry of Health, National Health Insurance Authority – Dr. Kelechi Ohiri DG
15. Dr. Edwin Isotu Edeh – National Technical Officer for Public Health and Environment, WHO
16. National Population Commission – Aisha Kasuwa
17. National Council on Climate Change – Rukayya Muhammed
18. National Meteorological Agency (NIMET) – Mr. Adeleke Oyegade
19. National Bureau of Statistics – Mr. Kehinde Julius Olagunju
20. Rivers State University – Dr. Kinsley Okpara
21. Ministry of Health, Adamawa State – Hon Commisioner, Director Public Health and Desk Officer Climate Change
22. Ministry of Health, Kano State – Hon Commisioner, Director Public Health and Desk Officer Climate Change
23. Ministry of Health, Akwa-Ibom State – Hon Commisioner, Director Public Health and Desk Officer Climate Change
24. Ministry of Health, Lagos State – Hon Commisioner, Director Public Health and Desk Officer Climate Change
25. Ministry of Health, Kwara State – Hon Commisioner, Director Public Health and Desk Officer Climate Change
26. Ministry of Health, Enugu State – Hon Commisioner, Director Public Health and Desk Officer Climate Change
27. Mrs. Judith Onyeneke – FMoH Secretariat
28. Madam Ranti Okesade – FMoH Secretariat
29. Dr. Munirat Abdullahi – FMoH Secretariat
30. Mrs. Omolola Comfort – FMoH Secretariat
31. Dr. Jaggu Akolo Yohanna – FMoH Secretariat
32. Mrs. Obile Uchendu – FMoH Secretariat
33. Mr. Richard Essien – FMoH Secretariat
34. Mrs. Margaret Dachak – FMoH Secretariat
35. Mr. Nankat Danjuma – FMoH Secretariat
36. Mr. Macdonald C. Onyejeakor – FMoH Secretariat
37. Mr. Akilu Abubakar – FMoH Secretariat

38. Mrs. Blessing Ashwe – FMoH Secretariat
39. Miss Amina Garba - FMoH Secretariat
40. Mrs. Justina Nathaniel – FMoH Secretariat
41. Mr. Jibrin Sheidu – FMoH Secretariat
42. Miss. Yemisi Soyode – FMoH Secretariat
43. Miss. Victoria Attah – FMoH Secretariat
44. Dave McConalogue, Head of Health – FCDO Nigeria
45. Anya Gopfert, Climate and Health team – FCDO London
46. Dr Ebere, Health Advisor – FCDO Nigeria
47. Jabulani Nyenwa, Senior Director – Palladium
48. Dr. Gwarzo Usman, Team Leader – Lafiya project
49. Dr. Kiaka Joy Kaegon – Halcyon
50. Dr. Shola Dele-Olowu – Amp Health
51. Maruchi Wotogbe – DDP
52. Dr. Peter Tarfa – Former National Focal Point for Climate Change in Nigeria
53. Salma Mijinyawa, Technical Advisor – Palladium
54. Antonios KOLIMENAKIS – WHO
55. Brama KONÉ – WHO
56. Diarmid CAMPBELL-LENDRUM – WHO
57. Elena Villalobos Prats – WHO
58. Gimaiyo, Gerishom – Rockefeller Foundation
59. Jean Nouboussi – Global Fund
60. Jeremiah MUSHOSHO – WHO
61. Jessica Leete Werner Flannery – World Bank
62. Jo-Angeline Kalambo – Global Fund
63. Kuzmak, Greg – Rockefeller Foundation
64. Loreta Rufo – World Bank
65. Munirat Iyabode Ayoka Ogunlayi – World Bank
66. Nilofer Khan Habibullah – World Bank
67. Olumide Olaolu Okunola – World Bank
68. Onoriode Ezire – World Bank
69. Owen K. Smith – World Bank
70. Seon Mi Choi - Global Fund
71. Stephen Geoffrey Dorey – World Bank
72. Supriya Madhavan – World Bank
73. Tamer Samah Rabie – World Bank
74. Zara Shubber – World Bank

Federal level KIIs

1. Rukayya Muhammad – Climate Change and Health Desk Officer, National Council on Climate Change (NCCC)
2. Dr. Zainab Pisagih - Deputy Director, Environment & Climate Change; Regional Development, Federal Ministry of Budget & Economic Planning
3. Mrs Dolapo John Akhigbe - Special assistant technical EU support Nigerian climate change response programme, Federal Ministry of Environment
4. Babarinde Segun – Director, Federal Ministry of Water Resources
5. Mrs. Mariam Shaibu - Assistant Director, Child Development department and unit head (Health Desk), Federal Ministry of Women Affairs
6. Iyabo Lawal Mustapha - Assistant Director, Federal Ministry of Agriculture and Food Security
7. Agatha Oluchukwu Anokwu - Assistant General Manager (Climate Services), National Meteorological Services (NiMet)
8. Isa Abubakar – National Emergency Management Agency (NEMA)
9. Director Afeguba – National Population Commission (NPC)
10. Prof. Haruna Ayuba - Climate Change Expert and Vice-Chancellor Bingham University, Kodope, Nasarawa State

11. Dr Okpara Kingsley - Associate Professor, Environmental Management and Technology, Rivers State University
12. Mrs. Bibian Ama - programme coordinator, Gender Empowerment and Environment social initiative (GEESI)
13. Comrade Echezona Asuzu - National Coordinator/Head NLC Climate Change and Green Jobs, Nigeria Labour Congress
14. Edwin Isotu - National Technical Officer for Public Health and Environment, WHO
15. Chiranjibi Tiwari - Climate Change and WASH Manager, UNICEF
16. Anne-Marie Abaagu - Executive Director, Women Environmental programme
17. Damaris Uja - Monitoring and Evaluation Manager, Women Environmental programme
18. Mr. Benson Attah - Executive Director, Community Emergency Response Initiative (CERI)

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16. Anne-Marie Abaagu - Executive Director, Women Environmental programme
17. Damaris Uja - Monitoring and Evaluation Manager, Women Environmental programme
18. Mr. Benson Attah - Executive Director, Community Emergency Response Initiative (CERI)

State and LGA level KIIs

1. Nuhu Yahya - State Health Educator /Health Promotion Officer, Adamawa State Ministry Of Health, Public Health Dept
2. Haruna Maisaje - Director Environmental Health, Adamawa State Primary Health Care Development Agency
3. Alhaji Abubakar Adamu - Director Environmental Degradation Control, Adamawa State Ministry Of Environment And Natural Resources
4. Amin Williams – Adamawa State Rural Water And Sanitation Agency (RUWASA)
5. Hon. Nathaniel Pagiel - Vice Chairman Yola-South LGA, Adamawa State
6. Wenakam Wesley Fwa - Executive Chairman, Demsa LGA, Adamawa State
7. Abdulmumini Abubakar - District Head Of Yola, Adamawa Emirate Council, Adamawa State
8. Kpana P Dambo – Secretary, Demsa District Head, Adamawa State

9. Saviour Peter Udo - Acting General Manager, Akwa Ibom State Rural Water and Sanitation Agency (AK-RUWATSAN)
10. His Highness, Etebom Okon Udo Ekpo - Clan Head, Ikono LGA, Akwa Ibom State
11. Barrister John Akpan - Vice Chairman, Ikono LGA, Akwa Ibom State
12. HRM Edidem Sylanus Effiong Okon - Paramount Ruler of Uyo LGA, Akwa Ibom State
13. Chris Okon - District Health Information System (DHIS) Focal Point, Akwa Ibom State Primary Health Care Development Agency
14. Kufre Eshiet - Neglected Tropical Diseases (NTDs) Coordinator, Ministry of Health, Akwa Ibom State
15. Dr. Uwemedimo Udo - Transition Chairman, Uyo LGA, Akwa Ibom State
16. Nnamdi Arum - Deputy Director / HOD Climate Change, Enugu State Ministry of Environment & Climate Change
17. Chika Mbah - Senior Special Assistant to the Governor on WASH, Enugu State Ministry of Water Resources
18. Okezie Nweke JP - Director of Personnel Management, Enugu East LGA, Enugu State
19. Chief Simeon Agbo - Culture Chairman, Amorji Nike, Enugu East LGA, Enugu State
20. Lady Uzoma Okolo – Chairman, Aninri LGA, Enugu State
21. Igwe Godwin Ifesinachi Onuoha - Traditional Ruler (Igwe), Aninri Traditional Council, AninriLGA, Enugu State
22. Dr. Shehu Abdullahi Muhammad - Incident Manager for EOC, Emergency Operations Center, Kano State
23. Abdulhamid Bala - Director, Ecology and Forestry, KANO STATE Ministry of Environment and Climate Change
24. Yusuf Abdullahi. Acting General Manager, Kano State RUWASA
25. Musayyib Lawal Ungogo - Senior special reporter KAROTA, Ungogo LGA, Kano State
26. Abba Muhammad - Dausayi Village Head, Ungoggo LGA, Kano State
27. Chairman Gezawa LGA, Kano State
28. Director Epidemiology And Diseases Control Kano State Primary Healthcare Management Board
29. Dr Amina Ahmed El-Imam - Honourable Commissioner, Kwara State Ministry of Health
30. Dr M.S. Oguntoye – Director PHC Services, Kwara State Primary Health Care Development Agency
31. Mall. Sheu Ndauusa Usman - Honourable Commissioner, Kwara State Ministry of Environment
32. Alhaji Suleiman Yahaya - Secretary of Ilorin West LGA, Kwara State
33. Mallam Kolapo Balogun Olayinwola - Afon District Head, Asa LGA, Kwara State
34. Kinrinjin A. Adebara - Director Personnel Management (DPM), Asa LGA, Kwara State
35. Alhaji Umar Salihu Baba Offa - Ward Chairman, Ubandawaki, Ilorin West LGA, Kwara State
36. Professor Akinola Emmanuel Abayomi - Honourable Commissioner, Lagos State Ministry of Health
37. Bankole Michael - Deputy Director, Climate Change and Environmental Planning Department, Lagos State Ministry of Environment and Water Resources
38. Titilope Ngozi Akosa - Executive Officer, Centre for 21 st century issues
39. Mrs Adeseun Dupe Sewa - LGA Health Educator, Ikeja LGA, Lagos State
40. Agannanoh M. N - HOD Environmental Services, Ikorodu LGA, Lagos State
41. High Chief Semiu Akanni Anifowose - Balee of Anifowose, Ikeja LGA, Lagos State
42. High Chief Adeolu Emmanuel, Sonomonu of Ikorudu, in Ikorodu LGA, Lagos State

State and LGA level FGDs

1. Demsa LGA Health Team, Adamawa State
2. Borong PHC Centre Health Care Workers, Demsa LGA, Adamawa State
3. Ward Development Committee (WDC) Borong PHC Centre, Demsa LGA, Adamawa State
4. Health Care Workers, Yola South LGA, Adamawa State
5. Local NGOs, Yola South LGA, Adamawa State
6. Yola South LGA WDC, Adamawa State
7. Yola South LGA Women Group, Adamawa State
8. National Council for Women Societies (NCWS), Demsa LGA Branch, Adamawa State

9. Yola-South LGA Health Team, Adamawa State
10. Organisation of Persons with Disability in Yola South Local Government of Adamawa State
11. LGA Health Team, Uyo LGA, Akwa Ibom State
12. Health Care Workers, Comprehensive PHC Centre Uyo, Uyo LGA, Akwa Ibom State
13. Ward Development Committee, Ikot Okuboh, Uyo LGA, Akwa Ibom State
14. Women Group Ikot Okuboh, Uyo LGA, Akwa Ibom State
15. LGA Health Team, Ikono LGA, Akwa Ibom State
16. Health Care Workers, Ibiaku Ikono PHC Centre, Ikono LGA, Akwa Ibom State
17. WDC Ikono LGA, Akwa Ibom State
18. Women Group in Ibiaku – Ikono LGA, Akwa Ibom State
19. Joint Association of Persons with Disability (JONAPWD), Akwa Ibom State Chapter
20. Network of NGOs in Akwa Ibom State
21. Joint Association of Persons with Disability (JONAPWD), Enugu State Chapter
22. LGA Health Team, Enugu East LGA, Enugu State
23. Health Care Workers, Abakpa Health Centre, Enugu East LGA, Enugu State
24. Ward Development Committee (WDC), Enugu East LGA, Enugu State
25. Women Group Enugu East LGA, Enugu State
26. LGA Health Team, Aninri LGA, Enugu State
27. PHC Workers, Aninri LGA, Enugu State
28. Women Group Aninri LGA, Enugu State
29. Ward Development Committee (WDC) AMORJI ANINRI, Aninri LGA, Enugu State
30. NGO/CBO Community in Enugu State
31. Organisation of Persons with Disability in Kano State
32. Group of NGOs and CBOs in Kano State
33. LGA Health Team, Ungogo LGA, Kano State
34. Health care workers Ungogo LGA, Kano State
35. Women group Ungogo LGA, Kano State
36. Ward Development Committee, Ungogo LGA, Kano State
37. LGA Health Team, Gezewa LGA, Kano State
38. PHC Workers, Gezewa LGA, Kano State
39. Women Group Gezewa LGA, Kano State
40. Ward Development Committee, Gezewa LGA, Kano State
41. Ilorin West LGA Health Team, Kwara State
42. Health Care Workers Ilorin West LGA, Kwara State
43. Ilorin West LGA Women Group, Kwara State
44. Ward Development Committee (WDC) Ilorin West LGA
45. Women Group, Asa LGA, Kwara State
46. Asa LGA Health Team, Kwara State
47. Health Care Workers, Asa LGA, Kwara State
48. Ward Development Committee (WDC), Afon, Asa LGA, Kwara State
49. Organisation of Persons with Disability in Kwara State
50. Group of NGOs and CBOs in Kwara State
51. NGO Community Ikorodu LGA, Lagos State
52. Ikorodu LGA Health Team, Lagos State
53. Women Group Ikorodu LGA, Lagos State
54. Ward Health Committee, Ikorodu LGA, Lagos State
55. Ikeja LGA Health Team, Lagos State
56. PHC Workers Ikeja LGA, Lagos State
57. Women Group Ikeja LGA, Lagos State
58. Ward Health Committee, Ikeja LGA, Lagos State
59. Persons with disability, Ikorodu LGA, Lagos State
60. Community-based Organisations (CBOs), Ikeja LGA, Lagos State


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