NATIONAL STRATEGIC PLAN FOR ELIMINATION OF DOG MEDIATED HUMAN RABIES 2022 - 2026

☆ FEDERAL MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT

☆ FEDERAL MINISTRY OF HEALTH

☆ FEDERAL MINISTRY OF ENVIRONMENT

SEPTEMBER, 2022

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ACKNOWLEDGEMENT

The National Strategic Plan (NSP) for the Elimination of Dog-Mediated Human Rabies is the result of the collective efforts and commitment of the multidisciplinary and multisectoral Nigeria One Health collaborating ministries: Federal Ministry of Agriculture and Rural Development (FMARD), Federal Ministry of Health (FMoH) and Federal Ministry of Environment (FMEnv). The support and dedication of the leadership and staff of these three ministries, catalyzed the processes leading to the production of this document, and provides the enabling environment for the productive implementation of the planned activities.

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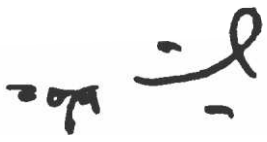
Finally, the commitment of the Honourable Ministers of Agriculture, Health and Environment who recognized the importance of neglected zoonotic diseases such as rabies is acknowledged. Their continued support ensured production of this strategic plan on the elimination of rabies. The Ministers can take pride in pursuing the vision and as a result saving many thousands of human lives in the country.



DR. ERNEST A. UMAKHIHE
Permanent Secretary, Federal Ministry of Agriculture and Rural Development

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ACEGID	Africa Centre of Excellence in Genomics of Infectious Diseases
ACENTDFB	Africa Centre of Excellence in Neglected Tropical Diseases and Forensic Biotechnology
APAA	Action for Protection of Animals Africa
AU-IBAR	African Union Inter-African Bureau for Animal Resources
BA-N	Breakthrough ACTION-Nigeria
CINEHSS	Centre for Integrated National Environmental Health Officer
CGPP	Core Group Partners Project
DVS	Director of Veterinary Services
EHORECON	Environmental Health Officers Regulation Council of Nigeria
EHOs	Environmental Health Officers
EHS	Environmental Health and Sanitation
FAO	Food and Agriculture Organization
FDVPCS	Federal Department of Veterinary and Pest Control Services
FGN	Federal Government of Nigeria
FMARD	Federal Ministry of Agriculture and Rural Development
FME	Federal Ministry of Education
FMEnv	Federal Ministry of Environment
FMoH	Federal Ministry of Health
GARC	Global Alliance for Rabies Control
IBCM	Integrated Bite Case Management
IDSR	Integrated Disease Surveillance and Response
IEC	Information, Education and Communication
JRA	Joint Risk Assessment
LMS	Livestock Management Services
MoA	Ministry of Agriculture
M&E	Monitoring and Evaluation
M&EL	Monitoring Evaluation and Learning
NADIS	National Animal Disease Information System
NAQS	Nigeria Agricultural Quarantine Service
NBMA	National Biosafety Management Agency
NBS	National Bureau of Statistics
NCDC	Nigeria Centre for Disease Control
NERLS	National Environment Reference Laboratory Services
NESREA	National Environmental Standard and Regulation Enforcement Agency
NGO	Non-Governmental Organization

NIMR	Nigeria Institute for Medical Research
NPF	Nigeria Police Force
NPS	National Parks Service
NRL	National Reference Laboratory
NSCDC	Nigeria Security and Civil Defence Corps
NTWG	National Technical Working Group
NVMA	Nigeria Veterinary Medical Association
NSP	National Strategic Plan
PEP	Post Exposure Prophylaxis
PrEP	Pre- Exposure Prophylaxis
REDISSE	Regional Disease Surveillance Systems Enhancement
RIG	Rabies Immunoglobulins
RRT	Rapid Response Team
SARE	Stepwise Approach to Rabies Elimination
SDGs	Sustainable Development Goals
SMoA	State Ministry of Agriculture
SMoH	State Ministry of Health
UAR	United Against Rabies Forum
USAID	United States Agency for International Development
USD	United States Dollars
VCN	Veterinary Council of Nigeria
VTHs	Veterinary Teaching Hospitals
WHO	World Health Organization
WOAH	World Organization for Animal Health

FOREWORD

This National Strategic Plan (NSP) for the Elimination of Dog-mediated Human Rabies in Nigeria is a document that has been produced through the collaboration and immense contributions of the three core One Health (OH) Ministries viz; Agriculture and Rural Development, Health and Environment. It outlines planned interventions towards controlling and eventually eliminating the scourge of rabies from both human and animal populations in the country. The NSP has been developed for Nigeria in response to, and in alignment with the Global Agenda to end dog-mediated human rabies by the year 2030. This is being coordinated by the tripartite of World Health Organization (WHO), World Organization for Animal Health (WOAH) and Food and Agriculture Organization (FAO). The coming together of the tripartite, in collaboration with the Veterinary Services and Health Systems of all Countries across the world is a testimony to the urgent need to globally eliminate rabies and protect human and animal populations from the menace of this deadly but preventable disease.

The WHO puts the figure of annual human mortality due to rabies at 59,000. This high figure may even be an under-estimation as most of the mortalities associated with the disease are not reported especially in developing countries such as Nigeria. It is of great concern to note that about 80% of these deaths occur in rural communities.

The first documented case of rabies in Nigeria was in 1912. Since then, the incidence of the disease with associated socio-economic and negative livelihood impacts have continued to increase. Rabies is endemic in all geopolitical zones of Nigeria with a large proportion of the population at risk of infection. Over the years, the National Veterinary Research Institute (NVRI), Vom records indicate that 59-75% of samples associated with dog bite cases are confirmed to be rabid. This is worrisome!

In 2008, WOAH ranked rabies as the most important zoonosis in Nigeria. Furthermore, the 'One Health' re-prioritization of zoonotic diseases in 2022 ranked rabies among the top six important zoonoses in the country. This calls for greater commitment to rabies control and elimination in part fulfillment of the Nigerian government obligations to global and national health security.

This document is initially a five-year plan which provides the roadmap to the realization of the goal of achieving the elimination of Dog-mediated Rabies in Nigeria by 2030. The Government of Nigeria is confident that the full implementation of the strategies enunciated in this document will enable the realization of the set goal and hereby assures of its preparedness to fully support the programme.

Our experiences and the lessons learnt in response to the COVID-19 pandemic demonstrated what collaboration across sectors can achieve. Rabies control programmes offer a great example for One Health implementation. The structures and trust that underpin these are crucial for other zoonotic diseases including those that are pandemic prone. We call on all stakeholders to join hands in the fight to control and eliminate rabies in Nigeria. Together we can do it come 2030.

Dr. Osagie Ehanire
Honourable Minister of Health

Barr. Mohammed H. Abdullahi
Honourable Minister of Environment

Dr. Mohammed Mahmood Abubakar
Honourable Minister of Agriculture and Rural Development

September 22, 2022

EXECUTIVE SUMMARY

Nigeria currently has a human population of over 216 million and an annual estimated growth rate of 2.6%. The National Bureau of Statistics (NBS, 2004) captured the dog population in Nigeria as 5 million. By extrapolation, the population of dogs in Nigeria presently should be 7-10 million. Dogs are important reservoirs of rabies all over the world. Rabies is mainly transmitted through the bite of infected animals especially dogs and it kills 100% of its infected victims in the absence of timely and efficient post-exposure-prophylaxis (PEP). In Nigeria, dogs are kept for different reasons including security, shepherding, hunting, breeding and companionship. Majority of dogs are unlicensed and roam freely with no history of vaccination. From reported cases of rabies, stray dogs are the main source of infection. The incidence of rabies is on the increase annually and this can partly be due to dog owners' ignorance on the dangers of rabies, inadequate public awareness on proper dog keeping, poor access to vaccines; thereby necessitating a robust national plan.

Rabies is an ancient known disease in Nigeria. It was reported in Nigeria since 1912 and in recent times, there are documented cases of latent rabies. The disease has been reported in dogs, cats, cattle, sheep, goats, horses, donkeys and wildlife. Several human suspected cases have also been reported especially in children. It is the most infectious zoonosis with known feasible tools and mechanisms for elimination. It is a 100% vaccine preventable disease like small pox. However, the transmission from an infected to susceptible population is lower for rabies compared to the human small pox or even the animal rinderpest viral diseases which were eradicated globally since 1980 and 2011, respectively. With the heightened insecurity in the country and increasing number of people keeping guard dogs in Nigeria, there is a likelihood of increase in rabies cases; hence the need to bring to an end, deaths due to dog- mediated human and animal rabies.

In December 2015, in line with the United Nations Sustainable Development Goals (SDGs), the Tripartite leadership of the Food and Agricultural Organization (FAO), World Health Organization (WHO) and World Organization for Animal Health (WOAH) set a global agenda to end dog-mediated human rabies by the year 2030. The agenda provided the Stepwise Approach to Rabies Elimination (SARE) tool to enable countries plan, monitor and evaluate their progress towards the goal of eliminating dog-mediated human rabies. This requires multisectoral and multidisciplinary collaborations in the designing and implementation of programmes, policies, legislations and research.

A One Health approach is envisioned to enhance surveillance and reporting thereby improving the data quality on rabies occurrence in humans and animals, provide better access to vaccines and PEP for bite victims and improve community education and buy-in for dog vaccination. Therefore, the Integrated Bite Case Management (IBCM) activities outlined in the plan will help in the prevention of human and animal deaths and improve case detection. The successful elimination of rabies, a model zoonosis is therefore possible and very essential to provide a road map and best practices for other zoonoses in-country incorporating and modelling the One Health approach. In response to the global

awakening to bring to an end the 'cycle of neglect' which has resulted in sustaining the endemic status of rabies in Nigeria, this National Strategic Plan (NSP) was developed. This NSP jointly developed by all relevant ministries, research institutes, academia, relevant professional bodies, development partners, national and international non-governmental organizations among others, will serve as a guide towards dog- mediated human rabies elimination in Nigeria.

CHAPTER ONE
INTRODUCTION

1.1 Background and Justification

Rabies is an important zoonosis and a highly fatal neurological disease of all warm-blooded mammals primarily caused by the classical rabies virus of the genus Lyssavirus and family *Rhabdoviridae* in the order Mononegavirales, transmitted by the bite of a rabies infected animal (Rupprecht *et al.*, 2002; Nel, 2013). Rabies virus could also be transmitted to man or susceptible animals via scratch by an infected animal or when infectious material usually saliva comes into direct contact with human mucosa or fresh wounds. Human-to-human transmission through bite is possible but rare. Also in rare cases, rabies may be contracted via transplantation of an infected organ (Vora *et al.*, 2013). Although no human cases have been documented following the ingestion of raw meat from a rabies infected animal, butchering or eating a rabid animal may potentially transmit rabies. Fatality rate of rabies in an outbreak is almost 100% and consequently has the highest case fatality in comparison to all other infectious diseases (Rupprecht *et al.*, 2018). When recommended human Post-Exposure Prophylaxis (PEP) is administered promptly to exposed individuals before onset of the clinical signs of the disease, it is highly effective, otherwise death is inevitable.

Rabies occurs globally in all continents of the world except the Antarctica (Fooks *et al.*, 2014). The Centre for Disease Control (CDC) and Prevention (2009), reported the absence of indigenous rabies cases (excluding bat rabies) in 7 African countries (Cape Verde, Libya, Mauritius, Réunion, São Tomé and Príncipe, and Seychelles).

Although effective vaccines are available for humans and animals, globally canine rabies is still estimated to cause approximately 59,000 human deaths, over 3.7 million disability-adjusted life years (DALYs) and 8.6 billion USD economic losses annually. The largest component of the economic burden is due to premature death (Hampson *et al.*, 2015). Dog vaccination, provision of PEP to exposed persons, enhanced laboratory-based surveillance, Pre-Exposure Prophylaxis (PrEP) vaccination of at-risk groups, coupled with educational outreach to improve community knowledge, are the cornerstones to rabies prevention and control (Zinsstag *et al.*, 2011; Lushasi *et al.*, 2020; Hampson *et al.*, 2019).

In developing countries, 99% of human rabies deaths are due to bites from rabid dogs, but data on dog bite injuries and related mortality are fragmented (Hampson *et al.*, 2015). It is difficult to say when rabies first occurred in Nigeria but the fact that almost all the indigenous tribes in the country have a vernacular name for rabies suggests that the disease is well known and has been long in existence in the country. The earliest official record of rabies in Nigeria was in the 1912 Annual Report of Southern Nigeria describing two cases of rabies in humans (Bougler and Hardy, 1960; Tomori and David-West, 1985). From then to date, the disease has remained a persistent endemic problem all over the country, with many reports of deaths in both humans and animals (Thorne, 1954; Boulger and Hardy, 1960; Ojo and Adeoye, 1967; Owolodun, 1969; Elegbe and Banerjee, 1970; Bisseru, 1972; Nuru, 1973; Umoh and Belino, 1979; Fagbami *et al.*, 1981; Smith, 1982; Tomori and David-West, 1985; Ezeokoli and Umoh, 1987; Bello *et al.*, 2007, Otolorin *et al.*, 2017: Audu *et al.*, 2019; Dauda *et al.*, 2020; Tekki *et al.*, 2021).

1.2.2 Economic Activities

Nigeria is a culturally diverse, middle-income, mixed economy and an emerging market, with expanding manufacturing, financial, service, communications, technology and entertainment sectors. It is ranked as the 21st largest economy in the world in terms of nominal GDP, and the 20th largest in terms of purchasing power parity. It is the largest economy in Africa; its re-emergent manufacturing sector became the largest on the continent in 2013. As a regional power, Nigeria's economy represents about 55% of West Africa's GDP (African Development Bank, 2013), and accounts for 64% of GDP based on purchasing power parity (PPP) valuation of the fifteen- member countries in the ECOWAS sub-region. It produces a large proportion of goods and services for the West African sub-region.

1.2.3 Administrative Structure

Nigeria is a federal republic with three tiers of government; Federal (National), State and Local levels. It is divided into 6 geopolitical zones namely; North-West, North-East, North-Central, South-West, South-East and South-South. The country is made up of 36 states and a Federal Capital Territory (Figure 1). At the state level, the relevant Ministry of Local Government and Chieftaincy Affairs, or Bureau of Local Government Affairs is responsible for the administration of state-level Acts governing local authorities. There are 774 Local Government Authorities (LGAs) which is the third (3rd) tier of government of the Nigerian federation.

The Head of State and Head of Government is the President, who is democratically elected by the people of Nigeria. The national assembly comprises of Senate and House of Representatives. The Senate and House of Representatives have 109 and 360 elected members respectively, providing legislative functions of the government.

The domestic dog is the major reservoir of the disease in Nigeria and the main source of exposure to humans and other animals. The disease has been documented in a variety of domestic and wild animals such as cat, cattle, sheep, goats, pigs, horses, donkeys, caracal lynx (*Fidelis caracal*), civet cat (*Vivera civetta*), ferret and Chimpanzee (Okoh, 1976; Kasali, 1977; Ikede and Adeyemi, 1984; Ezeiburo *et al.*, 1980; Oboegbulem, 1983; Mshelbwala *et al.*, 2013; Dauda *et al.*, 2020). Apart from the cat in which it has been difficult to ascertain the occurrence of the disease from dog bites, rabies in all the domestic animals had been reported to occur sequel to dog bites. Most human deaths due to rabies in Nigeria were not confirmed by laboratory techniques but by clinical presentations (Otolorin *et al*, 2015). Rabies is under-diagnosed and under-reported in Nigeria.

In 2022, rabies was ranked among the top six priority zoonotic diseases in Nigeria using the US CDC One Health zoonotic disease re-prioritization process. Also, the country has continued to record outbreaks from several states, requiring a more coordinated approach in its control in line with the 'step wise approach to rabies elimination' (SARE) tool. In 2015, the World Health Organization (WHO), the Food and Agriculture Organization (FAO), the World Organization for Animal Health (WOAH) and the Global Alliance for Rabies Control (GARC), in line with the United Nations Sustainable Development Goals, developed a Global Strategic Plan and has recently formed a 'United Against Rabies' '(UAR)' forum with a target of zero human deaths from dog-mediated rabies by 2030 (GARC, 2018). This forum provides an enabling environment for worldwide elimination of human dog-mediated rabies by 2030. This National Strategic Plan for Elimination of Dog-Mediated Human Rabies in Nigeria provides indicator-based activities and was developed in line with the "Global Strategic Plan to eliminate dog-mediated human rabies deaths by 2030".

1.2 Demographics/ Country Profile

1.2.1 Geography and Population of Nigeria

Nigeria is in West Africa along the Atlantic Ocean's Gulf of Guinea. The country's land borders are with Republics of Benin to the west, Cameroon to the east, Chad to the northeast, and Niger to the north. It has a land area of 356,667 square miles (923,768km^2) and a coastline area of 530 miles. It is the most populous country in Africa with a population of about 216 million and a projected annual population growth rate of 2.6%. The country has two major seasons each year; dry season from October to March and the rainy season from April to September. Natural disasters with outstanding health emergencies are not frequent in Nigeria except for seasonal flooding and consequently, internal displacement of persons and animals. Adverse effects of diseases are often exacerbated by low socioeconomic status, inadequate political will, low level of education, less than optimal health care services, poor transportation, and communication.

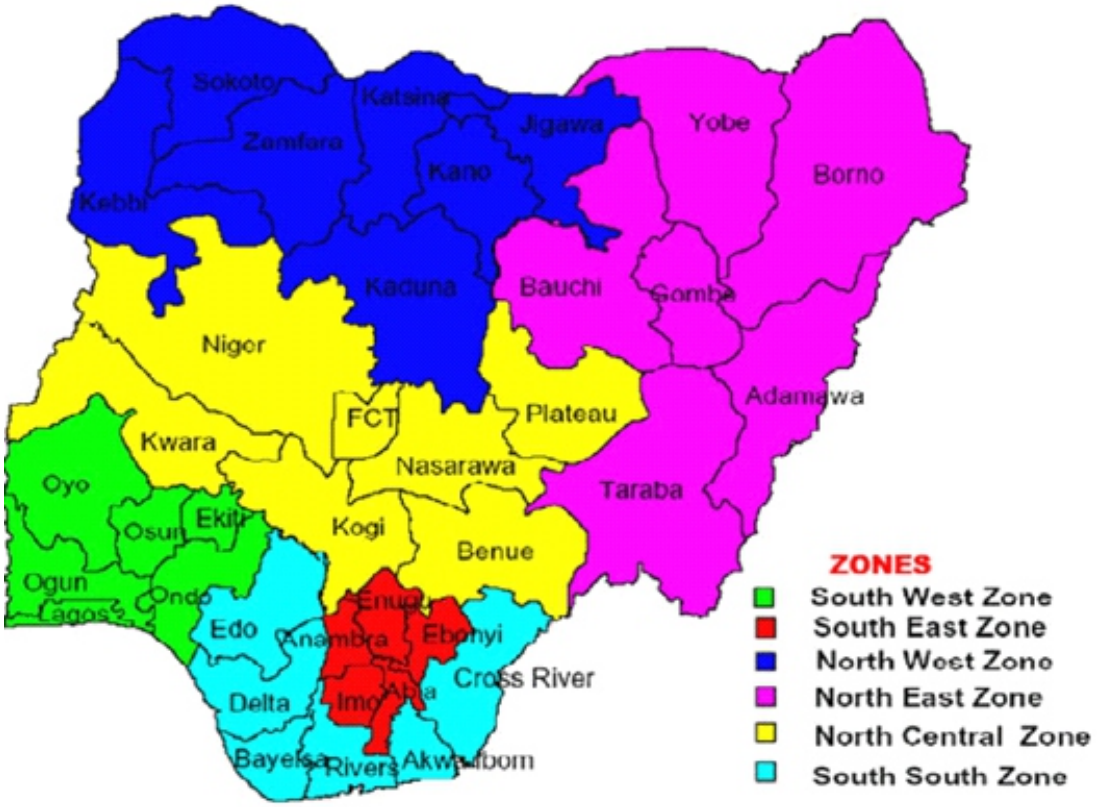


Figure 1: Map of Nigeria showing the 6 Geo-political zones

1.2.4 Animal and Human Health Systems in Nigeria

The Animal Diseases Control Act 2022 (as amended) and Nigeria National Health Act (2014) provide legal frameworks for regulation, development and management of both Animal Health and National Health Systems respectively, setting standards for veterinary and public health services in the Nigerian federation.

1.2.5 Animal Health Structure

The organization of the Animal Health Services in Nigeria mirrors the administrative and political organization of the Federal system; (a) the federal level is in charge of the development of policies, implementation of protocols, monitoring and coordination of development programmes, national disease control, and development of relevant legislations (b) the state veterinary services are in charge of disease control, provision of clinical services, animal products quality control, meat inspection, agricultural extension services and development of regulations, and (c) local government veterinary services mainly participate as mobilization and extension agents in operational actions in close coordination with the state Area Veterinary Officers, livestock farmers, traditional institutions, law enforcement agents and other stakeholders to facilitate delivery of services, disease reporting, control of livestock diseases and pests.

The structure of the National Veterinary Service includes the following agencies:

a) **The Federal Department of Veterinary and Pest Control Services** (**FDVPCS)** of the Federal Ministry of Agriculture and Rural Development (FMARD) has eight divisions at the headquarters and 37 field offices at state capitals and FCT for ease of collaboration with the States Veterinary Services. The Department functions as the policy adviser to the Government on all animal health, safety and wholesomeness of food of animal origin for human consumption and Pest Control Services. It draws its mandate from the Animal Diseases Control Act 2022 (as amended) and the World Organization for Animal Health (WOAH) standards, recommendations and guidelines for animal health and welfare. The Department is involved in the prevention, control and eradication of trans-boundary animal diseases and pests, control of vector and vector-borne diseases, zoo-sanitary certification services, provision of veterinary public health services including Antimicrobial use and Antimicrobial resistance (AMU-AMR), food safety services and zoonotic diseases control to guarantee healthy national herd, wholesomeness of foods of animal origin, international veterinary certification, international trade in animal and animal products and the general economic well-being of the populace.

b) **The National Veterinary Research Institute (NVRI)** is the national reference laboratory for the diagnosis of animal diseases that collaborates with international reference laboratories. National Veterinary Research Institute is recognized as a regional laboratory for West and Central African countries for Avian Influenza and Trans-boundary Animal Diseases (TADs). It is also involved in the production and testing of vaccines for the control of animal diseases such as rabies in Nigeria and the West African sub-region, conducts research and training in relevant veterinary fields.

c) **Nigeria Agricultural Quarantine Service (NAQS):** Ensures full compliance to the regulations of management of animals on transit, mandatory rest, take-off, feeding and watering of animals on transit and reporting of suspected communicable and or infectious diseases in animals and animal products in transit.

d) **The Veterinary Council of Nigeria (VCN):** regulates all veterinary practice and education in Nigeria. There is a post graduate college of veterinary surgeons, eleven accredited faculties and colleges of veterinary medicine and three colleges of animal health and production providing training for veterinary surgeons and veterinary paraprofessionals. A robust private veterinary sector is in place, mainly involved in the supply and distribution of veterinary medicinal products and drugs, vaccines, equipment and livestock feeds, provision of routine clinical services, preventive care for livestock and consultancy services.

Other supporting agencies relevant in surveillance and other aspects of animal diseases control include; the Veterinary Teaching Hospitals in Nigerian Universities, the Veterinary Medicine and Allied Products Directorate of the National Agency for Food, Drugs Administration and Control (NAFDAC), the National Park Services, the One Health coordinating unit of the Nigeria Centre for Disease Control (NCDC), private veterinary practitioners and private veterinary laboratories, Military and paramilitary agencies

1.2.6 Human Health Structure

In 2015, Federal Ministry of Health (FMoH) estimated a total of 34,176 health facilities in Nigeria of which 88.1% are primary health care facilities, 11.7% secondary and 0.2% tertiary. Of these, 33% are owned by the private sector, which provides 60% of health care in the country. While 60% of the public primary health care facilities are in the northern zones of the country, they are mainly health posts and dispensaries that provide only basic curative services (NSDPH, 2018).

Since health is on the concurrent list, each of the three tiers of government has its roles and responsibilities regarding health issues. Integrated Disease Surveillance and Response (IDSR) is a strategy within the WHO-AFRO region which promotes rational use of resources by integrating and streamlining common surveillance activities. Health facilities e.g. dispensaries, health centres, clinics, hospitals (both private and public) constitute the first level of disease surveillance and reporting. The laboratory is an integral component of surveillance, especially for the purpose of case confirmation through identification of causative organisms or pathogens, management, and public response/interventions. The NCDC manages the National Reference Laboratory (NRL) in Gaduwa, Abuja, and supports a network of public health laboratories across the country. There are other laboratories with capacity for the diagnosis of human rabies, including those under the Africa Centre of Excellence in Neglected Tropical Diseases and Forensic Biotechnology (ACENTDFB, ABU Zaria), Africa Centre of Excellence for Genomics of Infectious Diseases (ACEGID), Nigerian Institute for Medical Research (NIMR), among others. In addition, the NCDC is the secretariat for the coordination of One Health (OH) implementation activities in Nigeria.

1.2.7 Environmental Health Structure

Over the years, poor environmental sanitation and negative environmental changes have contributed significantly to the high prevalence of communicable diseases in the country including rabies, malaria, cholera, typhoid, other diarrheal illnesses, Lassa fever, monkeypox, yellow fever, acute respiratory infections, tuberculosis, helminthic infections etc. These have accounted for a significant percentage of morbidity and mortality in humans. Despite increased efforts by successive g overnments and development partners at improving public health and quality of life, basic health indicators have remained poor as these environments-related diseases still play significant roles in creating ill health. The environmental Health structure is operational across the three tiers of government (federal, states and local government). The federal level formulates and implements policies and guidelines.

The Department of Pollution Control and Environmental Health is saddled with the task of implementing some components of the policies which include: health education, school health services, noise pollution control, market sanitation and abattoir waste management. The Department works closely with National Environmental Standards and Regulations Enforcement Agency (NESREA), Environmental Health Officer Registration Council of Nigeria (EHORECON) and National Park Services (NPS) and has 37 desk offices across the states.

To further strengthen coordination and management of activities, the FMEnv through the department is currently developing a Centre for integrated National Environmental Health Surveillance System (CINEHSS) to compliment the efforts from the National Environmental Reference Laboratory (NERLS). In addition, the Ministry recently developed the Biosafety Act under the National Biosafety Management Agency (NBMA) with other stakeholders to promote biosafety and biosecurity in all sectors including the agricultural sector.

1.2.8 Biodiversity and Wildlife Resources

Nigeria occupies a unique geographic position in Africa with one of the richest biodiversity on the continent due to its highly varied climate and diverse geographic features. It has about 8,000 recorded species of plants, 22,000 species of animals including insects and over 3,000 species of birds and varied species of microorganisms (NBSAP, 2010). In addition, it is a global hotspot for primate species, with great diversity found in the National Parks and Gulf of Guinea forests of Cross River State and adjacent parts of Cameroon. The National Park Service (NPS) is saddled with the task of conserving, preserving, protecting and enhancing of floras and faunas of protected areas (NBSAP, 2010).

Currently, there are 7 existing National Parks (NP) in Nigeria and 10 more awaiting presidential proclamations. The NPS is headed by the Conservator General, while Ecology and Resource Management (ERM) department generally oversees the affairs of the unit parks. There are Game Reserves (GR) within the states which are managed by Game Guard Rangers (GGR) as appointed by their state commissioners.

CHAPTER TWO
EPIDEMIOLOGY OF RABIES

2.1 Reservoir

In Africa generally, rabies virus cycle is maintained primarily among domestic dogs. However, other carnivores may serve as non-maintenance host (Knobel *et al.*, 2004). This suggests that mass vaccination targeting domestic dogs would have the greatest impact in reducing the risk of infection in all other species including humans, livestock, and wildlife (Lembo *et al.*, 2010). The role of bats and other carnivores in human rabies transmission in Africa appears minimal. However, in some parts of the world like the Americas, bats are the source of most human rabies deaths while deaths following exposure to foxes, raccoons, skunks, jackals, mongoose, and other wild carnivores host species are rare.
Majority (84%) of rabies outbreaks in Africa and Asia occur in the rural hard-to-reach communities and low-income people. Approximately, 60% of rabies occur in children under 15 years, making rabies the seventh most important infectious disease worldwide (WHO, 2018; Mauti *et al.,* 2020).

2.2 Transmission

The most common mode of transmission of rabies to humans is usually following a bite by an infected animal. Transmission can also occur via animal scratch, or when infectious material such as saliva or brain tissue comes into direct contact with human mucosa or fresh skin wounds in the laboratory or during butchering. Human-to-human transmission through bite is possible but rare. Also in rare cases, rabies may be contracted via transplantation of an infected organ. Ingestion of raw meat or other tissues from animals infected with rabies has not been documented as a source of human infection.

2.3 Clinical features in animals

The incubation period in animals can vary considerably. In dogs and cats, it is between 2 to 12 weeks, although longer incubation periods have been reported. There are two distinct forms of rabies in animals; furious and dumb forms. The furious form is the classic "mad-dog syndrome" and may be seen in all species. The animal becomes irritable and may viciously and aggressively use its teeth, claws, horns, or hooves to attack inanimate objects, humans and other animals, without provocation. Such animals lose caution and fear of humans and other animals. The dumb/paralytic form of rabies manifests with ataxia and paralysis of the throat and jaw muscles, often with profuse salivation and the inability to swallow. These animals may not be vicious. Rabid dogs or cats die within 10 days of onset of symptoms.

2.4 Clinical features in humans

In humans, the incubation period for rabies typically ranges from 1–3 months but may vary from less than a week to more than a year. The initial symptoms of rabies include fever, sore

throat, pain or an unusual or unexplained tingling, pricking, or burning sensation (paraesthesia) at the bite site. As the virus spreads, it progresses through the central nervous system, causing fatal inflammation of the brain and spinal cord, leading to either of the two forms of the disease (furious or paralytic rabies). Signs exhibited by patients with furious rabies may include: hyperactivity, excited behaviour, hydrophobia (fear of water), photophobia, aero-phobia, and death after a few days. Paralytic rabies accounts for about 30% of the total number of human cases. This form of rabies runs a less dramatic and usually longer course than the furious form. The muscles gradually become paralyzed, starting at the site of the bite or scratch, coma slowly develops and death eventually occurs. The paralytic form of rabies is often misdiagnosed, contributing to the under-reporting of the disease. Once symptoms of the disease develop, fatality is 100%.

2.5. Diagnosis of Rabies

In animals, the direct Fluorescent Antibody Test (dFAT) is the recommended diagnostic test. This test detects the presence of rabies antigens in brain tissue. Other diagnostic techniques include reverse Transcription Polymerase Chain Reaction (RT-PCR), direct Rapid Immunohistochemistry Test (dRIT) and serological tests (fluorescent antibody neutralization test, rapid fluorescent focus inhibition test). Several tests are required to diagnose rabies in human victims; no single test is sufficient. Tests are performed on samples of saliva, serum, spinal fluid, and skin biopsies of hair follicles at the nape. Saliva can be tested by virus isolation or reverse transcription followed by polymerase chain reaction (RT-PCR). Serum and spinal fluid are tested for antibodies to rabies virus. Skin biopsy specimens are examined for rabies antigen in the cutaneous nerves at the base of hair follicles. If ethical permission is obtained, diagnosis can be performed on the brain tissue using dFAT. Other diagnostic tests that have been used are RT-PCR and dRIT.

2.6. Prevention and Control

Vaccination is the most effective method of pre-exposure treatment against rabies infection (Chen *et al.,* 2013). Once exposure occurs, modern prophylaxis entails immediate wound care, local infiltration of rabies immune globulin around and in the site of bite and parenteral administration of modern cell culture vaccines in multiple doses (CDC, 1982; WH0, 2010). Pre-exposure prophylaxis (PrEP) should be given to selected population groups at risk of occupational exposure. Canine rabies elimination is the key towards ultimate reduction of the disease burden, as first illustrated in developed countries (Rupprecht *et al.*, 2006; Chen *et al.*, 2013). Implementation of oral vaccination in free-ranging carnivore hosts demonstrates the feasibility of disease abatement in wildlife populations in particular, as demonstrated in Europe and North America, with an enhanced need for application to developing countries in the Americas, Africa and Eurasia (Rupprecht *et al.*, 2006). The low level of commitment to rabies control in many countries could be partly attributable to lack of accurate and extensive surveillance data to indicate the public health burden of the disease (Weyer and Blumberg, 2007).

2.7 Rabies Situation in Nigeria

2.7.1 History of Rabies in Nigeria

Rabies is one of the deadliest tropical zoonoses and remains an important public health challenge in Nigeria. It has been reported severally in humans and dogs since 1912 and 1925, respectively (Bougler and Hardy, 1960; Umoh and Belino, 1979; Tomori and David-West, 1985; Umoh *et al.*, 1988). Nigeria documents approximately 10,000 dog-bite incidents annually (NCDC, 2018) with over 1600 deaths as in Figure 2 (Hampson *et al.*, 2015). The last national rabies mass dog vaccination campaign conducted in Nigeria was in 1982 (WHO, 2019; Mshelbwala *et al.*, 2022). These vaccination campaigns reduced rabies incidence to the barest minimum, but the collapse of the vaccination programme after 1982 has changed the rabies situation and today, rabies is more widespread in every part of the country. The Federal Ministry of Agriculture and Rural Development (FMARD) has been providing anti-rabies vaccines to all the states from 2006 to date in order to assist in mass dog vaccination (MDV) campaigns and outbreak response with recent supports from WOAH and REDISSE. However, there are challenges in accessibility of vaccines as well as implementation of the national rabies control guidelines.

2.7.2 Burden of Rabies in Nigeria

The current surveillance system and diagnostic capacity for rabies in Nigeria is insufficient and has resulted in underestimation of the burden of rabies in Nigeria. The National Veterinary Research Institute (NVRI) Vom reports showed 3,555 out of 3,770 animal rabies cases confirmed in dogs during the period of 1928 to 1990 in Nigeria. While human rabies survey in 1981 revealed 169 cases of laboratory or clinically diagnosed human rabies cases from 38 health care centres and five state epidemiological units from 1969 to 1978 (Fagbami *et al.*, 1981). In the last six years, over 1000 cases of suspected human rabies has been reported in Nigeria. The highest was in 2019 (Figure 3). Considering the fact that the disease is highly under reported, the above figures are not the true reflection of human cases of rabies in the period under review. Consequently, efforts need to be intensified to strengthen disease reporting in order to reflect the true situation of rabies in the country for proper public health planning and implementation of interventions.

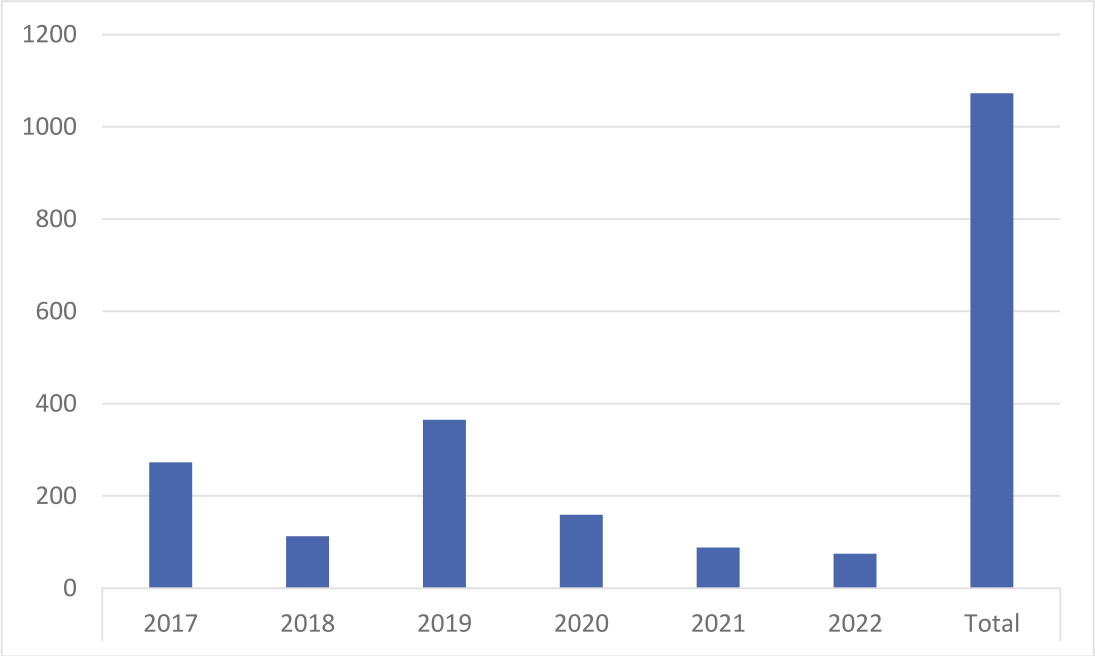


Figure 2: Cases of suspected human rabies from 2017-2022 in Nigeria (NCDC)

From a scoping review of 32 published dog rabies studies (Mshelbwala *et al.*, 2021) between 1999 and 2019, the prevalence of rabies virus antigen detection among dogs varied between 3% and 28%, with more studies in the north (Figure 3). Most dog bites were unprovoked (36.4%-97%) and had low vaccination rates of 12–38%. Also, the GARC between 2006-2018 reports the highest percentage (78.4%) of rabies positive animal samples per year in Nigeria in 2009 (Figure 4). While from January 2018 to August 2022 the highest rabies positive cases were in 2019 (Figure 5).

In the period under review (2015-2018) 28% of the health facilities (HF) in Nigeria had access to biologics. The highest percentage of HF (9%) was documented in 2015, then there was a downward trend thereafter (Figure 6).

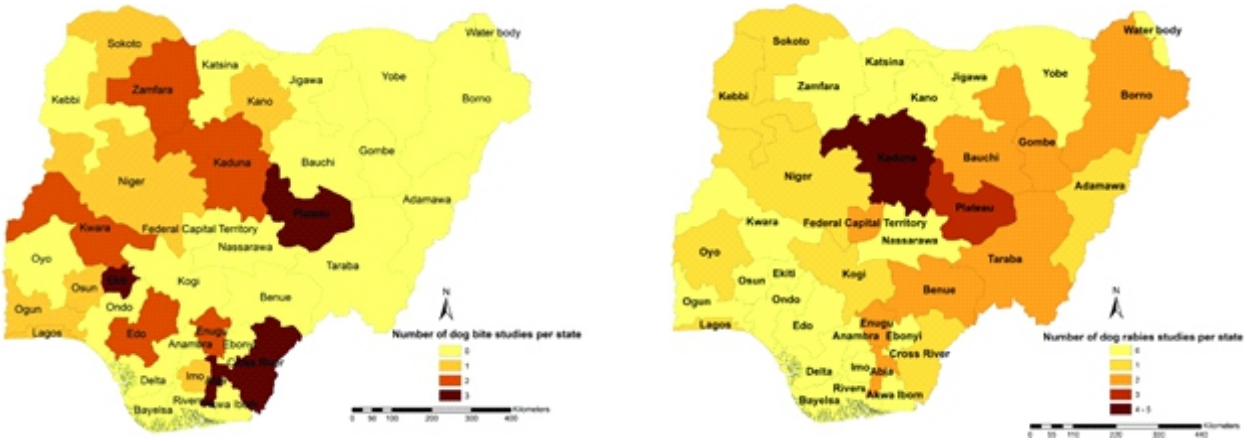


Figure 3: Spatial distribution of selected dog bite and dog rabies studies (1999-2019) across Nigeria (Mshelbwala *et al.*, 2021).

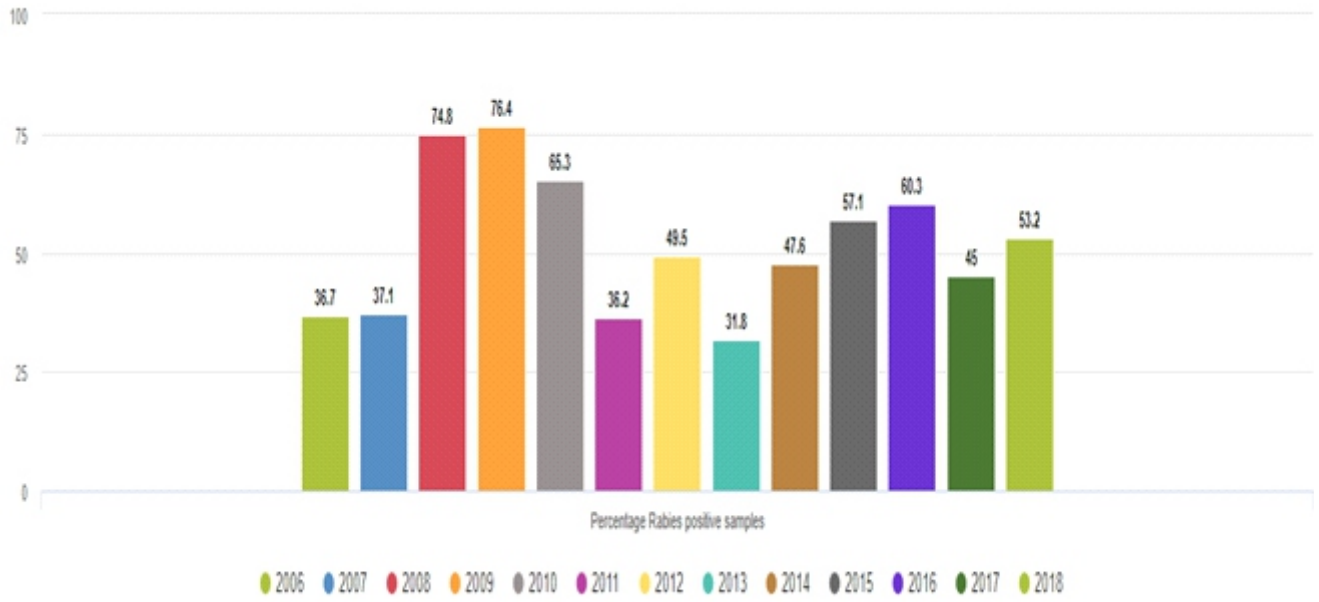


Figure 4. Percentage of rabies positive samples per year (2006-2018) in Nigeria (Source: GARC Nigeria)

Figure 5: Distribution of Animal rabies cases across the six geopolitical zones (Source: NVRI)

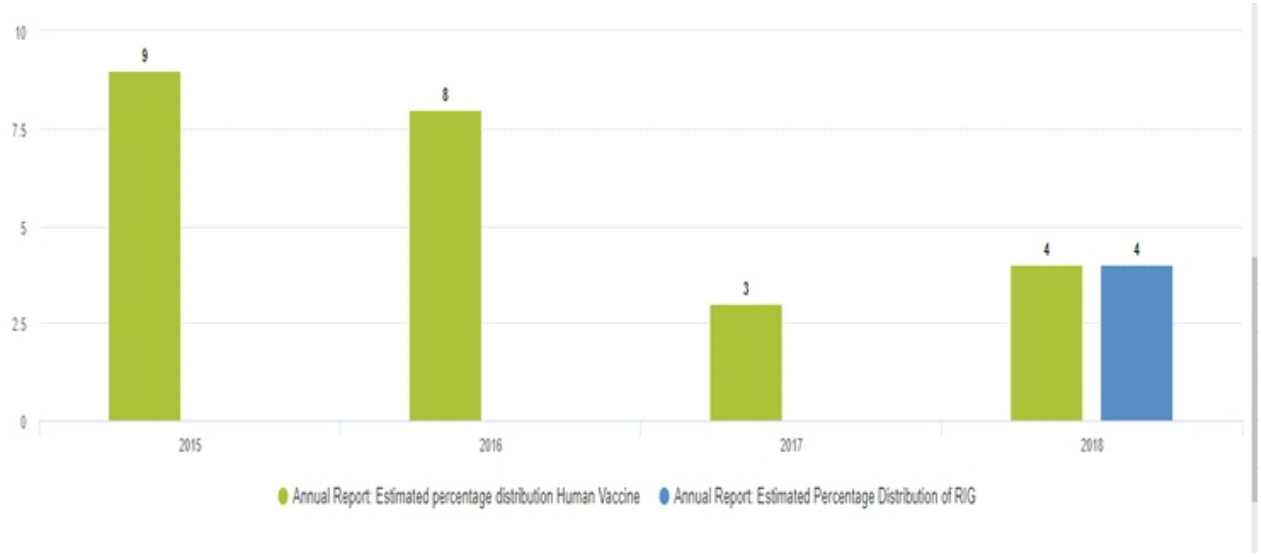


Figure 6: Percentage of healthcare facilities with access to rabies biologics (2015-2018) in Nigeria (Source: GARC Nigeria)

CHAPTER THREE

RABIES PREVENTION AND CONTROL IN NIGERIA

3.1 Current canine rabies control policy

Available evidence indicates a very long experience with rabies in Nigeria. However, control efforts have remained patchy. The National Reference Laboratory at NVRI handles an "erratic stream" of samples from field outbreaks. Active surveillance is limited to isolated surveys in dogs and bats and passive surveillance data consistently document rabies cases across the country. Local outbreaks are accompanied by mostly independent responses from the health and veterinary authorities. Recently, with the establishment of One Health platform in Nigeria, outbreaks are jointly investigated and managed multi-sectorally. The importation of dogs through formal entry points is subject to checks and quarantine with facilities available at major airports. However, Mshelbwallacross border movements of dogs across porous land borders continue to be a challenge.

The FDVPCS continuously supports states veterinary services with vaccines for routine and annual vaccination campaigns. Evaluation of vaccinations and immunization status of dogs and dog ecology studies are done mainly as part of research in universities rather than active nation-wide surveys. Public awareness campaigns are sporadically conducted, more often in response to local outbreaks such as those organized by the local and national chapters of the Nigeria Veterinary Medical Association (NVMA) in collaboration with federal and state governments. Human mortality due to dog-mediated rabies is on the increase. Moreover, accessibility to post exposure vaccines and immunoglobulins is limited and difficult to obtain at local hospitals due to cost and lack of a national or state stockpiles.

An overview of Nigeria's progress in line with the stages of SARE reveals that over the past years, the FDVPCS has consciously built the capacity of field epidemiology officers (Federal and States), private veterinarians, veterinary laboratory technologists, farmers, dog breeders and other stakeholders to escalate disease reporting through appropriate channels to the right quarters. The NADIS platform has also recently undergone an upgrade for real time reporting which is expected to enhance surveillance, reporting and improve data collection. There are many documented and undocumented cases of dog bite cases and confirmed cases of rabies in animals and suspected cases in humans in Nigeria. While the National One Health platform and action plan has ushered in a new era of multi- sectoral collaborations, there is no dedicated policy for control of dog-mediated human rabies in Nigeria.

3.2 Legal Framework and Legislation

The Nigerian landscape abound with laws and regulations relevant to rabies control. These laws have variable levels of implementation and or enforcement, mostly without deliberate coordinated action plans for rabies control. The Government has a national programme for the control of canine rabies which revolves around annual vaccination of dogs greater

than 3 months. Below are some of the laws that are deployable in rabies control across the OH sectors:

3.2.1 Dog Ordinance (Rabies control law) of 1942 (repealed).

The Dog Ordinance was initially intended for the control of rabies within the municipality of colonial Lagos, and subsequently provided the enabling legislation for the whole of Nigeria. The law provides amongst other provisions for:

- Prohibition of importation of dogs into Nigeria for the purposes of preventing the introduction of dogs with rabies.
- Prohibition of the keeping of dogs without license.
- Vaccination of dogs against rabies.
- Declaration of diseased areas, provision of movement of dogs in diseased areas, other measures of rabies control including disposal of dead dogs.

Overall, the major legislation for animal disease control in Nigeria is the Animal Disease Control Act which is complemented by other laws for a comprehensive legal and regulatory framework for the control of rabies, as enumerated below:

3.2.2 Animal Disease Control (Repealed and Re-enactment) Act 2022

It is the enabling law empowering the veterinary services at all levels of government for the control and prevention of animal diseases. The law is resident in the FMARD under the authority of the Minister. Its key provisions amongst others are:

- Control of importation of animals, animal products, semen, hatching eggs, vaccines, and biologics.
- Control of animal movement including provisions of control posts.
- Handling of infected animals.
- Surveillance for animal diseases and disease reporting
- Declaration of disease situations and intervention measures.
- Handling and disposal of dead animals.
- Vaccinations and vaccine handling for prophylaxis and in response to outbreaks

Currently, the Dog Control Policy of the FDVPCS derived from the Act provide the major guidelines for the control of rabies in dogs. The Dog Control Policy initiative for the country provides the enabling environment for the development of mechanisms (strategies and work plans) for the implementation of various provisions of the Dog Control (Canine Health and Welfare) Regulation 2022. The highlights of the various provisions are as follows:

- Regulations for the control of dogs within the country so that they do not cause danger (associated with rabies), distress, or nuisance to the environment.
- Regulations for the importation of exotic dogs into the country through strict and rigorous veterinary certification processes and procedures
- Regulations to ensure responsible dog ownership and control of stray dog population
- Guidelines for implementation of risk-based surveillance for dog–mediated rabies as well as integrated bite case management.
- To consolidate other regulations relating to the licensing, control, and registration of dogs for the prevention and control of rabies.

3.2.3 NVRI Act No.35 (1975)

This Act is the enabling law of the National Veterinary Research Institute (NVRI), that mandates the institute to amongst other issues:

- Conduct research into all aspects of animal diseases, their treatment and control.
- Develop and produce animal vaccines, sera and biological to meet the National demand (including rabies vaccines).
- Surveillance and diagnosis of animal diseases; including sharing of laboratory data with the FDVPCS and other stakeholders.
- Train intermediate manpower in veterinary laboratory technology and animal health and production technology.

3.2.4 Nigeria Agricultural Quarantine Service Act, 2017

This act prevents the entry, establishment and spread of exotic diseases of plants, animals and aquatic resources and their products into Nigeria. It enables the country conduct risk assessment for exotic diseases and monitor the importation of dogs as the first line of defense against importation of rabies through dog movement.

3.2.5 Veterinary Surgeons (Amended) Act, 2016

This Act provides for the training and registration of Veterinary Surgeons and matters connected therewith. The law mandates the Veterinary Council of Nigeria to maintain standards of veterinary education and practice. It also enables the Council to register and monitor the conduct of veterinarians and para-veterinarians in Nigeria, and where necessary institute disciplinary measures against practitioners in cases of unethical conduct.

3.2.6 National Environmental Standard Regulation Enforcement Agency Act, 2007

This Act enforces compliance with the provisions of international agreements, protocols, conventions, and treaties on the environment, including climate change, biodiversity, conservation, desertification, forestry, oil and gas, chemicals, hazardous wastes, ozone depletion, marine and wildlife, pollution, sanitation, and such other environmental agreements as may from time to time come into force.

3.2.7 Nigeria Centre for Disease Control (NCDC) Act 2018

The Act establishes the Nigeria Centre for Disease Control for the prevention, detection, investigation, monitoring and control of Communicable disease in Nigeria and for related matters. The law provides for the development of guidelines and standards for relevant public health activities at all levels in the country and communicate information to the public on the need to protect themselves from public health threats.

The NCDC Act empowers the agency to also develop and maintain a network of reference and specialized laboratories for pathogen detection, disease surveillance and outbreak response; Coordinate the operationalization of, and ongoing international health regulations, including trans-border disease surveillance and control activities and lead the collaboration with global health agencies. The agency coordinates the implementation mechanisms of the Nigeria multisectoral One Health Action plan that was revised in 2022 and the National Action Plan for Health Security (2018-2022) including the implementation of the Global Health Security Agenda.

3.3 In-country competent authorities and other stakeholders for rabies control

The implementation of this NSP is anchored on the existing OH collaborations of the Federal ministries of Agriculture and Rural Development, Health, and Environment at the national level and the States Ministries of Agriculture, Health and Environment at sub-national levels.

The key competent authorities and stakeholders' analysis are presented in Annex II:

3.4 Key on-going activities in control of rabies in Nigeria

3.4.1 Rabies surveillance

Rabies is a notifiable disease in Nigeria and is captured in the routine national surveillance systems of both the animal and the human sectors, though there is gross under-reporting. Surveillance is ideally supposed to be coordinated jointly between the human health and animal health sectors but this is seldom practiced.

The national veterinary epidemio-surveillance network (ESN) established during the Pan African Programme for the Control of Epizootics (PACE), and effectively deployed in the activities of the rinderpest eradication programme, is still in place in Nigeria. The network continues to serve for the detection, control and reporting of all WOAH listed diseases including dog-mediated rabies. The network comprises the following:

i. Federal Veterinary Services at Headquarters and 37 State field offices (one per state and FCT)
ii. State Veterinary Services with Zonal and Area Veterinary offices located at the LGAs
iii. Local Government Agriculture Departments with veterinary units.
iv. A total of 591 surveillance agents and points located at disease high risk areas such as livestock/live bird markets, abattoirs, and control posts, etc. These surveillance agents comprise of veterinary surgeons and veterinary paraprofessionals.

The National Veterinary Research Institute Laboratory, eleven (11) University Veterinary Teaching Hospitals Laboratories and several private laboratories whose activities are supervised by government laboratories under a public-private-partnership arrangement are in place for both surveillance and disease diagnosis.

Passive surveillance is routinely carried out by veterinary surgeons and veterinary paraprofessionals especially at the surveillance points. Disease outbreak incidence are reported by the veterinarian, veterinary paraprofessionals, or community animal health worker to the surveillance agent or Area/Zonal veterinary officer who carries out the preliminary investigation and institutes preliminary control measures. The report is then made to the Director of Veterinary Services (DVS) at the State level while samples are forwarded directly to the central laboratory at NVRI or through the Veterinary Teaching Hospitals (VTHs) as appropriate. The affected DVS, in liaison with the Federal Epidemiology Officer domiciled in the State, then makes a report to the Chief Veterinary Officer of Nigeria (CVON) who in turn notifies the AU-IBAR and WOAH. Meanwhile, disease outbreak mitigation measures are implemented to control and prevent further spread of the disease.

The existing surveillance system is outlined in Figure 7. The Integrated Disease Surveillance and Response (IDSR) strategy (JEE, 2017) employed by NCDC, integrates surveillance activities for different diseases (NCDC, 2019). The IDSR should capture all suspected human cases of rabies but covers less than 50% of the country's health facilities (Fall *et al.*, 2019). Challenges to the implementation of IDSR include inadequate funding, insufficient disease reporting tools (via paper-based registers), and lack of personnel capable of detecting, reporting, collating and interpreting surveillance data (Ibrahim *et al.*, 2020). The situation for animal health surveillance is worse. There are inadequate risk assessments, outbreak investigations and response including poor linkage and data sharing between the public health and veterinary sectors which are needed to guide rabies control and prevention measures.

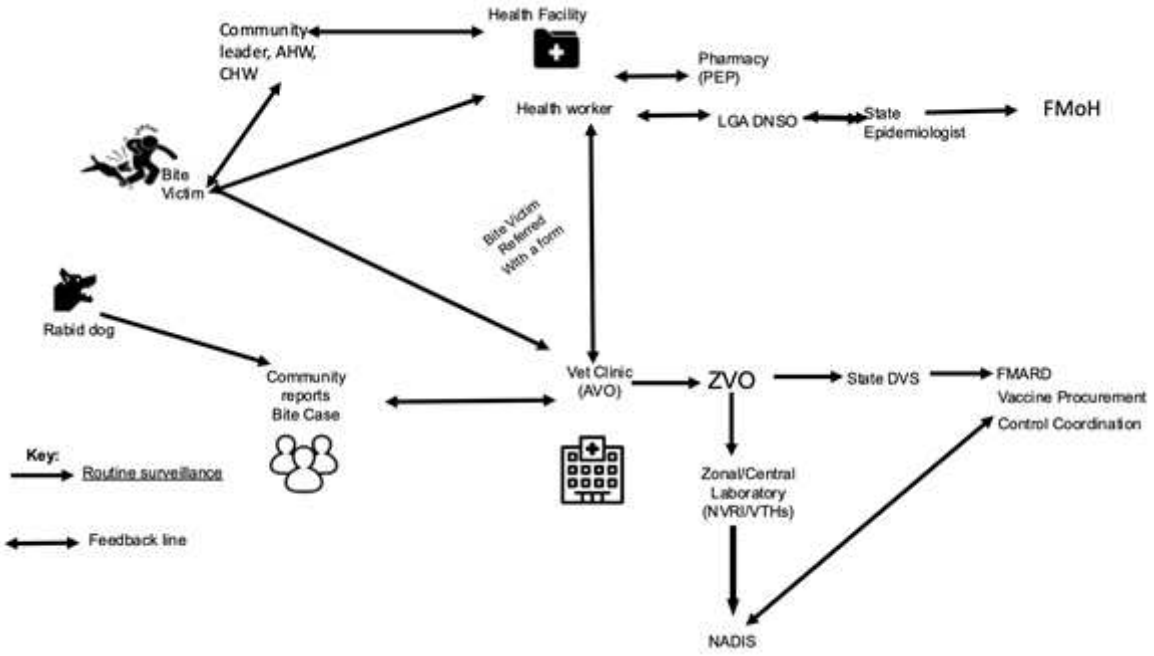


Figure 7: Nigeria's rabies Routine surveillance framework.

PEP = post-exposure prophylaxis; DNSO = the Disease Notification and Surveillance officer; LGA = Local Government Area, NCDC = The Nigeria Centre for Disease Control; FMARD = Federal Ministry of Agriculture and Rural Services Development, NADIS = National Animal Disease Information service; NVRI = National Veterinary Research Institute; VTHs = Veterinary Teaching Hospital; DVS = State Director of Veterinary Services. (Source: Kia GSN unpublished)

3.4.2 Laboratory diagnosis and capacities

Surveillance capacity in both the animal and human health sectors is limited and disease detection is hampered by inadequate laboratory facilities and difficulties in submitting samples to laboratories from rural areas (JEE, 2017; Konzing *et al.*, 2019). These limitations also render national epidemiological data unreliable with substantial under-reporting of both human and animal rabies cases (Fall *et al.*, 2019) and under estimation of the mortality burden of rabies and its economic impact (Ibrahim *et al.*, 2017; Okoh *et al.*, 2018). This had led to rabies control not being prioritized by decision makers against other competing public health concerns in the past.

The NVRI, Vom produces the dog anti rabies vaccines as well as serves as the WOAH reference laboratory for rabies diagnosis. are Also, the Department of Veterinary Public Health and Preventive Medicine servicing the Veterinary Teaching Hospital of ABU Zaria conducts the WOAH and WHO gold standard approved direct fluorescent antibody test (dFAT) (Okoh *et al.*, 2018; Suleiman *et al.*, 2020; Mshelbwala *et al.*, 2022) (Table 2), and

recently, the Joseph Sarwuan Tarkaa University Makurdi (JOSTUM). Moreover, the cost of acquiring and maintaining a fluorescent microscope and obtaining good conjugate limits the use of dFAT in Nigeria.

There is some limited capacity in-country for rabies molecular diagnosis in NVRI and some Universities such as the Ahmadu Bello University Zaria which hosts the World Bank Funded Africa Centre of Excellence for Neglected Tropical Diseases and Forensic Biotechnology (ACENTDFB). One of the Diseases ACENTDFB focuses on is rabies and researches are ongoing on epidemiology, control vaccine production and treatment.

Table 1: Summary of studies reporting the prevalence of rabies virus detection among Nigerian dogs.

SN	State	Year	Type of test	Total sampled	# positive	Prevalence	Ref
1	Abia	2013	FAT, dRIT and RICT (NVRI)	100	5	5%	[23]
2	Abia	2014	FAT (ABU)	185	13	7%	[49]
3	Enugu	2015	FAT (NVRI)	152	6	4%	[103]
4	Enugu	2018	FAT, RT-PCR, (NVRI & Abroad)	252	23	9%	[104]
5	Kogi	2020	FAT (ABU)	208	11	5%	[19]
6	Plateau	2018	FAT & RT-PCR (NVRI & Abroad)	532	92	17%	[33]
7	Lagos	2013	FAT (ABU)	444	7	2%	[30]
8	Adamawa	2010	FAT and Microscopy (NVRI)	50	22	44%	[105]
9	Bauchi	2014	FAT (NVRI)	202	44	22%	[95]
10	Sokoto	2010	FAT and MIT(NVRI)	50	13	26%	[106]
11	Borno	2006	Microscopy and Immunohistochemistry	52	16	31%	[32]
12	Kaduna	2017	FAT & RICT (NVRI)	50	8	16%	[29]
13	Kaduna	2014	FAT, dRIT, RT-PCR and MIT (NVRI and abroad)	30	15	50%	[107]
14	Kaduna	2012	FAT (ABU)	200	14	7%	[108]
15	Kaduna	2011	FAT (ABU)	100	6	6%	[98]
16	Kaduna	2019	FAT (ABU)	154	6	4%	[59]
17	Cross River	2013	FAT (ABU)	177	6	3%	[80]
18	Taraba	2014	FAT (ABU)	188	15	8%	[57]
19	Taraba	2019	FAT (NVRI)	150	3	2%	[109]
20	Abuja	2012	FAT (NVRI)	50	50	100%?	[110]
21	Abuja	2014	FAT (ABU)	150	18	12%	[111]
22	Gombe	2020	FAT and RT-PCR (ABU)	50	3	6%	[81]
23	Oyo	2016	dRIT (UI)	47	5	11%	[28]
24	Gombe	2019	FAT (NVRI)	118	9	8%	[112]
25	Borno	1999	In situ hybridisation (Abroad)	25	11	44%	[31]
26	Benue	2009	FAT (NVRI)	76	12	16%	[113]
27	Plateau	2015	FAT (NVRI)	203	10	5%	[24]
28	Benue	2020	FAT(ABU)	464	52	11%	[114]
29	Kebbi	2019	FAT and RT-PCR (ABU)	49	6	12%	[115]
30	Plateau	2013	FAT (NVRI)	321	150	47%	[116]
31	Niger	2015	FAT (NVRI)	471	4	1%	[117]
32	Bauchi	2007	FAT (NVRI)	44	10	22%	[118]

ABU- Ahmadu Bello University, dRIT- Direct Rapid Immunohistochemistry Test, FAT- Fluorescent Antibody Test, MIT–Mouse Inoculation Test, NVRI- National Veterinary, RT-PCR- Reverse Transcription Polymerase Chain Reaction

https://doi.org/10.1371/journal.pntd.0009617.t001

3.4.3 Awareness and education

Awareness activities on rabies are carried out especially during World rabies day celebrations and preceding mass dog vaccination exercises. There are numerous IEC materials to support this effort. Several workshops have been carried out targeting school children, because they are more often exposed to dog bites due to their intimate relationship with pets.

3.4.4 Integrated Bite Case Management

Integrated Bite Case Management (IBCM) is an approach for rabies surveillance that directly and formally links workers in public health and veterinary sectors to assess the risk of rabies among animal bite patients and biting animals, respectively (Wallace *et al.*, 2015; Lushasi *et al.*, 2020). The IBCM increases rabies case detection (Wallace *et al.*, 2015), improves the administration and cost-effectiveness of PEP (Undurraga *et al.*, 2017), and is a potential surveillance strategy for verifying freedom from rabies.

The urgent need to enhance surveillance to improve timely case detection and informed rabies control and prevention, by operationalizing a "One Health" approach in view of the global target of "Zero by 30", calls for the implementation of IBCM . This will support intersectoral collaboration between health and veterinary workers in Nigeria. There is need for capacity building, training of government personnel and other health workers to implement IBCM. This will entail risk assessments of bite patients by health workers, investigations by the veterinarians or livestock field officers to diagnose rabid animals, and the use of a mobile phone application to support integration (Lushasi *et al.*, 2020).

The IBCM targets PEP to cases identified as bitten by suspect rabid dogs rather than indiscriminately, thereby controlling PEP demand as rabies incidence declines. The IBCM should therefore be encouraged under all scenarios (Hampson *et al.*, 2019).

3.4.5 Mass dog vaccination campaigns

Mass dog vaccination (MDV) campaigns especially coordinated from the national level remains the singular most effective control measure for dog-mediated human rabies. The FDVPCS supports states veterinary services with supply of vaccines for mass vaccination and routine immunization in veterinary clinics. States also acquire dog anti-rabies vaccines directly from the NVRI that produces the low egg passage live attenuated vaccine. Dog mass vaccinations may also take place alongside other livestock vaccinations, particularly in peri-urban and rural locations. Vaccination coverage is impeded by inadequacy of vaccines at field level, passive attitude of dog owners to vaccination encouraged by low level of enforcement of laws that mandate compulsory vaccination of eligible dogs.

3.4.6 Updating dog population data (Census) in Nigeria

Dog ecological studies or local dog counts have been conducted in many parts of Nigeria. Most of the surveys were in urban areas and were not contiguous in space and time. These

surveys are associated with rabies-related epidemiological research in universities with a few conducted by FMARD. Most of the survey undertaken were ground direct street counts, with few instances of aerial surveys. A nation-wide or large multiple state surveys are yet to be conducted. However, the unconnected studies provide very valuable information for organizing vaccinations and further ecological studies. The rather scanty population data provide estimates of population of household and other categories of dogs, demographic information, population density, accessibility to vaccination and coverage, dog management practices and ownership patterns. Currently, dogs in Nigeria are categorized into 6 population groups (Annex III). The grouping is derived from dog ecology studies and intended to guide targeted interventions such as public health education, awareness campaigns and surveillance. Updating available dog population data is imperative for planning of vaccinations and other interventions.

CHAPTER FOUR

ELIMINATING DOG-MEDIATED HUMAN RABIES IN NIGERIA

Nigeria is endowed with human and natural resources, with one of the largest human populations in the world. This presents huge opportunities and problems in surveillance, vaccination coverage and other aspects of rabies control.

4.1 Achievements, Gaps and Challenges

There is a growing societal awareness on rabies in Nigeria, partly due to increased access to information on conventional and new media including during World Rabies Day that is celebrated widely across Nigeria. There is also an increasing political commitment with on-going activities on One Health in the country. Nigeria has the capacity for anti-rabies vaccine production and can leverage on existing number of both public and private laboratories for rabies diagnosis; with a few having capacity to genotype rabies virus isolates. Since 2019, the country has established a National One Health platform that has developed multisectoral surveillance system and re-prioritization of endemic zoonotic diseases which has ranked rabies as a priority zoonosis.

There is a general increase in interest in zoonotic diseases among influential national stakeholders and development partners. However, there is inadequacy of data on burden of rabies due to poor surveillance and reporting. Rabies vaccines and biologics for prevention of human rabies are in short supply and most field activities for rabies control are uncoordinated, with inadequacies in mass dog vaccination coverage and integrated bite case management(IBCM) across the country for laboratory diagnosis of rabies. The public health infrastructure particularly at sub national level is suboptimal, the existing legislations have gaps in coverage and largely unenforced due to limited resources, mass illiteracy and ignorance on rabies impact and its control.

A matrix of the strengths, weaknesses, opportunities, and threats in rabies control is provided in Annex IV.

4.2 Assessment of Rabies Programmes

Nigeria conducted a multisectoral assessment of previous Rabies intervention programmes in March 2022 with the support of the Global Alliance for Rabies Control (GARC) using the Stepwise Approach towards Rabies Elimination (SARE) tool.

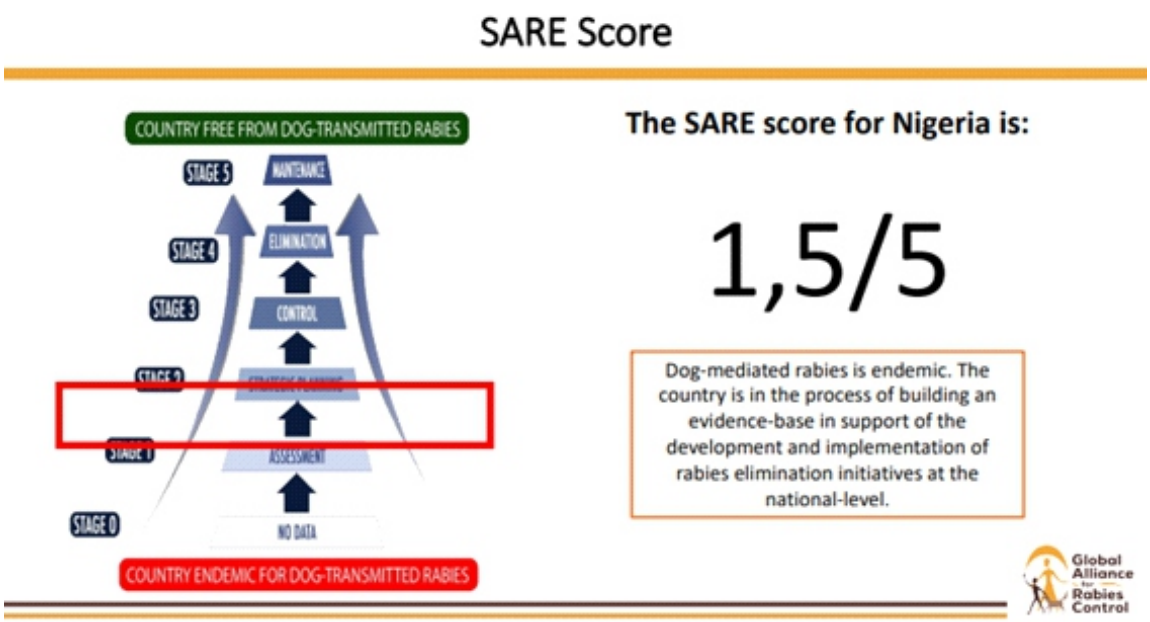
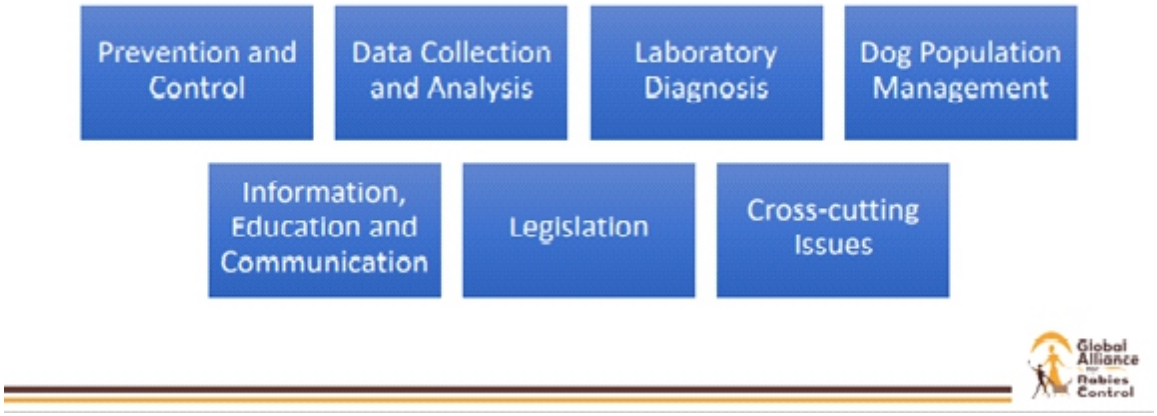


Figure 8. Stepwise Approach to Rabies Elimination: Score for Nigeria

SARE SCORE 1.5

SARE phase	stage	estimated timeline (yrs)	completed
ASSESSMENT	0-1	1 ,2 ,3	ongoing
STRATEGIC PLANNING	2	4 ,5 ,6	ongoing
CONTROL	3	7 ,8, 9	ongoing
ELIMINATION	4		

Figure 9. Stepwise Approach to Rabies Elimination: Phases and Timeline



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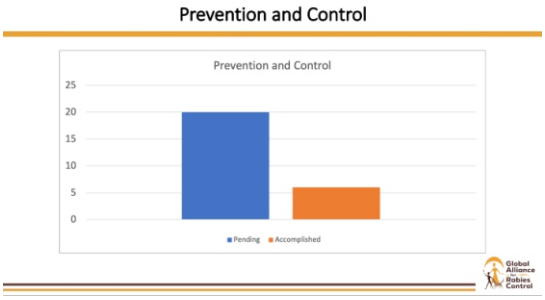

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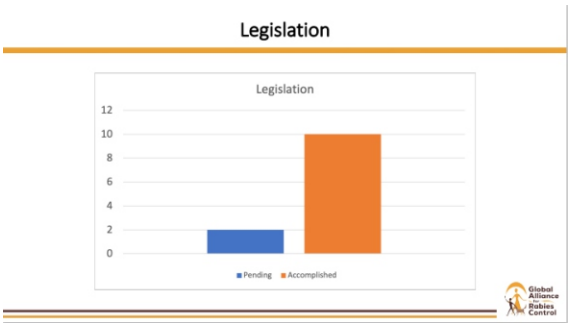

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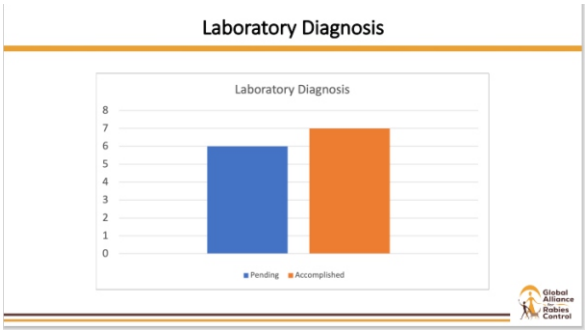
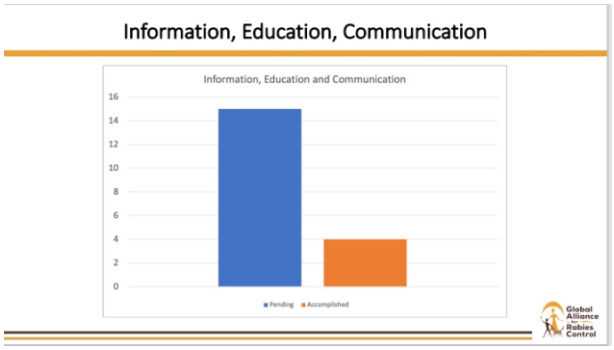
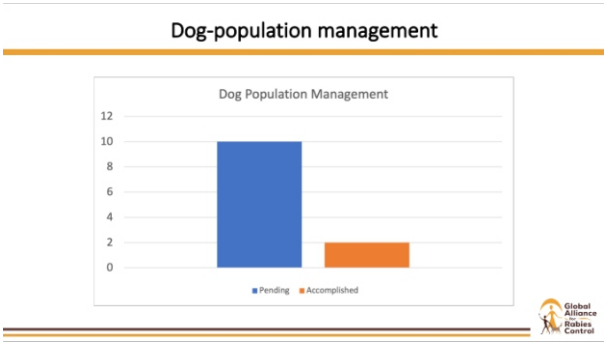


d.

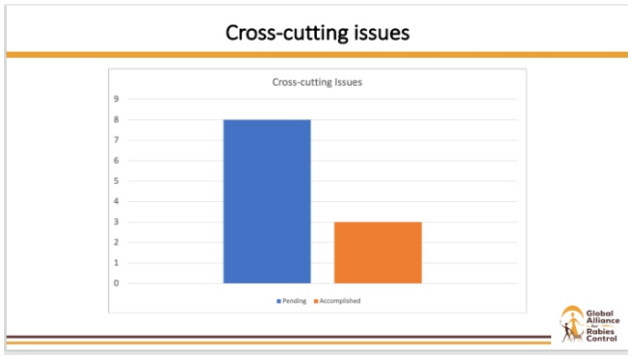
ure 10. Stepwise Approach to Rabies Elimination: Components



e.



f.



g.

The country was assessed based on the following thematic areas: Data Collection and Analysis, Prevention and Control, Laboratory Diagnosis, Legislation, Information Education Communication, Dog population management and Cross cutting Issues and had a score of 1.5.

Based on the findings, a national work plan was generated to fill the identified gaps and move the country forward from its present step towards the goal of eliminating dog mediated human rabies by 2030.

These findings guided the process during the development of this NSP in determining the common objectives and strategic interventions.

The action plan for rabies elimination and outline of programme implementation strategy are presented as Annexes I and V respectively .

4.3. Rationale for Rabies Prevention and Control

Rabies imposes a heavy public health and economic burden, particularly on vulnerable rural communities, through deaths and loss of income on livestock. An estimated 10 million people are exposed to rabies vizrus each year in Nigeria although the annual death toll is not known. Livestock are also lost each year due to rabies. Rabies is preventable through vaccination of dogs and dog population management. Additionally, rabies is prevented through community awareness and engagement, appropriate wound

management, and access to post-exposure immunization. Investing in these preventive measures will save several lives in Nigeria each year and reduce the economic impact of this disease. Furthermore, the infrastructure required to build effective rabies programmes is the same that is required to provide essential medicines, vaccines and health care to vulnerable populations. By investing in rabies elimination programmes, Nigeria will strengthen the human and veterinary health systems, improve healthcare access, and maximize the impact of each investment.

Evidence from around the globe shows that elimination of dog-mediated rabies is cost-effective and feasible with strong and sustained commitment from the human and animal health sectors. Adequate momentum has been generated globally to promote action and investment for rabies elimination with mechanisms and support in place to engage countries in rabies elimination. The time is now for Nigeria to harness the support of the global community to establish an effective and sustainable National programme.

4.4. Overall Goal

Through the implementation of the National Plan for Eliminated of Dog-Mediated Human Rabies and the fostering of collaboration across ministries and communities, Nigeria aims to decrease human deaths in the short term and ultimately eliminate human deaths from dog-mediated rabies by year 2030.

4.5 Specific Objectives

In achieving the elimination of dog-mediated human rabies by 2030, Nigeria intends to achieve the following specific objectives:

i. Strengthen capacity to detect and respond to rabies outbreaks
ii. Effectively use vaccines, medicines, tools, and technologies to reduce risk of rabies in animals and humans
iii. Generate, innovate, and measure impact by providing effective policies, guidance, governance and ensuring reliable data management system
iv. Sustain commitment and mobilize resources
v. Establish and sustain effective communication, advocacy and education of stakeholders in support of rabies control and elimination interventions.

4.6 Programme Implementation Strategy

The strategy is specified below for each strategic objective alongside the proposed strategic actions.

4.6.1 Strengthen capacity to detect and respond to rabies outbreaks.

The strategic actions are as follows:

a. Sustainable laboratory capacity
   i. Mapping and assessment of Veterinary public health laboratories
   ii. Upgrading of already existing laboratories with equipment, reagents, etc.
   iii. Review of existing SOPs
   iv. Upgrade efficiency of sample collection
   v. Continuous proficiency testing of laboratories

b. Strengthening of One Health response teams (Federal, State and LGA.
   i. Capacity building of Response teams in all states including FCT
   ii. Undertake Rapid Response Training
   iii. Provision of logistics, fueling of vehicles, transportation of samples, Cold-chain facilities.
   iv. Conduct interstate coordination workshops
   v. Quarterly Inter and intra-state collaborations to be encouraged and sustained.

4.6.2 Effectively use vaccines, medicines, tools and technologies to reduce animal and human rabies risk.

The strategic actions include:

a. Effective use of vaccines and tools to control rabies in dogs
   i. Capacity building for professionals on humane animal handling and vaccination.
   ii. Conduct mass vaccination of at least 70% of the dog population in the country.
   iii. Upgrade dog vaccination data records from paper based to digital platform, examples Software, tablets/laptops, internet, identification micro-chips/collars and scanner.
   iv. Sero-monitoring of vaccinated dogs.
   v. Advocacy and communication to increase awareness and improving education.

b. Effective use of vaccines and tools to reduce human rabies risk

i. Identify and assess health care facilities that have the required infrastructure to store and administer rabies PrEP and PEP.

ii. Capacity building for 95% of technical staff on handling human samples and vaccination.

iii. Procure and import required cell culture vaccine and rabies immunoglobulin to meet local demand.

iv. Ensure that Integrated Dog Bite Cases Management and centres are developed and implemented.

v. Sustained logistics for human and animal vaccines/serum.

vi. Improve cold chain facilities (cold rooms, freezers/refrigerators, cold-chain vehicles) to store and transport vaccines at all levels.

vii. Assess and identify animal health facilities that have the required infrastructure to store vaccine carrier, ice-packs and consumables.

viii. Contact health facilities quarterly to determine whether vaccine and rabies immunoglobulin (RIG) stock is available.

ix. Assess and enhance dog vaccines production and distribution to states.

4.6.3 Generate, innovate and measure impact by providing effective policies, guidance, governance and ensuring reliable data management system

The Strategic actions:

a. Provision of effective policies and guidelines.

I. Identify all existing policies and guidelines that may pertain to rabies control, dog population control or management.

ii. Conduct needs assessment of policies lacking in national and subnational levels based on global standards.

iii. Advocacy to relevant legislative authorities at all tiers of government regarding inclusion of identified policies.

b. Strengthening/ establishment of a robust rabies surveillance system.

i. Review scientific literature regarding rabies in the country in the past 10 years.

ii. Identify and build capacity for focal persons on rabies surveillance, reporting and diagnosis across all sectors.

iii. Assess available equipment, personnel and resources required for rabies data analysis.

iv. Identify whether existing capacity for other diseases can be used for rabies analysis.

v. Establish an interoperable functional rabies surveillance system.

vi. Continuous M&E of the rabies surveillance system.

c. Strengthening disease outbreak response.

i. Develop SOPs for integrated case investigation and response based on surveillance.

ii. Capacity building of One health RRT to investigate suspected dog and human rabies outbreak.

iii. Strengthen data sharing across the sectors.

iv. Operationalize the Joint Risk Assessment (JRA) protocols by all relevant professionals.

v. Develop sample collection SOP for outbreak response.

d. Harmonization of cross-border activities with neighboring countries.

i. Identify information that need to be reported to the relevant authorities.

ii. Collate and share relevant data with identified authorities.

iii. Facilitate buy-in from identified stakeholders.

iv. Conduct annual cross-border stakeholders' workshops.

4.6.4 Sustain commitment and Mobilize resources

The strategic actions:

a. Sustainable resource mobilization and financing for rabies elimination efforts.

i. Identify all potential partners relevant to rabies control.

ii. Engage key stakeholders and partners.

iii. Mobilize resources to support rabies elimination programmes.

iv. Develop a resource accountability framework (M &EL).

4.6.5 Establish and Sustain Effective Communication, Advocacy and Education

a. Conduct Advocacy, communication, and social mobilization on Rabies.

i. Increase awareness of rabies prevention and control at all levels.

ii. Improve capacity of personnel across the One Health sectors on Risk Communication

iii. Advocate rabies and other zoonotic diseases prevention and control to policies makers.

iv. Improve community participation in rabies prevention and control.

v. Conduct and promote rabies operational research.

A detailed action plan for rabies elimination and outline of the programme implementation strategy are provided in Annexes I and V.

4.7 Dog-Mediated Rabies Control Programme Governance Structure

The rabies elimination plan management will be aligned with the National One Health governance structure. The programme anticipates a Steering Committee that provides overall oversight over the project; the Rabies Technical Committee at national level and at sub national level with desk officers for each of the three sectors. A detailed organogram for the governance of the proposed programme is presented as Annex VI.

4.7.1 Rabies Steering Committee

This committee is the main organ of oversight for the project with membership including:

- Minister of Agriculture and Rural Development
- Minister of Health
- Minister of Environment
- Minister of finance, budget and national planning
  (Same as the One Health steering committee)

4.7.2 Rabies Technical Committee

Membership of the Rabies Technical Committee include:

- Chief Veterinary Officer of Nigeria
- Director Public Health (FMoH)
- Director Pollution Control and Environmental Health (FMEnv)
- DG NCDC
- Heads of relevant Technical Departments in MDAs

4.7.3. Rabies National Technical Working Group

To ensure a timely and effective implementation of the NSP upon validation, a National Technical Working Group with membership drawn from the core "One Health" MDAs and partners has been constituted. The membership and terms of reference is represented in Annex VII

4.7.4. State Technical Working Group

This will have corresponding membership like that of the national level, with each State Director of Veterinary Service hosting the secretariat

BUDGET

This document is in 2 parts: the core part describing the programme, goals and objectives including the strategic plan and the flexible part which describes the detailed action plan and budgets including indicators to monitor the strategic interventions. This document structure allows flexibility to adjust budget and action plans according to changing conditions if necessary without the need to change the entire document.

Nigeria will require an estimated ₦ 31.5 billion (70 million USD) in the next 5 years for rabies prevention and control nationwide. Investing this amount will save the lives of children and the livelihoods of adults, reduce the heavy economic burden imposed from lost income and livestock and strengthen health systems.

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Annex I

ACTION PLAN FOR RABIES ELIMINATION												
		SARE SCORE 1.5					estimate cost		N 000 000			
Objective	Strategic intervention	Planned activities	Responsible authority	Time line	Expected output	indicator/ target	yr1	yr2	yr3	yr4	yr5	Total
Objective 1: To strengthen capacity to prevent, detect and respond to rabies outbreaks	1 Sustainable laboratory capacity	1. Mapping and assessment of veterinary/public health laboratories	FMARD,FMOH	1 yr	Rabies laboratories identified	No. of laboratories with capacity to diagnose rabies	46.08	-	-	-	-	46.08
		2. Upgrading of already exisitng laboratories with equipment, reagents etc.	FMARD,FMOH	5yrs	Existing laboratorial upgraded and equipped	No. of labs upgraded amd equipped	96.693	77.88	68.78	62.90	58.20	364.453
		3 Review and dissemination of existing SOPs	FMARD,FMOH, FMEnv	6 mths	Defined TORs	Health facilities have access to updated SOPs	50.90	-	-	-	-	50.9
		4. Upgrade efficiency of sample collection	FMARD, FMOH	2 yrs	Improved sample collection	No. and quality of samples collected	54.00	24.90	-	-	-	78.9
		5 Continous proficiency testing of labaratories.	FMARD,FMOH, NVRI, NCDC	5 yrs	Improved standards of laboratories	No. of labs that pass proficiency test.	19.40	8.50	8.50	8.50	8.50	53.4

	2. Strengthening of One Health Response teams (Federal, State and LGAs)	1a Capacity building of Response teams in all states including FCT	FMARD,FMoH, FMEnv, NCDC	1 yr	Functional One Health response team established	No of states with functional One Health response team	84.09	-	-	-	-	-	84.09		
		1b Undertake Rapid Response Training and simulation ex	FMARD,FMoH, FMEnv, NCDC	5 yr	Rapid respsonse trainings and simulation exercises conducted	No. of trainings conducted, No. of simulation exercise conducted	64.09	32.04	8.00	8.50	8.50		121.13		
		1c Provision of logistics, fueling of vehicles, transportation of samples, Cold-chain facilities. Provision of 2 Vehicles at the National Level, 6 at all Geopolitical zones.	FMARD,FMoH, FMEnv, NCDC	5 yr	Items procured and functional RRT at al levels	No of states with functional RRT	5,430.00	73.28	73.28	73.28	73.28		5,723.12		
		2. Conduct interstate coordination workshops	SMOA,SMOH, SMEnv	5 yrs	interstate coordination workshop conducted	No. of workshops conducted	52.00	45.00	45.00	45.00	45.00		232		

		3. institute and sustain Quarterly Inter and intra state collaborations	SMOA,SMOH, SMEnv	5 yrs	Quarterly inter and intra state collaboration sustained	No. of quarterly inter and intra state meetings held	50.00	40.00	40.00	40.00	40.00	210
• Objective 2: To effectively use vaccines, medicines, tools and technologies to reduce animal and human rabies risk	1 Prevention and control of rabies in dogs	1 Conduct dog population census	FMARD, NBS	2 yrs	Dog census conducted	Country wide populaiton of dogs established	4,389.00	3.30	-	-	-	4,392.30
		2. Capacity building for professionals on humane animal handling and vaccination.	FMARD, SMOA & AH	5 yrs	Capacity building for professionals conducted	No. of professionals trained	97.83	73.60	56.10	23.00	23.00	273.53
		3. Procurement of ARV and Conduct of mass vaccination of at least 70% of the dog population in the country.	FMARD, SMOA & AH	5 yrs	Vaccines procured Mass vaccination conducted annually	No of vaccines procured Percentage of dog population vaccinated	2503.06	2503.06	2503.06	2503.06	2503.06	12,515.30

	4. Upgrade dog vaccination data records from paper based to digital platform, examples Softwares, tablets/laptops, internet, identification micro-chips/collars and scanner.	FMARD, SMOA & AH	1 yr	Vaccination data upgraded	Data accessible online	35.50							35.5
	5. Sero-monitoring of vaccinated dogs	FMARD, SMOA & AH	5 yrs	Sample of vaccinated dog monitored	Percentage of dogs with protective titre	837.50	837.50	-	-	-	-	-	4,187.50
	6. Advocacy and communication to improve availability to vaccination	FMARD, SMOA, AH	5 yrs	Increased availability to vaccination	No. of dogs presented for vaccination	3.10	3.10	3.10	3.10	3.10	3.10	3.10	15.5

		1. Identify and Assess health care facilities that have the required infrastructure to store and administer rabies PrEP & PEP	FMOH, NPHCDA	1 yr	Health care facilities meeting WHO standards identified	No of health care facilities marked to have required infrastructure identified.	12.00	-	-	-	-	12
		2. Capacity building for 95% of technical staff on handling human samples and vaccination.	FMoH, NCDC, WHO, SMOH etc.	5 yrs	95% of technical staff trained	No. of technical staff trained.	97.83	73.60	56.10	23.00	23.00	273.53
		3.Procure and import required cell culture vaccine and rabies immunoglobulin to meet local demand.	FMOH, NPHCDA	5 yrs	Vaccines and RIG available health facilities	No. of vaccines and RIG administered at all levels of government.	89.00	70.00	70.00	70.00	70.00	369
		4. - To ensure that Integrated Dog Bite Cases Management and centers is developed and implemented	FMOH, FMARD, SMOA, SMOH	5 yrs	Dog bite management centers created	No of dog bite management centres created	44.00	25.00	25.00	25.00	25.00	144

	3 Sustained logistics for human and animal vaccines/serum	1. Improve cold chain facilities (cold rooms, freezers/refrigerators, cold-chain vehicles) to store and transport vaccines at all levels	FMARD, FMOH, NVRI, NPHCDA and partners	1 yr	Cold chain facilities and logistics available	No. of cold chain facilities and logistics available	780.00	-	-	-	-	780
		2. Assess and identify animal and human health facilities that have the required infrastructure to store vaccine carrier, ice-pack and consumables	FMARD, FMOH, NVRI, NPHCDA and partners	1 yr	Human and veterinary health care facilities identified	No of vaccines and RIG administered at all levels of government.	10.25	-	-	-	-	10.25
		3. Contact health facilities quarterly to determine whether vaccine and RIG stock is available	FMOH	5 yrs	Health care facilities contacted quaterly	Official records and reports	1.69	1.69	1.69	1.69	1.69	8.45

		4. Assess and enhance dog vaccines production and distribution to states	FMARD, NVRI	5 yrs	Dog vaccine production and distribution enhanced	No. of vaccines produced and distributed.	280.00	90.00	80.00	80	80	610
Objective 3: To strenghten the legal framework for Rabies in Nigeria.	1. Provision of effective policies and guidelines.	Identify all existing policies and guidelines that may pertain to rabies control, dog population control or management	FMOH, FMARD, FMEnv, FMOJ,	1yr	Policies and guidelines identified	No. of Policies and guidelines identified	2.60	-	-	-	-	2.6
		Conduct needs assesment of policies lacking in national and subnational levels based on global standards	FMOH, FMARD, FMEnv, FMOJ, Academia	1yr	Needs assessment conducted	Report of Needs assessment	7.00	-	-	-	-	7

		Advocacy to relevant legislative authorities at all tiers of government regarding inclusion of identified policies	FMOH, FMARD, FMEnv, FMOJ, Academia	5yrs	Advocacy conducted	1. No. of policies updated2. Reports of the advocacy meetings.	16.00	8.00	8.00	8.00	8.00	48
	2. Strengthening/ establishment of a robust rabies surveillance system	1. Review scientific literature regarding rabies in the country in the past 10 years	FMOH, FMARD, FMEnv, Academia	1yr	Literature review ccnducted	Literature review report	1.60	-	-	-	-	1.6
		2. Identify and communicate with focal persons for rabies surveillance and laboratories to determine whether any suspect or confirmed cases have been identified	FMOH, FMARD, NVRI, VTHs, FMEnv, SMOH, SMOA, Private partners	1yr	1. Rabies focal persons for surveillance and laboratory identified 2. Enhanced surveillance	1. No. of focal persons identified 2. No. of surveillance or case reports	1.00	-	-	-	-	1

	3. Strengthening disease outbreak response	1. Develop SOPs for integrated case investigation and response based on surveillance	FMOH, FMARD, FMEnv	1yr	SOP developed	Availability of SOP	14.03	-	-	-	-	14.03
		2. Capacity building of One health RRT to investigate suspected dog and human rabies outbreak	FMOH, FMARD, FMEnv, SMOH, SMOA, SMOEnv	5yrs	Improved capacity of One Health RRT	Case investigation reports	35.40	17.00	17.00	17.00	17.00	103.4
		3. Implement data sharing across the sectors	FMOH, FMARD, FMEnv, SMOH, SMOA, SMOEnv	5yrs	Data sharing platforms strenghtened	Availability and accessibility of data	3.50	3.00	3.00	3.00	3.00	15.5
		4. Operationalize the Joint Risk Assessment (JRA) protocols by all relevant professionals	FMOH, FMARD, FMEnv, SMOH, SMOA, SMOEnv	5yrs	JRA implemented	JRA reports	12.00	10.00	10.00	10.00	10.00	52

		3. Assess available equipment, personnel and resources required for rabies data analysis	FMOH, FMARD, FMEnv	1yr	Assessment conducted	Assessment report	8.80	-	-	-	-	8.8
		4. Identify whether exisiting capacity for other diseases can be used for rabies analysis	FMOH/NCDC, FMARD, FMEnv	1yr	Existing capacity identified	No of laboratories and resources with capacity for rabies analysis	5.00	-	-	-	-	5
		5. Establish an interoperable functional rabies surveillance system	FMOH, FMARD, FMEnv, SMOH, SMOA, Private partners	1yr	Interoperable functional rabies surveillance system established	Official records and reports	18.00	6.00	6.00	6.00	6.00	42
		6. Continuous M&E of the rabies surveillance system	FMOH, FMARD, FMEnv, SMOH, SMOA	5yrs	Annual monitoring and evaluations conducted	M and E reports	12.00	10.00	10.00	10.00	10.00	52

		5. Develop sample collection SOP for outbreak response	FMOH, FMARD, FMEnv	1yr	SOP developed	Availability of SOP	5.50	-	-	-	-	5.5
	4. Harmonization of cross-border activities with neighboring countries	1.Identify information that need to be reported to the relevant authorities	FMOH, FMARD, FMEnv	5yrs	Needed information reported	Offical reports	3.00	3.00	3.00	3.00	3.00	15
		2.Collate and share relevant data with identified authorities	FMOH, FMARD, FMEnv	5yrs	Relevant data collected and shared	Availability of data	2.50	2.50	2.50	2.50	2.50	12.5
		3. Facilitate buy-in from identified stakeholders	FMOH, FMARD, FMEnv	5yrs	NSP accepted by all stakeholders	Signed MOU	3.50	3.50	3.50	3.50	3.50	17.5
		4.Conduct annual cross-border stakeholders workshops	FMOH, FMARD, FMEnv, ECOWAS, AU	5yrs	Workshop conducted	Workshop report	19.25	17.20	17.20	17.20	17.20	88.05

Objective 4: To sustain commitment and mobilize resources	1. Sustainable resource mobilization and financing for rabies elimination efforts	1.Identify all potential partners relevant to rabies control	FMOH, FMARD, NVRI, VTHs, FMEnv, SMOH, SMOA, Private partners	1yr	Partners identified/ mapped	No. of partners	1.00	-	-	-	-	1
		2. Engage key stakeholders and partners	FMOH, FMARD, NVRI, VTHs, FMEnv, SMOH, SMOA, Private partners	5yrs	Stakeholders engaged	Minutes of stakeholder meetings	15.77	12.00	12.00	12.00	12.00	63.77
		3. Mobilize resources to support rabies elimination programs	FMOH, FMARD, NVRI, VTHs, FMEnv, SMOH, SMOA, Private partners	5yrs	Resources mobilised	Amount of resources mobilised	5.00	5.00	5.00	5.00	5.00	25

		3. Improve community participation in rabies prevention and control	FMOH, FMARD, NVRI, VTHs, FMEnv, SMOH, SMOA, Private partners	5yrs	Community participation in rabies	1. Community based case reports 2. No. of communities engaged 3. No. of media engagements 4. No. of extension workers reached 5. Feedback mechanism	20.00	20.00	20.00	20.00	20.00	100
		4. Conduct and promote rabies operational research	FMOH, FMARD, NVRI, VTHs, FMEnv, NCDC, NBS,UTHs	5yrs	1.Operational research conducted 2. Contributions to existing knowledge	1.Published research papers/conference papers 2. Operational research reports	20.00	12.00	12.00	12.00	12.00	68
							15,394.96	4,139.15	4,032.81	3,961.23	3,956.53	31,484.68

		4. Develop a resource accountability framework (M &EL)	FMOH, FMARD, NVRI, VTHs, FMEnv, SMOH, SMOA, Private partners	5yrs	M and EL developed	Official reports and records	4.50	2.50	2.50	2.50	2.50	14.5
Objective 5: Communication, Advocacy and Education	Conduct Advovacy, communication and social mobilization on Rabies	1. Increase awareness of rabies prevention and control at all levels	FMOH, FMARD, NVRI, VTHs, FMEnv, FMOI, FMOE, SMOH, SMOA, private partners	5yrs	IEC materials developed	Availability of IEC materials	25.00	20.00	20.00	20.00	20.00	105
FMOH, FMARD, NVRI, VTHs, FMEnv, FMOI, FMOE, SMOH,SMOA,		2. Advocate rabies and other zoonotic diseases prevention and control to policies makers	FMOH, FMARD, NVRI, VTHs, FMEnv, SMOH, SMOA, Private partners	5yrs	Approved budget line for rabies control	Release of budgeted funds	5.00	5.00	5.00	5.00	5.00	25

Annex II: Rabies key stakeholder analysis

Key stakeholders	What is their interest	Level of interest	Power of influence	Action
Federal and State Veterinary Services	Prevention and control of rabies	Very high	Very high	Policies, Awareness creation, rabies prevention, control, surveillance, and reporting
Public/Private Veterinary practices	Prevention and control of rabies	Very high	Very high	Awareness creation, rabies prevention, control, surveillance, and reporting
Federal Ministry of Health	Prevention and control of rabies	Very high	Very high	Policies, Awareness creation, rabies prevention, control, and reporting
NCDC	Prevention and control of rabies	Very high	Very high	Policies, Awareness creation, rabies prevention, control, and reporting
FMEnv	Prevention and control of rabies	High	High	Control of stray dogs
Federal Ministries of Information, Finance, Educations, National Orientation Agency	Improved awareness and behavior change	High	High	Public awareness, risk communication

Research Institutes NVRI, NIMR, ACENTDFB, ACEGID	Diagnosis and Research on rabies as well as production of vaccines	High	High	Research, Diagnosis, Production of vaccines policy support
Veterinary Council of Nigeria	Veterinary training, education, and practice	High	High	Training, rabies prevention, control, and reporting
Nigeria Agricultural Quarantine Service (NAQS)	Control of Rabies	Very high	Very high	Surveillance, reporting and dog movement control
Academia, Faculties of Veterinary Medicine	Training and Research on rabies.	High	High	Training, diagnosis, and policy support
Key stakeholders	**What is their interest**	**Level of interest**	**Power of influence**	**Action**
Veterinary Paraprofessionals and Community Animal Health Workers	Prevention and control of rabies	High	High	Awareness creation, rabies prevention, control and reporting, dog control
Military and Paramilitary	Prevention and control of rabies	Medium	Low	Awareness creation, rabies prevention, control and reporting, dog movement control

Traditional and Religious Leaders, etc.	Create awareness	Medium	Low	Lobby Influencers, Reporting to appropriate authorities
Development partners, International NGOs	Support technically and financially rabies disease control	Very high	Very high	Financial and Technical support
Local NGOs, CBOs and CSOs	Grassroot community technical support and Awareness creation	Very high	Very high	Awareness creation, support of community rabies prevention, control
Media	Awareness creation	Medium	Medium	Awareness creation
Dog owners	Rabies control, responsible dog ownership	Very high	Very high	Disease reporting, responsible dog ownership
Relevant Professional Associations	Awareness creation	Very high	High	Awareness creation

Annex III: Categorization of dog populations and ownership patterns in Nigeria

Dog Category	Description	Other Characteristics
Responsibly owned dogs	This category of dogs consists of mainly companion/pet dogs and institutionally owned dogs, such as those kept by security agencies. In homes they are kept for security and commercial breeding.	They are found all over Nigeria, consisting mainly of exotic (imported) and cross bred dogs. Some indigenous breeds of dogs may also be responsibly kept. They are routinely vaccinated and have regular veterinary care.
Owned but free roaming dogs	Neighbourhood dogs that have owners but are not responsibly kept, may be for companionship or security.	Found in urban, peri-urban, and rural areas. May be on leash periodically or completely off leash. Consists of a large proportion of urban dogs in Nigeria. They roam locally for food or mates and are largely identifiable in the community. Vaccination may be irregular or none.
Slaughter dogs	These are dogs intended for human consumption	They are slaughtered in few numbers at illicit slaughter points. They may be purchased in groups or in singles from local markets or illegally imported from neighbouring countries. Could include stray dogs arrested from local communities or even owned dogs stolen from households. Vaccination status is unknown.

Hunting dogs	These dogs are mobile, owned and may exist in packs intended for hunting.	Hunting dogs are found across Nigeria, may be owned by officially registered hunting associations. May take part in locally organized vaccination campaigns. Generally, vaccination is not regular. This category of dogs is also at risk of exposure to wildlife or animal carcasses killed by wildlife.
Dog Category	**Description**	**Other Characteristics**
Herd-associated dogs	Generally found in rural areas, associated with livestock herds mainly intended as early warning against theft.	Rarely vaccinated, found largely among nomadic herds, may be cross border. Accessible during vaccination campaigns for other livestock diseases.
Feral dogs	These are dogs that are not identifiable within the community.	They scavenge for food and are noticeable at refuse dumps, around abattoirs, other locations harbouring food waste. They may originate from any of the above group of dogs, where human contact/intimacy is lost, such as in situations of conflict. They are generally in poor condition and are more at risk of infections and spreading of infections.

Annex IV: Rabies Control in Nigeria: Strengths, Weaknesses, Opportunities and Threats

The strengths, weaknesses, opportunities, and threats (SWOT) analysis of the main topic patterning to dog-mediated rabies in Nigeria are shown in the table below.

Main topic	Strengths	Weaknesses	Opportunities	Threats
1. Information, Education, Advocacy, communication and social mobilization	• Presence of a few international and local NGOs. • Access to various media outlets • Good coverage of mobile network in-country	• Inadequate rabies awareness among people in various zones of the country • Inadequate knowledge on rabies PEP and PreEP • Insufficient involvement of other competent authorities and stakeholders • Lack of adequate funding for awareness creation • Inadequate infra-structure in some areas	• High demand for rabies awareness information • Possibility of increasing rabies awareness through media use • Possibility of real time communication Presence of public private partnership • Online resources available	• Existence of areas without network coverage and unable to access media • Existing insecurity challenges
Main topic	**Strengths**	**Weaknesses**	**Opportunities**	**Threats**
2.Prevention and Control: Availability and accessibility to anti-rabies biologicals and vaccines	• Existence of well-structured human health facilities • Availability of Public-Private Partnership (PPP) policy to leverage on.	• Inadequate and insufficient cold chain system in animal sector especially at grass root level • Very limited access to biologicals in rural areas. • Inadequate supply of human and animal anti	• Availability of some efficient biological and vaccine in the free market in few locations • Availability of alternative sources of electrical power • Possible access of vaccines from OIE dog	• Insecurity in Nigeria

	• Available man-power manpower for capacity building	rabies vaccine • Poor knowledge on availability of PEP services • Inadequate power supply • High cost of PEP • Low priority of Rabies in health facility plannings	vaccine bank • Available local dog rabies vaccine production	
reporting, analysis and response	zoonoses in Nigeria • Presence of surveillance and reporting systems in human and animal sectors • Availability of veterinary/ livestock extension officers at various levels • Presence of well-structured health de-livery facilities • Clear government structure from grass root levels to national • Presence of SORMAS, a computing platform for surveillance	• Uncoordinated response by various sectors • Inadequate funding • Sub-optimal public health infrastructure • Inadequate legislation • Integrated Bite Case Management (IBCM) not yet implemented • Poor linkages between research findings and government policies. • Inadequate local government funding for research activities. • Lack of a rabies research agenda • Inadequate national KAP studies	• Decentralized government system • Presence of partnership and collaboration with international partners	• Inadequate funding

	• Presence of One Health Coordination Desk at the NCDC	• Inadequate skilled manpower • Poor dog vaccination coverage		
Main topic	**Strengths**	**Weaknesses,**	**Opportunities**	**Threats**
3. Laboratory diagnostic capacity	• Presence of diagnostic laboratories at various level • Presence of trainable laboratory technologists at various levels	• Unavailable WHO approved diagnosis only in very few laboratories • Poor laboratory infrastructure in the rural areas • Inadequate laboratory equipment and reagents • Inadequate skills and knowledge • Inadequate funding of laboratories • Dilapidated laboratories • Improper sample collection, preservation and submission protocols	• Presence of diagnostic laboratory infrastructures at • Presence of trained and trainable laboratory technologists at various levels • Collaboration with international laboratories	• Unreliable power supply • High laboratory maintenance cost
Main topic	**Strengths**	**Weaknesses**	**Opportunities**	**Threats**
4. **Rabies Surveillance and outbreak**	• Prioritization of rabies among the 6 top priority	• Mainly paper based reporting especially in animal sector	• Presence of ICT technology (SORMAS)	• Existing insecurity challenges

	• Presence of the research institutions, scientists, and higher learning institutions.			
Main topic	**Strengths**	**Weaknesses,**	**Opportunities**	**Threats**
5. Cross cutting issues: Resource mobilization, Partnerships and Intersectoral collaborations	• Existence of PPP policy and players • Presence of local government structures • Availability of multisectoral resource mobilization strategy • Presence of the OH Coordination Desk at the NCDC • Presence of multi-sectoral MOU for participating sectors • Existence of NTWG • Existing collaboration with other internal and external organizations	• Poor regional collaborations on Rabies • Disproportionate allocation of resources by government • Poor budgetary allocations for rabies	• Increasing partnership interest • Possibility of involving private entities • Possibility of collaboration between multiple sectors	• Inadequate funding • Partners changing

Annex V: Outline of Programme Implementation Strategy

Objective	Strategic Actions
1. To strengthen capacity to detect and respond to rabies outbreaks	i. Mapping and assessment of Veterinary public health laboratories ii. Upgrading of already existing laboratories with equipments, reagents, etc. iii. Review of existing SOPs iv. Upgrade efficiency of sample collection v. Continuous proficiency testing of laboratories vi. Capacity building of Response teams in all states including FCT vii. Undertake Rapid Response Training viii. Provision of logistics, fueling of vehicles, transportation of samples, Cold-chain facilities. ix. Conduct interstate coordination workshops x. Quarterly Inter and intra state collaborations to be encouraged and sustained.
2. To effectively use vaccines, medicines, tools and technologies to reduce animal and human rabies risk	i. Capacity building for professionals on humane animal handling and vaccination. ii. Conduct mass vaccination of at least 70% of the dog population in the country. iii. Upgrade dog vaccination data records from paper based to digital platform, examples Softwares, tablets/laptops, internet, identification micro-chips/collars and scanner.

vi. Sero-monitoring of vaccinated dogs.

v. Advocacy and communication to increase awareness and improving education.

vi. Identify and assess health care facilities that have the required infrastructure to store and administer rabies PrEP & PEP.

vii. Capacity building for 95% of technical staff on handling human samples and vaccination.

viii. Procure and import required cell culture vaccine and rabies immunoglobulin to meet local demand.

ix. Ensure that Integrated Dog Bite Cases Management and centres is developed and implemented.

x. Advocacy and communication to increase awareness and improving education.

xi. Improve cold chain facilities (cold rooms, freezers/refrigerators, cold-chain vehicles) to store and transport vaccines at all levels.

xii. Assess and identify animal health facilities that have the required infrastructure to store vaccine carrier, ice-pack and consumables.

xiii. Contact health facilities quarterly to determine whether vaccine and RIG stock is available.

xiv. Assess and enhance dog vaccines production and distribution to states.

3. To generate, innovate and measure impact by providing effective policies, guidance, governance and ensuring reliable data management system

e. Provision of effective policies and guidelines.

i. Identify all existing policies and guidelines that may pertain to rabies control, dog population control or management.

ii. Conduct needs assesment of policies lacking in national and subnational levels based on global standards.

iii. Advocacy to relevant legislative authorities at all tiers of government regarding inclusion of identified policies.

f. Strengthening/ establishment of a robust rabies surveillance system.

iv. Review scientific literature regarding rabies in the country in the past 10 years.

v. Identify and build capacity for focal persons on rabies surveillance, reporting and diagnosis across all sectors.

vi. Assess available equipment, personnel and resources required for rabies data analysis.

vii. Identify whether exisiting capacity for other diseases can be used for rabies analysis.

viii. Establish an interoperable functional rabies surveillance system.

ix. Continuous M&E of the rabies surveillance system.

g. Strengthening disease outbreak response.

x. Develop SOPs for integrated case investigation and response based on surveillance.

xi. Capacity building of One health RRT to investigate suspected dog and human rabies outbreak.

xii. Implement data sharing across the sectors.

xiii. Operationalize the Joint Risk Assessment (JRA) protocols by all relevant professionals.

xiv. Develop sample collection SOP for outbreak response.

h. Harmonization of cross-border activities with neighboring countries.

xv. Identify information that need to be reported to the relevant authorities.

xvi. Collate and share relevant data with identified authorities.

xvii. Facilitate buy-in from identified stakeholders.

xviii. Conduct annual cross-border stakeholders' workshops.

4. To sustain commitment and mobilize resources

i. Identify all potential partners relevant to rabies control.

ii. Engage key stakeholders and partners.

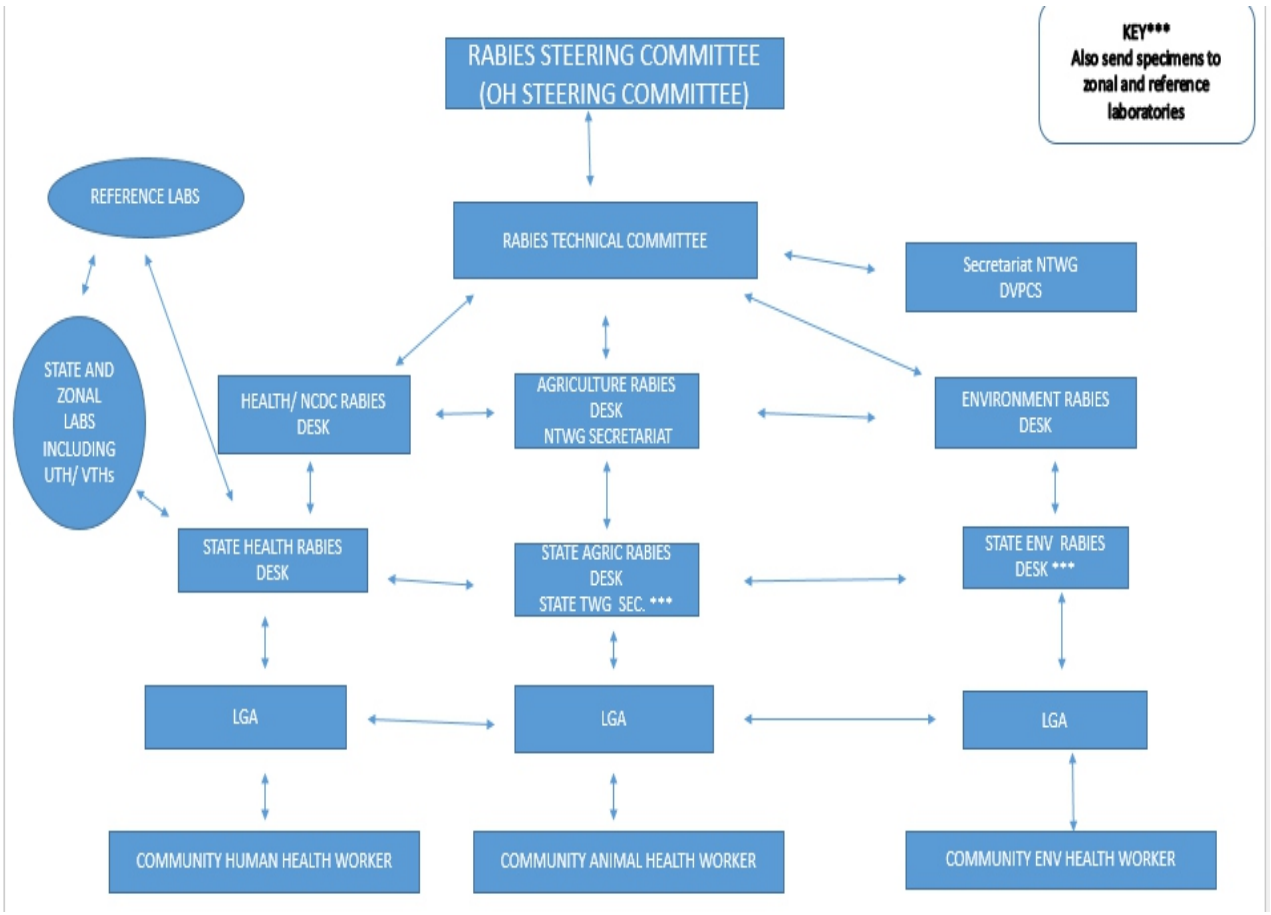
iii. Mobilize resources to support rabies elimination programmes.

iv. Develop a resource accountability framework (M &EL).

5. Communication, Advocacy and Education

- Increase awareness of rabies prevention and control at all levels.
- Improve capacity of personnel across the One Health sectors on Risk Communication
- Advocate rabies and other zoonotic diseases prevention and control to policies makers.
- Improve community participation in rabies prevention and control.
- Conduct and promote rabies operational research.

Annex VI: Dog-Mediated Rabies Elimination Programme Governance Structure



Annex VII

The National Technical Working Group (NTWG) Membership and Terms of Reference for Implementation of the National Strategic Plan (NSP) for elimination of dog mediated human rabies.

NTWG Membership

- Federal Ministry of Agriculture and Rural Development
- Federal Ministry of Health
- Federal Ministry of Environment
- Federal Ministry of Finance
- Federal Ministry of Information
- Federal Ministry of Education
- Nigeria Centre for Disease Control
- Military, Police & Paramilitary
- Development Partners & CSOs
- Nigeria Veterinary Medical Association
- National Veterinary Research Institute, Vom
- Nigeria Agricultural Quarantine Service
- Academia
- Media

Terms of Reference

1. Facilitate Implementation of the National Strategic Plan(NSP) for elimination of dog mediated human rabies

2. Advocate and create awareness on the NSP across the three (3) tiers of Government

3. Facilitate Resource mobilization for implementation of the NSP

4. Monitor and report progress of implementation of the NSP to relevant Authorities

5. Convene Quarterly meetings/as the need arises

6. Review and update the NSP as at when due

7. Any other assignment as maybe assigned by Implementing Authorities

Annex VIII:
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