National Centre for Animal Health

Annual Progress Report

FY 2019 - 2020

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ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture and Forests
Department of Livestock
NATIONAL CENTRE FOR ANIMAL HEALTH
Serbithang: Thimphu

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FOREWORD

The National Centre for Animal Health, Serbithang, Department of Livestock, Ministry of Agriculture and Forests, is pleased to release the Centre's Annual Progress Report for the Financial Year 2019 – 2020. The report highlights the progress, achievements, and experiences of the Centre while undertaking the mandate of animal health services in the country. As the national competent centre for animal health, the centre has a very crucial role to play in supporting various programmes under the livestock sector, with the ultimate objective of enhancing livestock production in the country.

I, on behalf of the management of National Centre for Animal Health, Serbithang, would like to thank all the Unit Heads and the staff at the Centre for their invaluable contributions in achieving the Centre's mandates, and more importantly, for documenting all activities undertaken. I acknowledge their contributions and supports in producing this annual report on time especially while challenged with unprecedented times due to COVID-19 pandemic.

I would also like to express my sincere appreciation to all the Regional Directors of Regional Livestock Development Centres, the Programme Directors of various commodity centres, District Livestock Officers, Farm managers of central farms, and all the Veterinarians and Veterinary paraprofessionals, for their continued support and successful implementation of animal health programmes in their respective jurisdictions. I extend my sincere appreciations to the relevant international partners for their technical and financial support provided for the implementation of animal health activities in the country. I also extend appreciations to the Department of Public Health, Ministry of Health, and Bhutan Agriculture and Food Regulatory Authority, for their continued support and cooperation in prevention and control of animal diseases.

I also thank the Director General and the Chief of various Divisions under the Department of Livestock, for their continuous guidance and support to the Centre.

Lastly, I extend my appreciation to the Disease Prevention and Control Unit of the Centre for coordinating to publish this document as an annual event.

Tashi Delek

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EXECUTIVE SUMMARY

During the financial year 2019-2020, the National Centre for Animal Health (NCAH), Serbithang, Thimphu, received a total of 6,312 samples from the field and performed 12,790 tests to confirm various animal diseases. New laboratory diagnostic techniques were introduced in the Centre for diagnosis of Crimean-Congo Haemorrhagic Fever (CCHF), Rabies, *Streptococcus agalactiae*, *Campylobacter, Enterococci*, and tick identification. The national external quality assurance system (NEQAS) was also coordinated and conducted for the four Regional Livestock Development Centres (RLDCs), for *Brucella* Rose Bengal Test (RBT).

In strengthening disease prevention, control, and elimination programmes in the country, the Centre, in collaboration with other relevant stakeholders, developed and endorsed the National Peste des Petits Ruminants Prevention, Control, and Eradication plan (NPPR-PCEP) 2020; the National Influenza Pandemic Preparedness Plan and Standard Operating Procedures (NIPPP&SOPs) 2020; and the National Foot and Mouth Disease Prevention and Control Plan (NFMDPCP) 2020"; and also finalized the animal health's part of the Strategic Plan for the elimination of dog-mediated human rabies and rabies freedom by 2030; National Contingency Plan for African Swine Fever (NCPASF) 2020; and Generic Animal Disease Outbreak Management System of Bhutan. With the reported outbreaks of 28 zoonotic and 21 non-zoonotic notifiable animal diseases in the country, the Centre achieved the excellent APA score in line with the target set for FY 2019-2020 to reduce the number of notifiable animal disease outbreaks in the country.

Vaccinations, routine or responsive, being one of the most important and common strategies for prevention and control of animal disease outbreaks, the Centre, during the FY 2019-2020, produced 10,730 doses of Classical swine fever vaccine and Anthrax vaccines, procured 7,680,540 doses of livestock and poultry vaccines of worth BTN 5.5 M, and distributed them to the Dzongkhags and relevant Central agencies.

To maintain uninterrupted animal health services delivery in the country, the Centre carried out on-time procurement and distribution of veterinary medicines and equipment to various animal health centres across the country; veterinary medicines of worth BTN 24.97M were distributed to Dzongkhags and relevant agencies during the FY 2019-2020.

The Centre, through National Dog Population Management and Rabies Control Programme (NDPM-RCP), sterilized 8,870 dogs and cats and vaccinated 7,914 dogs (stray and owned) against rabies during the FY 2019 – 2020. In collaboration with the RLDCs and Dzongkhags, the 13th World Rabies Day 2019 was observed, with the theme *"Rabies: Vaccinate to Eliminate ",* through mass dog vaccination campaigns and advocacy programmes. Events were organized in seven different districts of Bhutan, mainly focusing on rabies-endemic southern and eastern Dzongkhags: Samtse, Chhukha, Dagana, Sarpang, Trongsa, Trashigang, and Samdrup Jongkhar.

The Centre, in collaboration with various relevant stakeholders, carried out or initiated several disease surveillance and research activities: collaborative studies on important zoonotic diseases like Anthrax, Rabies, Crimean-Congo Hemorrhagic Fever (CCHF), bat derived zoonotic diseases and gid disease surveillance.

In response to the COVID-19 pandemic, the centre participated through a one-health approach to face the pandemic; some veterinarians and laboratory professionals from the Centre were actively involved. Being a part of Technical Advisory Group (TAG) members for COVID-19, the establishment of the COVID-19 diagnostic centre at the Regional Referral Hospital, Monggar, etc. were some of the highlights.
Other important one-health activities were also coordinated, like the development of animal health's part of the Strategic Plan for the Elimination of dog-mediated human rabies by 2030, incorporation of human health's part in the National Influenza Pandemic Preparedness Plan, etc.

The Centre was able to smoothly sail through first half of the year in implementing plan activities. However, since the beginning of the second half of the year, as experienced by all, the Centre also had to go through unprecedented and difficult times in the face of COVID-19 pandemic. Many of the activities that were impacted by this situation, unfortunately, had to be left unattended.

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1. BACKGROUND

The National Centre for Animal Health (NCAH), Serbithang, is located about 12 km away from Thimphu, the capital city of Bhutan. Initially, the Centre started as a Diagnostic Laboratory in 1978 in Chhubachu, Thimphu. Later, under the aegis of the United Nation Development Programme and Food and Agriculture Organization project, it was named as Royal Veterinary Diagnostic Laboratory (RVDL) and shifted to Serbithang in 1981. It was subsequently strengthened under European Union project assistance between 1991 and 1999 and was renamed as Royal Veterinary Epidemiology Centre (RVEC). The Centre is responsible for animal disease diagnosis, disease prevention and control programme, and providing technical backstopping to Dzongkhags and livestock commodity centres. In 2005, RVEC was renamed as National Centre for Animal Health (NCAH) and is one of the central programmes under the Department of Livestock, Ministry of Agriculture and Forests. The Centre has a campus area of 8.8259 acres and has 42 staff. The Centre provides excellent environment for aspiring leaders in animal health.

1.1 Mandates

- ✓ To function as the national referral laboratory for animal health;
- ✓ To function as the national centre for veterinary epidemiology;
- ✓ To ensure availability of quality veterinary medicines, vaccines and equipment; and
- ✓ To function as an institute for capacity development in animal health.

1.2 Functions

- ✓ Develop, implement, and evaluate disease prevention and emergency response plans for livestock diseases and zoonoses;
- ✓ Support development of policies, strategies, and plans for animal health;
- ✓ Coordinate, monitor, and evaluate disease prevention and control programmes;
- ✓ Prioritize and research animal health;
- ✓ Liaise with national and international agencies for technical collaborations;
- ✓ Plan, coordinate, and conduct animal health research in liaison with relevant agencies;
- ✓ Maintain and disseminate animal health and epidemiological information regularly;
- ✓ Provide referral services on laboratory diagnostic activities;
- ✓ Support capacity development in animal health programmes;
- ✓ Coordinate and implement antimicrobial resistance (AMR) studies in the veterinary sector through one-health approach;
- ✓ Implement, monitor, and evaluate the management of veterinary medicines, vaccines, and equipment at the national level; and
- ✓ Conduct disease surveillance and control activities at the national level.

2. MAJOR FUNCTIONAL UNITS OF NCAH

The Centre coordinates all national level animal health programmes in collaboration with the four Regional Livestock Development Centres (RLDCs) and the Dzongkhag livestock sectors. The main functional units are Disease Prevention and Control Unit (DPCU); Laboratory Services Unit (LSU); Drug, Vaccines, and Equipment Unit (DVEU); and Biological Production Unit (BPU) (See Figure 1). The National Dog Population Management and Rabies Control Programme (NDPM-RCP), which was initiated in 2009 as a joint project between Humane Society International (HSI), an US-based non-governmental organization, and Royal Government of Bhutan (RGoB) and ended in 2018, operates from the centre.

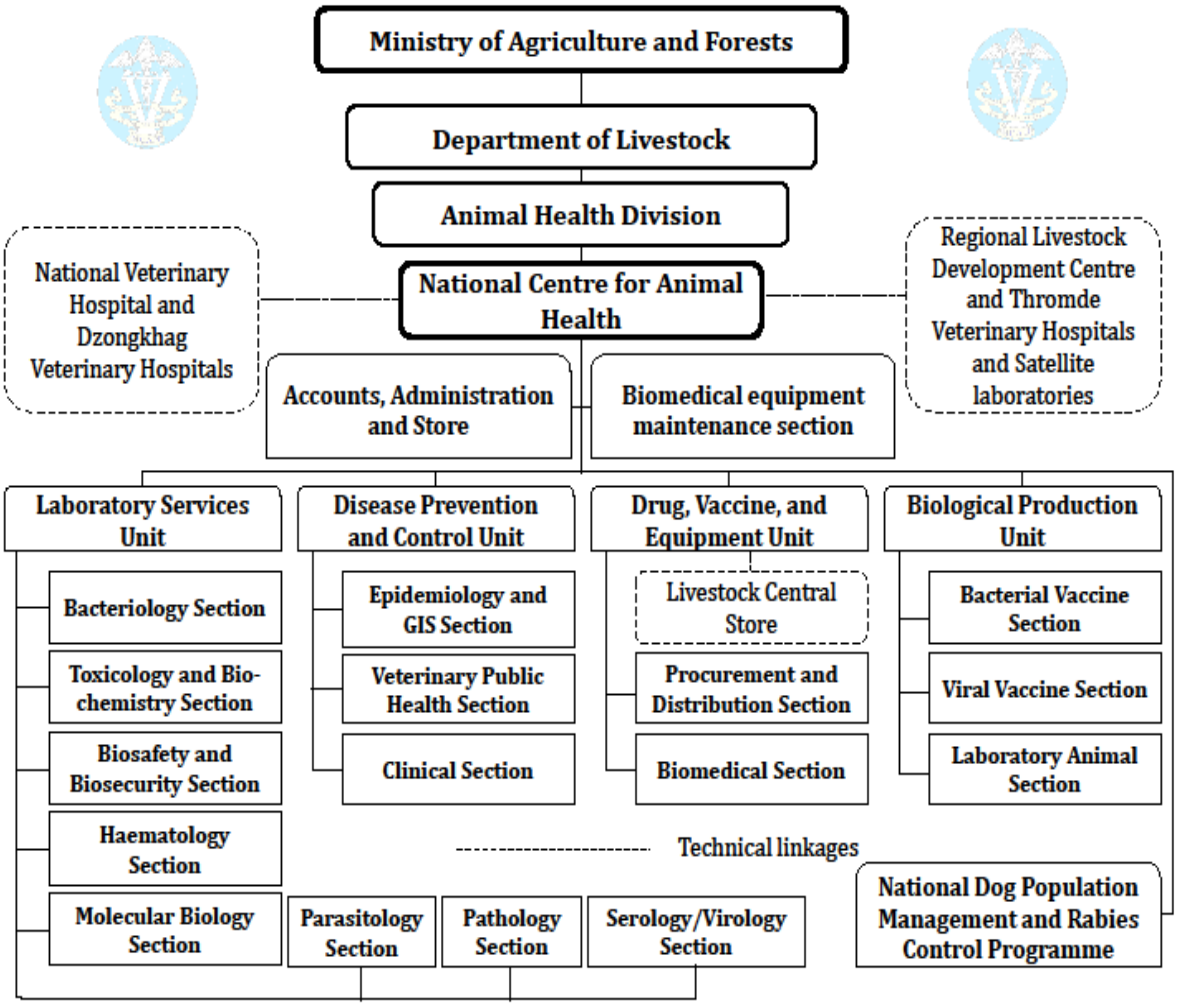


Figure 1: Organogram of NCAH

2.1 Disease Prevention and Control Unit (DPCU)

The Disease Prevention and Control Unit (DPCU) acts as the focal unit for planning, implementation, and monitoring of livestock disease prevention and control programmes in the country. The unit has three sections: Epidemiology and Geographic Information System (GIS) section; Veterinary Public Health section and Clinical section.

2.1.1 Human resources

The unit is manned by the following staff:

- Dr Sangay Rinchen, Senior Veterinary Officer, Head
- Dr Pelden Wangchuk, Senior Veterinary Officer
- Mr Kinzang Namgay, Senior Livestock Health Supervisor
- Ms Karma Dekar, Data Manager/Administrative Assistant

2.1.2 Main mandates

- To formulate, implement, and monitor various nationally coordinated animal disease prevention and control programmes in the country;
- To formulate animal disease emergency response plans (contingency plans) for trans-boundary emerging animal diseases;
- To plan and implement zoonotic disease prevention and control programmes through One-Health approach, in collaboration with the Ministry of Health;
- To maintain the livestock disease information in the country through the online *TADinfo* database system, analyse, and report sharing to the relevant stakeholders;
- To maintain the animal health information in the country through the Veterinary Information System (VIS) database, analyse, and report sharing to the relevant stakeholders;
- To act as the focal agency for contact with international organizations such as World Organization for Animal Health (OIE), FAO, WHO and Animal Production and Health Commission for the Asia Pacific (APHCA) on all matters of animal health concerns;
- Catering of clinical services to the clients from around the Centre.

2.2 Laboratory Services Unit (LSU)

The Laboratory Services Unit (LSU) functions as the national veterinary referral laboratory in the country. It is mandated with providing referral laboratory services. Besides, the rapid tests, the unit has the capacity for advanced diagnostic tests such as Enzyme-linked immunosorbent assay (ELISA), Fluorescent antibody test (FAT) and molecular assays for emerging and re-emerging infectious disease such as Foot and Mouth Disease (FMD), Highly Pathogenic Avian Influenza (HPAI), Classical Swine Fever (CSF), African Swine Fever (ASF), *Brucella*, PRRS, PPMV and Rabies. The molecular assays consist of both real-time Polymerase chain reaction (PCR) and conventional technologies. The unit has bio-safety level 2 plus facility for secure handling of high-risk pathogens. The unit is responsible for monitoring and evaluating bio-safety measure implementation for veterinary laboratories in the country. The unit is also responsible for coordinating collaboration of advance level diagnostic research with international

reference laboratories and institutes. It is also mandated to carry out laboratory-based surveillances/research.

2.2.1 Human resources in LSU

The followings are the available human resource in the Laboratory Services Unit during the FY 2019-2020 (See Table 1).

Table 1: Overall human resource capacity during the FY 2019-2020

Specialization	Sections	Number
Animal Health Specialist – I (Parasitologist)	Parasitology	1*
Animal Health Specialist – III (Pathologist)	Pathology	1
Animal Health Specialist – III	Molecular biology, Microbiology, Immunology	1**
Laboratory Officer	Bacteriology, Molecular biology, Biosafety, Bio-security, Biochemistry and Toxicology	2
Sr. Laboratory Technician	Parasitology, Serology, Virology and Bacteriology	3
Assistant Laboratory Technician	Serology, Virology, Haematology, Biochemistry, Toxicology, Pathology and Post-mortem	6
Laboratory Attendant	General	1
Total		15

* Superannuated in September 2019
**Assumed the post of Programme Director of the Centre since October 2019

2.2.2 Main mandates

The main mandates of the Laboratory Services Unit are:

- Providing referral veterinary laboratory diagnostic services to the clients:
  - Provide routine veterinary laboratory diagnostic services, animal health programs and One-Health activities in the country;
  - Serve as the national referral laboratory for the diagnosis of animal diseases.
- Major Livestock Disease Surveillance/Survey:
  - Lead/coordinate and conduct laboratory-based animal health research activities in the country.
- Coordination and implementation of biosafety and bio-security programmes:
  - Implement and monitor bio-safety measures and good laboratory practices in all veterinary laboratories in the country.
- Strengthening and enhancing laboratory diagnostic capacities:
  - To serve as a focal laboratory for antimicrobial resistance monitoring in animals in the country;

- To participate in international proficiency testing for specific diagnostic methods;
- To coordinate National External Quality Assurance System (NEQAS) through engaging regional laboratories in the country in proficiency testing scheme
- To technically backstop regional, satellite and district laboratories in the country;
- Validation and introduction of new diagnostic tests/up-gradation of diagnostic tests for the emerging and re-emerging diseases in the country;
- To liaise, collaborate, and establish efficient laboratory networks with the outside agencies such as National Food Testing Laboratory, Bhutan Agriculture and Food Regulatory Authority; Clinical Laboratory, Jigme Dorji Wangchuck National Referral Hospital; Royal Centre for Disease Control, Department of Public Health; and Wildlife Clinic, Nature Conservation Division, Department of Forests and Park Services;
- To liaise, collaborate and establish efficient laboratory networks with the international reference laboratories such as OIE and WHO Referral Laboratories.

- Laboratory skill enhancement:
  - To develop human resource capacity by conducting diploma course in laboratory technology in collaboration with other relevant institutions;
  - Conduct refresher courses and up-gradation courses for laboratory technicians.

2.2.3 Diagnostic capacities in LSU

The unit has eight sections: Bacteriology, Serology/Virology/Molecular biology, Toxicology, Biochemistry, Parasitology, Post-mortem, Histopathology and Haematology Section. The different sections under the LSU are equipped with advanced diagnostic facilities. The summary of diagnostic tests and capacities available in each section are as follows:

2.2.3.1 Parasitology Section

The section provides routine diagnostic services for parasitic disease and recommends control guidelines and advisory services to the government livestock farms, Dzongkhags and private livestock agencies. It also provides other professional backstopping to RLDCs, SVLs and DVHs/DVLs. Besides the routine activities, the section regularly conducts research and surveillance on parasitic diseases in collaboration with government farms, RLDCs and the Dzongkhags. The section is also responsible to provide refresher/in-service courses to field staffs and training to the farmers concerning parasitic diseases and control programmes.

The section is manned by the following staff:

- Ms Tshewang Dema, Assistant Laboratory Technician
- Ms Ugyen Pema, Assistant Laboratory Technician

The following are the lists of diagnostic services that are being provided:

- Identification of parasites through direct technique;
- Identification of parasites through qualitative tests (Sedimentation and Floatation methods);
- Identification of parasites through quantitative tests (Stoll method);
- Urine sedimentation test for nematodes;
- Skin scraping examination using 10% KOH digestion method;
- Blood parasite examination;
- Pepsin digestion test;
- Faecal culture (simple tube method, culture tube method, Baermann's method);
- Tick identification (stereo-zoom method);
- Post-mortem recovery of helminths, post mortem worm count;
- *Microfilaria* identification from the blood (modified Knott's method);
- Worm staining and preservation;
- ELISA for *Fasciola*;
- Isolation and identification of Taeniid eggs.

2.2.3.2 Bacteriology Section

The section provides routine diagnostic services for microbial diseases (bacteria and fungi) in livestock through culture and identifications. The section also has the capacity to test and identify important bacterial pathogens like *Salmonella, Bacillus anthracis, Escherichia coli*, *Staphylococcus* spp., *Streptococcus* spp., *Pasteurella,* etc. and perform antimicrobial susceptibility testing for important bacterial pathogens.

The section is manned by the following staff:

- Dr RB Gurung, Specialist – III
- Ms Puspa Maya Sharma, Senior Laboratory Officer
- Mr Tenzinla, Senior Laboratory Technician
- Ms Tshewang Dema, Assistant Laboratory Technician

The section has the following diagnostic capacities:

- Bacterial culture and identification using sheep blood agar, MacConkey agar and other selective media and various biochemical tests;
- Fungal culture and identification using Sabouraud agar;
- Staining techniques - Grams, Giemsa, Methylene blue, Ziehl-Nielsen/Acid-fast, Leishman, Lactophenol, Spore staining and Capsule staining;
- Species identification of important bacterial pathogens – *Salmonella spp., E. coli, Staphylococcus spp., Bacillus anthracis, Clostridium spp., Pasteurella, Pseudomonas spp., Erysipelas rhusiopathiae, Brucella spp., Aeromonas hydrophila and Streptococcus spp.;*
- Enumeration of bacteria - total aerobic count by pour plate technique and spread plate technique, total coli count by pour plate technique and spread plate technique, Most Probable Number (MPN) technique;
- Detection of *Mycobacterium species* by acid-fast technique;

- Agglutination tests: Slide agglutination test (SAT), Tray agglutination test (TAT) and Micro-titre plate agglutination test (MAT);
- Detection of mastitis in milk samples through the California mastitis test (CMT), Cell count and White side test (WST);
- Antimicrobial susceptibility test (AST), disk diffusion method;
- Intra-dermal test for bovine tuberculosis (TB) using purified protein derivatives (PPD).

2.2.3.3 Haematology Section

The section conducts the basic haematological tests to support clinical diagnosis in animals (livestock, pets, birds and wildlife species).
The section is manned by the following staff:

- Dr NK Thapa, Animal Health Specialist – II
- Ms Tshewang Dema, Assistant Laboratory Technician

The haematological parameters and tests commonly conducted in this section are:

- Haemoglobin estimation (Hb);
- Packed Cell Volume (PCV);
- Total Red Blood Cell Count (TRBCC);
- Total White Blood Cell Count (TWBCC);
- Differential Leukocyte Count (DLC);
- Erythrocyte Indices – Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC) and Mean Corpuscular Haemoglobin (MCH);
- Erythrocyte Sedimentation Rate (ESR);
- Wet film examination for blood parasites like Microfilaria and Trypanosomes.

2.2.3.4 Biochemistry and Toxicology Section

The section conducts basic tests for clinical biochemistry in serum and also qualitative analysis of urine to support the clinical diagnosis. The section also conducts basic toxicological tests especially, screening of important Mycotoxin in animal feeds.
The section is manned by the following staff:

- Dr NK Thapa, Animal Health Specialist – II
- Ms Dechen Wangmo, Senior Laboratory Officer
- Ms Ugyen Pema, Assistant Laboratory Technician

Followings are the diagnostic capacities available in this section:

- Rapid tests for Aflatoxin in animal feed;
- Quantitative estimation of Mycotoxin (Aflatoxin, Ochratoxin, Fumonisin) in animal feeds;
- Mineral estimation for Ca, Mg and P in serum;
- Qualitative urine analysis;
- Qualitative and quantitative biochemistry.

2.2.3.5 Molecular biology, Serology, and Virology Section

The section performs tests on routine and also on the samples referred by the Regional/District/Satellite Laboratories in the country.

This section is equipped with advanced diagnostic facilities such as real-time PCR, conventional PCR, ELISA and has the capacity to undertake rapid diagnosis of emerging diseases including the Highly Pathogenic Avian Influenza (HPAI), African Swine Fever (ASF), Infectious Bursal Disease (IBD), Newcastle disease (ND) and Rabies.

The Molecular biology, Serology, and Virology section is manned by:

- Dr RB Gurung, Animal Health Specialist – III
- Ms Puspa Maya Sharma, Senior Laboratory Officer
- Ms Dechen Wangmo, Senior Laboratory Officer
- Mr Purna Bahadur Rai, Senior Laboratory Technician
- Mr Dawa Tshering, Senior Laboratory Technician
- Ms Kelzang Lhamo, Assistant Laboratory Technician

The diagnostic capacities available in this section are:

- Rapid antigen detection tests for Avian Influenza type A, H5, Newcastle disease (ND) virus, Infectious Bursal Disease (IBD), Foot and Mouth Disease (FMD) and Rabies;
- FAT for Rabies;
- Antibody ELISA for FMD, Brucellosis, Rabies, ND, IBD, CSF, Infectious bovine rhinotracheitis (IBR), Leptospirosis, Contagious Bovine Pleuropneumonia (CBPP), Contagious Caprine Pleuropneumonia (CCPP), Porcine reproductive and respiratory syndrome (PRRS), Johne's Disease (JD), Avian Leucosis complex (ALC) and Peste des petits ruminants (PPR);
- Antigen ELISA for CSF and PPR;
- Typing ELISA (sandwich) for FMD;
- Conventional PCR for *Brucella* and FMD;
- Real-time PCR for AI Type A, (H5, N1, H7, N8) FMD, CSF, ASF, PRRS (EU and NA), Pigeon Paramyxovirus (PPMV) and ND;
- Agglutination tests - HA/HI for ND and H7N9;
- Slide agglutination test for *Salmonella* and *Mycoplasma*;
- Rose Bengal test (RBT) for *Brucella*.

2.2.3.6 Post-mortem and Pathology Section

The section has Post-mortem and Histopathology section which provides necropsy and histo-pathological diagnosis, respectively.

The section is manned by the following staff:

- Dr NK Thapa, Animal Health Specialist – II
- Ms Passang Bida, Assistant Laboratory Technician
- Ms Ugyen Pema, Assistant Laboratory Technician
- Mr Tenzinla, Senior Laboratory Technician

The section is responsible for following diagnostic capacities:

- To conduct post-mortem examination and diagnosis in poultry, ruminants, canine, feline, equine, swine species and wild animals including reptiles and fish;
- To perform histopathological examination and diagnosis through processing and examination of slides (H and E, Grams, ZN, pigment staining and pearls staining);
- To perform immuno-histochemistry.

2.2.3.7 Bio-safety and Bio-security section

The section is mandated to implement and monitor bio-safety measures and good laboratory practices (GLP) in all veterinary laboratories in the country. Thus, this section is an aide-de-section for all other sections.

The section is manned by the following staff:

- Ms Dechen Wangmo, Senior Laboratory Officer

The section is responsible for the following:

- Planning coordination and implementation of bio-safety and bio-security plans;
- Technical support on bio-safety and bio-security measures;
- In-house training on bio-safety and bio-security;
- Reporting and monitoring;
- Samples referral to collaborating laboratories;
- Procurement of routine and research laboratory test kits, reagents, and consumables.

2.3 Drugs, Vaccines and Equipment Unit (DVEU)

2.3.1 Human Resources

During the FY 2019-2020, the unit is manned by the following technical officials:

- Dr Ugyen Namgyel, Senior Veterinary Officer, Head
- Ms Karma Pelden Zangmo, Pharmacist
- Mr Namgay Dorji, Senior Livestock Health Supervisor
- Ms Phuntsho Wangmo, Senior Extension Supervisor

2.3.2 Main mandates

The main mandate of the DVEU is to coordinate implementation of the overall management of the Essential Veterinary Drug Programme (EVDP) in the country. This mandate is implemented through various functions and activities such as:

- Timely procurement, storage and distribution of veterinary medicines, vaccines, equipment, and non-drug items;
- Monitoring of medicines, vaccines, and equipment supply, stock position, and storage at the Livestock central store (LCS) and field level;
- Maintenance of veterinary equipment and cold chain equipment;
- Audit quality control and quality assurance through testing of veterinary medicines at the Drug Regulatory Authority (DRA) approved laboratories;
- Ensure proper management of the revolving fund;

- Coordinate training and/or meetings related to Essential Veterinary Drug Programme;
- Coordinate/organize the National Veterinary Medicine Committee (NVMC) meetings;
- Liaise with DRA and take follow-up action concerning drug inspection reports.

2.4 Biological Production Unit (BPU)

2.4.1 Human resource

During FY 2019-2020, the unit is manned by the following staff:

- Mr Harka Bahadur Tamang, Senior Livestock Health Supervisor
- Mr Migma, Senior Laboratory Technician
- Ms Karma Choki, Assistant Laboratory Technician
- Ms Sonam Deki, Livestock Health Supervisor
- Mr Sangay Nidup, Laboratory Attendant

2.4.2 Main mandates

The unit is primarily responsible for:

- Production of viral and bacterial vaccines and biologicals;
- Import/procurement of vaccines which are not produced within the country;
- Provision of technical support and monitor the cold chain facilities in the field to ensure the effective storage of vaccine and veterinary biologicals.

2.5 National Dog Population Management and Rabies Control Programme (NDPM & RCP)

The NDPM & RCP started as a collaborative effort of Royal Government of Bhutan (Department of Livestock) and Humane Society International (HSI) with a 50-50 partnership, with the fund support in both cash and kind.

Phase I: September 2009 – June 2012

- 35,689 dogs were covered under Catch, Neuter, Vaccinate and Release (CNVR) programme.

Phase II: July 2012 to June 2015

- The Community Animal Birth Control (CABC) Programme was initiated to control dog population in Bhutan.

Phase III: November 2015 to June 2018

- After the end of Phase II, the project was further extended by three years, to streamline CABC and ensure on-going impact before the project can be entirely handed over to the RGoB by HSI.
- As per the MoU signed between DoL and HSI on 9th November 2015, the partnership was based on 65% contribution from RGoB in cash and 35% contribution from HSI, which were all in kind.

After the end of phase-III in June 2018, the programme was supported by RGoB and has been coordinating and conducting high-volume low-cost spay-neuter along with rabies control, with a limited budget, which is the main mandate of the project.
The Project Management Unit (PMU) of NDPM and RCP is located at the National Centre for Animal Health, Serbithang, with the following staff:

- Dr Hiruka Mahat, Deputy Chief Veterinary Officer, Project Coordinator
- Animal Welfare Officers (AWOs) on paid-when-working basis

Main mandates

- Maintain manageable stray-dog population in the country
- Support rabies control programme in the country

2.6 Administrative section

During the financial year 2019-2020, the administrative section is manned by the following officials:

- Dr RB Gurung, Programme Director
- Ms Phuentsho Choden, Administrative Assistant II
- Ms Karma Dekar, Senior Administrative Assistant IV
- Mr Rinzin Dorji, Storekeeper
- Ms Pemo, Senior Telephone operator II

2.7 Accountant section

The section, during the FY 2019-2020, is manned by the following officials:

- Mr Tshewang Dakpa, Accounts Assistant III
- Ms Pari Chhetri, Accounts Assistant II

3. KEY ACHIEVEMENTS OF NCAH

The National Centre for Animal Health, Serbithang under the guidance of Animal Health Division, Department of Livestock and through the support of Regional Livestock Development Centres, Dzongkhag Livestock Sectors and other commodity programmes, achieved the following milestones during the FY 2019-2020.

3.1 Establishment and strengthening of laboratory diagnostic capacity

3.1.1 Proficiency testing

- National external quality assurance system (NEQAS) coordinated and conducted for four RLDCs for *Brucella* RBT.

3.1.2 Introduction of new diagnostic technology

a) Serological tests
   - Introduction of ELISA for CCHF
   - Introduction of RAPINA test for Rabies

b) Cell culture facilities established; Acquired CO_2 incubator

c) Bacterial techniques

- Isolation, identification & Antimicrobial sensitivity testing of *Streptococcus agalactiae*;
- SOP developed for isolation, identification & Antimicrobial sensitivity testing of *Campylobacter* and *Enterococci*.

d) Parasitological techniques: Tick identification

3.1.3 Samples analysis

- A total of 6,312 samples were referred or collected by the Centre and performed 12,790 tests to confirm various animal diseases.

3.1.4 Samples referred to international reference laboratories

- One anthrax soil sample was referred to NIID, Japan. About 35 samples are pending to be referred due to travel restrictions.

3.1.5 Assistance in the establishment of Molecular diagnostic centre for COVID-19

- Two laboratory personnel; Ms Puspa M Sharma and Ms Kelzang Lhamo were mobilized with the equipment to establish the COVID-19 diagnostic centre at the Regional Referral Hospital, Monggar.

3.1.6 Laboratory Information Management (LIMS)

Laboratory Information Management System (LIMS) was officially launched on the website. The main aim of the LIMS is to manage information generated for all veterinary laboratory activities in the country.

The main features of the system include entering sample details, track the status of sample submitted, view test results, diagnosis and generate reports as per the requirement.

The system also reduces the usage of the paper and provide fast communication of results as it is online based.

3.1.7 Important diseases diagnosed

- Bovine: Fascioliasis, Ascariasis, Streptococcal Mastitis. FMD, Brucella,
- Goats: CCHF
- Swine: Classical swine fever (CSF), Erysipelas
- Equine: Strangles
- Avian: NCD, ALC, Salmonellosis, Mycoplasmosis, IBD, PPMV in pigeon
- Canine: CD, Rabies, Zygomycosis, Dermatophytosis
- Wildlife: PPR in Takin, Pasteurellosis in Takin
- Cheese: *Clostridium* spp.

3.2 Strengthened Disease Prevention and Control Programme in the country

3.2.1 Development and/or revision of National Disease Control Plans

The Centre, in coordination with other stakeholders, developed and also revised the following national disease prevention and control plans to guide disease prevention, control, and elimination programme in the country:

- Developed and endorsed the "National Peste des Petits Ruminants Prevention, Control, and Eradication plan (NPPR-PCEP) 2020";
- Revised and developed the "National Influenza Pandemic Preparedness Plan and Standard Operating Procedures (NIPPP & SOPs) 2020";
- Revised, developed, and endorsed new edition of the "National Foot and Mouth Disease Prevention and Control Plan (NFMDPCP) 2020";
- Developed and finalized the animal health's part of the "Strategic Plan for the elimination of dog-mediated human rabies and rabies freedom by 2030";
- Developed and finalized the "National Contingency Plan for African Swine Fever (NCPASF) 2020";
- Developed and finalized the "Generic Animal Disease Outbreak Management System of Bhutan".

3.2.2 Coordination of major disease outbreak investigations and containment

In coordination with other stakeholders, the Centre responded to rapid containment of following animal disease outbreaks in the country:

- Anthrax
- Brucellosis
- Rabies
- Foot and Mouth Disease
- Infectious Bursal Disease
- Black Quarter
- Classical Swine Fever
- Haemorrhagic Septicaemia
- Newcastle Disease
- Strangles

3.2.3 Strengthened animal disease information system

- Carried out TAD*info*-based data validation of notifiable animal disease outbreaks in the country, and submitted a six-monthly and annual report to the World Organization for Animal Health (OIE) through WAHIS interface;
- Carried out a real-time update of notifiable animal disease outbreaks in the country, on Centre's web page;
- Initiated fortnightly animal disease information sharing in the name of "Fortnightly e-Bulletin: Animal Disease Information of Bhutan, starting from January 2020.
- Following validation and analysis of notifiable diseases reported, the Centre published the "Status of notifiable animal diseases in Bhutan, 2019";

- Management and monitoring of animal health information -- maintained into the Veterinary Information System (VIS) database system - carried out regularly.

3.2.4 Reduction of incidences of zoonotic and notifiable diseases

There were reported outbreaks of 28 zoonotic and 21 non-zoonotic notifiable animal diseases in the country against the excellent Annual Performance Agreement (APA) target of 31 and 61, respectively, for the FY 2019 – 2020; the Centre was able to achieve the excellent score as per the APA target set for the FY 2019 – 2020, in reducing the number of zoonotic and notifiable disease outbreaks in the country.

3.3 Strengthened vaccine procurement and distribution

For disease prevention and control programme in the country, the Centre:

- Procured 7,680,540 doses of livestock and poultry vaccines of worth BTN 5.5 M;
- Produced 10730 doses of vaccines locally: 9,530 doses of Classical Swine Fever vaccine (in four batches) and 1,200 doses of Anthrax vaccine.

3.4 Strengthened Veterinary medicine and equipment procurement and distribution system

- Veterinary medicines of worth BTN 24.47 M was procured for the FY 2019-2020, BTN 3.37 M more than the approved budget; the additional amount was secured by the unit from the Ministry and NDPM flagship Programme;
- Veterinary medicines of worth BTN 24.97M were distributed to Dzongkhags, Central Farms/Agencies and other non-departmental agencies and Projects during the FY 2019-2020;
- Veterinary equipment and non-drug items of worth BTN 1.3M was distributed to Dzongkhags and Central agencies during the FY 2019-2020;
- A comprehensive assessment and verification of the existing stock situation of medicines in LCS, Phuentshogling was carried out;
- Conducted workshop to review and revise strategies for the management of EVDP, and a day later, 12th National Veterinary Medicine Committee (NVMC) Meeting was held to discuss on the follow-up actions to the 11th NVMC meeting and to endorse the revised strategies developed during the technical workshop;
- The fast-track tendering for medicines and vaccines for FY 2020-2021 was carried out and completed during the FY 2019-2020;
- A sum of BTN 2.98 M was secured through Country Grant Fleming Fund Project to train all the animal health staffs in the country on the use of G2C database.

3.5 National Dog Population Management and Rabies Control Project (NDPM and RCP)

- During the fiscal year 2019-2020, a total of 8,870 surgeries were carried out both in dogs and cats in the field clinics;
- Through mass dog vaccination programmes, a total of 7,914 dogs (stray and owned) were vaccinated against rabies during the FY 2019 – 2020;

- The Centre, in collaboration with the RLDCs and Dzongkhags, observed the 13th World Rabies Day with the theme "Rabies: Vaccinate to Eliminate "through mass dog vaccination campaigns and advocacy programmes. Events were organized in seven different districts of Bhutan, mainly focusing on rabies-endemic southern and eastern Dzongkhags: Samtse, Chhukha, Dagana, Sarpang, Trongsa, Trashigang, and Samdrup Jongkhar;
- Except for one human rabies case in 2016, no dog-mediated human rabies cases were reported since 2013. Therefore, Bhutan is well-on-track for achieving the global target of Zero-by-30, that is, freedom from canine-mediated human rabies by 2030.

3.6 Disease surveillance and animal health research

- A retrospective study on mortality of pigs at the Regional Pig Breeding Centre (RPBC), Yusipang
- Health Screening of Animals at National Jersey Breeding Centre with urine parameters
- Laboratory analysis of Dog faecal samples & Scats from Yak rearing areas
- Survey on Yak health and management practices in highland Dzongkhags
- Disease screening of yak bulls to be exported to Nepal and Sikkim

3.7 One Health activities

The Centre coordinated several one-health activities in the country:

- Participated in response to COVID-19 pandemic in Bhutan through collaborative one-health approach;
- Coordinated development and incorporation of the public health part of National Influenza Pandemic Preparedness Plan and Standard Operation Procedures;
- Coordinated development of Strategic Plan for the elimination of dog-mediated human rabies by 2030.

3.8 Capacity building

The Centre conducted some training/workshops to enhance the skills and expertise of the laboratory and animal health staffs in the country during the FY 2019-2020:

- Training of Trainers on Dog Population Management and Mass Dog Vaccination Apps and Community Engagement;
- Training-workshop on tick identification using morphological keys;
- Master Trainer's Training on the use of G2C database;
- Refresher Training on Laboratory Biosafety & Biosecurity.

3.9 Infrastructure development

Besides routine activities, the Centre carried out:

- Construction and Installation of Reverse Osmosis Water Plant through Fleming Fund Country Grant
- Construction of retaining wall at RO Water Plant site

- Construction of two numbers of biological and non-biological pits
- Procurement of two numbers of double-layered water tank (5000 Litres)

3.10 Financial achievement

The Centre utilized 98.85 per cent (40.07M) of the total approved budget of 40.538M during the FY 2019-2020.

UNIT-WISE ACHIEVEMENTS FOR THE FY 2019-2020

4. ACHIEVEMENTS OF DISEASE PREVENTION AND CONTROL UNIT (DPCU)

4.1 Development and/or review of National animal diseases prevention, control, and elimination plan documents

The Disease Prevention and Control Unit, in coordination with other stakeholders, developed and revised the following plan documents, to guide and direct the field professionals to implement various animal disease prevention and control programmes in the country:

- Developed and endorsed the *"National Peste des Petits Ruminants Prevention, Control, and Eradication plan (NPPR-PCEP) 2020"*;
- Revised and developed the *"National Influenza Pandemic Preparedness Plan and Standard Operating Procedures (NIPPP&SOPs) 2020"*;
- Revised, developed, and endorsed new edition of the *"National Foot and Mouth Disease Prevention and Control Plan (NFMDPCP) 2020"*;
- Developed and finalized the animal health's part of the *"Strategic Plan for the elimination of dog-mediated human rabies and rabies freedom by 2030"*;
- Developed and finalized the *"National Contingency Plan for African Swine Fever (NCPASF) 2020"*;
- Developed and finalized the *"Generic Animal Disease Outbreak Management System of Bhutan".*

4.1.1 National Peste des Petits Ruminants Prevention, Control, and Eradication Plan (NPPR-PCEP) 2020

Peste des petits ruminants (PPR), also known as goat plague, is a viral disease of goats and sheep characterized by fever, necrotic stomatitis, diarrhoea, pneumonia and death. It is considered a highly contagious trans-boundary disease that has a serious socio-economic impact on the smallholder farmers and the government.

The overall objective of this document is to control PPR in Bhutan and ultimately eliminate it by 2028. Achieving this objective will contribute to poverty alleviation through the improved rural livelihood of smallholder farmers. Achieving this goal is monitored through verification of the absence of PPR outbreak in the country and OIE recognizing freedom status.

The purpose of this plan document is to guide the implementation of PPR control and eradication programme by strengthening laboratory diagnostic capacity, epidemiological capacity, prevention strategy, biosecurity measures, and legal

framework. Progress on implementation phases shall be assessed using PPR monitoring assessment tool (PMAT) on an annual basis.

PPRV eradication is feasible because of the favourable epidemiological features: the absence of the long term-carrier state in animals, no known reservoirs in wildlife or the domestic animals other than small ruminants, and life-long immunity after single-dose vaccination, including growing political support following global eradication of rinderpest. The control and eventual eradication of the disease will contribute significantly to achieving the sustainable development goals by 2030. Bhutan aims to free from PPR by 2030.

Lessons learned from the Global Rinderpest Eradication Programme demonstrate that the use of a highly efficacious rinderpest vaccine capable of immunising animals against all rinderpest virus strains was a vital contributor to the campaign's success. Similarly, efficient PPR vaccines are available and can induce life-long protective immunity in vaccinated animals.

The Strategic Approach of the PPR eradication is based on four different Stages of the PPR Global Control and Eradication Strategy (PPR GCES): The four stages correspond to a combination of decreasing levels of epidemiological risk and increasing levels of prevention and control.

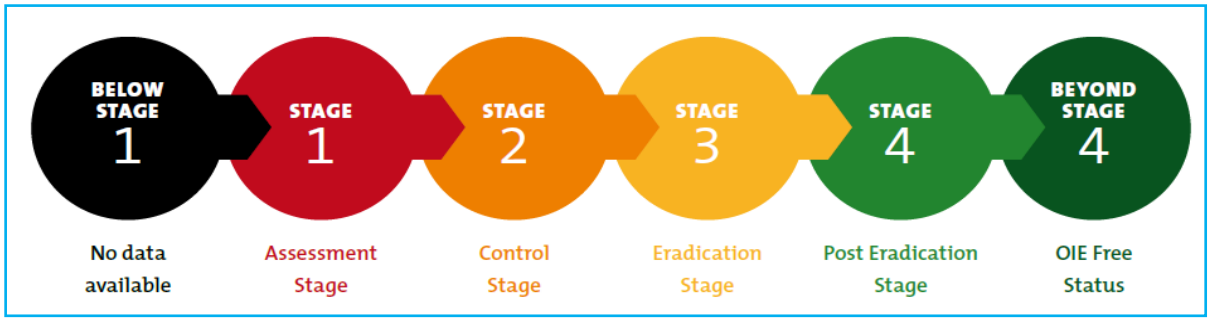


Figure 2: Stepwise approach for PPR Eradication

The usual progression of a **Stepwise approach** is to move from one Stage (n) to the Stage immediately after (n+1); this will be the case for most countries where PPR is endemic, notably in developing countries which may not have the resources to tackle the disease straight away on a national scale.

Bhutan is in Stage 3 of PPR-GCES Stages. This risk-based strategic plan is formulated to support the acceptance of the country into stage 4 and then to stage beyond 4 while a few typical items of stage 2 activities may still be continued. As such this plan contains elements (most of them) typical of stages 3 and 4.

The overall strategic approach of the plan is based on a preventive responsive vaccination campaign targeting the small ruminant population at high risk and in targeted areas as well as rapid containment of the outbreak.

Bhutan shall implement various activities to achieve "**Free from PPR"** by 2028.

Detail timeline for control and eradication of Peste des petits ruminants (PPR) in Bhutan is given in the following figure.

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bhutan	1	2	2	2	3	3	3	3	3	4	4	4	free		

Sl. No.	Stage		When		Lead Agency	Collaborator
	From	To	From	To		
1.	2 (Control)	3 (Eradication)	2017	2020	NCAH	RLDCs, Dzongkhags, BAFRA and DoFPS
2.	3 (Eradication)	4 (Post-Eradication)	2020	2025	NCAH	
3.	4 (Post Eradication)	4 (Beyond Eradication)	2025	2026	NCAH	
4.	Eradication/ Freedom from PPR		2026	2028	OIE	DoL/NCAH

Figure 3: Timeline for PPR control and eradication

4.1.2 National Influenza Pandemic Preparedness Plan (NIPPP) and Standard Operating Procedures, 2020

Following the outbreaks of highly pathogenic avian influenza (HPAI-H5N1) in Southeast Asian countries in January 2004, Ministry of Agriculture & Forests (MoAF) and Ministry of Health (MoH) initiated contingency measures to prevent the incursion of the H5N1 virus into the country and to strengthen the surveillance system in the animal health and human health sectors to detect and respond to any outbreaks. Focal officers were identified from the Department of Livestock (DoL), Bhutan Agriculture & Food Regulatory Authority (BAFRA) of MoAF, and the Department of Public Health (DoPH) of MoH to facilitate collaboration between the two ministries to implement contingency measures. Risk assessments were carried out by DoL from January to February 2004. The assessment at that time indicated a very low risk for the incursion of the virus into the country. The risk had greatly increased from 2006 onwards due to frequent outbreaks of HPAI in Indian states of West Bengal and Assam.

Realizing the pandemic potential of the H5N1 virus and considering the imminent threat of incursion of HPAI into the country, MoAF and MoH initiated the development of the National Influenza Pandemic Preparedness Plan (NIPPP) under the World Bank-supported National Influenza Preparedness and Response Project. Through this project, the draft plan was tested through a series of desktop and field simulation exercises and core capacities were developed to respond effectively to an outbreak of HPAI and pandemic influenza in Bhutan. Although the first edition of the NIPPP document was printed out in 2011, the country was well prepared with the necessary preparedness in responding effectively to the first outbreak of HPAI H5N1 in Bhutan in February 2010.

With the changing epidemiological pattern of disease (H5N1/ H7N9) and challenges faced in the field, the NIPPP document was revised in 2014 and 2019. The experiences gained and the lessons learned during containment of various previous HPAI outbreaks are incorporated into this document.

The objectives of this NIPPP document are to:

- Strengthen surveillance for early warning, detection and response to HPAI H5N1/H7N9 and other Notifiable Avian Influenza Viruses;
- Rapidly contain or prevent/ delay spread of the virus at the source;
- Reduce the opportunities for human infection;
- Minimize morbidity, mortality and social disruption; and
- Monitor and evaluate the response capacity.

The key revisions/updates made in this document as compared with the NIPPP 2014 are:

- The incident command system has been updated in line with the Disaster Management Act of Bhutan 2013. The National Disaster Management Authority (NDMA) replaces the National Steering Committee as the highest authority on NIPPP. Linkages and coordination mechanisms have been built in the command system with the Disaster Management Committees at the National, District, Dungkhag and Gewog level to maintain coherence for the implementation of response activities in line with the Disaster Management Act of Bhutan 2013.
- The roles and responsibilities of the National Incident Command Committee (NICC) have been defined for both normal (peace) times and during an outbreak.
- The composition of the National Incident Command Committee (NICC) and Incident Operation Centre (IOC) have been reviewed and updated. The number of technical members in NICC was reduced with the formation of the Technical Advisory Committee (TAC).
- The National One Health Technical Committee will function as Technical Advisory Committee to guide NICC, IOC and field offices on prevention and control of HPAI during outbreaks. The Terms of Reference for TAC is developed and included in this document.
- Roles of the National Centre for Animal Health and Regional Livestock Development Centre are specified.
- A timeline has been indicated from the time a case of avian influenza is suspected until deactivation of the IOC/NICC to have a common understanding of the roles and responsibilities at all levels of the command system.
- To ensure that the compensation is fair, transparent and timely to all eligible farmers/owners, compensation committee members are categorized into Dzongkhag and Thromde level.
- The protocol for information sharing and reporting has been included.
- The fund mobilization and release mechanisms have been explained clearly in line with the Disaster Management Act of Bhutan 2013.

- The Standard Operating Procedures (SOPs) have been updated based on the latest scientific evidence/knowledge. New SOPs have been added on vehicle disinfection, movement of poultry/poultry products during outbreak time, surveillance on Avian Influenza (AI) H7N9.
- Given the emergence of AI H7N9 in China and the imminent threat to Bhutan, the surveillance and response mechanisms for this novel influenza virus has also been incorporated in this document.
- Information on the historical outbreaks of HPAI H5N1 in Bhutan has been included along with the virus clades circulating in the country.
- Dzongkhag Disaster Focal person has been included as a member of the compensation committee and IOC.
- A flow chart for budgeting and disbursement process for compensation has been developed for reference by the IOC/NICC.
- The forms under Standard Operating Procedures are pretested, revised based on the field experience and are attached as printable forms.

4.1.3 National Foot and Mouth Disease Prevention and Control Plan (NFMPPCP) 2020

Foot and Mouth Disease is a highly contagious viral disease that affects domestic cloven-hoofed animals (cattle, swine, sheep, and goats) and wild animals (deer, bison and feral swine). The disease is characterized by fever, vesicular (blister-like) lesions and subsequent erosions (ulcers) on the surfaces of mouth, tongue, nostrils, muzzle, feet and teats. It is considered the most contagious disease of livestock and is of high priority for the Department of Livestock in Bhutan. FMD causes crippling socio-economic consequences through the loss of young stock, decreased production and trade.

The disease is endemic in Bhutan, and as per the annual livestock census 2019, there are 434,612 FMD susceptible livestock species in Bhutan of which 70% comprises of cattle. FMD is the most important disease affecting livestock production in Bhutan and it is a notifiable disease as per the Livestock Rules and Regulations of Bhutan 2017.

This plan encompasses information on organizational set up for animal health, the nature of the disease, principles and strategies for its prevention and control. Besides organizational setup, it also identifies approaches for early preparedness and response, the monitoring and evaluation mechanism that are required for effective implementation of the outlined activities.

Provisions in the OIE International Animal Health Code and Progressive Control Pathway for FMD stages and principles guided in preparing the document.

The goal is to progressively increase the level of control through 6 stages of PCP in achieving FMD free country status with vaccination.

Purpose of this plan document is to:

- To inform policymakers and stakeholders on the nature and objectives of the FMD control programmes at national, regional and district levels;
- To provide field professionals and relevant stakeholders with strategic directions to progressively decrease the outbreak incidences;

- To determine the national FMD PCP stage and provide direction to progress to the next stage.

The document covers the prevention and control plan for FMD at all levels. The document outline measures that will be considered in control of FMD and is periodically tested through simulation/exercise and updated from time to time as per the need.

Progressive Control Pathway for Foot and Mouth Disease **(PCP-FMD)** has been developed by FAO (Food and Agriculture Organization of the United Nations) and EuFMD (European Commission for the Control of Foot-and-Mouth Disease) to assist and facilitate FMD endemic countries to progressively reduce the impact of the disease and a load of FMD virus. The PCP-FMD approach has been adopted by FAO and OIE (World Organisation for Animal Health) as a working tool in the design of FMD country (and some regional) control programmes.

The PCP-FMD is a set of FMD control activity stages (See Figure 4) that focuses on first identifying and then addressing the risks for FMD introduction and spread. If adequately implemented, the activities should enable countries to progressively increase their level of FMD control to the point where an application for OIE endorsement of a national official control programme will eventually lead to the OIE recognition of an FMD free status with or without vaccination in accordance to the requirements of the OIE *Terrestrial Animal Health Code*. The PCP-FMD consists of two distinct domains:(i) a Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs) pathway from Stage 0 up to and including stage 3 and (ii) an OIE pathway beyond Stage 3.

The PCP approach is based on the following principles

- Understanding the epidemiology of FMD and active monitoring for FMD virus (FMDV) transmission pathways are the foundation of a control programme, and therefore the activities to meet these requirements are common in all stages. FMD monitoring and evaluation system should be in place at Stage 2 and higher to measure the effectiveness of the control programmes;
- Activities are conducted to mitigate the disease risk and reduce virus transmission in the susceptible domestic animal population, as appropriate for the particular PCP Stage;
- In each PCP Stage, activities and their impacts are measurable, comparable between countries and generate information of benefit to national as well as international stakeholders;
- Available resources are optimised by targeting control measures to specific critical control points along the value chains where their impact is greatest. Critical control points may be production systems and/or husbandry practices and/or particular geographic locations where the risk of FMD entry, spread and/or consequences is highest.

As per the PCP-FMD, the risk zone identification and categorization are imperative for defining the strategies in each zone and establish disease status in the country. The

country is divided into three risk zone (High, Medium and Low) (See Figure 5) based on the disease epidemiology, proximity to neighbouring countries, road connectivity, etc. The disease risk zones will be used in guiding the strategies for surveillance, vaccination and animal movement regulation. However, the risk zones should be reviewed periodically based on the disease status to increase the efficiency of the prevention and control programme.

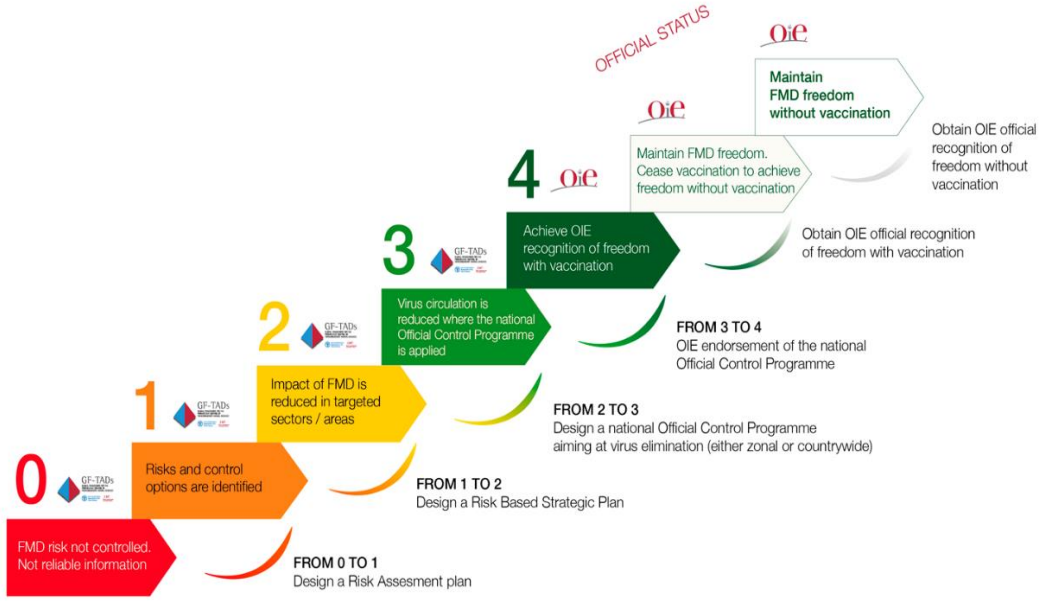


Figure 4:PCP-FMD

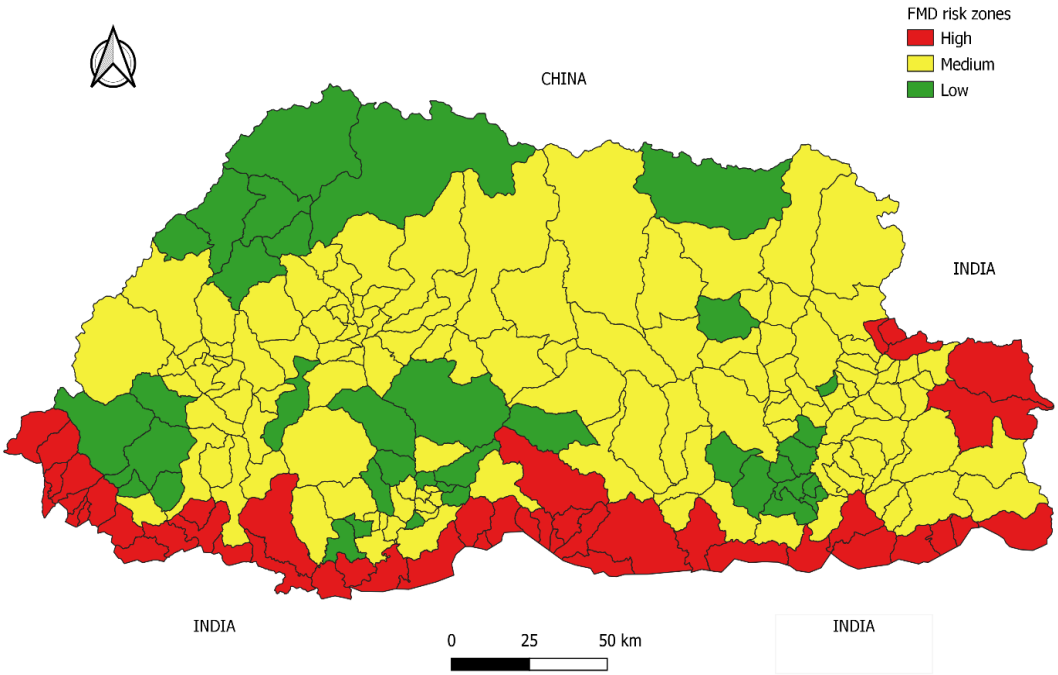


Figure 5: Risk zoning for Foot and mouth disease in Bhutan

4.1.4 Strategic Plan for the elimination of dog-mediated human rabies by 2030

Rabies cause approximately 59,000 human deaths annually globally, with most deaths occurring in Africa (36.4%) and Asia (59.6%) (Bourhy et al., 2010). The domestic dog is responsible for more than 99% of human rabies deaths in the world. Elimination of rabies in humans can be achieved by eliminating rabies in dogs and other reservoirs. Rabies in dogs can be eliminated through sustained mass vaccination, control of dog population and responsible pet ownership. Human rabies can be prevented through prompt administration of post-exposure prophylaxis (PEP) following suspected rabid animal bites. An efficient and effective surveillance system is critical to detect humans and animals' rabies cases. Adoption of an integrated One Health approach is important in the management of rabies prevention and control strategies.

Rabies is a notifiable disease in Bhutan. Rabies commonly occurs in the southern belt of Bhutan along the borders with India; however, isolated cases have been documented in the interior parts of the country, as a result of incursion from bordering areas. Therefore, it is important to control the disease at the source and prevent endemic transmission in the country. As part of the global effort to eliminate rabies by 2030, Bhutan has been actively implementing various strategies to control and eliminate dog-mediated rabies in the country through One Health approach and aims to achieve zero dog-mediated human and animal rabies by 2030. Although cross-border rabies transmission is a challenge as it is difficult to regulate the free movement of dogs across the porous border, elimination of dog-mediated human rabies is feasible in the country. Bhutan has achieved a drastic reduction of human rabies deaths over the decades and since 2017 no human rabies case has been reported. Two rounds of self-assessment of national rabies prevention and control programme were conducted on World Rabies Day i.e., 28 September 2017 and in June 2019 through consultative workshop using Stepwise Approach towards Rabies Elimination (SARE) tool. Both the assessments indicated that Bhutan is on the right track and is currently in Stage 3.5 (Figure 1) with much of the activities being achieved. Therefore, this makes a good case for Bhutan to work towards the elimination of dog-mediated rabies by 2030 as part of the 12th Five Year Plan program. However, the maintenance of rabies-free status would require the continuous implementation of various activities and enhance an effective surveillance system to detect cases in both human and animals for early response. For instance, dog vaccination, rabies awareness and risk communication making PEP accessible and building capacity for rabies diagnosis and surveillance are crucial and are the common activities from the beginning and across all stages of the elimination program. This ***"Strategic Plan for the elimination of dog-mediated human rabies in Bhutan"*** provides performance and impact-based indicator activities to be implemented to eliminate rabies deaths in humans in Bhutan.

The main goal of the plan is to eliminate dog-mediated human rabies by 2030. The main objectives are as follows:

- To enhance rabies prevention and control in dogs;
- To provide timely access to PEP to all potentially exposed individuals

- To reduce the dog population at a manageable level and promote responsible pet ownership;
- To enhance community engagement in rabies prevention and control through community awareness and behaviour change education, and
- To institute coordination and collaboration mechanism through One Health approach at all levels

Guiding principles of the Strategic framework are as follows

- Dog bites are the primary source of human rabies. Human rabies prevention is possible through mass dog vaccination, promotion of responsible pet ownership and dog population control program with a partnership approach (One Health approach).
- Dog bites are a medical urgency and thorough cleaning of a bite wound is an important first step which needs to be promoted at the community level through advocacy, awareness and education.
- Death from rabies is preventable through timely use of post-exposure rabies prophylaxis (PEP); therefore, PEP should be made easily accessible, affordable and available for those that require it.
- Enhanced surveillance is the key to monitoring the progress and performance of the existing control programme

The following are the key strategies that will be implemented to achieve the rabies elimination plan in Bhutan.

✓ Organizational setup for rabies elimination
✓ Prevention and control of rabies in dogs
✓ Prevention of rabies in humans
✓ Strengthen and enhance rabies surveillance
✓ Strengthen disease outbreak response
✓ Conduct and promote operational research
✓ Advocacy, communication and social mobilization
✓ Enhance partnerships and coordination

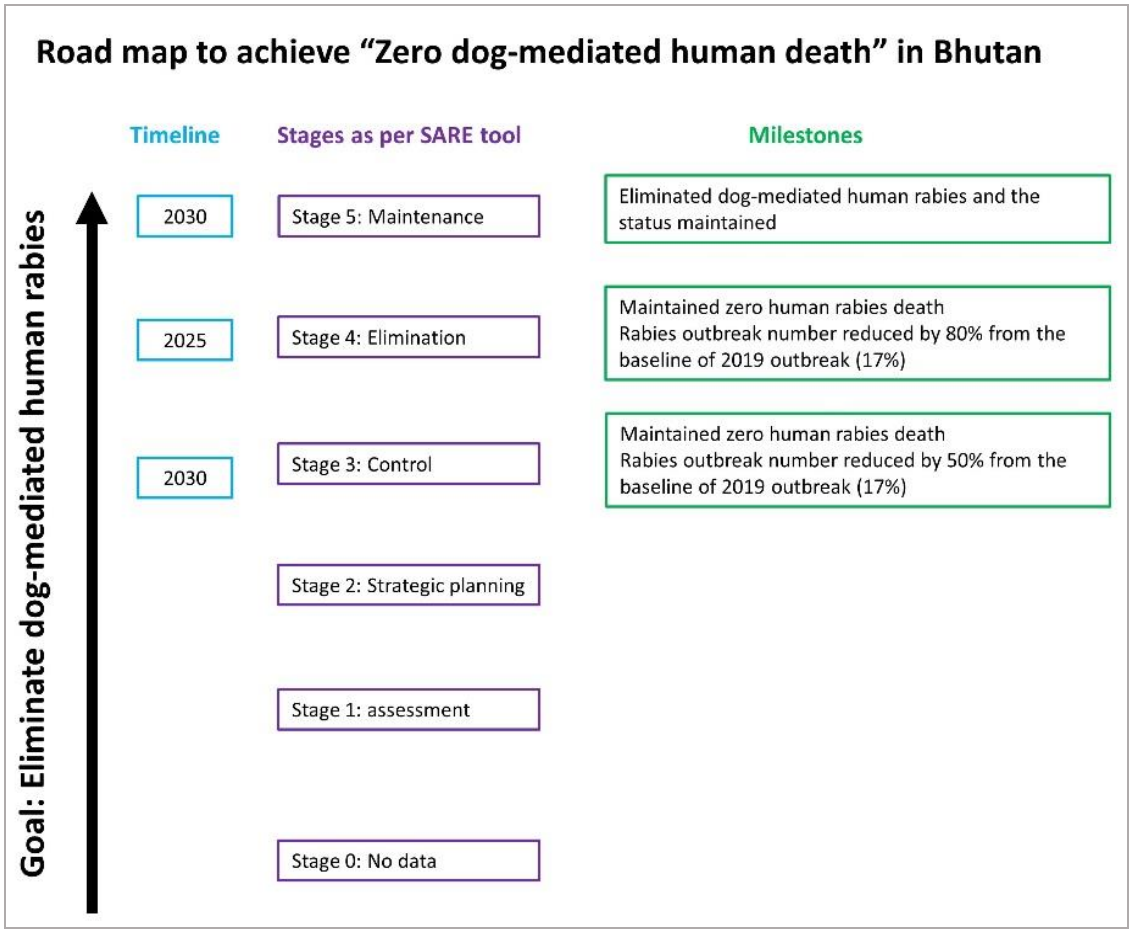


Figure 6: Timeline to achieve the milestones for the elimination of dog-mediated human rabies in Bhutan, following the SARE stages.

Table 2: Road map for Bhutan to eliminate dog- mediated human rabies by 2030

Goal	**Milestone**		**Target**
	2022	**2025**	**2030**
Eliminate dog-mediated human rabies	Rabies outbreak numbers reduced to 50% from the baseline of 2019's outbreak (17 nos.).	Rabies outbreak numbers reduced to 75% from the baseline of 2019's outbreak (17 nos.).	Dog-mediated rabies transmission interrupted.
	Zero human death from dog-mediated rabies maintained	Zero human death from dog-mediated rabies maintained	Zero human death from dog-mediated rabies maintained

4.1.5 National Contingency Plan for African Swine Fever (NCPASF) 2020

African swine fever (ASF)was discovered by R.E Montgomery in Kenya in 1921, as a new disease, causing high mortalities in imported European pigs. Following decades, ASF was observed in several Sub-Saharan countries.

The first occurrence of ASF outside the African continent occurred in Portugal in 1957, near Lisbon, where an ASF outbreak caused mortalities around 100%. Three years later, in 1960, after an epidemiological silence, ASF reappeared in Portugal, rapidly spreading to the whole Iberian Peninsula. Since then, ASF remained present in Spain and Portugal for more than twenty years, until eradication was achieved in 1994 in Portugal and 1995 in Spain, consequent to great human and economic efforts.

During these years of ASF in the Iberian Peninsula, several European and American countries suffered outbreaks of ASF, mainly caused by the movement of contaminated meat products. However, these outbreaks were eradicated except on the island of Sardinia, where the disease remains endemic since 1978.

Since 2016, a pattern of a significant increase in the number of outbreaks was identified. The disease is present in the African, European, and most recently, the Asian continent. It has never been reported in Oceania, and it was eradicated in the Americas in the '90s. Since 2016, 24% of the reporting countries and territories (48/200) have reported the disease. In Europe, the disease occurred for the first time in Moldova in September 2016, then in June 2017 in the Czech Republic, followed by Romania in July 2017 and more recently in Hungary, and Bulgaria, in April and August 2018 respectively. A recurrence of the disease in wild boars has been reported in Belgium in September 2018. In Asia, the disease was reported for the first time in China (People's Republic of) in August 2018, in Mongolia in January 2019, then in Vietnam in February 2019, in Cambodia in March 2019, and in Hong Kong (SAR-PRC) in May 2019 and India in May 2020.

ASF is present in domestic pigs and wild boars in Europe, while Asia and Africa have notified outbreaks mainly in domestic pigs, and few cases in wild boar (300 cases reported in Asia since August 2018). During this period, Europe accounted for the majority of outbreaks with 96% (9,756) of all outbreaks, but the highest impact in terms of animal losses was reported in Asia (1,711,677 animals lost, which is 68% of the total global reported losses for this period).

This contingency plan is applicable for the prevention of incursion, preparedness, and emergency response in the event of an African swine fever outbreak in Bhutan. The document is prepared after considering the risk factors for the incursion of ASF outbreak in the country, viz., recent outbreaks in North-East states of India: Assam and Arunachal Pradesh, pig farming and production in neighbouring Indian states, pig rearing system in the country, pork import figures, the threat of sylvatic transmissions, etc.

This NCPASF is developed to ensure that all the required resources, expertise, and services are mobilized and deployed immediately to respond to the morbidity, mortality, and social disruption to the minimum. It is also developed for rapid response

resource mobilization to respond during the event of ASF outbreaks, for smooth implementation processes.

The main objectives of this NCPASF are:

- To prevent the incursion of ASF virus into Bhutan;
- Rapid containment of ASF virus circulating in the domestic and wild pig population

In the absence of vaccines, the only available option for ASF elimination is stamping out by slaughter and disposal of all infected and potentially infected pigs. The main elements of a stamping-out policy for ASF are;

- ✓ Zoning of the country into infected zones, surveillance zones, and free zones;
- ✓ Quarantine procedures to contain the disease, including pig-movement controls and prohibitions on the sale of potentially infected pig products;
- ✓ Enhanced epidemiological surveillance for ASF;
- ✓ The immediate slaughter of infected and potentially infected in-contact pigs, with prompt and fair compensation to owners;
- ✓ Safe burial or burning of carcasses and other infected materials;
- ✓ Cleansing and disinfection of infected premises;
- ✓ Keeping infected premises/villages without pigs for a safe period.

4.1.6 Generic Animal Disease Outbreak Management System of Bhutan

Over the years, the Department of Livestock in collaboration with Bhutan Agriculture and Food Regulatory Authority (BAFRA) and Department of Public Health (DoPH), Ministry of Health (MoH), has developed important animal disease prevention and control plans: National Influenza Pandemic Preparedness Plan (NIPPP); National Rabies Prevention and Control Plan (NRPCP); National Foot and Mouth Disease Prevention and Control Plan (NFMDPCP); Guidelines for Preparedness, Surveillance and Control of Anthrax in Human and Animals in Bhutan; and National Gid (Coenurosis) Disease Prevention and Control Plan.

With the non-declining trend of outbreaks of some of the diseases like Foot and mouth disease (FMD) and rabies, the existing plan documents are being revised based on past experiences and aligning to updated international standards and recommendations. Prevention and control plan documents for other important diseases like Peste des petits ruminants (PPR) and bovine Brucellosis are in the process of development.

Considering the possibility for the introduction and spread of exotic zoonoses like Crimean Congo Haemorrhagic Fever (CCHF), Japanese Encephalitis, Nipah virus, etc., and other emerging and re-emerging terrestrial animal diseases, the need to develop a generic animal disease management system was felt, as a part of preparedness and response to the outbreak of these diseases.

This document outlines the structure of the animal disease outbreak management with a clear chain of command, decision making and roles and responsibilities of the different committees – comprising relevant agencies at different levels – and fund

mobilisation. This disease control command structure is aligned with the existing guidelines and control plans.

This generic guideline applies to all animal diseases (for which no specific control plan has been developed) with significant public health and or socio-economic impacts and requires implementation coordinated outbreak control measures. However, activation of different hierarchical committees enlisted in this document shall be decided by the Department of Livestock, Ministry of Agriculture and Forests.

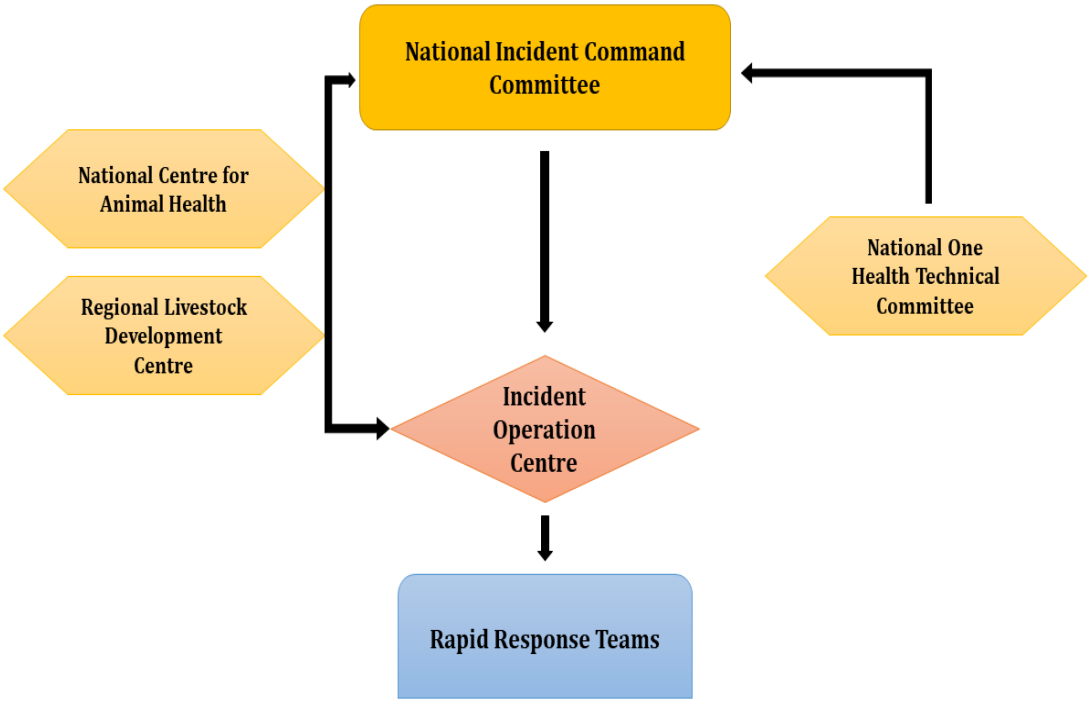


Figure 7: Incident command structure during important animal disease outbreaks

4.2 Strengthening of Database Management and Disease Reporting System

- Validation of Animal health data for FY 2019-2020 entered into the Veterinary Information System (VIS) database by field veterinarians, veterinary paraprofessionals and data managers;
- Carried out regular updating and validation of notifiable animal disease outbreaks' data entered into the TADi*nfo* database by field veterinarians and data managers;
- Two six-monthly and an annual report on notifiable animal diseases were compiled and submitted to Office International des Epizootic (OIE), through the World Animal Health Information System (WAHIS);
- To keep the field professionals and relevant stakeholders updated with the disease outbreaks happening around the country, DPCU regularly updated animal diseases outbreak's notification on the NCAH website, and also started with the "Fortnightly E-bulletin: Animal Disease Information of Bhutan" issue, starting from January 2020;
- Carried out validation and analysis of notifiable animal diseases reported during the calendar year 2019, and produced a detailed report on the "Status of notifiable

animal diseases in Bhutan, 2019", soft copy of which was uploaded onto the Centre's website and also shared with relevant stakeholders;

4.2.1 Status of the notifiable animal diseases in Bhutan, 2019

Notifiable animal disease means a zoonotic or non-zoonotic animal disease listed by the veterinary administration in the country, and that, as soon as detected or suspected, must be reported to the nearest animal health centres by the fastest means of communication. This report presents a brief descriptive analysis of the reported notifiable animal diseases during the calendar year 2019 (January-December) and the trend of outbreaks since 1996. The data used in this analysis were retrieved from the Veterinary Information System database (VIS), 1996 to 2010; the online Transboundary Animal Disease Information System (TADI*nfo* database), 2011-2019; and the offline disease outbreak database maintained at the Disease Prevention and Control Unit (DPCU), NCAH – recorded in reference to the flash and follow up reports submitted by the disease outbreak investigation team in the field.

During the calendar year 2019, a total of 44 separate animal disease outbreaks were reported from across the country, of which rabies (17) and Foot and mouth disease (14) were the major disease outbreaks reported – forming 72 per cent of the total outbreaks. 17 Dzongkhags, except Lhuentse, Punakha and Gasa, reported an outbreak of different animal diseases, affecting 6,614 domestic chickens and 866 cattle, horses, yaks, goats, dogs and cats combined. During these outbreaks, a total of 4,344 domestic chickens and 85 other livestock species died.

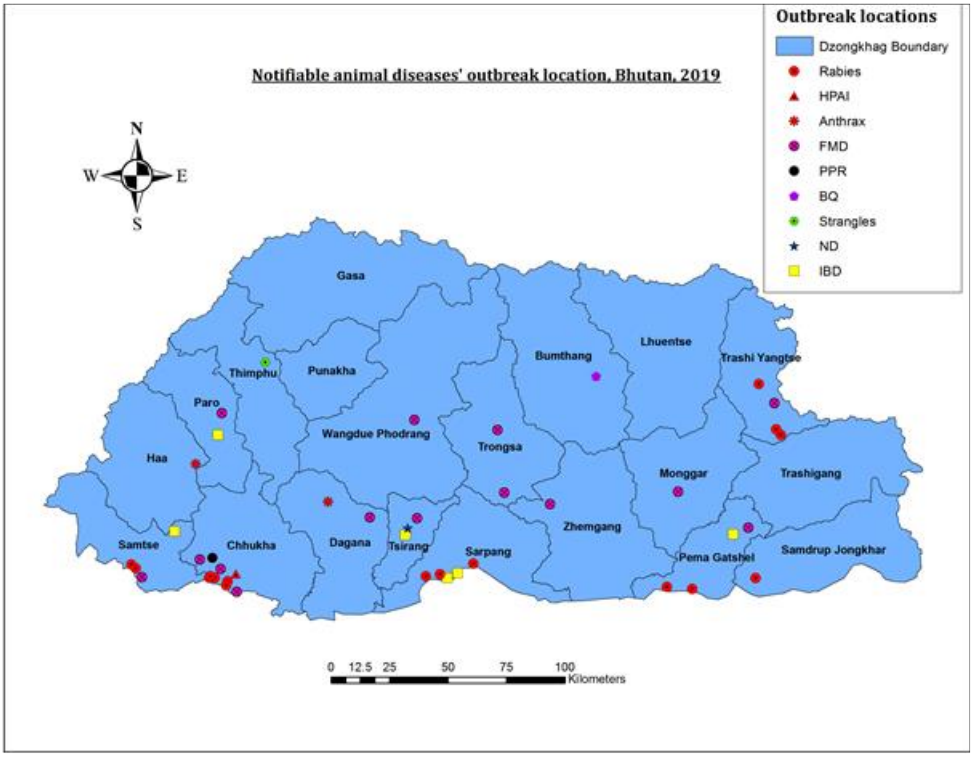


Figure 8: Notifiable animal disease outbreak distributions, 2019

4.3 Reduction in incidences of notifiable and emerging animal diseases

During the fiscal year 2019-2020, separate outbreaks of a total of 28 zoonotic (See Figure 10) and 21 non-zoonotic (See Figures 9) animal diseases were recorded, against the excellent APA target of 61 and 31, respectively.

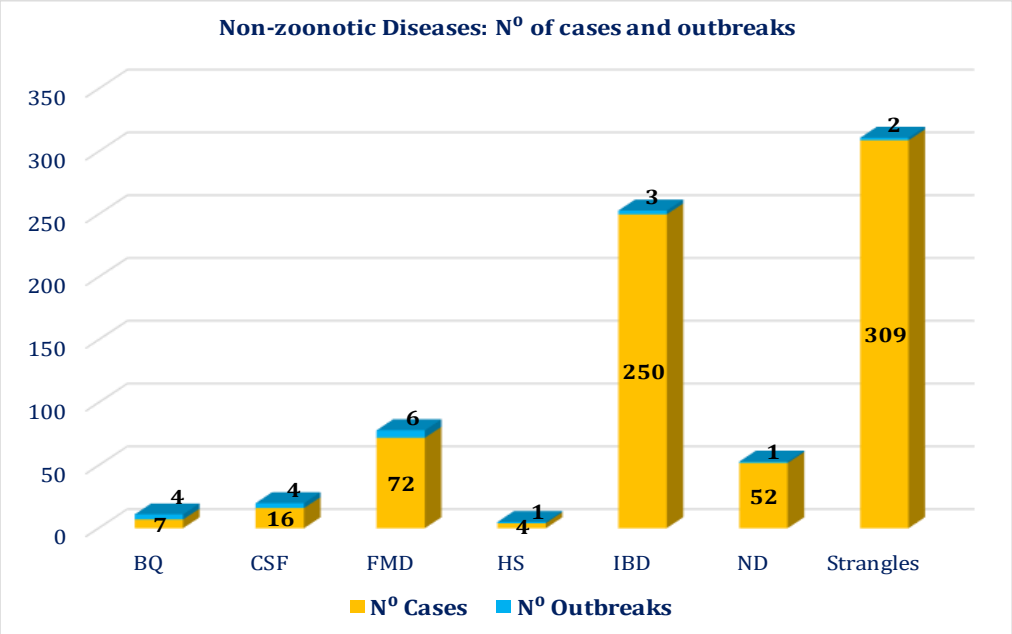


Figure 9: Non-zoonotic notifiable disease outbreaks, FY 2019-2020

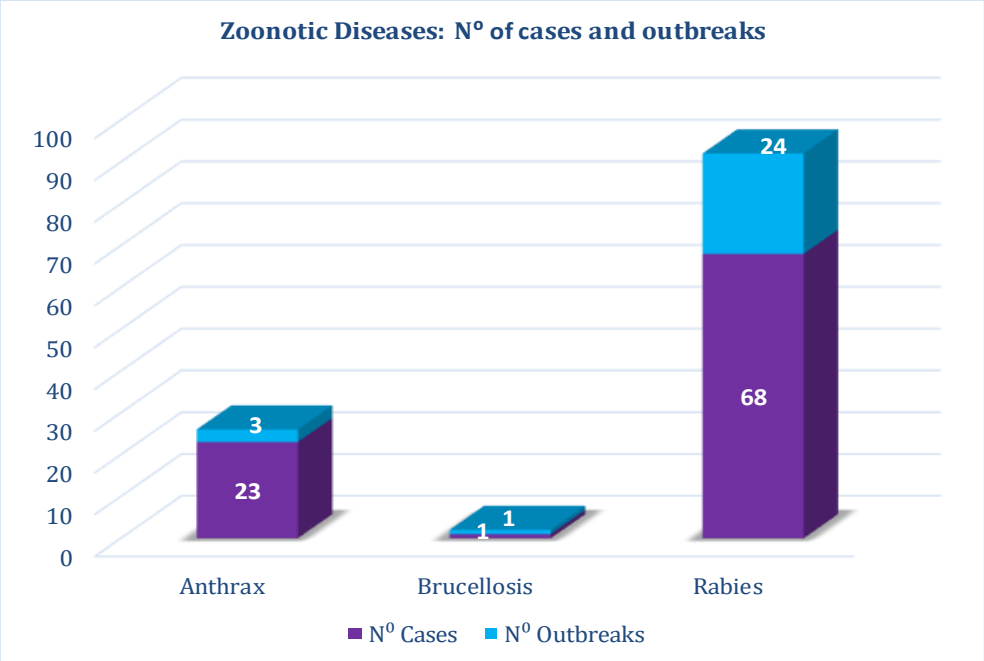


Figure 10: Zoonotic disease outbreaks, FF 2019-2020

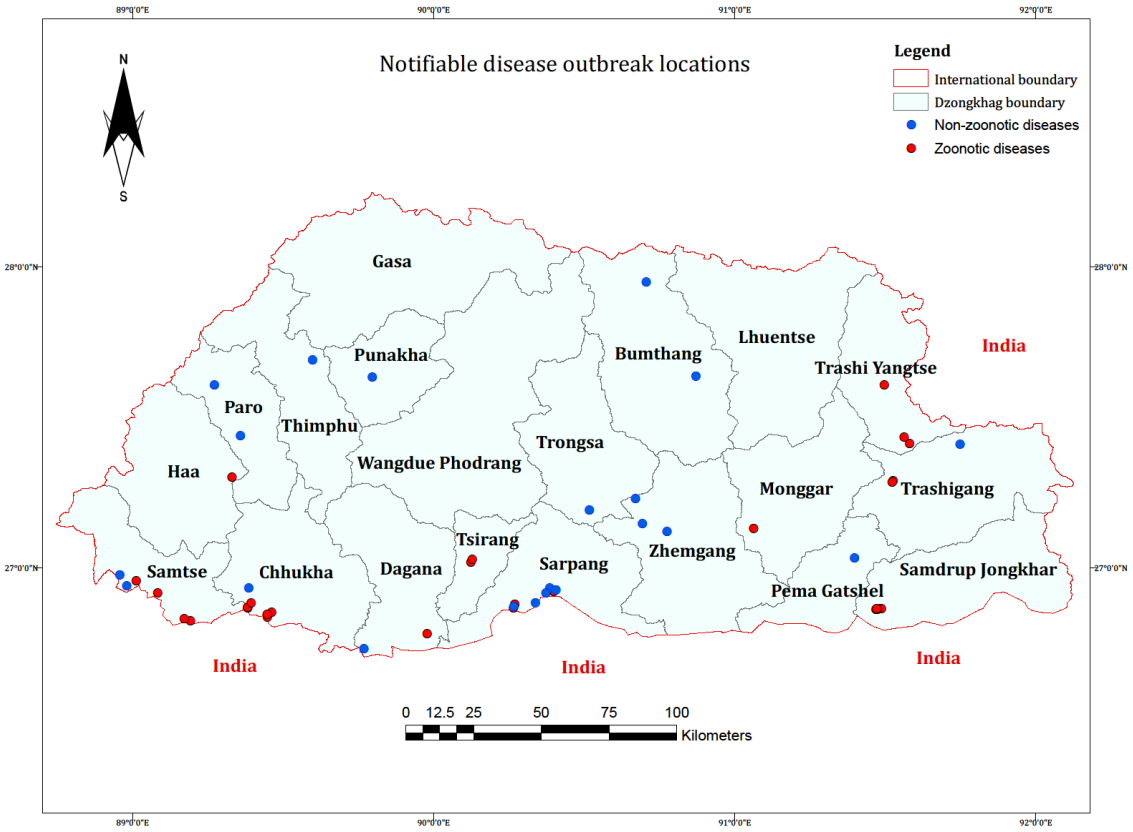


Figure 11: Notifiable animal disease outbreak distributions, FY 2019-2020

With 24 outbreaks recorded in the FY 2019-2020, rabies disease alone accounted for 88 per cent of the total zoonotic disease outbreaks in Bhutan; a total of 68 animals (dog, cattle and goat) were affected (See Figure 12).

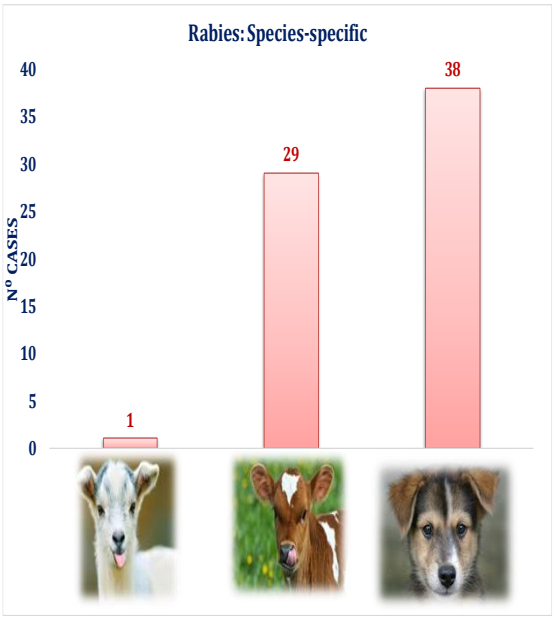


Figure 12: Rabies cases, species-wise

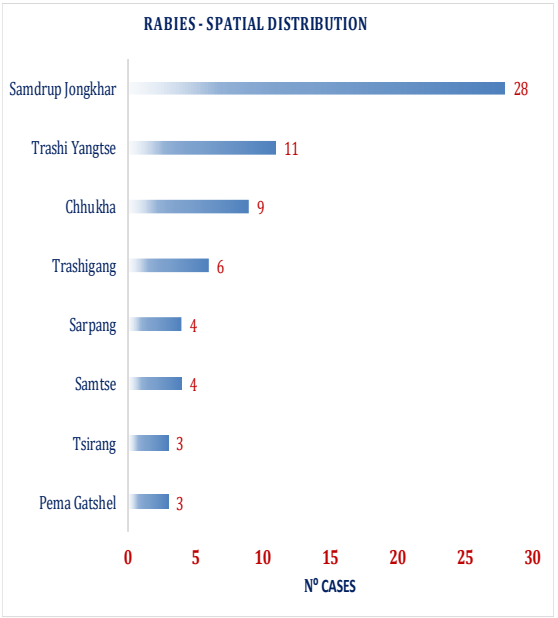


Figure 13: Rabies cases, Dzongkhag-wise

Samdrup Jongkhar Dzongkhag recorded the highest number of rabies cases (See Figure 13), and the maximum number of cases was recorded in January. As recorded over the past years, the FY 2019-2020 also recorded the same pattern of distribution of rabies cases; Trashigang and Trashi Yangtse in the east (bordering the Arunachal state of India), Sarpang and Samdrup Jongkhar in the south-east (bordering Assam state), and Chhukha and Samtse in the south and south-east (bordering West Bengal state).

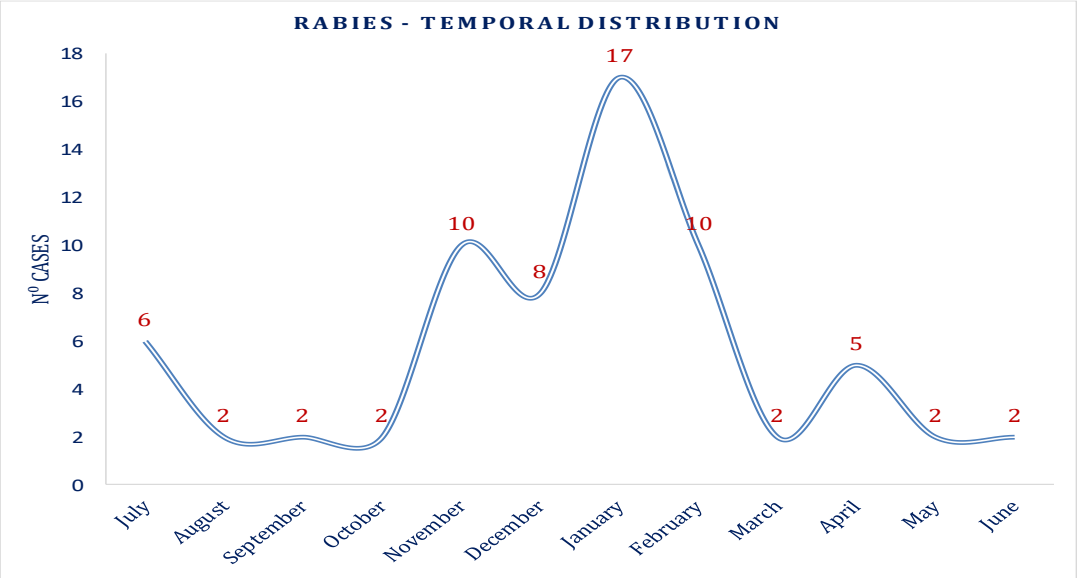


Figure 14: Rabies cases, temporal distribution

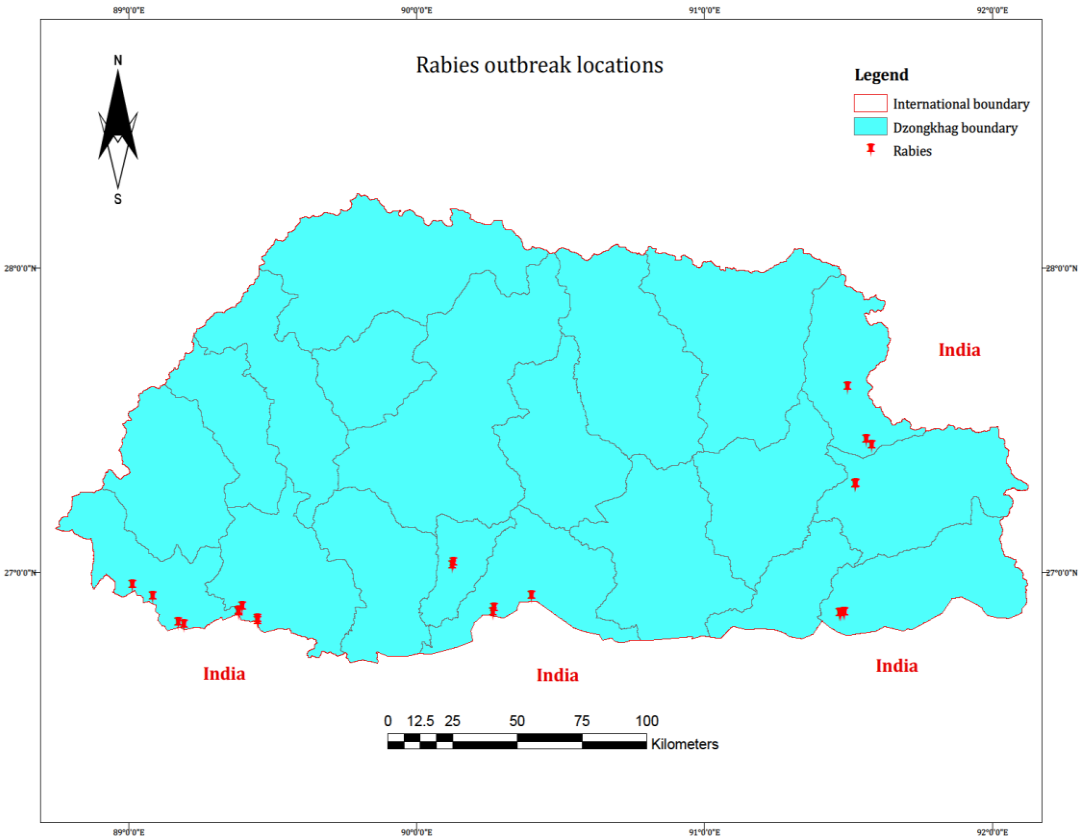


Figure 15: Rabies cases, spatial distribution

4.4 Disease outbreak investigation and containment

The DPCU, LSU and other technical units of NCAH, in collaboration with the RLDCs, Dzongkhag livestock sectors, and other relevant stakeholders, coordinated investigation and containment of following diseases' outbreak in the country:

- Anthrax
- Brucellosis
- Rabies
- Foot and mouth disease
- Infectious bursal disease
- Black quarter
- Classical swine fever
- Haemorrhagic septicaemia
- Newcastle disease
- Strangles

4.4.1 Investigation of the rabies outbreak in Trashi Yangtse

Team members: Dr Sangay Rinchen, Sr. Veterinary Officer; Ms Kezang Lhamo, Sr. Laboratory Technician, Ms Dechen Choden, Sr. Laboratory Technician; Mr Tshewang Rigzin, Driver; Mr Nima, Animal Welfare Official; Mr Tashi, Animal Welfare Official

Background

While most of the northern and central regions of the country were once considered free of rabies, the disease has re-emerged in the eastern areas particularly Trashigang and Trashi Yangtse after not reporting any case for more than a decade. The last rabies cases from these Dzongkhags were reported in 2007 when there was a massive outbreak spreading towards Monggar. In 2016, Trashigang faced a major outbreak requiring continuous containment activities that lasted almost for a year incurring huge disease containment cost and economic losses to the farmers. Currently, the outbreak is ongoing in Trashi Yangtse.

Following interventions were carried out by the investigating team:

a) Inventory of the activities undertaken by the Rapid Response Team
b) Risk assessment and extension of ring vaccination area
c) Determining the protective antibody-titre in the recently vaccinated dogs
d) Syndromic surveillance for rabies
e) Integrated Bite Case Management
f) Risk assessment: Doksum outbreak
g) Contact tracing

Chronology of the rabies outbreak

The following figure shows the chronology of cases recorded during the outbreak.

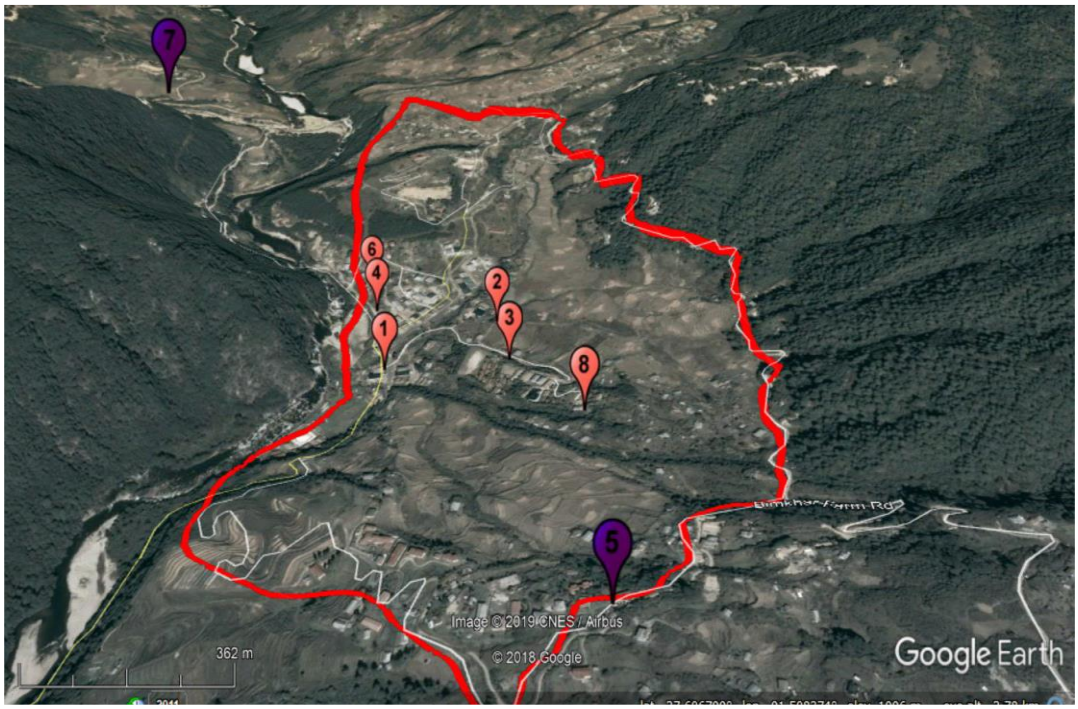


Figure 16: Figure showing rabies cases reported from Trashi Yangtse in numerical order.

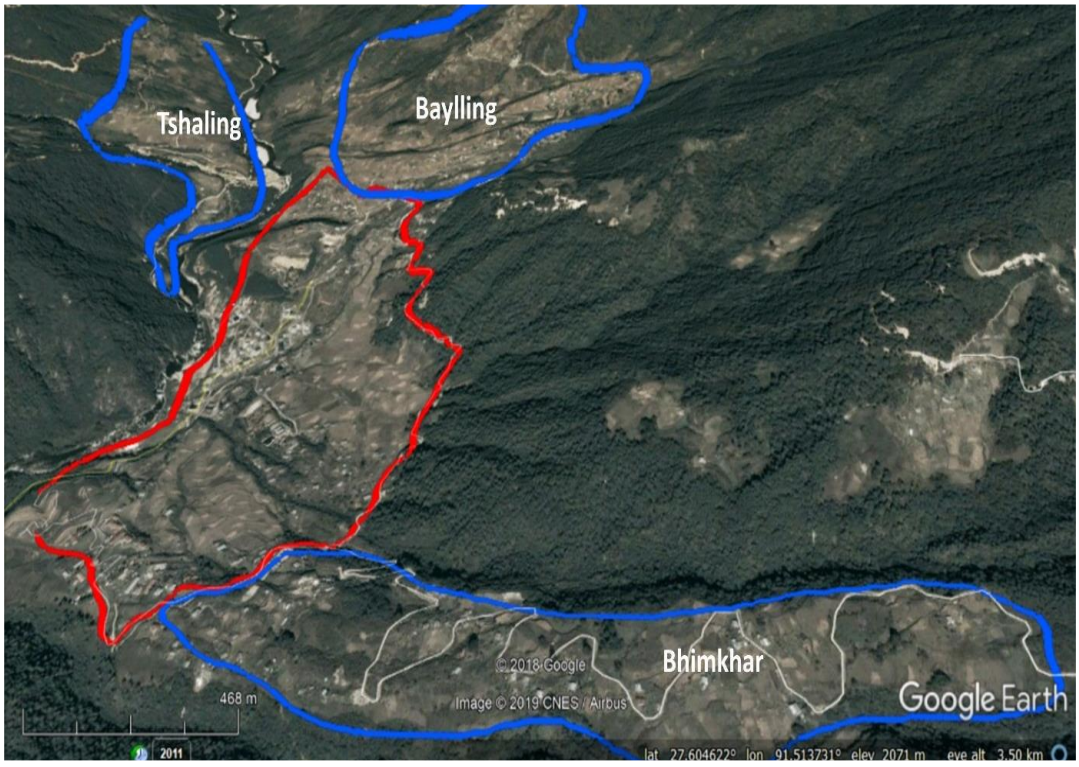


Figure 17: Showing infection (red) and protection (blue) zones.

4.5 One-Health activities

The unit participated and/or coordinated following one-health activities:

- A multi-sectoral approach to face COVID-19 pandemic;

- Development of the "Strategic Plan for the elimination of dog-mediated human rabies by 2030";
- Human National influenza pandemic preparedness plan incorporation into the NIPPP and SOPs.

4.5.1 Bhutan's multi-sectoral approach to face COVID-19


TAG members harmonizing local and central COVID-19 response plan
(Image credit: Dr Tandin Zangpo)

As the COVID-19 pandemic unfolded around the world, the importance of a multi-sectoral approach to address the sanitary crisis had become more evident. In Bhutan, the sharing of expertise is at the centre of the response strategy.

The Ministry of Health has involved experts from different domains in the National Technical Advisory Group. Among them, veterinarians and veterinary paraprofessionals play a key role by sharing their expertise in epidemiology, laboratory testing, regulations, and policies.

Veterinary epidemiologists have had notably contributed to the development of the National COVID-19 Preparedness and Response Plan and the establishment of the standard operating procedures. They also worked on adapting and deploying the national plan to the different districts.

The Veterinary Services shared their expertise on contact tracing and quarantine measures to support the control of people movement in-and-out of the country. In the field, laboratory officers from the Veterinary laboratories have been trained on diagnostic protocols for COVID-19 and have been deployed with all the necessary material to establish a new testing facility.


Community engagement for awareness, advocacy and interview at Bhutan-India international border
(Image credit: Dr Ratna Gurung)

The country recognises the risks and is prepared to deploy the necessary resources if the situation aggravates. The experience of Bhutan demonstrates that a truly operational One Health approach can effectively reduce the impact of the sanitary challenges, such as COVID-19.

4.6 Clinical services

In supplementation to the veterinary clinical services provided by Dzongkhag Veterinary Hospital (DVH), Thimphu, and National Veterinary Hospital (NVH), Motithang, the Clinical Service Section of the centre caters animal health services to the domestic animals brought into the centre from nearby areas.

During the fiscal year 2019-2020, a total of 127 clinical cases were attended (See Figure 18), 35 animals were spayed/neutered (See Figure 19), and 282 were vaccinated (See Figure 19).

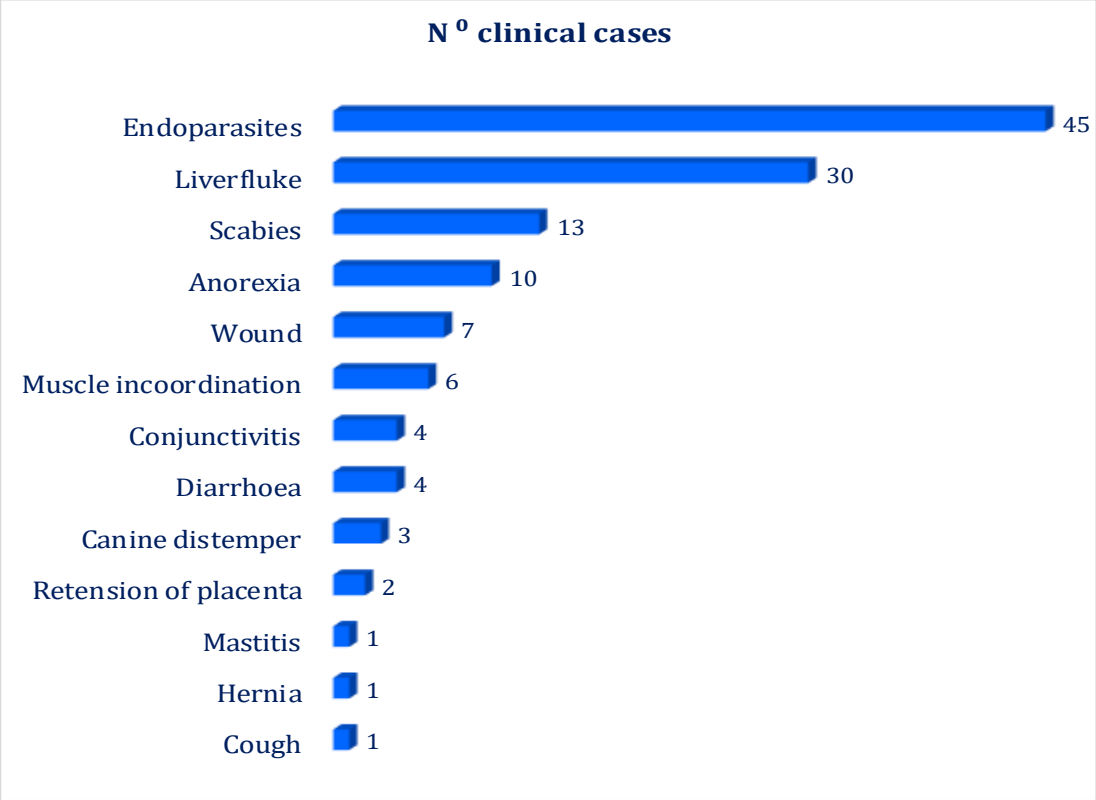


Figure 18: Clinical cases attended, 2019-2020

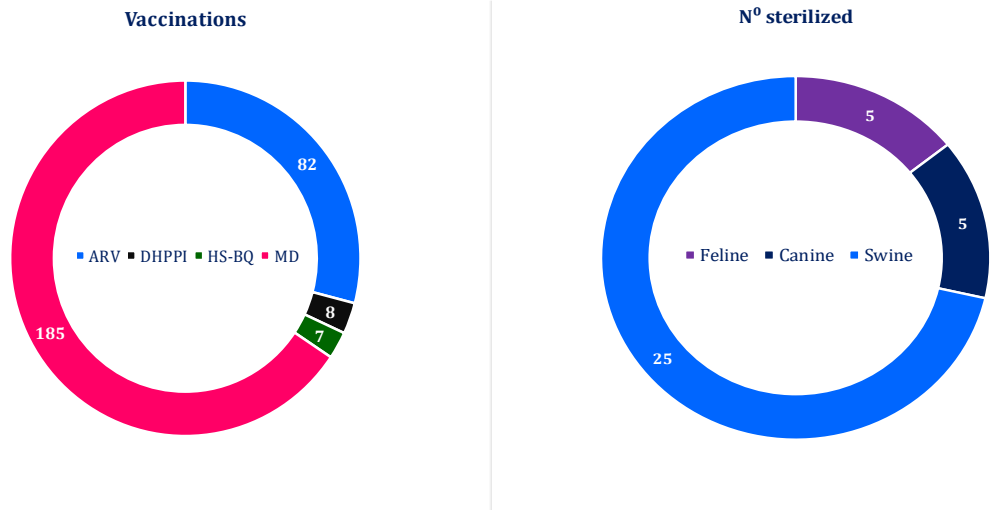


Figure 19: Vaccinations and sterilizations conducted, FY 2019-2020

4.7 Other works

- Coordinated review, planning, and development of the Centre's annual performance agreement document for the fiscal year 2019-2020.

- Coordinated compilation of annual progress report for the centre and supporting documents for evaluation of the Centre's annual performance agreement with Animal Health Division, Department of Livestock, for the fiscal year 2018-2019.
- Coordinated mid-term review of the Centre's activities in line with the annual performance agreement of the fiscal year 2019-2020.

5. ACHIEVEMENTS OF LABORATORY SERVICES UNIT (LSU)

During the fiscal year, 2019 – 2020, a total of 6,312 numbers of various laboratory samples were received or collected and 12,790 laboratory tests were performed for routine tests, disease outbreaks, disease screening, surveillance and research. About 18 samples were discarded due to improper submission of samples and mainly due to lack of diagnostic kits especially in Toxicology due to travel restrictions (See Table 3).

Table 3: Summary of samples received, and tests performed during FY 2019-2020

Section	Samples Received	Tests conducted	Samples discarded/rejected
Toxicology	40	98	12
Bio-Chemistry	41	858	2
Parasitology	2149	2909	0
Clinical path/Haematology	235	1095	0
Bacteriology	544	3,976	0
Post Mortem	176	172	4
Histopathology	872	1217	0
Serology	1664	1877	0
Virology	456	400	0
Molecular	135	188	0
Total	**6,312**	**12,790**	**18**

About 49% of the samples comprised for routine, 37% for research, 7% for disease outbreaks, 6% disease screening, 1% regulatory for BAFRA, and <1% for clinical cases (See Figure 20).

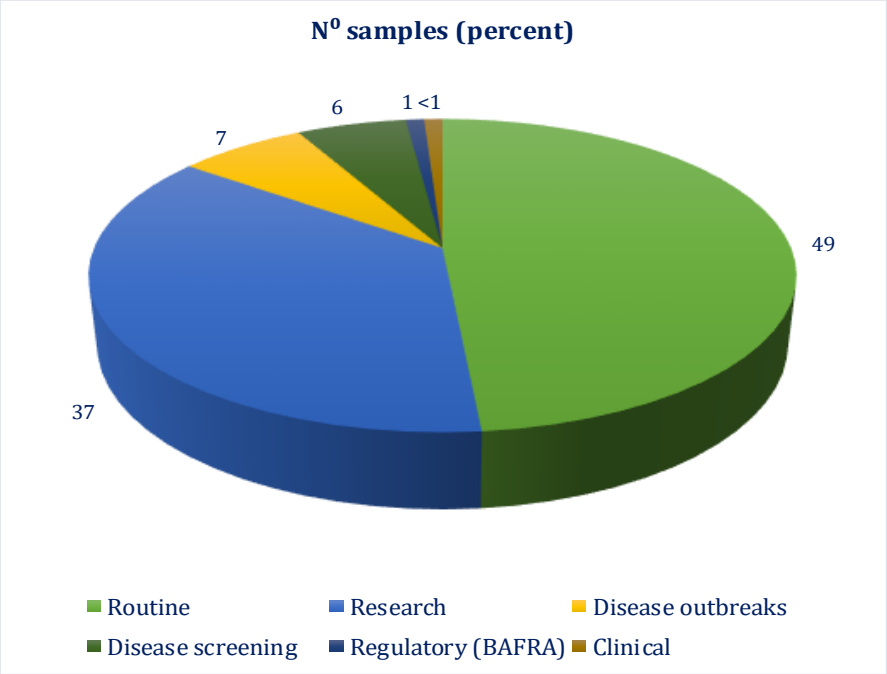


Figure 20: Various categories of samples received and processed.

The samples comprised of various species: 27% from bovine, 19% canine, 16% ovine/caprine, 13% avian, 10% swine, 9% yaks, 4% from wild animals, and 2% from humans (See Figure 21).

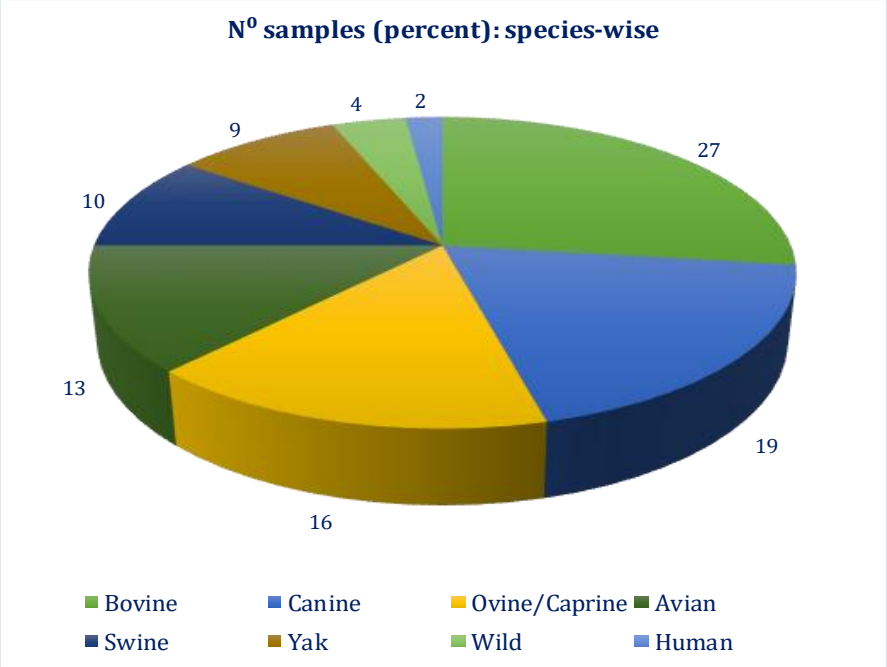


Figure 21: Species-wise sample category

5.1 Section-specific achievements, LSU

5.1.1 Histopathology, Post-mortem section

A total of 176 animal carcasses and 813 tissue samples and smears were received and processed in the pathology section (See Table 4).

Table 4: Samples and tests performed in the Pathology section during the FY 2019-2020

Sample type	Number	Test type	Number
Tissue, organs	810	Histopathology- H and E Staining	869
Biopsy	3	Giemsa staining	3
		Acid Fast staining	7
Carcass	176	Post-mortem/Necropsy	172 (4 unfit for necropsy)
Total	**989**		**1,051**

Significant findings

Histopathology: Common cases diagnosed were IBD, ALC, Pneumonic Pasteurellosis and PPR in Takin.

Post-mortem: Erysipelas in swine, and ALC, Newcastle disease and Infectious Bursal Disease in poultry, and Canine distemper in dogs.

5.1.2 Parasitology section

A total of about 2,149 samples were received and 2,909 tests were performed by the section. The details of tests performed by this section are shown in Table 5.

Table 5: Sample and tests performed in Parasitology section, FY 2019-2020

Sample type	Number	Test type	Number
Faecal samples	1737	Direct examination, Sedimentation, Stoll's dilution, Floatation	1777
Soil samples	399	Test validation for taeniid egg isolation from soil	8
Skin scrapping	2	10% KOH digestion	2
Blood smear	10	Giemsa staining	10
Intestine	1	Direct smear	1
Total	**2149**		**2909**

During the year, the section commonly detected parasitic infestations through the microscopic detection of eggs of *Fasciola, Coccidia, and Ascaris* in bovine and Taeniasis in stray dogs.

5.1.3 Bacteriology Section

About 544 different samples were received/collected and 3,976 different tests were conducted. The detail of the samples tested in the bacteriology section is as shown in Table 6.

Table 6: Samples and tests performed in the Bacteriology section during 2019-20

Type of specimen	**Specimen Received**	**Types of test**	**Tests conducted**
Blood smear	10	Culture	1023
Whole blood	3	Gram stain	270
Aspirate fluid	2	Motility	256
Urine	2	Sensitivity test	82
Thoracic fluid	2	CMT	80
Organs	38	White Side test	80
Cloacae swab	73	Cell count	77
Buccal swab	16	Bio-chemical test	1554
Wound swab	9	Acid Fast stain	1
Vaginal swab	20	Methylene Blue Stain	4
Ear swab	10	Inoculation test	140
Saliva swab	1	Giemsa stain	1
Pus swab	6	Pour Plate Techniques	280
Ocular swab	4	LPCB Stain	58
Milk	124	Microbial Library for *Staph. aureus*	40
Nasal swab	52	Microbial Library for *E. coli*	30
Impression smear	3		
Froth swab	4		
Tracheal swab	1		
Foot swab	1		
Skin scraping	53		
Soil Sample	90		
Aborted Foetus	5		
Ear Tip in 50% Glycerol	1		
Ice cream	1		
Cheese	7		
Yogurt sample	4		
Yogurt culture	2		
Total	**544**		**3976**

Significant findings

Significant findings include *Streptococcus equi* from Strangles in horses, *Streptococcous uberis*, *S. agalactiae* & *S. dysgalactia* from mastitis in cattle of NJBC, and *Pasteurella* from the Takins. Furthermore, *Clostridium* was isolated from cheese samples.

5.1.4 Bio-Chemistry/ Toxicology section

In the Toxicology section, 40 feed samples were screened against Aflatoxins. Serum biochemistry was performed in 20 samples. Also, 21 urine samples were screened against various parameters to assess the health of the animals at NJBC, Samtse.
Details of samples and tests conducted in this section are presented in Table 7.

Table 7: Sample type and the tests conducted in Bio-Chemistry/Toxicology section 2019-2020

Sample type	Number	Test type	Number
Feed	40	Aflatoxin	98
Serum	20	Mineral bio-chemistry	210
Urine	21	Urine biochemistry	30

Significant findings

While conducting Aflatoxin test in the animal feed, only one tested positive from a private poultry farm in Thimphu.

5.1.5 Hematology section

Basic haematological tests were also conducted to support the clinical diagnosis in animals. Details of samples and tests conducted in this section are presented in Table 8.

Table 8: Sample type and the tests conducted in Haematology section

Sample type	Number	Test type	Number
Blood smear	8	PCV	212
Whole blood	227	Hb	212
		DLC	231
		TRCC	200
		TWCC	200
		Knott's test	20
Total	**235**	**Total**	**1,095**

5.1.6 Molecular Biology, Serology and Virology Section

The section performed various tests such as rapid tests, Rose Bengal Test for *Brucella abortus*, ELISA, and PCR, as described below in Table 9.

Table 9: Sample and test performed in serology, virology, and molecular section

Section	Type of specimen	Numbers Received	Type of tests	Tests conducted
Serology	Serum	1662	RBT	383
			IBR ELISA	13
			Brucella ELISA	252
			Mycoplasma Gallisepticum Ab	11
			PPR ELISA	59
			CSF ELISA	2
			PPR rapid	18
			BDV ELISA	13
			Mycoplasma Synoviae Ag rapid	12
			Salmonella pullurum Ag rapid	11
			Brucella Agglu(Human)	33
			RAPINA	99
			Rapid EIV	5
			IBD ELISA	30
			CCHF ELISA	936
	Swabs/Organs	2	Rapid IBD	2
	Sub Total	1664		**1877**
Virology	Brain	15	FAT	**15**
	Serum	47	FMD NSP(Rapid)	47
	Cloacae swab	43	Rapid AI	6
	Swabs/Organs	2	Rapid NDV	2
	Bursa swab	11	Rapid IBD	2
	Tracheal swab	57	NDV	47
	Cloacae swab	35	AIV	45
	Eye swab	1	CDV	1
	Bursa swab	11	CPV	1
	Serum	234	IF for CCHF	**234**
	Sub Total	456		**400**
Molecular	Swabs/Organs	13	PCR PRRS-NA	15
			PCR PRRS-EU	15
	Bacteria colony	13	Conventional PCR *Brucella*.	15
	Organ	4	Conventional PCR *Brucella*.	6
	Bacteria colony	4	Conventional PCR-Anthrax	6
	Bacteria colony	6	Conventional PCR erysipelas	8
	Swabs/Organs	9	PPMV RT PCR	11
	Organ	25	CSFV PCR	25

Organs/Swab	10	PCR FMD	12
Swabs/Organs	19	PCR AI	19
Organs/Swab	24	PCR NDV	36
Organs/Swab	3	PCR PPMV	5
Swabs/Organs	5	PCR-ASF	15
Sub Total	**135**		**188**

Significant findings

Important findings in serology includes *Brucella* antibody from cattle in NJBC, Samtse, and CRC, Wangkha; CSF in pigs; CCHF in goats; IBD, *Mycoplasma* and *Salmonella* in poultry; and PPR in Takin.

Important findings in virology include rabies detection by FAT in canines and Canine distemper virus.

Important findings in molecular biology include PPMV in pigeon, NDV in poultry, FMDV in bovine, and CSF in swine.

5.1.7 Bio-safety and Bio-security section

The section is mandated to implement and regulate bio-safety and bio-security measures in the daily laboratory activities. Thus, this section is an aide-de-section for all other sections.

Followings are the activities completed by this section:

- Routine Bio-safety monitoring in the laboratory;
- Developed SOP for Laboratory Waste Management with the support of Fleming Fund;
- Co-ordinate the maintenance of laboratory equipment;
- Developed the incident report form, weekly equipment inspection form, equipment maintenance form, and also laboratory auditing checklist;
- Visited NVH, Motithang, for monitoring and evaluation of biosafety activities in the laboratory;
- Maintained monthly temperature for fridges, incubators, and deep freezers;
- Issued laundry basket and container for all the sections;
- The section conducted internal auditing for the national laboratory to as a part of monitoring of bio-safety and bio-security measures;
- Conducted refresher training on biosafety & biosecurity for the staff of NVL and BPU.

The section visited the laboratory at National Veterinary Hospital, Motithang as a follow up visit. There were a significant improvement and necessary changes made as per the recommendations provided earlier. However, it was noticed that the focal person for bio-safety & biosecurity was not nominated, also SOP for equipment maintenance and monitoring of laboratory visitors were yet to be developed.

5.2 Introduction of new tests

During the financial year 2019–2020, the following new diagnostic technologies for important diseases were established:

a) Serological tests
   - Introduction of ELISA for CCHF
   - Introduction of RAPINA test for Rabies

b) Cell culture facilities established; Acquired CO_2 incubator

c) Bacterial techniques
   - Isolation, identification & Antimicrobial sensitivity testing of *Streptococcus agalactiae*
   - SOP developed for isolation, identification & Antimicrobial sensitivity testing of *Campylobacter* and *Enterococci*

d) Parasitological techniques: Tick identification and validation of isolation of Taeniid eggs from environmental soil samples.

5.3 Samples referred to international laboratories

Details of the sample referred are provided in Table 10.

Table 10: Sample referred to international laboratories.

Species of animals	Sample type	Samples referred to	Numbers of samples	Remarks
Other(soil)	DNA extracted in FTA card	NIID, Japan	1	Anthrax
Takin	Serum, Ocular & Nasal swab in PBS, Organs in PBS & whole blood in FTA card	NIAH, Bangkok	35	PPR from Takins at JDWNP (Could not be referred due to restriction of flight)

5.4 Assessment of the national antimicrobial resistance surveillance system in the food and agriculture sector - Mission Report (2-4 September 2019)

Antimicrobial resistance (AMR) poses a fundamental threat to human and animal health, development, and security. Common and life-threatening infections are increasingly becoming untreatable because of AMR. Following the adoption of the FAO Resolution in June 2015, FAO Action plan on AMR was developed to promote and strengthen the development and the implementation of national action plans against AMR through a "One Health" approach. One of the four focus areas of the FAO Action plan is to strengthen the evidence base through a developed capacity for surveillance of AMR in food and agriculture (Focus Area 2). AMR surveillance is the cornerstone for assessing the level of AMR and for providing information for action in support of local, national and global strategies. As part of the efforts to strengthen the evidence base focus area, FAO has developed the ''Assessment Tool for Laboratories and AMR Surveillance Systems'' (FAO-ATLASS) to support food

and agriculture sectors of countries in assessing their surveillance system related to AMR. The first step proposed with the use of ATLASS is to map the existing national AMR surveillance system in the food and agriculture sectors, including laboratory analytical capacities and networks, to determine gaps in the system and define targets for capacity building. Recommendations from the assessment will be drawn to the country on: (1) How to strengthen the national AMR surveillance system; (2) How to improve coordination among all actors of the AMR surveillance systems at the national level, including better linkages between public health and veterinary public health. This will also allow better harmonization and improved coordination across AMR surveillance systems to ensure a regional/global surveillance of AMR.

FAO RAP worked with the National Centre for Animal Health (NCAH) and the Bhutan FAO Country office to organise the FAO ATLASS Mission to Bhutan from 2-4 September 2019.

The team was composed of the following ATLASS Regional Assessors: Dr Shawn Ting, FAO Regional Office for Asia and the Pacific; Ms Lin Yueh Nuo, National Centre for Infectious Diseases, Singapore; Dr Pattrarat Chanchaithong, Chulalongkorn University, Thailand; Rangsiya Prathan, Chulalongkorn University, Thailand. The ATLASS Mission to Bhutan involved the National Centre for Animal Health under the Department of Livestock (DoL) and BAFRA. OIE representative attended the debriefing meeting. The ATLASS mission was given support by the FAO country office in Bhutan. The mission was funded by OSRO/RAS/502/USA and the Fleming Fund.

Mission objectives

The ATLASS Mission in Bhutan had the following objectives: 1. Map the structure of the national AMR surveillance system in the food and agriculture sectors, including laboratory capacities and network; 2. Establish the baseline country capacities for AMR monitoring and surveillance in the food and agriculture sectors; 3. Identify prioritized steps for action and advocacy to strengthen the national AMR surveillance system through a stepwise approach, and; 4. Describe the linkages with AMR surveillance in other sectors in support of the One Health approach.

Conclusions and perspectives

The national AMR surveillance system for the food and agriculture sectors in Bhutan is currently at country PIP stage 1. Strengthening the "Data collection and analysis" pillars would allow Bhutan to achieve country PIP stage 2. NVL is the national reference laboratory for AMR and the only laboratory that has AST capacity. AST is performed only via the disk diffusion method. NVL was assessed to be at laboratory PIP Stage 2. The Fleming Fund Country Grant will provide much-needed resources that will strengthen the AMR surveillance system in the food and agriculture sector, especially for the "data production" and "data collection and analysis" pillars. AST capacity will also be developed in NFTL, Tsimasham RLDC lab, and Kanglung RLDC laboratory. Future ATLASS follow-up missions to Bhutan

should involve assessment of other laboratories that will have AST capacity. These can be the sentinel laboratories under the Fleming Fund Country Grant.

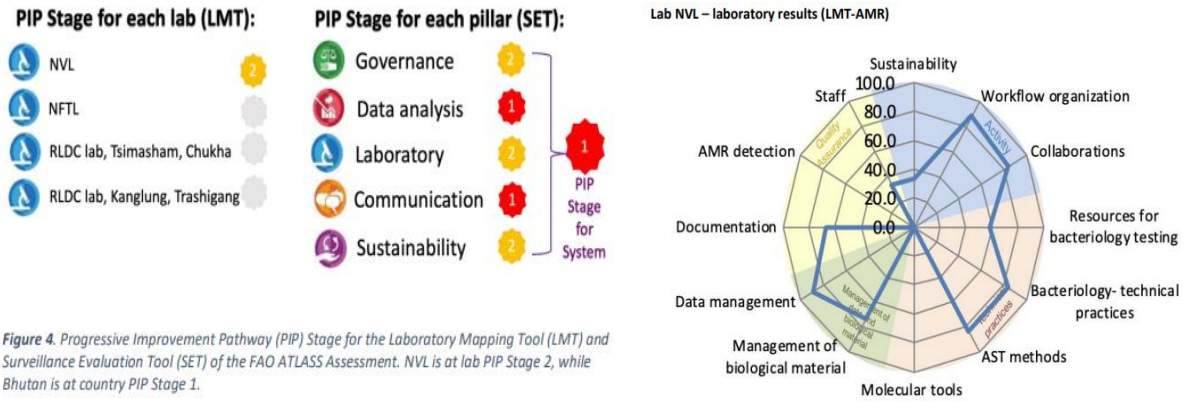


Figure 4. Progressive Improvement Pathway (PIP) Stage for the Laboratory Mapping Tool (LMT) and Surveillance Evaluation Tool (SET) of the FAO ATLASS Assessment. NVL is at lab PIP Stage 2, while Bhutan is at country PIP Stage 1.

5.5 Laboratory quality assurance

5.5.1 National External Quality Assurance

During the fiscal year 2019 – 2020, as a part of national external quality assurance (NEQAS) in laboratory test performance, the National Veterinary Laboratory, National Centre for Animal Health, Serbithang, organized a round of proficiency testing with regional animal health laboratories at Regional Livestock Development Centres on Rose Bengal Test for screening Brucellosis in cattle. The main objective of this PT was to assess the performance of different regional laboratories in the screening of Brucellosis in cattle.

Details of coordinating and participating laboratories in PT are as follows:

1. Coordinating laboratory
   a. National Veterinary Laboratory, National Centre for Animal Health, Serbithang
2. Participating laboratories
   a. Regional Livestock Development Centres, Kanglung
   b. Regional Livestock Development Centres, Tsimasham
   c. Regional Livestock Development Centres, Wangdue
   d. Regional Livestock Development Centres, Zhemgang

5.5.1.1 Proficiency testing panel

Twenty serum samples collected and archived at the National Veterinary Laboratory, National Centre for Animal Health, Serbithang were identified. These samples were tested with RBT and ELISA to determine the level of agglutination reactivity in RBT and optical density (OD) values in ELISA. Accordingly, samples were classified as negative or positive. Depending on the level of reactions among positive samples (n =11), they were further classified as + (positive), ++ (positive) and +++ (strong positive). The panel also included a set of negative samples (n = 9), one positive control and one negative control. Antigen (Rose Bengal stained *B. abortus* suspension) was also supplied along with serum samples.

5.5.1.2 Test procedure

Following steps are the guide to perform RBT at each participating laboratory:

- Bring antigen and test/panel sera to room temperature (20°C ± 3°C)
- Pipette 25 µl of panel serum and place on agglutination plate (white smooth tile) leaving about 4 cm distance between each serum sample
- Similarly, pipette 25 µl of positive and negative control serum and place on the agglutination tile
- Pipette 25 µl of RBT antigen and place next to each serum sample and controls. The antigen and serum should not be mixed while placing on tile
- Once all antigen and serum samples are placed on a tile, start circularly mixing with a clean toothpick to develop a uniform borderline of the mixture.
- Match stick also can be used for this purpose. When match sticks are used, use only its tail end
- Set timer as soon as mixing is started
- Ten samples can be tested at one go to minimise delay in time between the addition of antigen to the first and last serum
- Hold the plate and oscillate gently for about 4 min; 20-25 oscillation is good to mix the antigen and serum properly
- Read the results under bright light depending on the level of reaction (agglutination or no agglutination)
- Read the results within 10 min after mixing of antigen and serum
- Read the results of control sera first, then the panel sera
- Record result in the provided form
- Negative and positive control serum should be used for each batch of panel serum tested

Table 11: Distinction of degrees of reaction

Reactivity	Description	Interpretation
0	No agglutination, no flakes	Negative (N)
+	Barely perceptible agglutination. May be doubtful	Positive (P/D)
++	Fine agglutination, definite flakes and some clearing	P
+++	Coarse clumping, definite clearing	SP

Note: 0, N (Negative); +, P/D (Positive/Doubtful); ++, P (Positive), +++, SP (Strong positive)

5.5.1.3 Collation of RBT results

The participating laboratories were coded as laboratory code 1, 2, 3 and 4 to maintain the anonymity of test results among all participating laboratories. The test results of all participating laboratories were collated and compared with the results of the coordinating laboratory. The results were collated as reported by participating laboratories (See Table 12).

Table 12: Collated RBT result of coordinating and participating laboratories

	NVL, NCAH		LAB CODE 1		LAB CODE 2		LAB CODE 3		LAB CODE 4	
SI no	Result	Intpn	Result	Intpn	Result	Intpn	Result	Intpn	Result	Intpn
1	++	P	++	P	++	P	++	P	++	P
2	+	P	++	P	++	P	+	P	0	N
3	+	P	++	P	++	P	+	P	+	D
4	+++	SP	+++	SP	+++	SP	+++	SP	++	P
5	0	N	0	N	0	N	0	N	0	N
6	+++	SP	+++	SP	+++	SP	+++	SP	+++	SP
7	+++	SP	++	P	++	P	+	P	0	N
8	0	N	0	N	0	N	0	N	0	N
9	+	P	+	P	++	P	+	P	+	D
10	0	N	0	N	0	N	0	N	0	N
11	0	N	0	N	0	N	0	N	0	N
12	0	N	0	N	0	N	0	N	0	N
13	+	P	+	P	++	P	+	P	0	N
14	+++	SP	++	P	++	P	+	P	0	N
15	+	P	+++	SP	+++	SP	++	P	+	D
16	0	N	0	N	0	N	0	N	0	N
17	0	N	0	N	0	N	0	N	0	N
18	0	N	0	N	0	N	0	N	0	N
19	0	N	+	P	++	P	+	D	0	N
20	+	P	++	P	+++	SP	+	P	+	D

5.5.1.4 Analysis of test result

Analysis of test results is shown in Table 3. Positive samples: Three laboratories (Lab code 1, 2 and 3) identified all 11 true positive samples as positive, thus had an estimated diagnostic sensitivity of 1.0. Whereas, one laboratory (Lab code 4) diagnosed 4 true positive samples as negative (false negative) resulting in estimated diagnostic sensitivity of 0.64.

Negative samples: Only one laboratory (Lab code 4) identified all 9 true negative samples as negative and received an estimated diagnostic specificity of 1.0. Whereas, three laboratories (Lab code 1, 2 and 3) diagnosed one true negative sample as positive (false positive) resulting in the estimated diagnostic specificity of 0.89.

An ideal test is the one with diagnostic estimates of 1.0 (sensitivity and specificity). Unfortunately, there is no commercial test available with the diagnostic estimate as 1.0. The diagnostic estimates reported here for all participating laboratories and coordinating laboratory is only relative estimates. However, these estimates are useful in recognizing the strength and weakness in the testing capacity of each laboratory and provide directions for improvement.

Laboratory 1, 2 and 3

a. Did not have an issue in identifying true positive samples as positive irrespective of samples having a different intensity of agglutination/reactions;
b. Had difficulty in correctly identifying the different intensity of agglutination among positive samples;
c. Had difficulty in identifying true negative sample as negative;
d. There is a need to improve on reducing the rate of the false-positive test result.

Laboratory 4

a. Did not have an issue in identifying true negative samples as negative;
b. Had difficulty in identifying true positive samples as positive;
c. There is a need to improve on reducing the rate of the false-negative test result.

Table 13: Calculation of diagnostic estimates (sensitivity and specificity)

Sl. no	Parameters	LAB CODE 1	LAB CODE 2	LAB CODE 3	LAB CODE 4
1	True positive	11	11	11	7
2	True negative	8	8	8	9
3	False positive	1	1	1	0
4	False negative	0	0	0	4
5	Sensitivity	1.00	1.00	1.00	0.64
6	Specificity	0.89	0.89	0.89	1.00

5.5.1.5 Conclusion

The result analysis was performed based on the ability to participate laboratory to correctly identify true positives and positive and true negatives as negative. Owing to the small size of PT panel, analysis on the ability of laboratories to correctly identify different intensities of reaction among positive samples were not performed. Although RBT is a very sensitive test, it is also a highly subjective test in terms of result interpretation. Performing and interpreting RBT requires a high level of experience. Therefore, performing this test and accurately interpreting result can be gained only regular practice. This applies to all the participating laboratories and works towards improving their performance.

5.6 Bio-safety and Bio-security Monitoring

5.6.1 Laboratory Auditing

Under the Bio-safety monitoring and evaluation program, Bio-safety unit carried out auditing of its centre on monthly basis and submitted the report to the head of the Laboratory for directives. During the monitoring and evaluation program, necessary feedbacks were also collected, and necessary advice/recommendations were provided. The unit had visited National Veterinary Hospital, Motithang, in January 2020 to monitor the bio-safety practices followed in the laboratory.

5.6.2 Monitoring the functionality of the equipment

Table 14: Details of equipment rectified.

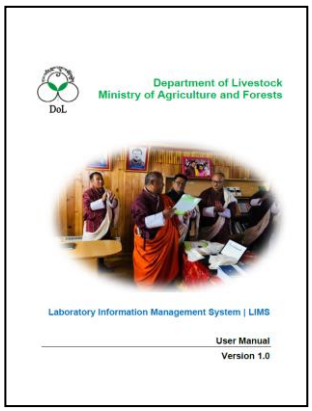
SI No.	Name of equipment	Remarks
1	Automatic tissue processor (HP)	Issues rectified
2	Deep Freezer (DF01-corridor)	Issues rectified
3	Fume hood (motor malfunctioned)	Issues rectified
4	Biosafety class II - Master mix and molecular	Issues rectified but again was faulty
5	Refrigerator R-2	Issue rectified
6	Biosecurity signage prepared 2 nos.	Installed at the entry gate
7	Autoclave (BPU)	Rectified
8	Cold room & warm room (BPU)	Rectified

5.6.3 Incidence Monitoring and Reporting

Table 15: Details of incidence monitoring and reporting

Date	Incident	Action
17.07.2019	Exhaust fan of fume hood burnt, and minor cut received by the technician	First aid provided

5.7 Laboratory Information Management System (LIMS) – Training Module



Laboratory Information Management System (LIMS) is the online database system designed to efficiently manage the information of all the veterinary laboratory activities in the country. It has the features for online entry of sample details, test result, diagnosis and recommendation. The system helps the veterinary laboratories to track samples from submission to testing and reporting. This database enables real-time tracking of sample testing status through a paperless system. Besides data storage and test result dissemination, customized analysis can also be performed to provide decisions required in policy interventions. This system is intended for all the laboratory facilities under the Department of Livestock (DoL) viz. National Centre for Animal Health (NCAH), Regional Livestock Development Centres (RLDCs), Satellite Veterinary Laboratories (SVLs) and Dzongkhag Veterinary Laboratories (DVLs).

The generic functionality of any LIMS database can roughly be divided into five laboratory processing phases:

a) Reception and login of a sample and its associated customer data

b) Assignment, scheduling, and tracking of the sample and the associated analysis
c) Processing quality controls associated with the sample and equipment
d) Storage of data associated with the sample analysis
e) Inspection, approval and compilation of report or further analysis

The LIMS was launched online during July 2019 and the users were to be trained on its usage. Accordingly, the training manual was developed. However, the training as proposed under Fleming fund could not be conducted due to the restriction of mass gathering.

5.8 Assessment of Electronic Record system

Assessment of electronic record system like Veterinary Information System (VIS), Transboundary Animal Disease (TAD) Info and Laboratory Information Management System (LIMS) was carried out by Advance Technical Corp, USA, voluntarily.

5.8.1 Summary of Recommendations

Urgent Priority

- Either attain direct access to VIS and LIMS databases or move VIS and LIMS to a server hosted by the Kingdom of Bhutan;
- Either attain direct access to VIS and LIMS source code or form an escrow source-code agreement with the vendor stating that the Department of Livestock will have full rights to VIS and LIMS should the vendor cease supporting either application;
- Determine vendor's commitment to attaining subject matter expertise and focus on veterinary medicine.

High Priority

- Initiate deep discussions about the future of LIMS and determine the costs in revamping the design to be more focused on operations;
  - Department of Livestock must have access to update reference tables (such as tests, specimens, etc.)
  - LIMS design has to be more cognizant of laboratory workflow and requirements (non-Pathology Cases do not require diagnoses)
  - Design of LIMS has to flow more smoothly and be more intuitive
- Determine a Department of Livestock staff member who can become more acquainted or even trained IT software development;
- NVH re-evaluate staffing needs in cost-sharing with clients, if a practice management system is deployed to optimize operations.

Medium Priority

- Plan for a complete overhaul of VIS as a secondary dataset derived from operations;
- Evaluate funding options with JICOA and / or Canadian partnerships;
- Establish the Department of Livestock's relationships with local World Bank representatives so that they are better aware of the impact of DoL programmes and needs;

- Include in DoL literature the idea of supporting sustainability by recommending practices that increase yield without increasing land consumption.

5.8.2 Options for LIMS and VIS

By our estimate based on the current rate of LIMS development, it will take an additional six months to get LIMS into reasonable shape for the handling of current operations. However, the design of LIMS is fixed based upon perceived laboratory requirements from two years ago. The needs of the laboratory will continue to evolve and LIMS will not have the capability to meet emerging requirements. For example, image capture, instrument interfacing and even the ability to directly email results are not part of LIMS. Their addition would require more customization and development.
The key problem is that the DoL will always be playing "catch up" with LIMS because LIMS has been created as a one-off custom programme.

5.9 One health advocacy meeting on AMR funded by WHO – Observing world antibiotic awareness week (WAAW)

November 18th – 24trh is observed as *World Antibiotic Awareness Week* (WAAW) globally. The goal of the week was to raise awareness of the health risks posed by antibiotic resistance and to promote good practice in this area of concern, to limit the emergence and spread of resistant bacteria throughout the world. The theme is "The future of antibiotics depends on all of us".
Antibiotics have helped in saving millions of lives, reducing the disease burden in people and animals, contributed to improved food production and safety. Unfortunately, it's inappropriate use has led to the emergence and spread of antimicrobial resistance (AMR) in several microorganisms, complicating the management of many infectious diseases in human and animals. AMR also endangers food production.
Globally, about 70% of the antibiotics manufactured by pharmaceutical companies are used in veterinary practices that include production animals, companion animals and wildlife. This means a substantial amount of antibiotics are pumped into our food chain and environment. Weak compliance to regulations of prudent use of antibiotics will expose humans and animals to sub-therapeutic dose and facilitate resistance development.

It is also known that AMR has adverse effects in the functioning of human, animal and plant health systems. Hence, it requires multisector involvement (one health) to tackle the issue. Therefore, it is essential to preserve the efficacy by using responsibly and prudently in whatever areas we use.

To mark the WAAW, a half-day workshop on "**Advocacy on Antimicrobial Resistance to the One Health Stakeholders"** was held at National Veterinary Hospital, Motithang on 20th November 2019. The main objectives of the workshop were to create awareness to various stakeholders, on the AMR and to encourage the prudent usage of antibiotics in respective areas.

His Excellency Lyonpo Yeshey Penjor, Hon'ble Minister of Ministry of Agriculture and Forests, graced the occasion as Chief Guest. The program was attended by WHO Representative to Bhutan and Expert from the World Organisation for Animal Health (OIE). About 64 participants attended the advocacy program representing various agencies such as Department of Livestock, Bhutan Agriculture & Food Regulatory Authority, Department of Agriculture & Department of Forests & Park services under Ministry of Agriculture and Forests and Department of Medical Services and Department of Public Health under Ministry of Health, Drug Regulatory Authority and officials from Thimphu Dzongkhag Administration. The program was organised with the generous fund support from WHO and OIE.

5.10 Fleming Fund Country Grant Project

5.10.1 Infrastructure development/Office set up

The Fleming fund country grant was implemented with an inception phase of six months (April to September 2019) was initiated with a focus on strengthening the governance, office setups, and infrastructure development. The phase, however, had to be postponed till December 2019. During the inception phase, mainly infrastructure development was considered. The details are listed below in Table 16.

Table 16: Details of Infrastructure development

Sl.	Particulars	Location
1	• Installation of Reverse Osmosis (RO) Plant	NCAH, Serbithang
2	• Installation of benchtop • Installation of the Climate control unit (AC) • Installation of emergency shower • Hand sanitizing station • Installation of water storage tanks	LSU, NCAH Serbithang
3	• Installation of benchtop • Installation of the Climate control unit (AC)	RLDC Kanglung
4	• Installation of benchtop • Installation of the Climate control unit (AC)	RLDC, Tsimasham

5	• Installation of benchtop • Installation of the Climate control unit (AC)	NFTL, Yusipang

During the inception phase, various office equipment was also procured and distributed to the surveillance laboratories. The details are listed below Table 17.

Table 17: Details of office equipment

Sl. No.	Item	Quantity
1	Lap top (mid-end)	3
2	Lap top (high end)	3
3	Desktop	8
4	Multi-function printer	5
5	Projector	1
6	Lamination machine	1
7	Office furniture	1
8	Visitor chair	30
9	Steel almirah	2
10	Computer table	8
11	Stationaries	1

5.10.2 Detailed Technical Implementation

The detailed implementation of the technical activities started in January 2020 with sensitization workshops and other workshops and training as follows:

5.10.2.1 Sensitization workshop on Antimicrobial Resistance (AMR) and Fleming Fund Project Activities

The antibiotics have saved millions of lives since they were first discovered. In animals, we use antibiotics for improving welfare and for enhancing production. However, the indiscriminate use of these antibiotics has led to the emergence of resistant bacteria in which antibiotics no longer work also known as antimicrobial resistance (AMR). The UK Government has established the Fleming Fund to respond to the global threat of drug-resistant infections. The Fleming Fund is critical to achieving the resolution of the 68th World Health Assembly, 2015 (WHA A68/20); 84th World Animal Health Assembly (WAHA 2016); and in realising the 'Political Declaration of the High-Level Meeting of the United Nation General Assembly (UNGA) on

Antimicrobial Resistance, 2016'. The overall goal of the grant is to avert the human and economic burden of antimicrobial resistance (AMR).

Bhutan is one of the recipients of Fleming Fund Country Grants to improve the diagnosis and surveillance of AMR in both human health and the animal health sector thereby to inform policy and practices at national and international levels. The human health component implemented by Department of Medical Services which benefits five laboratories (surveillance sites) and animal health component is implemented by the Department of Livestock with four laboratories benefitting (National Centre for Animal Health, National Food Testing Laboratory and two Regional Livestock Development Centres Tsimasham and Kanglung).

In addition to the country grant, the Fleming Fund also supports Fleming Fellowship Scheme to provide continuing professional development and leadership training opportunities for relevant fellows. Seven Fleming Fellowships were provided to Bhutan out of which three are for the animal health.

The inception phase of the project (Country Grant) was implemented from April 2019 to November 2019 where the infrastructure development and other preparatory works were carried out in the beneficiary laboratories. Following the finalization of Detail Technical Implementation Plan (DTIP) in December 2019, one-day sensitization workshop was conducted on 3rd January 2020 at Royal Thimphu College to inform all the stakeholders on activities that shall be implemented through 18 months period. The meeting is expected to enhance coordination and collaboration among the various stakeholder including the policymakers.

Dr Tashi Samdup, the Director General of Department of Livestock, graced the opening ceremony as Chief Guest. About 31 participants including the representatives from the Fleming Fund Project Implementation Unit, Department of Medical Services, Department of Livestock (Animal Health Division, National Centre for Animal Health, National Veterinary Hospital, Regional Livestock Development centres) and Bhutan Agriculture & Food Regulatory Authority attended the one-day sensitization workshop.

5.10.2.2 Workshop on development of Standard Operating Procedures (SOPs)

Bhutan has received the UK government-based Fleming Fund Grant to improve the diagnosis of antimicrobial-resistant infections with an emphasis on antibiotics, to improve data management, surveillance and to inform policies/practices at national and international levels. The grant is aimed to improve the diagnosis and surveillance of antimicrobial resistance (AMR) in both human and animal health sectors. Under the Department of Livestock, National Centre for Animal Health (NCAH) is being identified as the beneficiary institute and four laboratories (National Veterinary Laboratory (NCAH); National Food Testing Laboratory (BAFRA); Regional Livestock Development Centre (RLDC) (Kanglung); and Regional Livestock Development Centre (RLDC) (Tsimasham) as surveillance laboratories for the project.

One of the main aims of the Fleming Fund Project is to strengthen microbiology laboratory capacity for AMR diagnostics at the surveillance laboratories. The capacity of

these laboratories needs to be enhanced and facilitated to identify, isolate and perform Antibiotic Sensitivity Test (AST) on WHO identified GLASS (Global AMR surveillance system) pathogens such as *Campylobacter spp*, *Enterococci spp*, *Salmonella spp and E. coli.* To produce valid test results, Standard Operating Procedures (SOP) are required for these bacteria.

Hence, a "workshop on the development of SOPs" was conducted at Phuentshogling from 14-19th January 2020. 12 participants representing the Technical Working Group (TWG) for Animal Health, representation from the Department of Livestock (Animal Health Division, National Centre for Animal Health, National Veterinary Hospital, Regional Livestock Development centres), Department of Public Health (Royal Centre for Disease Control) and Bhutan Agriculture & Food Regulatory Authority (Quality Control & Regulatory Division, National Food Testing Laboratory) attended the workshop. During the workshop following SOPs were developed:

A. Isolation and identification of who glass pathogens:
   i. *Campylobacter*
   ii. *Enterococci*
   iii. *Escherichia coli*
   iv. *Salmonella*
   v. Antimicrobial susceptibility Testing, (Disk Diffusion Method)
   vi. ESBL detection method
B. Isolate transportation
C. Laboratory Waste Management

5.10.2.3 Workshop to develop surveillance plan & sampling protocols for AMR surveillance in poultry under Fleming fund country grant

To enable implementation of the surveillance, several activities have been identified in the detail technical implementation plan (DTiP) of the project. One of the important activities on DTiP is to develop a surveillance plan for active AMR surveillance in broiler and layer chickens. Therefore, a workshop was conducted from 2nd to 6th February 2020 in Hotel Holiday Home, Paro with relevant officials from different stakeholders. In total, 12 participants comprising of TWG members and the representative from relevant stakeholders took part in the workshop. During the workshop following were developed:

a) AMR Surveillance plan for in broiler and layer chickens (DTiP no 3.6.5),
b) Sampling protocol (DTiP no. 3.6.1),
c) SOPs for sample collection, packaging and transportation (DTiP no. 3.6.2).

The workshop was organized by NCAH, Serbithang as the beneficiary institute for Fleming fund project in collaboration with Project Management Unit (PMU), Fleming Fund.

5.10.2.4 Microbiological Hands-on Training for Culture, Identification and Antimicrobial Susceptibility Testing (AST) for E. coli and Salmonella

One of the main aims of the grant is to improve the diagnosis and surveillance of antimicrobial resistance (AMR) in both human and animal health sectors. Under the Department of Livestock, National Centre for Animal Health (NCAH) is being identified as the beneficiary institute and four laboratories (National Veterinary Laboratory (NCAH); National Food Testing Laboratory (BAFRA); Regional Livestock Development Centre (RLDC) (Kanglung); and Regional Livestock Development Centre (RLDC) (Tsimasham) as surveillance laboratories for the project.

One of the objectives of the Fleming Fund country grant project is to strengthen microbiology laboratory capacity for AMR diagnostics at the surveillance laboratories. The capacity of these laboratories needs to be enhanced and facilitated to identify, isolate and perform Antibiotic Sensitivity Test (AST) on WHO identified GLASS (Global AMR surveillance system) pathogens such as *Campylobacter* spp., *Enterococci* spp., *Salmonella* spp. *and E. coli.*

Hence, five days long hands-on training on culture, identification and AST for *E. coli* and *Salmonella* spp. were conducted at (NCAH), Serbithang, from 6-10th January 2020 for laboratory technicians from Regional Veterinary Laboratories (RLDCs), National Veterinary Hospital (NVH) and National Food Testing Laboratory (NFTL). The training was conducted by a microbiologist from NCAH.

During the training, following activities were carried out:

- Preparation of bacteriological media;
- Perform culture and identification of *E. coli* and *Salmonella;*
- Antimicrobial susceptibility test(AST) - disk diffusion methodology.

Figure 22: A. Sheep blood agar (SBA) plates; B. Culture method for salmonella identification; C. Pure colonies of ATCC 13076 control organism (*Salmonella enteritidis*); D. Pure colonies in SBA; E. Observing the zone diameter on Muller Hinton agar; F. Explaining the zone diameter on Muller Hinton agar (AST)

5.9 Fleming Fellowship

The UK Government's Department of Health and Social Care has established the Fleming Fund to respond to the global threat of antimicrobial resistance (AMR). In Bhutan, the Fleming Fund activities comprise of Country grant and the Fellowship program. The Fellowship programme, through open competition, has selected three animal health professionals to develop and enhance skills on AMR surveillance, develop one health approaches on AMR and support country grant activities.

Following are the Fellows selected through open competition:

a) Antimicrobial Resistance (AMR) Surveillance Fellowship: Dr Ugyen Namgyel (Sr Veterinary Officer within the Animal Health Unit of Regional Livestock Development Centre, Wangdue Phodrang);

b) Antimicrobial Resistance (AMR) Laboratory Fellowship: Ms Puspa Maya Sharma (Sr Laboratory Officer / Microbiologist at the National Veterinary Laboratory, National Centre for Animal Health);
c) Antimicrobial Consumption/Usage (AMU/C) Fellowship: Dr Pema Tshewang, Dy Chief Veterinary Officer, National Veterinary Hospital, Motithang.

The fellows received a briefing on one health activities, training on R statistical tools, AMR testing and culture methodology. The fellows visited the host institute, Doherty Institute/University of Melbourne from 10th – 28th February 2020, to strengthen the AMR and AMU surveillance in food animals.

5.10 Establishment of COVID-19 testing facility at Monggar Referral Hospital

The National Centre for Animal Health mobilized two laboratory officials, Ms Puspa M Sharma, Sr. Lab officer and Ms Kelzang Lhamo, Asst. Lab technician, along with human health officials and the necessary equipment/facilities on an emergency basis to establish a new COVID-19 testing laboratory at Monggar Referral Hospital, the eastern part of the country on 17th March 2020. The officials optimized the real-time PCR machine for COVID-19 tests, performed RNA extraction and PCR for suspect samples of COVID 19, performed rapid tests from suspect samples and trained two human health officials from Monger Referral Hospital on RNA extraction, master mix preparation, use of QuantStudio 5 real-time PCR machine, result-analysis and storage and handling of positive samples and suspect samples.

Figure 23: A. RNA Extraction room; B. PCR room

Figure 24: A. Laboratory official at COVID-19 Testing laboratory; B. Dressed with PPE, ready for extraction.

5.11 Refresher Training on Laboratory Biosafety & Biosecurity

A one-day refresher training on **Biosafety & Biosecurity** was conducted at National Centre for Animal Health, Serbithang for the laboratory personals of Laboratory Services Unit and Biological Production Unit on 25th June 2020. The main objectives of the training were to ensure regular implementation of Good Laboratory Practices (GLP) in the laboratory and to monitor Biosafety and biosecurity measures in the laboratory.

About 15 laboratory personnel participated in the training. The training programme was conducted by pre-test with awards followed by video shows on wearing PPE, -working safely in BSC, chemical spills management. The presentation was also made on Good Laboratory Practices (GLP) and also the participants were sensitized on the newly developed SOP on Laboratory Waste.

5.11 Training-workshop on tick identification using morphological keys

Summary

The national-level tick identification training was conducted from 25-27th September 2019 at the National Centre for Animal Health (NCAH), Serbithang, Thimphu. The Department of Ecosystem and Public Health (EPH), Faculty of Veterinary Medicine, University of Calgary, Canada organized the training in collaboration with the NCAH as a part of the knowledge exchange program. University International Grants that fosters international activities of the University of Calgary funded the training workshop. Dr Susan Cork who is the founding Head and Professor with the Department of Ecosystem

and Public Health and Dr R.B Gurung who is the Programme Director of the NCAH coordinated the entire training workshop that was attended by four veterinarians, two laboratory technologists and 15 laboratory technicians. Dr Cork also conducted a seminar on "One Health approaches to control vector-borne diseases" to the training participants on 25th September 2019.

The technical training was led by Dr Tim J Lysyk and Dr Jamyang Namgyal. The former is a noted Canadian Entomologist who has worked as a Research Scientist with the Agriculture and Agri-Food Canada for decades while the latter is a Bhutanese veterinarian who is currently an MSc researcher under Dr Cork's supervision.

The technical sessions covered the following topics: 1. general history and classification of ticks; 2. basic biology and ecology of ticks; 3. life cycle of *argasid* and *ixodid* ticks; 4. collection and preservation of ticks; 5. step for tick identification using dichotomous, polychotomous and electronic keys; 6. a general overview of tick-borne diseases in animals; and 7. tick-induced paralysis. In the practical sessions, the participants examined a wide range of tick specimens Namgyal had collected from eastern Bhutan. The skills imparted in the practicals were: sorting the sex and the life stages (i.e., larva, nymph and adult); identifying the genus and then identifying species using genus-specific keys containing a detailed description of species. Namgyal also delivered a seminar on "Tick habitat distribution modelling" which is a part of his MSc research.

6. ACHIEVEMENTS OF DRUGS, VACCINES, AND EQUIPMENT UNIT (DVEU)

6.1 Procurement of medicines and vaccines during FY 2019-2020

The fast-track tendering for veterinary medicines and vaccines for FY 2019-2020 was completed by June 2019 as per the EVDP management cycle.

The summary of the tendering evaluation results is tabulated below;

Table 18: Tender evaluation result summary

Category	Total Tendered	Total Selected		Total Re-tender during the evaluation	
	Nos.	Nos.	%	Nos.	%
Veterinary Medicines	169	104	61.5%	65	38.5%
Vaccines	10	9	90%	1	10%

As per the tender evaluation report, a total of 104 medicine items were selected and 64 items needed to be procured either through re-tender, direct procurement or using Ministry of Health (MoH) tender. However, the Tender Award Committee recommended dropping 9 items out of 64 re-tender items from the procurement list as the items were non-essential and had substitutes. Further, only 28 items were recommended to procure either through direct procurement or using MOH tender. A total of 17 medicines items of wildlife and aquatic were recommended to go for re-tender.

A total of 121 medicine items were procured in the FY. 2019-2020, of which 98 items were procured through open tender, 18 items through direct procurement and 5 items using MoH tender as shown in the graph below.

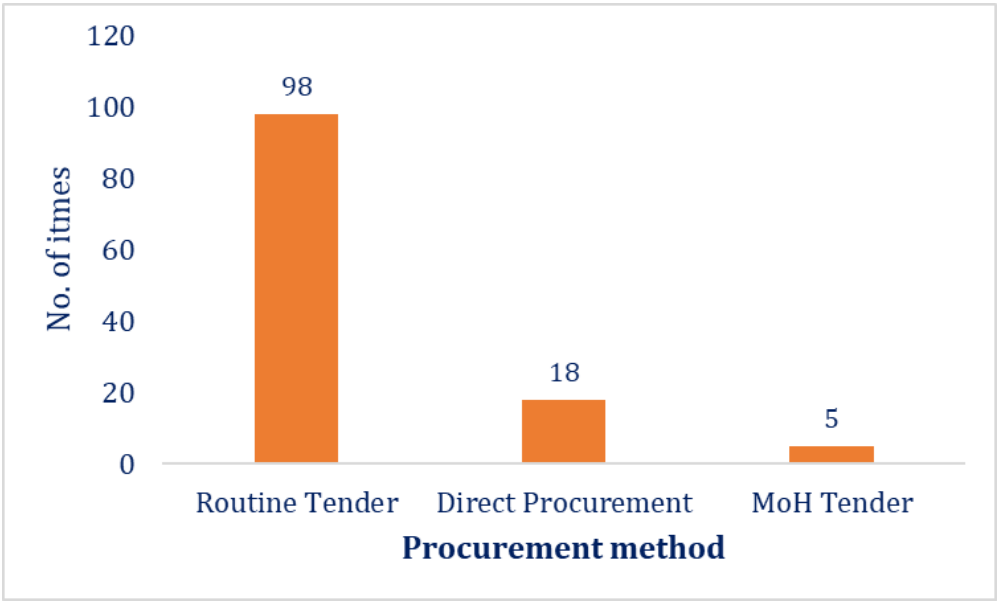


Figure 25: Number of items procured through various methods

The unit was approved with a total budget of BTN 23.1M from the total proposed budget of BTN 29M for the procurement of medicines for the FY 2019-2020. During the last FY 2018-2019, the unit had used a total amount of BTN 2M from the revolving fund account for procuring additional vaccine demand. As per the Terms of Reference of revolving fund operation, we had deposited BTN 2M during the FY 2019-2020 from the approved medicine budget, following which the Unit was left with only BTN 21.1M for the procurement of medicines.

As per the indent received from the field, the unit placed supply order for medicines worth BTN 25.59M. However, the suppliers could not supply medicines worth BTN 1.116 M due to various reasons. Therefore, medicines worth BTN 24.47 M was procured for the FY 2019-2020. The total amount incurred for the procurement was of BTN 3.37M over the approved available budget (21.1M). The additional amount, BTN 3.06 M, was secured by the unit from the Ministry and NDPM flagship Programme. The remaining amount of BTN 0.311 M was made up from the liquidity damage penalties for delay in supply of items and for unsupplied items from the suppliers.

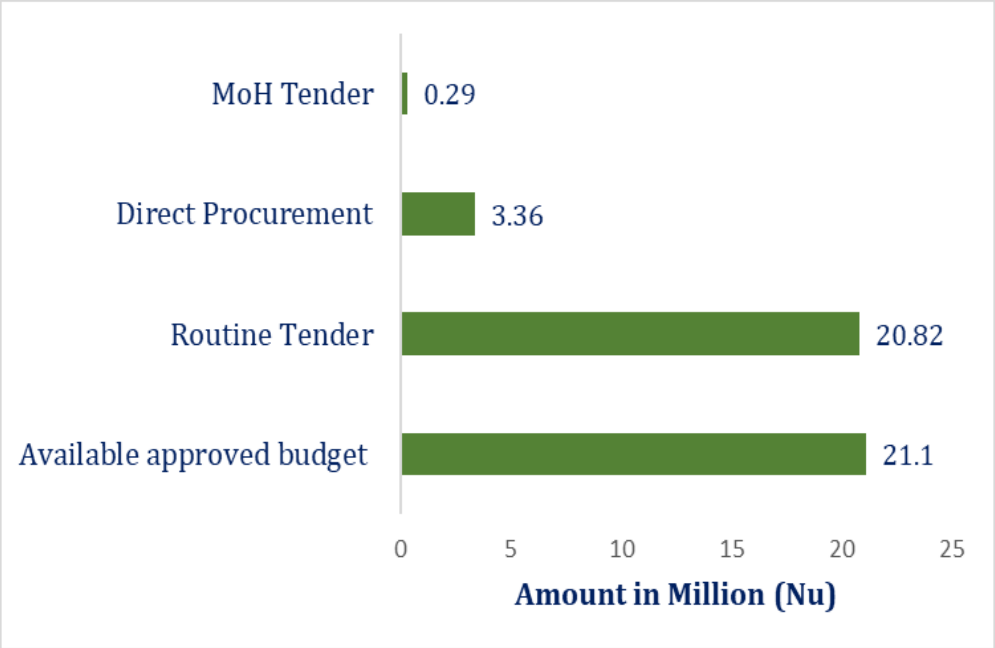


Figure 26: Graph showing the worth of medicines procured through various methods and the available approved budget.

6.2 Procurement of equipment and non-drug items during FY 2019-2020

The fast-track tendering for Veterinary Equipment and non-drug items for FY 2019-2020 was completed by November 2019, as per the EVDP management cycle.

The summary of the tendering evaluation results is tabulated below;

Table 19: Tender evaluation result summary

Category	Total Tendered	Total Selected		Total Re-tender during the evaluation	
	Nos.	Nos.	%	Nos.	%
Veterinary Equipment & non-drug items	181	174	96.13%	7	3.87%

The total tendered amount for procurement of Veterinary equipment and non-drug items (131 items) was BTN 58.054 M. However, the approved budget for procurement of veterinary equipment and non-drug items for the FY 2019-2020 was only BTN 3.35 M. Therefore, the supply order was placed for only 130 items amounting to BTN 3.36 M. However, the suppliers could not supply a total of 18 items amounting to 0.438M.

6.3 Verification and inspection of Veterinary drugs and equipment

A total of 10 verification/inspection visits were conducted by the verification team during the FY 2019-2020 to inspect the newly arrived consignments of veterinary medicines, equipment and non-drug items in the Livestock Central Store (LCS), Phuentshogling.

Table 20: Details of verifications visits for veterinary medicine consignments

Sl.no	Date of Verification	Team Members	Number of items		
			Accepted	Rejected	Pending
1	14th-16th Sept 2019	4	56	2	
2	14th-16th Oct 2019	2	11		
3	2nd-4th Dec 2019	4	44		1
4	11th-12th Dec 2019	4	11		
5	27th Dec 2019	3	4		2
6	22nd-25th June 2020	4	1		

Table 21: Details of verification visits for veterinary equipment and non-drug items consignments

Sl.no	Date of Verification	Team Members	Number of items		
			Accepted	Rejected	Pending
1	1st July 2019	3	5		
2	7th-8th May 2020	5	10	2	
3	22nd-23rd May 2020	5	16	3	
4	22nd-25th June	4	73	5	

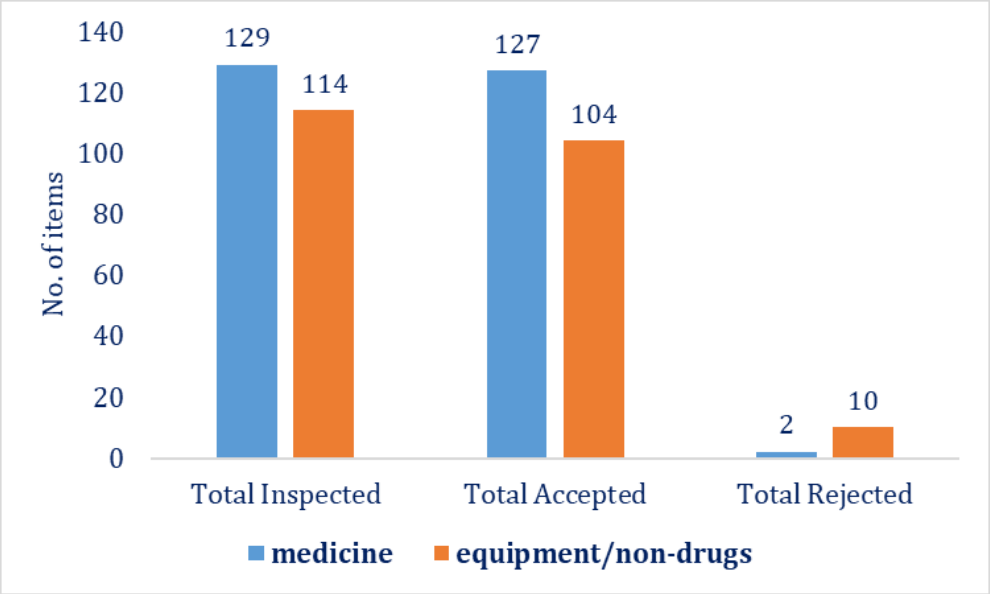


Figure 27: No. of items inspected, accepted and rejected during the consignment verification in FY 2019-2020

6.4 Distribution of Veterinary Medicines

As per the EVDP management cycle, the mass distribution of veterinary medicines was done two times in a year i.e. the 1st mass distribution in December 2019 and the second mass distribution in May 2020. The mass distribution was done up to the DVH point for Dzongkhags and till the respective Central Farms and Agencies' premises. The ad-hoc and emergency distribution of medicines was done throughout the year, as and when the requisitions were submitted to DVEU by the respective centres. The summary of the total amount (in Million) of veterinary medicines distributed to various Dzongkhags, Farms, Central Agencies and Non-Departmental Agencies/projects are tabulated below;

Table 22: Amount of Medicines Distributed during FY 2019-20 (In Million)

Sl.no.	User	1st Mass Distribution Amount (Million)	2nd Mass Distribution Amount (Million)	Emergency requisition Amount (Million)	Total Amount (Million)
1	Dzongkhags	15.12	4.04	1.59	20.74
2	Central Farms/ Agencies	2.03	0.67	0.66	3.37
3	Other Agencies*	0	0.31	0.55	0.86
TOTAL		**17.16**	**5.02**	**2.8**	**24.97**

**Non-departmental agencies and projects: BLDC, NDPM, Serbithang, and NCD, Taba*

A total of BTN 24.97M worth veterinary medicines were distributed to Dzongkhags, Central Farms/Agencies and other non-departmental agencies and Projects during the

FY 2019-2020. The amount of medicines distributed to the category of the agency is graphically represented below:

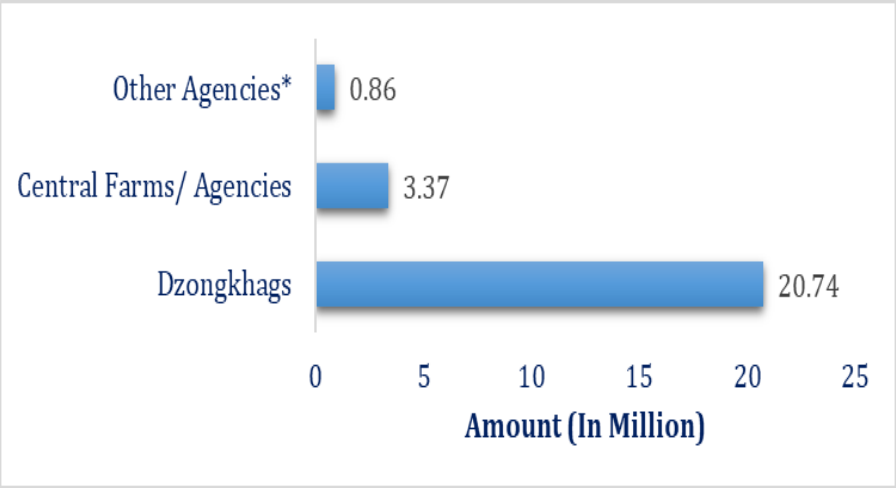


Figure 28: Amount of medicines distributed to the category of the agency during FY 2019-2020

The Dzongkhag-wise budget ceiling for medicines and the worth of medicines distributed for individual Dzongkhag during FY 2019-20 is tabulated below:

Table 23: Budget ceiling and medicines distributed, Dzongkhag-wise

Sl. No.	Dzongkhag	Budget Ceiling for Medicines (Nu in Million)	Medicines Distributed (Nu in Million)	% of overutilization of budget ceiling
1	Bumthang	0.569	0.590	3.68
2	Chukha	1.238	0.879	-29.02
3	Dagana	1.145	0.991	-13.49
4	Gasa	0.388	0.384	-0.96
5	Haa	0.646	0.698	8.11
6	Lhuentse	0.834	0.517	-37.99
7	Monggar	2.584	2.160	-16.40
8	Paro	1.664	1.400	-15.87
9	Punakha	1.217	1.304	7.19
10	Pema Gatshel	0.853	0.793	-7.09
11	Sarpang	1.399	1.191	-14.86
12	Samtse	1.527	1.801	17.95
13	Samdrup Jongkhar	1.361	0.843	-38.05
14	Thimphu	1.265	1.044	-17.46
15	Tsirang	1.659	1.283	-22.65
16	Tashigang	1.994	1.166	-41.52
17	Tashi Yangtse	0.651	0.500	-23.16
18	Trongsa	1.256	0.948	-24.55
19	Wangdue Phodrang	1.920	1.535	-20.07
20	Zhemgang	1.18	0.713	-39.56
	TOTAL	**25.35**	**20.741**	

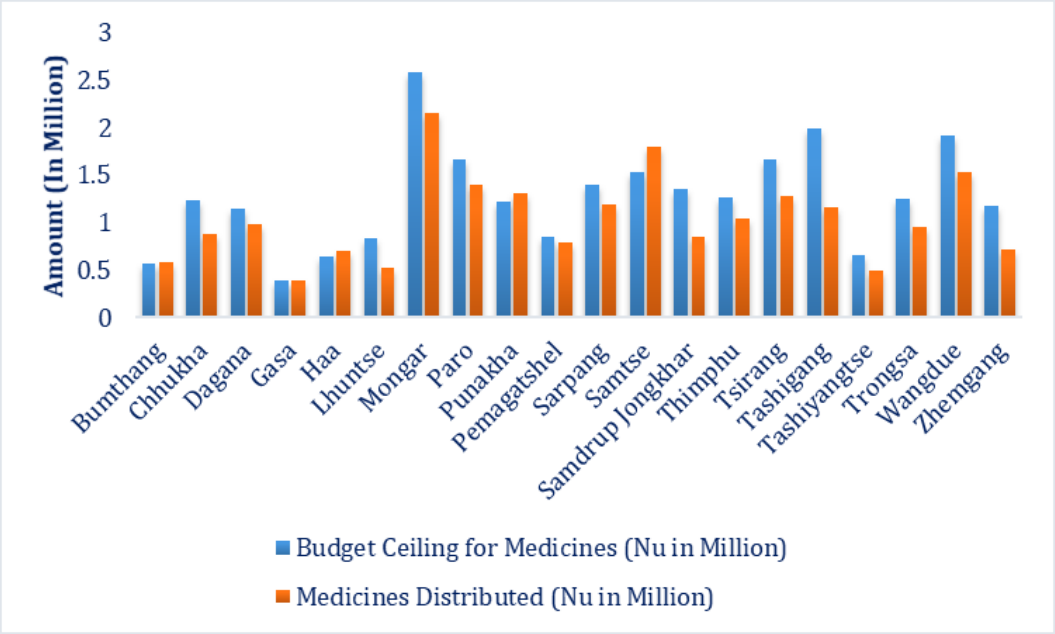


Figure 29: Dzongkhag-wise budget ceiling versus worth (In million) of medicines distributed

The Central Farm/Agency-wise budget ceiling for Medicines and the worth of actual distribution of medicines for individual Central Farm/Agencies during FY 2019-2020 is tabulated below:

Table 24: Budget ceiling and medicines distributed, Central agency-wise

Sl.no	Central Farms/ Central Agencies	Budget Ceiling for Medicines (Nu in Million)	Medicines Distributed (Nu in Million)	% of overutilization of budget ceiling
1	NCAH, Serbithang	0.129	0.098	-23.95
2	RLDC, Tshimasham	0.129	0.108	-15.96
3	RLDC, Wangdue	0.129	0.123	-4.36
4	RLDC, Kanglung	0.129	0.049	-62.34
5	NDRC, Yusipang	0.581	0.157	-73.04
6	NHRDC, Jakar*	0.150	0.077	-48.44
7	NVH, Motithang	0.556	0.562	1.15
8	NPRDC, Sarpang	0.297	0.151	-49.30
9	NJBC, Samtse	0.297	0.192	-35.33
10	NPBC, Yusipang	0.129	0.149	15.50
11	NHBF, Bumthang	0.129	0.022	-83.18
12	BSF, Bumthang	0.129	0.094	-27.29
13	NSBC, Bumthang	0.129	0.071	-44.73
14	CRC, Wangkha	0.129	0.113	-12.58
15	RPBC, Paro	0.129	0.125	-3.07
16	NPiRDC, Gelegphu	0.129	0.166	28.99
17	NNBF, Tashiyangphu	0.129	0.060	-53.42
18	RMBF, Zhemgang	0.129	0.020	-84.42
19	RMBF, Arong	0.129	0.092	-28.61

20	RPPBC, Lingmethang	0.194	0.165	-15.07
21	NRCWWF, Gelegphu	0.060	0.094	56.76
22	TVH Phuentshogling	0.060	0.183	205.33
23	TVH Gelegphu	0.129	0.116	-10.45
24	TVH, Nanglam	0.100	0.145	45.03
25	TVH, Dewathang	0.100	0.044	-55.99
26	NP&HBC, Lhuentse	0.025	0.188	650.62
	TOTAL	**4.355**	**3.37**	

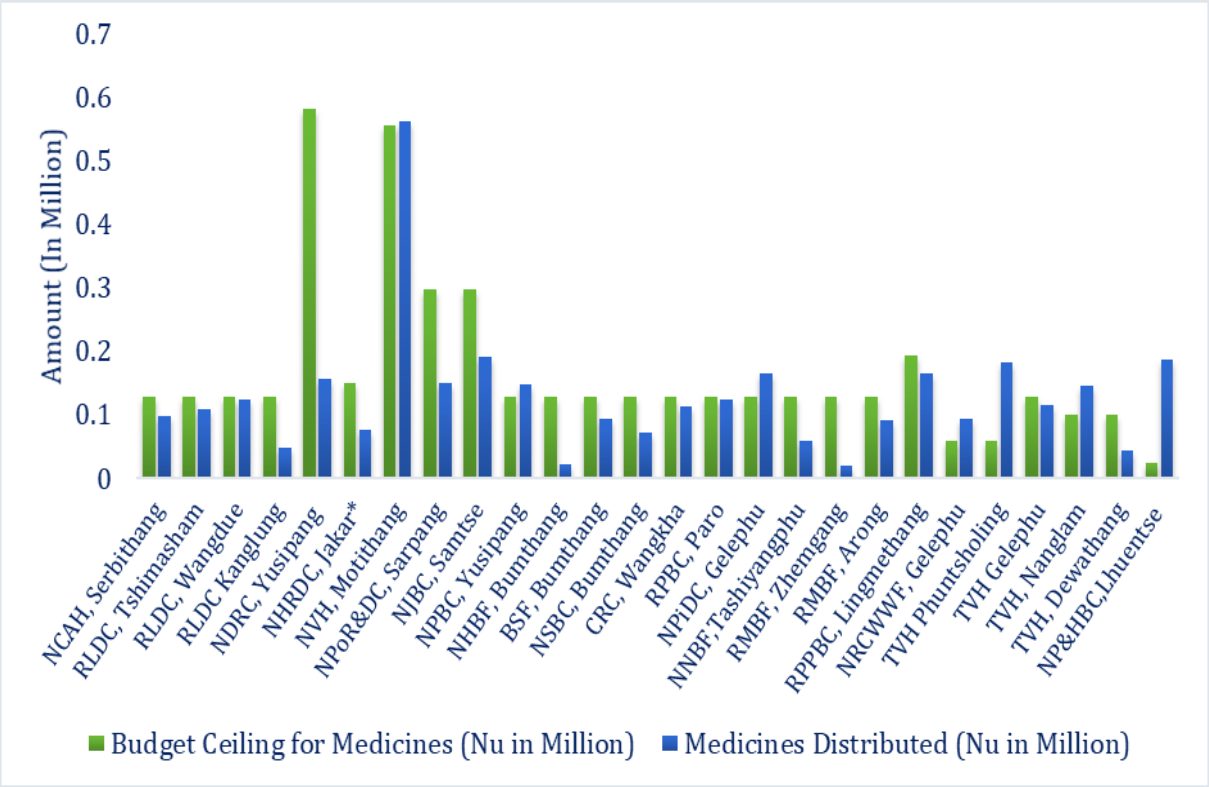


Figure 30: Central Farms/Agencies-wise Budget ceiling versus Medicines distributed

The worth of medicines distributed to Dzongkhags, Central Farms/Agencies and other non-departmental agencies during the FY 2019-2020 was compared with the budgetary ceiling allocated during indent collection. Most of the centres had received the actual distribution less than their budget ceiling and the total actual distribution amount was less by BTN 4.735M from the total budget ceiling. The reason is that the budget ceiling was allocated based on the proposed annual budget (29.705 M), whereas the approved budget was BTN 23.1M for the FY 2019-2020.

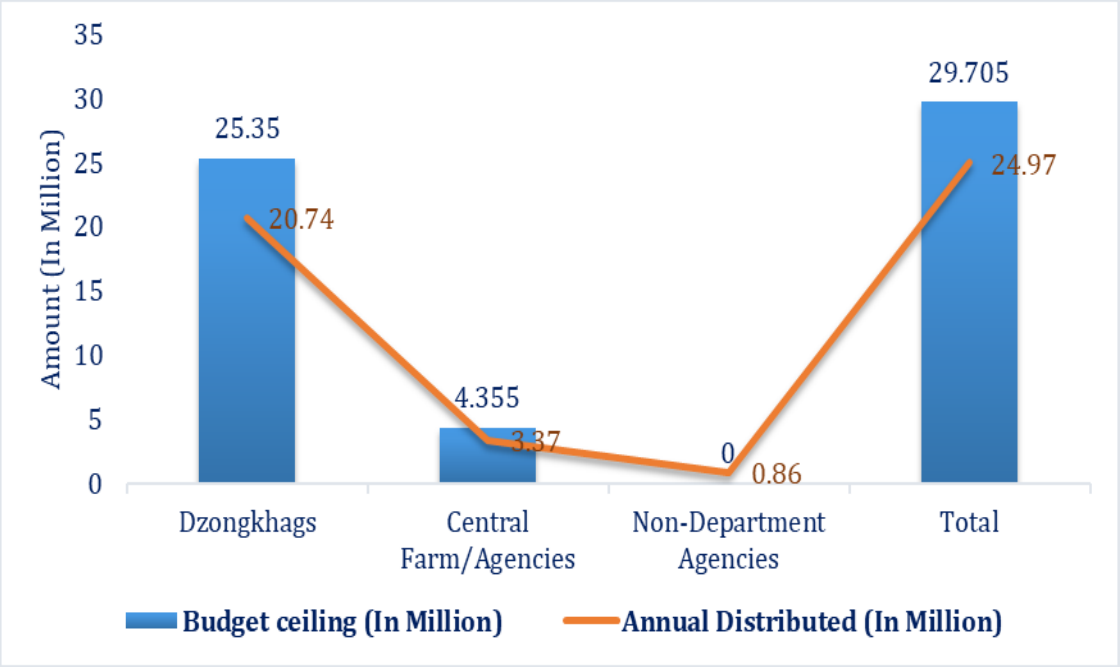


Figure 31: Budget ceiling vs medicine distributed (overall)

The unit received a total of 48 emergency medicine requisitions from 32 centres during the FY 2019-2020, of which, 10 requisitions were for CABC medicines of worth 1.25M. The details of the emergency medicine requisitions received and distributed during the FY 2019-2020 are tabulated below:

Table 25: Emergency medicines indented and distributed

Sl.no	Users	Total No. of times	No of Users involved	Amount (In Million)	Remarks
1	Dzongkhags	21	17	1.59	Highest No. of times from Haa and Paro, 2 times each
2	Central Farms/Agencies	18	12	0.66	Highest No. of times from NVH, 4 times
4	Non-departmental Agencies/Project	9	3	0.55	Highest No. of times from BLDC, 5 times
Total		**48**	**32**	**2.8**	

The table below shows the quantity of antimicrobials (in Kgs) as per the antimicrobial class distributed in the FY 2019-2020. The active ingredient of antimicrobials was calculated according to OIE method and tabulated as per the OIE Antimicrobial usage reporting option 1.

Table 26: Antimicrobial's usage (Kg)

Antimicrobial Class	Amount of Active ingredient (Kg)
Aminoglycosides	9.95
Amphenicols	2.18
1-2 gen. cephalosporins	7.80
3-4 gen cephalosporins	0.88
Fluoroquinolones	4.90
Nitrofurans	0.55
Penicillins	30.63
Sulfonamides (including trimethoprim)	234.57
Tetracyclines	57.61
Others*	112.97

**Povidone-iodine and Metronidazole*

6.5 Distribution of Veterinary equipment and non-drug items

As per the management cycle of EVDP, the distribution of veterinary equipment and non-drug items should be done in April-May 2020 along with the second mass distribution of medicines. However, due to COVID-19 travel restrictions imposed in the neighbouring countries, the supply of items was delayed. The items which were able to supply before the distribution timeline and those items in stock in LCS were distributed in May 2020 along with the second mass distribution of medicines. Although the unit did not receive indent for the equipment and non-drug items from the Eastern region, we have distributed the items to all the centres under the region. The worth of items distributed during the FY 2019-2020 are as follow:

Table 27: Equipment distributed (in Million BTN) to Dzongkhags

Sl. No.	Dzongkhag	Routine distribution Amount (Million)	Emergency distribution Amount (Million)	Total Amount (Million)
1	Bumthang	0.018	0.000	0.018
2	Chhukha	0.044	0.018	0.062
3	Dagana	0.034	0.010	0.043
4	Gasa	0.027	0.000	0.027
5	Haa	0.031	0.058	0.089
6	Lhuentse	0.013	0.011	0.024
7	Lhamoi Dzingkha	0.016	0.000	0.016
8	Monggar	0.017	0.000	0.017
9	Paro	0.024	0.057	0.082
10	Punakha	0.070	0.046	0.115
11	Pema Gatshel	0.015	0.042	0.058
12	Sarpang	0.050	0.000	0.050
13	Samtse	0.052	0.014	0.067
14	Samdrup Jongkhar	0.016	0.003	0.019

15	Thimphu	0.033	0.060	0.093
16	Tsirang	0.037	0.032	0.069
17	Trashigang	0.016	0.000	0.016
18	Tashi Yangtse	0.013	0.034	0.047
19	Trongsa	0.023	0.001	0.024
20	Wangdue	0.038	0.000	0.038
21	Zhemgang	0.031	0.001	0.032
TOTAL		0.617	0.388	1.005

Table 28: Equipment distributed (in Million BTN) to CAs

Sl. No.	**Central Farms/Agencies**	**Routine Distribution Amount (Million)**	**Emergency Distribution Amount (Million)**	**Total Distribution Amount (Million)**
1	NVH, Motithang	0.116	0.053	0.169
2	NCAH, Serbithang	0.007	0.002	0.008
3	NPBC, Yusipang	0.009	0.003	0.011
4	NDR&DC, Yusipang	0.006	0.007	0.013
5	TVH, Phuentshogling	0.020	0.004	0.024
6	RCRF, Wangkha	0.011	0.004	0.015
7	NJBC, Samtse	0.012	0.000	0.012
8	RLDC, Tshimasham	0.010	0.000	0.011
9	NSBC, Bumthang	0.009	0.000	0.009
10	BSF, Bumthang	0.013	0.000	0.013
11	RMBF, Zhemgang	0.004	0.000	0.004
12	TVH & SVL Gelegphu	0.017	0.000	0.017
13	RLDC, Zhemgang	0.005	0.000	0.005
14	RPPBC, Lingmethang	0.003	0.000	0.003
15	NNBF, Tashiyangphu	0.002	0.000	0.002
16	RMBF, Arong	0.003	0.000	0.003
17	TVH, Dewathang	0.012	0.000	0.012
18	TVH, Nanglam	0.004	0.000	0.004
19	NPHBC, Sertsham	0.003	0.000	0.003
	TOTAL	**0.266**	**0.072**	**0.338**

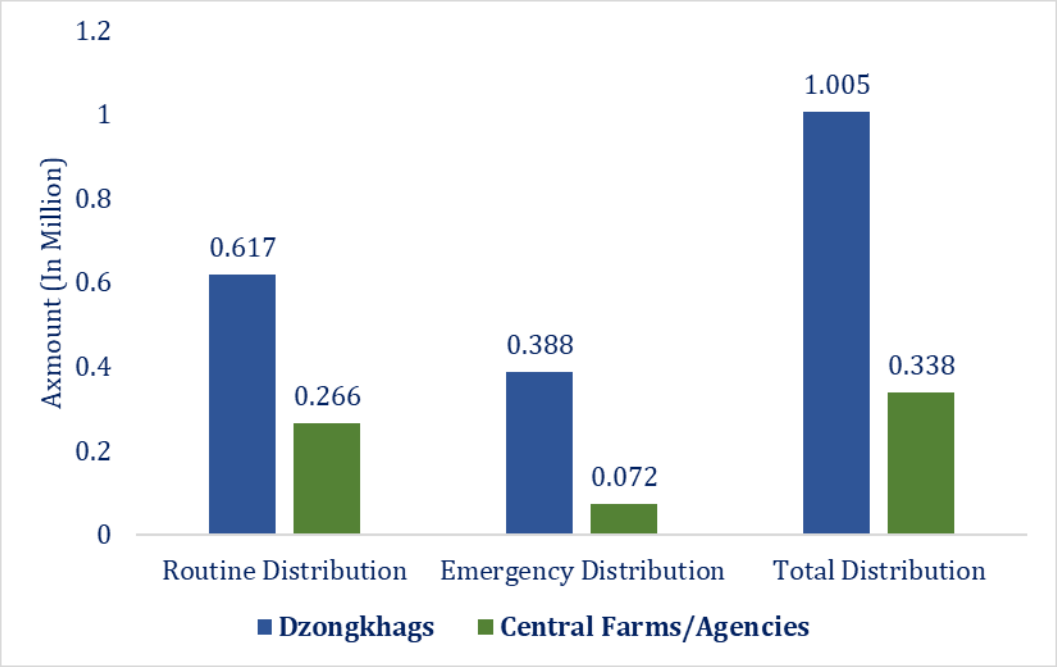


Figure 32. Graph showing the worth of equipment and non-drug items distributed through routine and emergency distribution.

6.6 Stock verification of medicines

A comprehensive assessment and verification of the existing stock situation of medicines in LCS Phuentshogling were carried out by a team from NCAH during May 2020, immediately after the second mass distribution. The main objective of conducting the verification was to assess the physical stock situation of veterinary medicines and understand the stock differences between physical, ledger and database management systems, assess the status of expired medicines and to improve and streamline the store management system in LCS.

During the assessment, the record stock and physical stock were found equal for only 32 items. For the majority of items (107), the physical stock was found to be more than the record stock, while 34 items were recorded as more in record stock compared to physical stock. The main reasons for the differences in the stock balance were found to be due to lack of dynamic database system for EVDP resulting in the issuance of items in the form of strips, packets or dozens from physical stock and entry of issue in the form of numbers, tablets, etc. in ledger/system and vice versa. This issue will be solved once the G2C database for Veterinary Medicines and equipment is implemented.

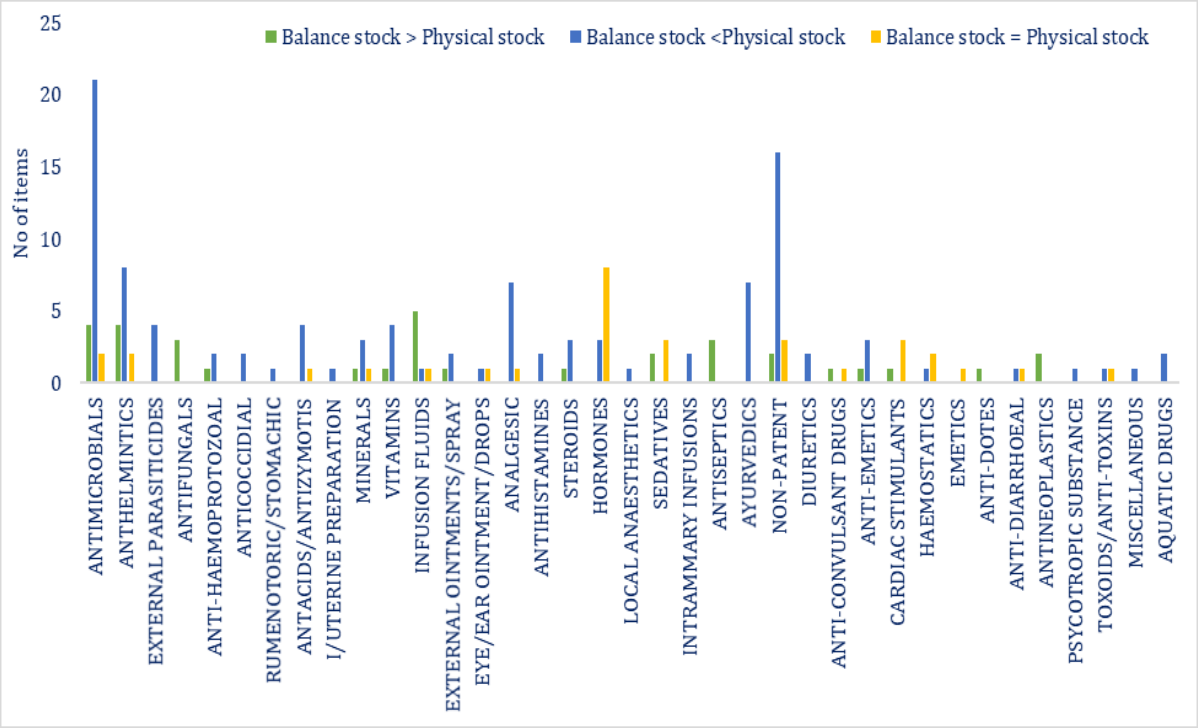


Figure 33: Record stock vs Physical stock – findings

As of June 2020, LCS Phuentshogling has a total physical stock of medicines amounting to the total value of BTN 2.549 M. The detail of the physical stocks in terms of amount for each medicine group is tabulated below:

Table 29: Physical stock balance details

Sl. No.	Medicine Groups	Amount (Nu. In Million)
1	Antimicrobials	0.1858
2	Anthelmintics	0.1465
3	External Parasiticides	0.2790
4	Antifungals	0.0104
5	Anti-Protozoals	0.1285
6	Rumenotoric/Stomachic	0.0022
7	Antacids/Antizymotis	0.0101
8	I/Uterine Preparation	0.0061
9	Minerals	0.0634
10	Vitamins	0.0261
11	Infusion Fluids	0.0511
12	External Ointments/Spray	0.0371
13	Eye/Ear Ointment/Drops	0.0011
14	Analgesic/Antipyretics/Anti-Inflammatory Drugs	0.0501
15	Antihistamines	0.0105
16	Steroids	0.0043
17	Hormones	0.0046
18	Local Anaesthetics	0.0847

19	Sedatives/Tranquilizers	0.0803
20	Intra-mammary Infusions	0.0178
21	Antiseptics/Disinfectants	0.0513
22	Ayurvedics	0.0425
23	Non-Patent/Chemical Drugs	0.2806
24	Diuretics	0.0032
25	Anti-Convulsant Drugs	0.0027
26	Anti-Emetics	0.0099
27	Cardiac Stimulants	0.8410
28	Bronchodilators	0.0000
29	Haemostatics	0.0055
30	Emetics	0.0000
31	Anti-Dotes/Anaesthetic Reversal	0.0024
32	Anti-Diarrhoeal	0.0050
33	Anti-neoplastics	0.0264
34	Psycotropic Substance	0.0001
35	Toxoids/Anti-Toxins	0.0026
36	Miscellaneous	0.0000
37	Aquatic Drugs (Specific)	0.0768
	TOTAL	**2.5495**

During the FY 2019-2020, medicines of total worth BTN 23,965.20 were expired in Livestock Centre Store, Phuentshogling. The quarterly report of expired medicines in the Livestock Centre Store for the FY 2019-2020 is as shown in the graph below. Compared to previous years, LCS has drastically reduced the amount expired.

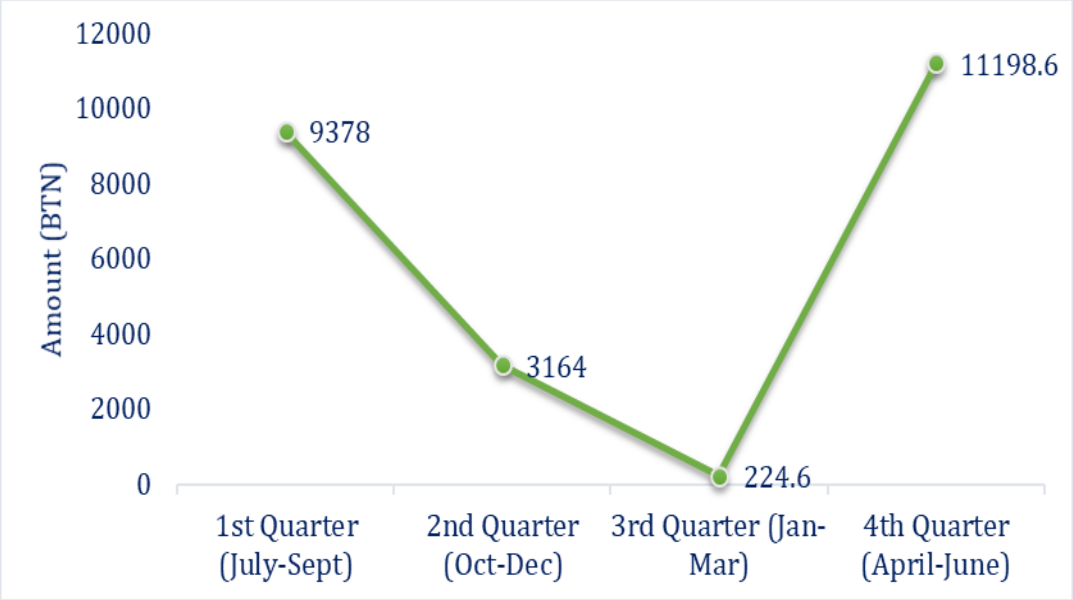
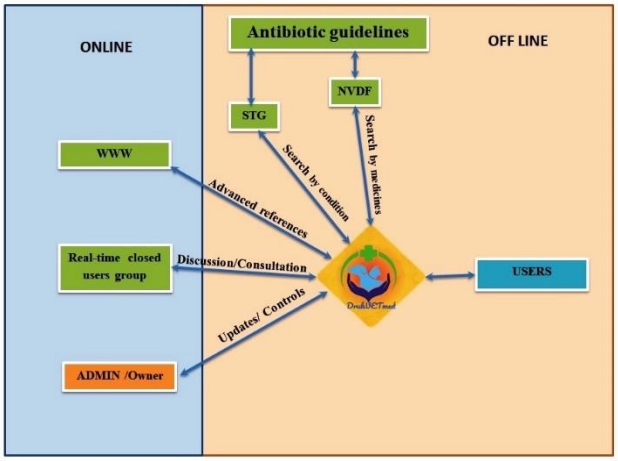


Figure 34: Medicines expired, quarterly.

6.7 Technical working group workshop to revise strategies for EVDP

A one-day workshop was conducted on 14th June 2020 in CNR to review and revise strategies for the management of EVDP along with the Workshop on development of Disease Control Plan. A total of 22 participants attended and carried the following group works:

a) Reviewed EVDL for both Veterinary Medicines and Vaccines; and Equipment and non-drug items. From the veterinary medicine list, 12 medicines were deleted and 6 medicines and 3 vaccines were added to the list. Similarly, 20 items were deleted from the equipment and non-drug items and added 23 items of veterinary equipment and non-drug items and 56 Fishery items;
b) Harmonized EVDP lists particularly antimicrobial categorizations with that of WHO, FAO and OIE lists;
c) Prioritized EVDP list for procurement purpose;
d) Developed TOR/guideline for the development of offline mobile apps for Veterinary drug formulary and the features and functions of Apps;



e) Worked out the basis of veterinary medicines budgetary ceiling calculation;

Table 30: Medicine budget ceiling calculation basis

Parameter	Weightage	Remarks
1. Livestock Population	70%	As it remains almost constant for a year and is reliable
2. Clinical Cases	20%	May segregate by livestock species especially poultry
3. Disease Outbreaks	10%	Less share as unpredictable
4. Other Criteria for thought		
4.1 Past year expiry drug (minus the weightage)	Minus 1%	

f) Revised the procurement cycle of veterinary equipment and consumables as shown below;

g) Developed Guideline for Management of Control Drugs.

6.8 12th National Veterinary Medicine (NVMC) Meeting

A one day "12th National Veterinary Medicine Committee (NVMC) Meeting" was held on 15th June 2020 at CNR Lobesa, to discuss on the follow-up actions to the 11th NVMC meeting and to endorse the revised strategies developed during the technical workshop conducted on the previous day. The meeting was attended by 22 participants including the 9 NVMC members.

New National Veterinary Medicine Committee (NVMC) Composition is as follows:

a) Chief Veterinary Officer, Animal Health Division: Permanent Member
b) Program Director, NCAH: Permanent Member
c) Head DVEU (member secretary): Permanent Member
d) The Representative from NVH: Dr Pema Tshewang (Chair)
e) The Representative from TVH: Dr Tshewang Gyembo (Vice-Chair)
f) The Representative from RLDCs: Dr Karma Wangmo, RLDC Kanglung
g) The Representative from Dairy Commodity Centre: Dr Dorji
h) The Representative from Poultry commodity Centre: Kuenga Thinley
i) The Representative from Fishery commodity Centre: Pema Thinley
j) The Representative from NCRCAN (Food and Fodder): Jambay Gyeltshen
k) The Representative from Wildlife: Dr Kinley Choden
l) The Representative from Dzongkhag Veterinary Hospital: Dr Jigme Wangchuk
m) The Representative from DTAC: Dr Jambay Dorji

6.9 Tendering and procurement of medicines and vaccines for FY 2020-2021

The fast-track tendering for medicines and vaccines for FY 2020-2021 was carried out and completed during the FY 2019-2020 in June 2020 as per the revised EVDP management cycle. This year we followed Limited Tendering Method through the e-GP system. The summary of tendering is as tabulated below:

Table 31: Summary of tendered, selected and re-tender items for 2020-2021

Category	Total Tendered		Total Selected		Total for Re-tender	
	Number	%	Number	%	Number	%
Veterinary Medicines	168	100	130	77.38	38	22.62
Vaccines	10	100	9	90%	1	10
Total	178	100	139	78.1	39	21.9

Table 32: Summary of Tendered Amount as per the indent received and selected quote

Category	Budget Proposed for 2020-21 (BTN)	Tender Amount Selected (BTN)	Balance (BTN)
Veterinary Medicines	27.0 M	26.7 M	+0.3M
Vaccines	3.6 M	5.22 M	-1.6 M

Table 33: Summary of Tendered Amount as per the revised indent (reworked based on selected quote)

Category	Budget Proposed for 2020-21 (BTN)	Tender Amount Selected (BTN)	Balance (Nu)
Veterinary Medicines	27.0 M	20.44 M	+6.56 M
Vaccines	3.6 M	5.22 M	-1.6 M

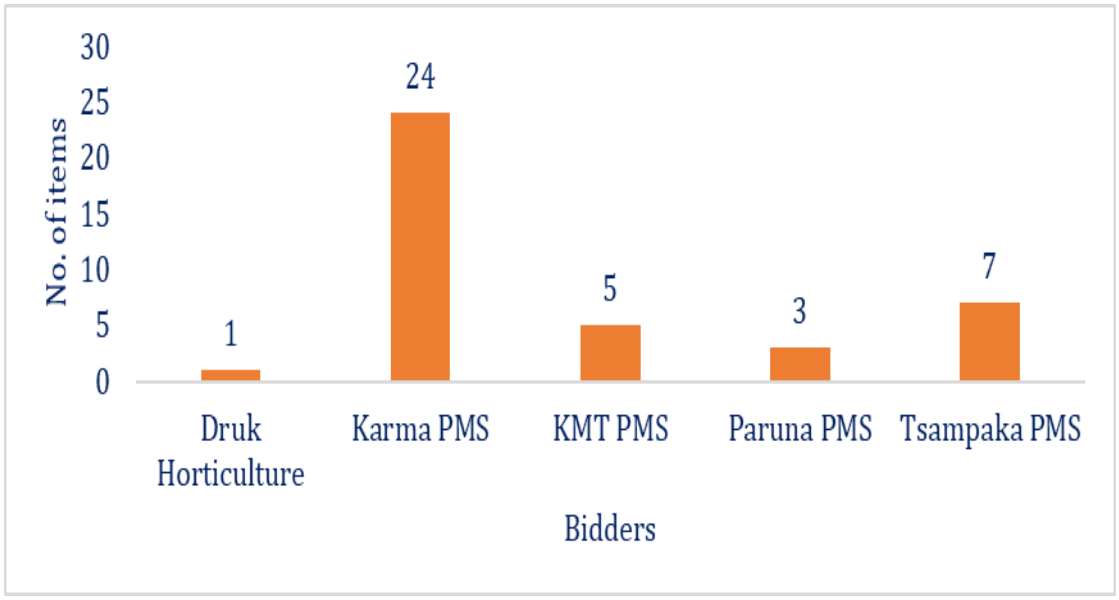


Figure 35: Graph showing number of items registered with DRA by the bidders

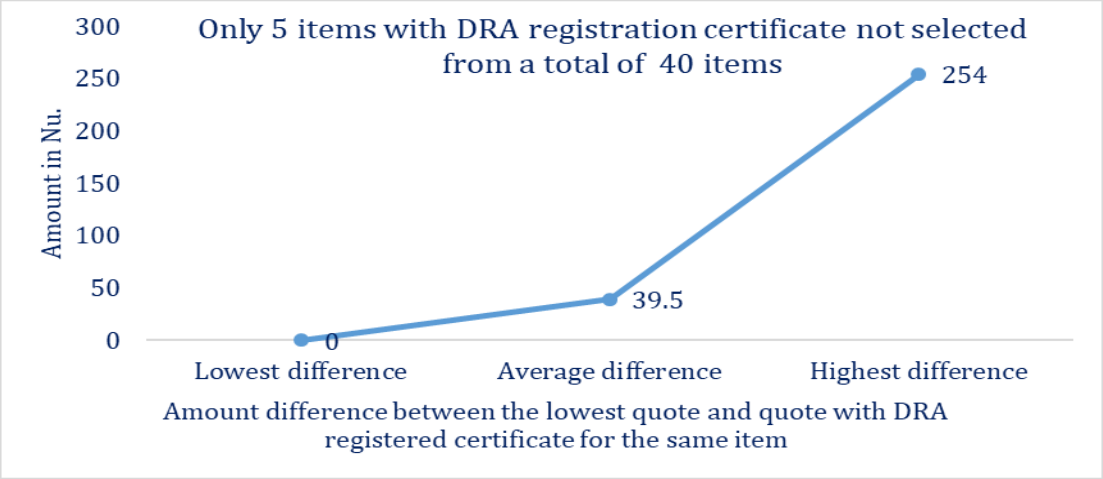


Figure 36: Graph showing the range and mean difference of the quote for the same item between the lowest quote and the quote with the DRA registration certificate for 40 items

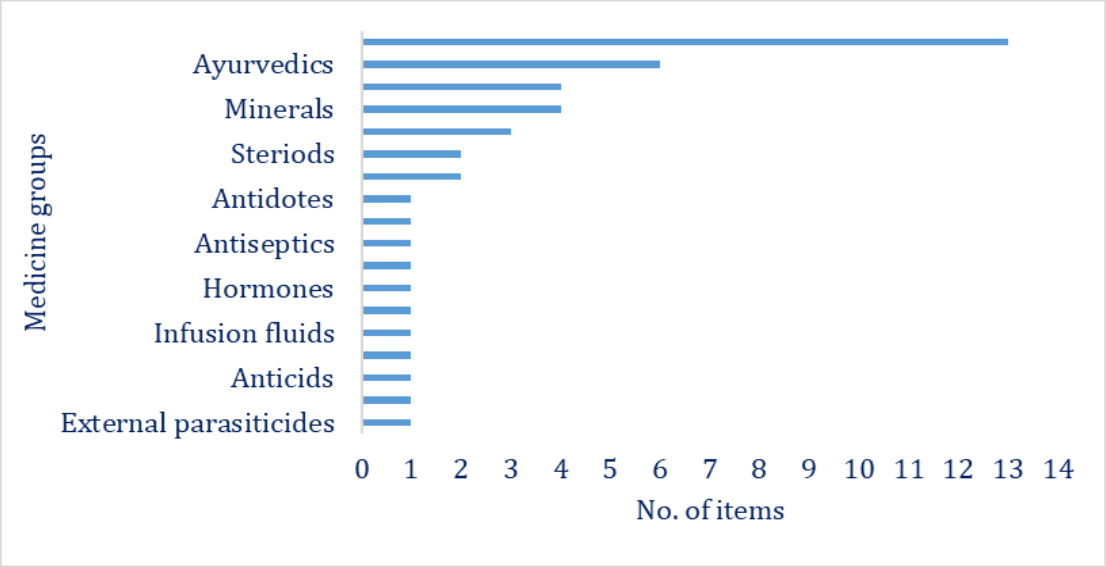


Figure 37: Number of items in each medicine group with decreased in the quoted price of selected items compared to last year

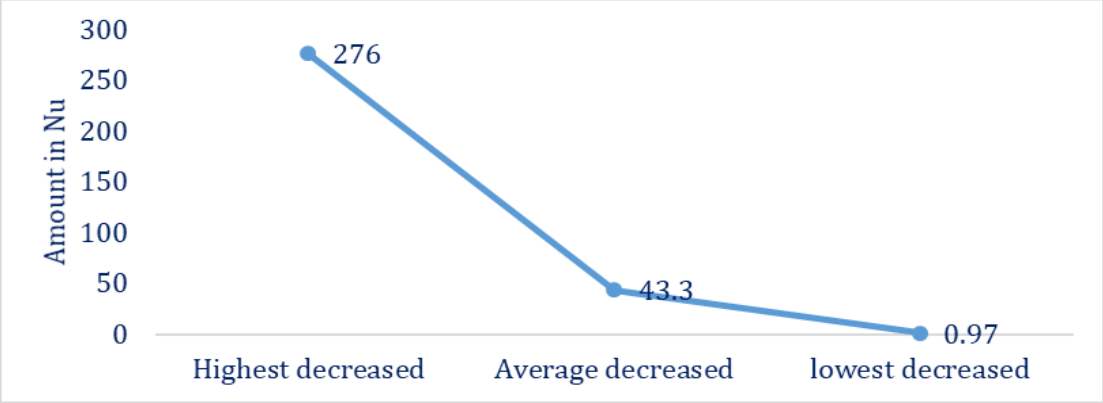


Figure 38: Graph showing the range and mean decreased in the price of the 45 items where the selected quote is reduced compared to last year

6.10 Other achievements of the Unit for FY 2019-2020

6.10.1 Training on G2C Database for EVDP

The unit in collaboration with ICTD, MoAF, conducted a three-day Master Trainer's Training on the use of G2C database for 11 participants at the ICT conference hall from 18th to 20th February 2020. The unit also secured a sum of BTN 2.98 M through Country Grant Fleming Fund Project to train all the animal health staffs in the country on the use of G2C database. Further, the training module was also developed in collaboration with ICT, MoAF and the software developer. The training shall be conducted in the coming FY 2020-2021.

6.10.2 Submission of antibiotic data to OIE

The annual routine antimicrobial consumption report to OIE for the period 1st July 2019 to 30th June 2020 was submitted successfully through reporting option 1.

6.10.2 Budget Utilization and Expenditure Statement for DVEU in FY 2019-2020

6.10.2.1 Expenditure for DVEU in FY 2019-2020

A total budget outlay of Nu. 27.15 M was approved for the DVEU during the FY 2019-2020 and the total expenditure for the unit was Nu. 26.702 M with an overall budget utilization of 98.35% during the year. Apart from the approved budget, the unit also secured and utilized a total amount of Nu. 3.06 M for procuring the additional medicines.

6.10.2.2 Schedule of bill payments and penalties deducted for the delay in supply and un-supplied items during FY 2019-2020

In addition to the RGoB approved budget of BTN 23.1 M for the procurement of veterinary medicines, a sum of BTN 3.06 M was secured and the medicines worth of BTN 24.47M was procured during the FY 2019-2020. From BTN 3.350M approved for the procurement of veterinary equipment and non-drug items, a sum of BTN 0.447 M got lapsed. The laps in the budget for veterinary equipment and non-drug items was mainly because of failure on the part of the suppliers to supply the items.

The unit accordingly levied liquidity damages for delay in the supply of items and penalties for unsupplied items to the suppliers, as shown below.

Table 34: Liquidity damage for delay and penalty for unsupplied items, imposed on suppliers

Sl.no.	Item Category	Delayed Penalty Amount (Million)	Unsupplied Penalty Amount (Million)	Total amount (Million)
1	Medicines	0.199	0.112	0.311
2	Equipment	0.092	0.044	0.136
	TOTAL	**0.291**	**0.156**	**0.447**

7. ACHIEVEMENTS OF BIOLOGICAL PRODUCTION UNIT (BPU)

7.1 Vaccines production and procurement

The Biological Production Unit, as per the mandate, produced procured and distributed vaccines in line with the annual work plan of the unit.

- Produced 10,730 doses in total out of which 9,530 doses of Classical Swine Fever vaccine (in four batches) and another 1,200 doses of Anthrax vaccine;
- Procured 7,680,540 doses of poultry and Livestock and canine vaccines (Nu. 1.58 M for poultry vaccines and Nu.3.92 m for other vaccines);
- Distributed locally produced vaccines – 10,220 doses and 5,387,961 doses of procured vaccines as per their requisition;

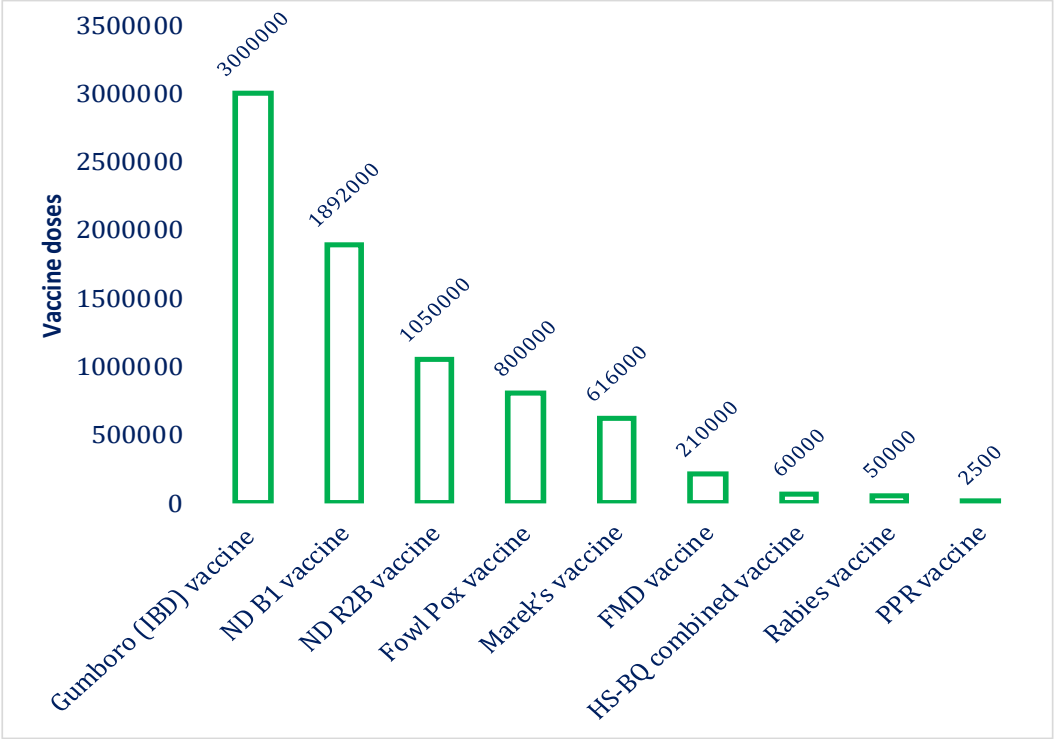


Figure 39: Vaccines procured, FY 2019-2020

- The initial approved budget for the total procurement of vaccines was just BTN 3.5M. However, the unit secured additional funds of about BTN 1.65M from the Department, to procure additional vaccines, due to the increasing demand for vaccines from the field every year. Annually around 5.5 m is being spent for the procurement of vaccines alone;
- Through support from FAO, Bhutan, the Unit received about 60,000 (600 vials x 100 ml) of PPR vaccine towards the end of January 2020; manufactured and supplied by Hester Bio-Sciences, Kathmandu, Nepal.

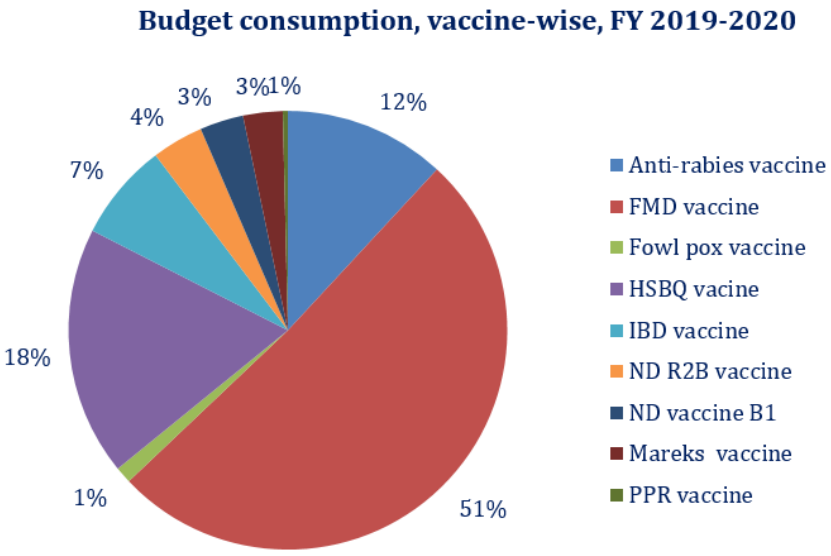


Figure 40: Vaccine-specific budget consumption

7.2 Mass Vaccine distribution

- The Biological Production Unit carried out the mass routine vaccine distribution only once during the current financial year;
- The first quarter mass vaccine distribution was done from 25th September onwards till 4th October 2019;
- During the first quarter mass vaccine distribution, even the vaccine for the second quarter was clubbed owing to the huge demand for all vaccines;
- Apart from the routine distribution, ad-hoc and emergency distributions were done as and when there was a requirement from Dzongkhag Veterinary Hospitals, Central Units including private poultry farms;
- During the distribution, it was ensured that:
  a) The vaccines are delivered to the destination;
  b) The temperature of the refrigerated van is well maintained throughout the travel time using data logger;
  c) Monitoring of the cold chain equipment (Refrigerators) in all the DVHs (as per standard format) was done;
  d) Monitoring of the vaccine stock, usages, expiry, etc. (as per standard format) were done;
  e) Issues if any were discussed with the In-Charge, DVH related to vaccines.

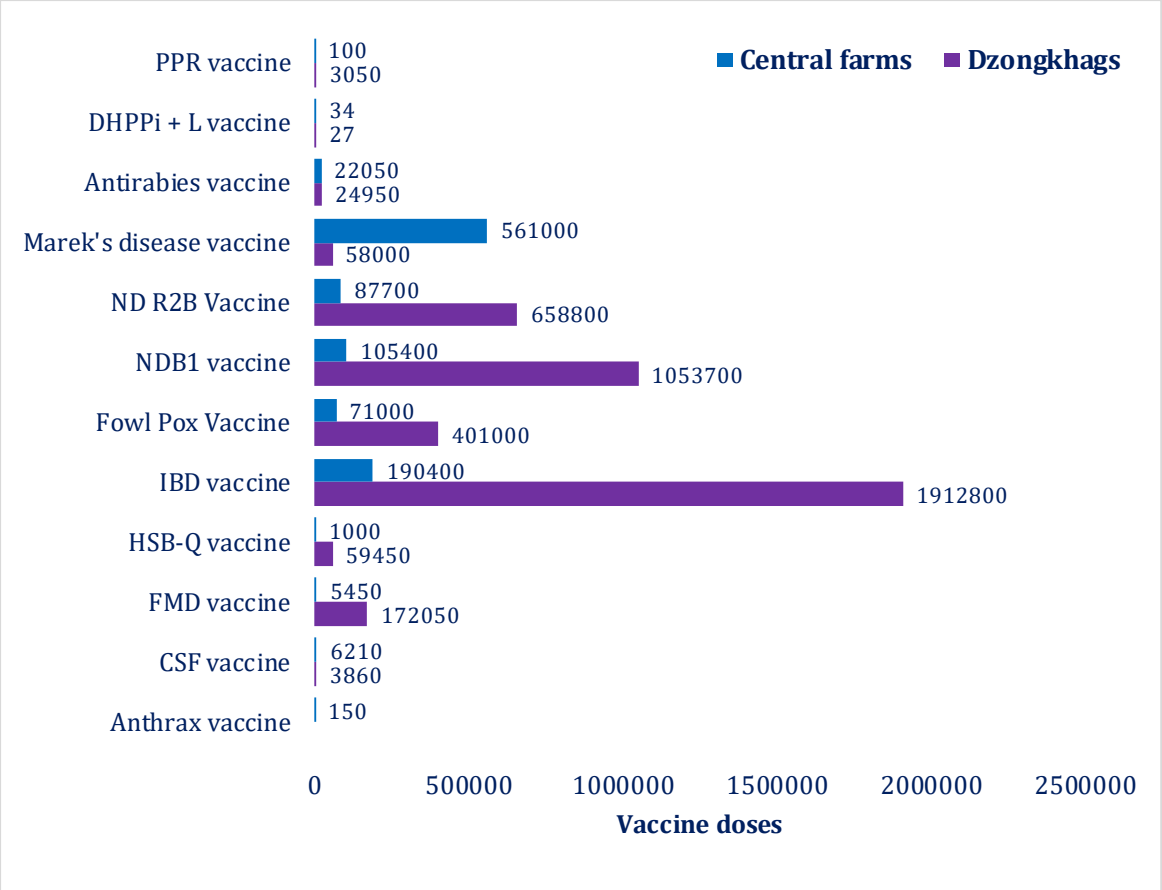


Figure 41: Vaccines distributed to Dzongkhags ad CAs, FY 2019-2020

7.3 Procurement of Laboratory Animals

The Unit managed with great difficulty to procure around 40 numbers (20 males and 20 females) of weaner rabbits from the Directorate of Animal Husbandry and Veterinary Services, Shillong, Meghalaya, India, in February 2020. These animals are procured once in two years and are used for the production of locally-produced Classical Swine fever vaccine.

7.4 Temperature recording using the data logger

- Temperatures recording of refrigerator van and vaccine storage rooms are shown below in Figure 42 and 43.
- In the graph (See Figure 42) below, the cold chain of vaccine maintained during distribution showed slightly above the recommended temperature of +2° to 8° Celsius. This is partly due to the sudden breakdown of the refrigerator van in between the distribution period.
- All the vaccines that are produced in-house, as well as those procured, are stored in the cool room until the final distribution.
- It is quite evident from the graph below that cold chain of vaccine maintained at the vaccine storage room is within the recommended optimal temperature of +2° to 8° Celsius.

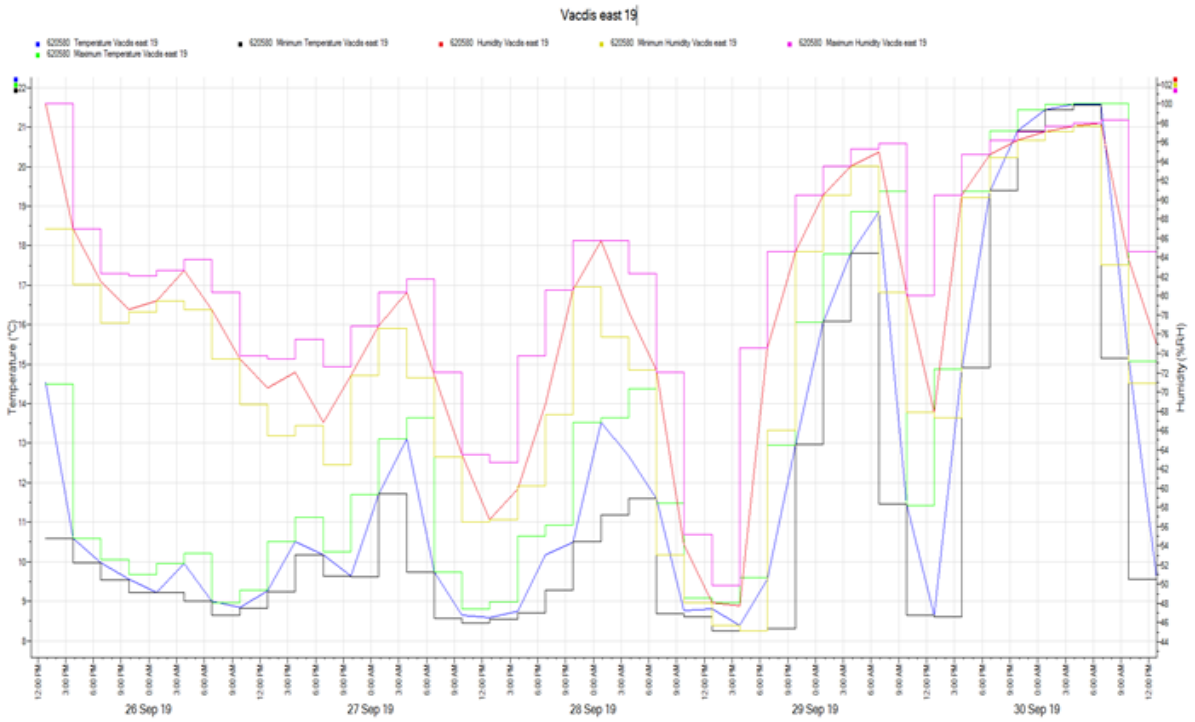


Figure 42: Graph indicating the maintenance of cold chain during the period of Vaccine distribution

Figure 43: The temperature recordings of the vaccine storage room, for the period from September 21, 2019, until November 4, 2019.

7.5 Additional activities

Besides the routine activities, the staff of the Biological Production Unit were also involved and participated in the following:

a. Scrub Typhus sample collection;
b. KAP survey in Haa, Thimphu, and Paro;
c. Sample analysis of Gid surveillance;
d. EPI Info data entry of yak health and management study
e. Training on Bio-safety and Bio-Security at Bangalore, India, conducted by the National Institute of Veterinary Epidemiology and Disease Informatics from August 19 to 24, 2019.
f. Attended Training workshop on strengthening the regulation of vaccines at Paro conducted by Drug Regulatory Authority from February 11 to 14, 2020.
g. Attended one-day Refresher Training on Bio-safety and Bio-Security on June 25, 2020, at NCAH conference hall, conducted by Laboratory Services Unit.
h. Tender evaluation for Veterinary Medicines and Vaccines for the FY 2020-21 from June 22 to 30, 2020.

8. ACHIEVEMENTS OF NATIONAL DOG POPULATION MANAGEMENT AND RABIES CONTROL PROGRAMME (NDPM-RCP)

Recognizing the importance of the Dog Population Management (DPM) in the country, Dasho Secretary, MoAF, was kind enough to allocate Nu. 8.000 Million through EU-RDCCRP for the FY 2019-2020. Due to the funds available, DPM activities across the country could be supported including feral dog population control in select areas.

Another landmark was in March 2020 when DPM was approved as a flagship programme by the Cabinet as a component under National Waste Management and Stray Dog Population Control Flagship. This further reiterated the importance of Dog Population Management in the country.

8.1 Overall activities and achievements

The following table shows the activities, in brief, carried out by the unit during the FY 2019-2020.

Table 35: NDPM&RCP activities, in brief, FY 2019-2020

Month	Dzongkhag/ Area	Activity	Remarks
August 2019	Thimphu	DPM/Indicator count, an Awareness campaign	The awareness campaign was led by RSPCA in all the schools in Thimphu
September 2019	Thimphu	DPM	The CABC in Thimphu was done in collaboration with RSPCA and JAST whereas the WRD 2019 and CABC in Nganglam was done in collaboration with RSPCA
	Kanglung	Mass Dog Vaccination and awareness campaign during World Rabies	

Day week

	Nganglam	DPM	
October 2019	Lhuentshe	DPM	A month-long programme covering most of the population was carried out.
	Nganglam	DPM	Except in Nganglam where RSPCA was collaborating in other Dzongkhags CABC was led by DLS with support of mobility, AWOs and medicines from NCAH
	Trongsa	DPM	
	Tsirang	DPM	
	Phobjikha, Wangdi	Feral Dog Population Management	The DoL along with DoFPS tackled the feral dog problem in Phobjikha Valley.
November 2019	Trashi Yangthe	Rabies Control/MDV	A National team was fielded for containment of Rabies Mass dog vaccination
	Thimphu	Feral dog control	AWOs in collaboration with DoFPS involved in feral dog control in the Peri-urban areas
	Thimphu	ToT on DPM and MDV Apps and Community Engagement	This training was carried out to a select group of Vets who were to be ToT by HSI consultants Dr Shrikant and Mr Faizen
	Haa	Dog Population survey and KAP survey	The survey was the first of its kind using DPM app mapping each dogs using GPS and a household survey carried out using Epicollect5. Coordination meeting with the Dzongkhag conducted to garner their support
December 2019	Samtse	DPM	With Samtse Dzongkhag, DPM Apps was used in the field for the first time independently
	Paro	DPM	In problematic area mainly army camps
	Thimphu	DPM	In areas of high juvenile dogs and puppies. This was done in collaboration with JAST
Jan-Feb 2020	P/ling/Jaigoan	DPM	In addition to routine DPM activities in Phuentshogling and Jaigoan area, four Vets from across the border were trained on CNVR protocol for two weeks.
	Chhukha	DPM	Upper Gewogs of Chhukha that was

			not covered during DPM P/ling
February 2020	Gelegphu	DPM Coordination Meeting	Conducted two days DPM coordination meeting wherein all Vets of the country attended the meeting
March 2020	Haa	DPM	DPM initiated in Haa as model Dzongkhag that has 100% sterilization coverage and 50% adoption rate. The campaign had to stop abruptly due to COVID-19 restrictions
	Phuentshogling	Mass dog vaccination	Aggressive mass vaccination campaign launched to contain rabies outbreak in which 1200 plus dogs were vaccinated in 9 days
	Sarpang	DPM and MDV	Both mass scale sterilization and vaccination campaign were carried out.
April 2020	Thimphu	Feral Dog Population Management	This intervention was undertaken exclusively in Kuenselphodrang area with the DoFPS
May 2020	Thimphu	Feral Dog Population Management	This intervention was undertaken exclusively in Kuenselphodrang area with the DoFPS
	Haa	DPM	DPM campaign resumes in Haa
June 2020	Haa	DPM	The DPM concludes in Haa
	Haa	M & E of DPM	The final M & E of DPM Haa is undertaken and a future road map submitted to the Dzongkhag. The M & E found 93% coverage in the Dzongkhag
	Thimphu	DPM	Large scale DPM starts in Thimphu in collaboration with Thimphu thromde, RSPCA and JAST which will be an on-going activity
	Paro	DPM Survey	Coordination meeting with the Dzongkhag and all relevant stakeholders followed by DPM survey for 3 days

8.2 Dog population Management

The main mandate is to carry out high-volume low-cost CNVR as well as routine sterilization in the DVHs. From July 2019 till 30 June 2020, a total of **8,870** surgeries were carried out both in dogs and cats in the field clinics. The detailed coverage, Dzongkhag-wise, is as shown in the graph below.

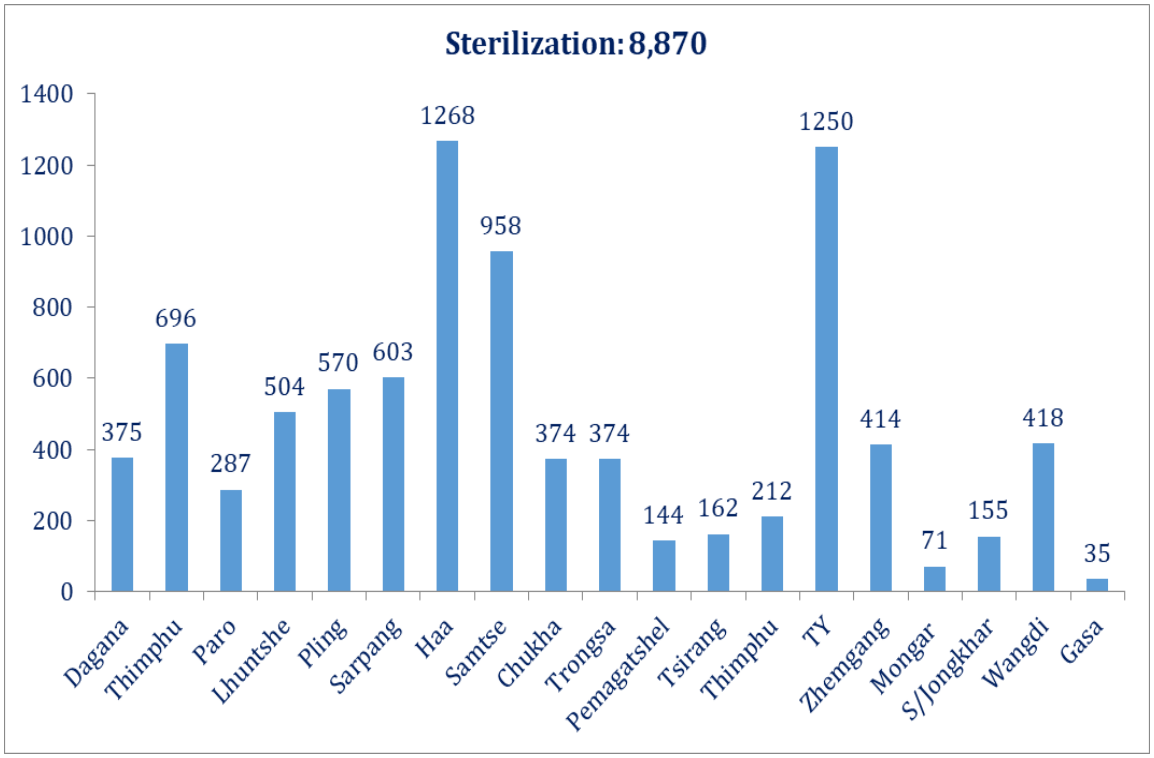


Figure 44: No of sterilizations carried out, Dzongkhag-wise

8.3 Mass Anti-Rabies Vaccinations

Another important mandate is to ensure that the dog-mediated rabies is prevented and eliminated in the long run. The rabies endemic Dzongkhags along the Indo-Bhutan border are endemic to rabies. In addition to vaccination in the endemic, routine vaccination takes place in all the Dzongkhags. During the FY 2019-2020, a total of 7,914 dogs (owned and stray) were vaccinated with the anti-rabies vaccine. The graph below depicts the numbers of dogs vaccinated against rabies.

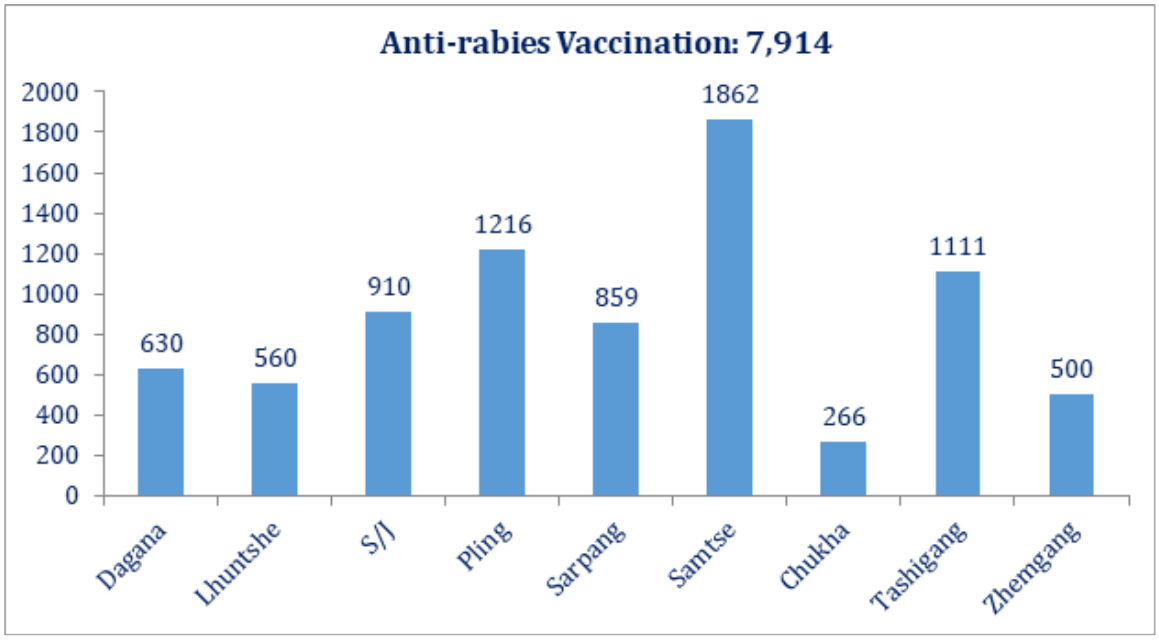


Figure 45: No. of dogs vaccinated, Dzongkhag-wise

8.4 Observation of the World Rabies Day 2019

September 28th, 2019, was the 13th World Rabies Day, and the year's theme focused on **vaccination**, the foundation of all rabies control efforts. The theme, ***Rabies: Vaccinate to Eliminate***, was used to raise awareness at many levels, for example: To ensure that dogs are kept vaccinated - as a reminder to dog owners, animal health professionals and local governments; to help people in need to seek and obtain PEP – through human health professionals and educators; to commit to the 2030 goal of eliminating rabies deaths – with national governments putting resources into rabies elimination.

In response to the "United Against Rabies – Zero by 30" collaboration calls upon national governments to take active and important steps toward the achievement of the target to end human deaths from dog-mediated rabies by 2030; the pledge was signed by Honourable Ministers: Ministry of Health and Ministry of Agriculture and Forests, reaffirming Bhutan's commitment to eliminate dog-mediated human rabies by 2030. In line with this, a joint statement was issued by the two ministers on the world rabies day, 2019.

Figure 46: Dzongkhags where WRD - 2019 was observed (yellow-shaded)

Mass dog vaccination campaigns and advocacy programme on the disease were carried out in seven Dzongkhags (See Figure 46) with the main focus on southern and eastern rabies-endemic Dzongkhag and those along the porous border of India and Bhutan.
During the day, besides mass awareness campaigns, a total of 1,618 dogs and cats were vaccinated against rabies and 81 dogs neutered (See Figure 47).

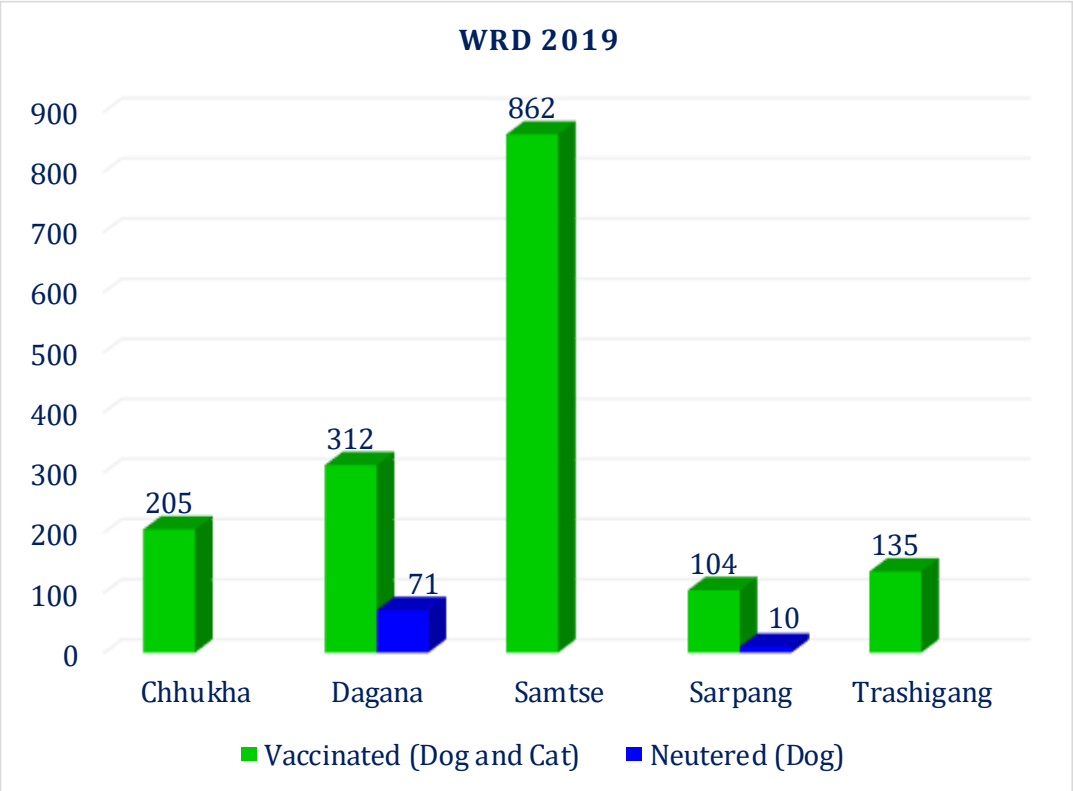
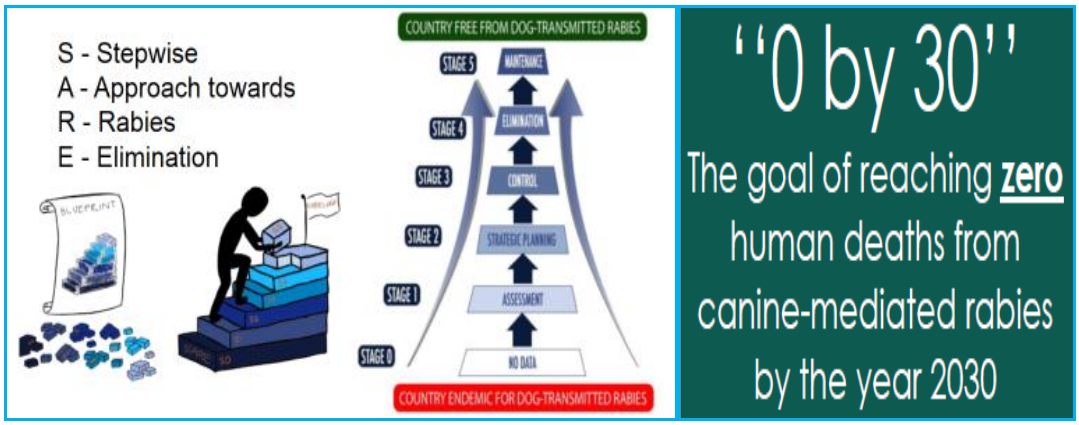


Figure 47: Dogs and Cats vaccinated and neutered during WRD 2019

8.5 Reduction in incidences of dog-mediated human rabies

Except for one human rabies case in 2016, no dog-mediated human rabies cases were reported since 2013. Therefore, Bhutan is well-on-track of achieving the global target of ***Zero-by-30***, that is, freedom from canine-mediated human rabies by 2030.



Bhutan ➤

9. DISEASE SURVEILLANCE, SURVEYS, AND RESEARCH

9.1 Retrospective study on mortality of pigs at the Regional Pig Breeding Centre (RPBC), Yusipang

Dr. NK Thapa[1], Ms. Puspa Maya Sharma[1], Mr. Tenzinla[1], Tshewang Dema[1], Ms. Menuka Rai[2] Mr. Choedup Gyeltshen[2] and Dr. RB Gurung[1]

[1]laboratory Services , National Centre For Animal Health, Serbithang , [2]regional Pig Breeding Centre, Yusipang

Summary

The overall mortality rate in pigs at Regional Pig Breeding Centre, Yusipang for the year 2018-19 was (6.78 ± 2.26) (Mean ± SE). The highest mortality rate was highest in adult (13.3%) followed by suckler (5.9%), weaner (5%) and grower (2.9%). The three main categories of the animal reared are Great Grand Parent, Grand Parent and Parent Stock.

Seasonally, the highest mortality was recorded from October to January in the sucklers and weaners from December to February. The high mortality in suckler and weaners during winter could be attributed to cold stress. In growers, the mortality was almost uniform throughout the seasons and considerable mortality in adult was recorded from April to August.

About 97.6% of sucklers and 67.7% of weaners were found suddenly dead and very less frequent cases of other conditions like weakness, diarrhoea, fever was recorded. Similarly, the majority of the growers died suddenly (31%) followed by lameness (24.1%), Blue ear (20.7%). In the adult group, the highest case reported was associated with Chronic illness and weakness (27.3%) followed by digestive related illness (21.2%) which includes, off feed, poisoning and vomiting, high respiration (15.2%) and reproductive problems (12.1%) which includes, vaginal discharges, mastitis, metritis and dystocia. As per the necropsy diagnosis, the highest cause of death was due to hepatic disorder (28.9%) followed by cardiopathy (15.6%), respiratory infection and septicaemia (12.5%) each.

The main isolates in the bacterial infection and septicaemia were *Escherichia coli, Erysipelothrix rhusiopathiae, Klebsiella, Streptococcus and Staphylococcus. Salmonella* was isolated from diarrhoeal cases in the piglet during May 2019. From the samples of the animals with the reproductive disorder, *Staphylococcus hyicus, Streptococcus, Corynebacterium*, *Actinomyces, Actinobacillus and Escherichia coli* were isolated during September 2019.

Molecular analysis conducted against African Swine Fever (ASF), Classical Swine Fever (CSF), Porcine Respiratory and Reproductive Syndrome (PRRS) and Brucellosis confirmed negative.

For any farm, three main steps in biosecurity measures are segregation, cleaning and disinfection. Hence, RPBC Yusipang should have adequate space for isolation of the sick animals, proper water supply for cleaning and adequate stock of disinfectants for routine disinfection. Also, proper health monitoring of the animals needs to be enhanced.

9.2 Health Screening of Animals at National Jersey Breeding Centre with urine parameters

Dechen Wangmo[1], Arpana Rai[2], Tshering Dem[2], Kiran gurung[2], Pema Wangchuck[2] , Purna Bdr. Rai[1], N.K Thapa[1]

[1]NCAH Serbithang, [2]NJBC, Samtse

Introduction

Analysis of urine is one of the approaches to assess the health of the animals. The measure of specific gravity will help in assessing the tubular function of the kidneys. It will reveal many of the diseases that could go unnoticed and undiagnosed because they generally do not produce pathognomonic clinical signs or symptoms. These diseases include diabetes mellitus, various forms of glomerulonephritis, and chronic urinary tract infections.

Observing the colour, transparency, microscopic and chemical characteristics of urine and urinary sediments coupled with microbial culture and sensitivity test is likely to identify the majority of the lower urinary tract disorders in domestic animals. It is a remarkable and readily available and an inexpensive tool for the diagnosis and management of numerous urinary tract abnormalities.

Hence, on a pilot scale, screening of animals through urine analysis was conducted at NJBC, Samtse, through random sampling.

Material & Methods

During June 2019, 17 urine samples were collected randomly and tested with urine strip (Urine Insta Test, CORTEZ diagnostic Inc, USA) from various categories of animals (Milch cow-5 urine samples, Dry Cow-3 samples, Heifer-7 samples and Bull-2 samples) at National Jersey Breeding Centre Samtse. The test detects the presence of bilirubin, ketone, specific gravity, blood, pH, protein, urobilinogen, nitrite, leukocytes, ascorbic acid.

Results & Discussions

The urine of all the animals had traces of protein and Leukocytes. However, the specific gravity, pH was within the normal range. Other parameters like bilirubin, ketone, blood protein. Urobilinogen, nitrite, ascorbic acid was negative (See Table 37).

Table 36: Summary of urine analysis conducted in animals of NJBC, Samtse.

Animal Category	Number of samples	Findings
Milking cow	5	All milking cow contains a trace of leukocytes & protein
Heifer	7	All heifer was found with a trace of leukocytes & protein
Dry cow	3	All dry cow was found with a trace of leukocytes & protein
Bull	2	All bull was found with a trace of leukocytes & protein
TOTAL	**17**	

The results were almost similar for all the animals. This could be due to the same type of feed and fodders fed to the animals.

Conclusion

There were no significant findings except a trace of Leukocytes in all the animals. This indicates that the animals were healthy without any infection or metabolic conditions or renal ailments.

9.3 Laboratory analysis of Dog faecal samples & Scats from Yak rearing areas

Introduction

After the Highland Research & Development workshop held in Gelegphu in January 2020, Taenia prevalence study in yak rearing areas was conducted at NCAH, serbithang. Gid caused by *Taenia multiceps*, one of the several genera under Taenidae family, is a concern for yak rearing communities in the highland areas of Bhutan. Taenia causes neuropathy in young yak calves by lodging cyst (intermediate stage) of the dog tapeworm, *T. multiceps.* Yaks, cattle, sheep, goats are the intermediate hosts, whereas, dogs and wild canids are the definitive hosts (intestinal adult worm). The disease causes significant economic losses to yak herders due to mortality of young yaks.

Methodology

A semi-structured questionnaire was developed to interview farmers on husbandry practices, mortality, migratory pattern. It is a concurrent study- Taenia prevalence established through laboratory analysis of dog faecal samples and scat sample. Administration of semi-structured questionnaire to establish baseline data of mortality due to gid and also to establish husbandry practices.

The study was conducted in 10 Dzongkhags and 26 Gewogs. The samples include environmental faecal sample, scat samples, soil samples from the yak rearing areas. Sample analysis was done by F/S, Sequential sieving (100µ, 40µ, 21µ).

Results

Through laboratory analysis of faecal and scat samples, the overall positivity of Taeniid was 62/563, suspected 8/563 a, non-taeniid 169/563 (See Figure 48).

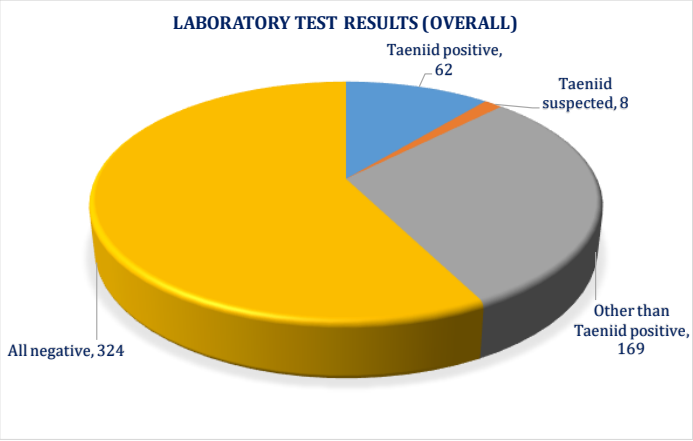


Figure 48: Overall test results

Gewog-wise comparison revealed highest Taeniid positive dog faecal samples from Merag, and scat samples from Kazhi (See Figure 49).

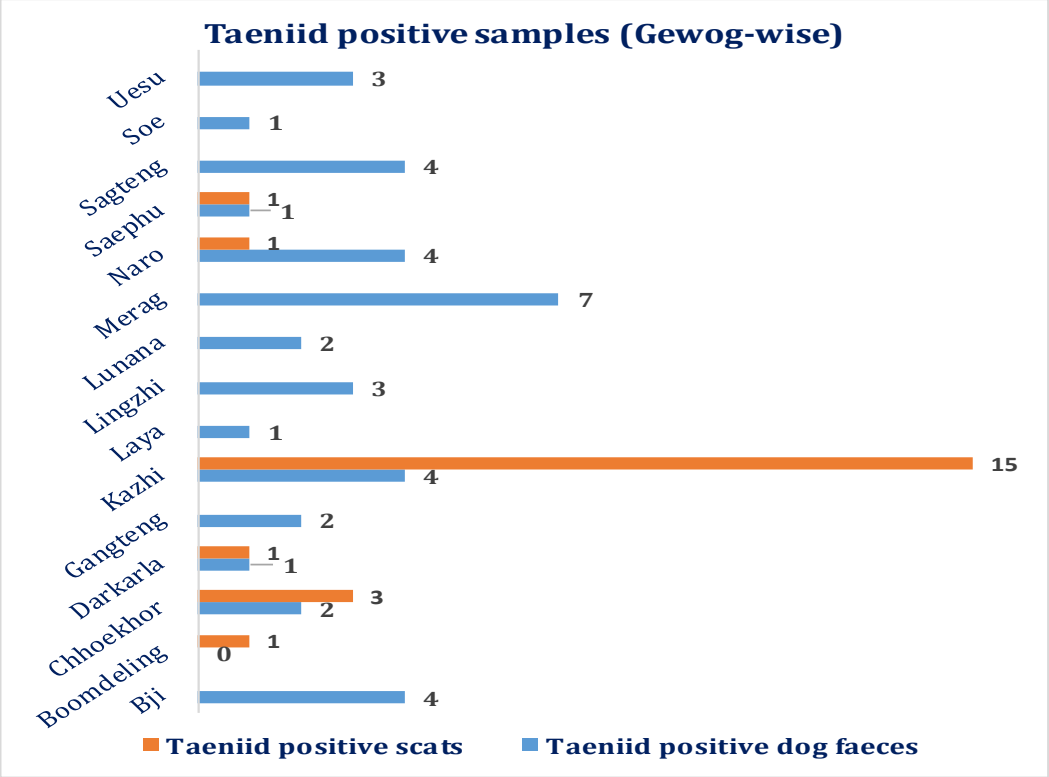


Figure 49: Gewog-wise Taeniid positive samples

When compared Dzongkhag-wise, Taeniid prevalence was highest in Wangdue Phodrang, followed by Thimphu, Trashigang, etc. (See Figure 50).

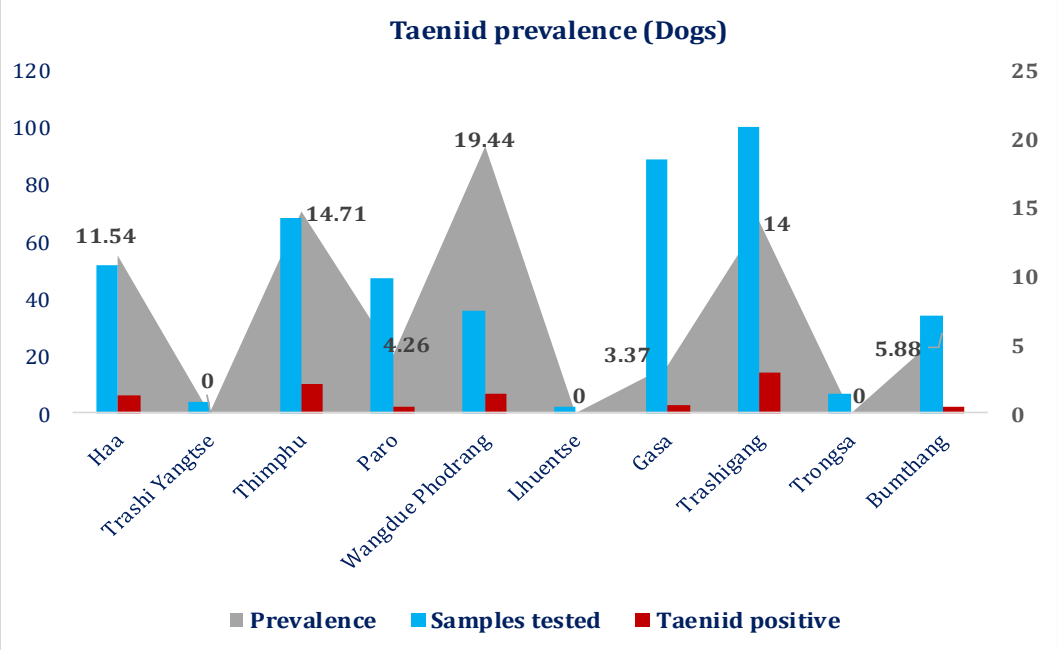


Figure 50: Dzongkhag-wise Taeniid prevalence

Conclusion

The overall average prevalence of Taeniid in Dogs is 44/439(7.32%) and wild canids 25/121(20.7%). Prevalence of Taeniid is highest in Wangdue Phodrang Dzongkhag 7/36(19.4%) in dogs and also in wild canids 17/34 (50%). Taeniid eggs have been detected in dog faeces in Trashigang (14%), However, the molecular analysis will confirm the presence or absence of *Taenia multiceps.* Controlled deworming needs to be done in the areas.

Further activities include optimization of a method for Taeniid egg isolation from soil samples and then the examination of soil samples for Taeniid eggs and molecular identification of *Taenia multiceps.*

9.4 The preliminary finding of the study to determine the level of anti-rabies antibody in dogs (pet and free-roaming) in endemic and non-endemic areas of Bhutan using RAPINA (Rapid Neutralizing Antibody) test

Background

Rabies is a zoonotic viral disease that affects all mammals. Infection in susceptible populations almost invariably leads to death. However, rabies can be prevented through the timely use of vaccines both before the exposure (pre-exposure prophylaxis) and after the exposure (post-exposure prophylaxis). In animals, especially dogs, anti-rabies vaccination is provided at one month of age followed by an annual booster. Sero-conversion after vaccination is necessary to provide protection. A serum antibody titre of 0.5 IU per ml is considered to have an adequate seroconversion post-vaccination. Sero-conversion is measured using serological techniques such as RFFIT (Rapid Fluorescent Focus Inhibition Test) and FAVN (Fluorescent Antibody Neutralization Test), however, these tests require sophisticated resources such as cell culture facility and trained personnel. Furthermore, these tests are time-consuming and expensive. There is a cheap and rapid alternative test developed to determine if there is an adequate seroconversion post-vaccination. The RAPINA is a novel, immunochromatographic test that uses inactivated virus to estimate the VNA level qualitatively. It is a simple, rapid, and inexpensive, although indirect, the assay for the detection of VNA levels. Although RAPINA doesn't exactly determine the level of antibody titer, it provides information if the serum has antibody more than or less than the recommended level of 0.5 IU per ml. As a part of the collaboration activity between National Centre for Animal Health, Serbithang and National Institute of Infectious disease, Japan, serum samples were collected from dogs (owned and un-notched free-roaming) in rabies non-endemic and rabies endemic area to determine virus neutralization antibody (VNA) against rabies using RAPINA. As the study is ongoing, we present only the result of samples that were collected from stray dogs in the rabies non-endemic area.

Materials and methods

Thimphu was selected as a rabies non-endemic area while **Phuentshogling** was selected as a rabies endemic area for sample collection. In total 250 sera samples were

planned to be collected (50 from owned dogs and 200 from un-notched free-roaming dogs). The total number of samples from owned and un-notched free-roaming dogs were calculated by dividing equally between rabies endemic and non-endemic areas. In this way, 25 sera samples from owned dogs and 100 from un-notched free-roaming dogs were planned to be collected each from endemic and non-endemic areas. From the owned dog's sample were to be collected only once. Whereas, in the free-roaming un-notched dogs, two samples were to be collected as described in figure 2 below.

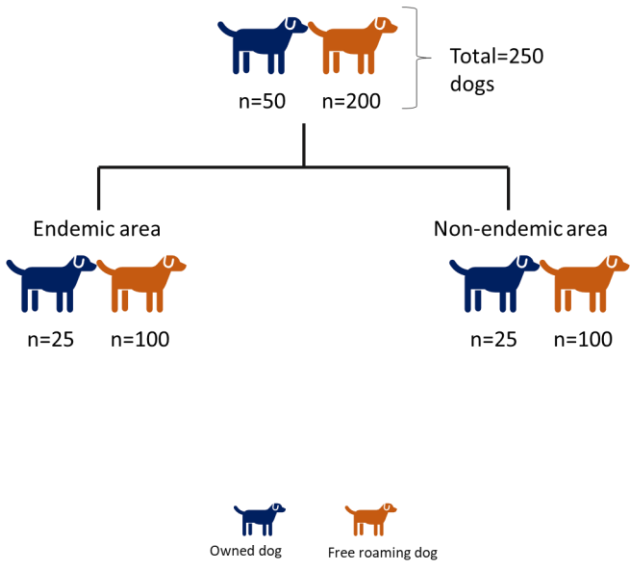


Figure 51: Schematic showing the number of samples to be collected categorized by areas and owned/free-roaming dogs.

In the un-notched dogs, after the first sample collection, the dogs were vaccinated against rabies. The second sample will then be collected 60-days post-vaccination or the first round of sample collection. For identification purposes, to ensure that after 60-days post-vaccination or sample collection the same dog is caught, the following approaches were used.

1. Collaring the dog with collar printed with unique dog ID
2. Taking pictures of the dog (mandatory)
3. Mandatory recording of the geo-coordinates from where the dog was caught

Figure 52: Sample collection, vaccination and second round of sampling schematic for un-notched free-roaming dogs

The samples from the owned dogs were collected from the dogs that are brought to National Veterinary Hospital, Thimphu, and Thromde Veterinary Hospital, Phuentshogling for clinical consultation. A laboratory official from the Laboratory Service Unit and an official from DPCU was assigned to collect the sample. In Thimphu, samples were collected from the free-roaming un-notched dogs during the CNVR program in the Thimphu Thromde.

Results

Fifty sera samples were collected from vaccinated pet dogs (25 from NVH, Thimphu, and 25 from TVH & SL, Phuentshogling), and a total of 105 sera samples were collected from unnotched free-roaming dogs under Thimphu Thromde (figure 3). Ninety-one samples were collected from adult dogs (55 females and 36 males) and 14 from young dogs (5 females and 9 males). Hundred more sera samples will be collected from unnotched free-roaming dogs in the rabies endemic areas.

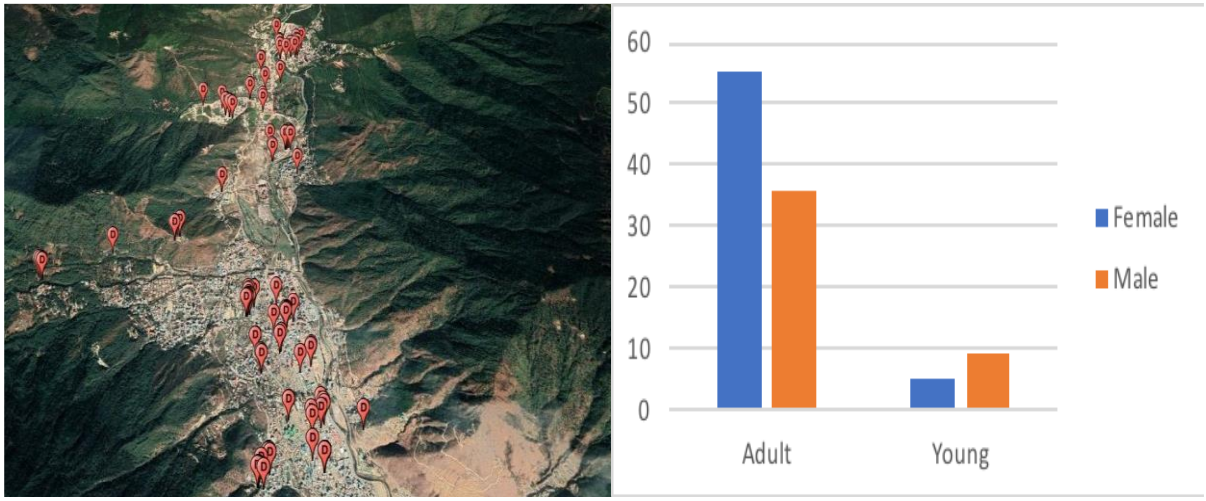


Figure 53: Geo-coordinates and gender and age-wise number of dogs that were caught for sample collection.

RAPINA test result

Assuming that the unnotched dogs were not neutered and vaccinated, we expect these dogs to have no antibody against rabies. Therefore, the expected result for the RAPINA test was to have antibody levels below 0.5 IU/ml for all the 105 dogs. However, it was observed that the 6 adult dogs (3 males and 3 females, 9%) had antibody titre above 0.5 IU/ml.

Discussion

Bhutan has initiated mass dog vaccination and sterilization program since 2009 and more than 10,2000 dogs have been neutered and vaccinated. The neutered dogs are identified by a permanent notch on the tip of the ear. Based on this method, especially in the rabies non-endemic areas, dogs that don't have a notched ear can be assumed as not neutered nor vaccinated. This is not true for dogs in the endemic areas because, besides neutering, annually mass vaccination is carried out in the endemic areas. Our finding of

dogs that had an antibody titre of more than 0.5IU/ml could be associated with the persisting antibody from the vaccination that was carried out in the free-roaming stray dogs in Thimphu in 2009. From this study, we can roughly guess the vaccination coverage among the free roaming unnotched dogs. It was 9% in our case and this data can be used in modelling the spread of rabies if in case a rabid dog is introduced into the population. The status of seroconversion is not evaluated in the pet dogs and the free-roaming dogs in the endemic areas due to the lack of adequate testing kits. Evaluation of serum titre in the free roaming unnotched dogs in the endemic areas will provide a fair idea on the vaccination coverage as well as the risk of possible rabies outbreaks.

9.5 Preliminary findings of the Yak health and management survey in the highland communities of Bhutan

Introduction

yak farming is and will continue to be a reliable source of livelihoods for mountain pastoralists in times ahead. Yak farming is and will continue to be a reliable source of livelihoods for mountain pastoralists in times ahead.

Taenia multiceps is an important zoonotic tapeworm and its larval form also known as *Coenurus cerebralis* causes Coenurosis. The adult tapeworm inhabits the small intestine of its definitive host domestic and wild canids (dog, fox, and wolf), while the metacestode parasitizes in the brain or spinal cord of the intermediate hosts (sheep, goat, cattle, and human), and then it affects the central nervous system of the intermediate hosts. Coenurosis leads to pronounced intracranial pressure, resulting in headache, ataxia, hypermetria, head deviation, blindness, stumbling, paralysis, and even death of the intermediate infected sheep, goat, cattle and even humans.

Coenurosis has spread worldwide and is distributed extensively, including in Europe and the USA, and especially in developing countries in Africa and Asia, and results in serious socioeconomic losses to the livestock husbandry industry throughout the world. Coenurosis in yaks indicates the presence of the definitive hosts of *T. multiceps* in humans and domestic animals' environment, which suggests its zoonotic potential and importance to public health concerns. For the freely grazing yaks, it is difficult to detect even though they are infected with parasites, and only when they start walking in a circular motion, it is evident and at times it will be late for surgical interventions. In Bhutan, yak farming is and will continue to be a reliable source of livelihoods for mountain pastoralists. To ensure that the highland communities sustain their livelihood and alleviate poverty, it is essential to provide targeted intervention measures. This study was undertaken to understand the common yak health and management problems and determine the gid prevalence in the highland communities.

Materials and method

Study area and study population

The study was conducted in ten highland Dzongkhags of Bhutan from February to June 2020. Bhutan is a kingdom with an area 38,394 square kilometres situated in the Eastern part of the Himalayan range. It is divided into 20 Dzongkhags (districts), and

further into 205 Gewogs. Out of 20 Dzongkhags, 10 Dzongkhags fall under the highland areas where people keep and rear yaks for their livelihood. The altitude ranges from 1500 to 4500 meters above sea level (NSB, 2010). As per record, there are 879 yak herders in the country. This study aimed to reach out to all these yak herders.

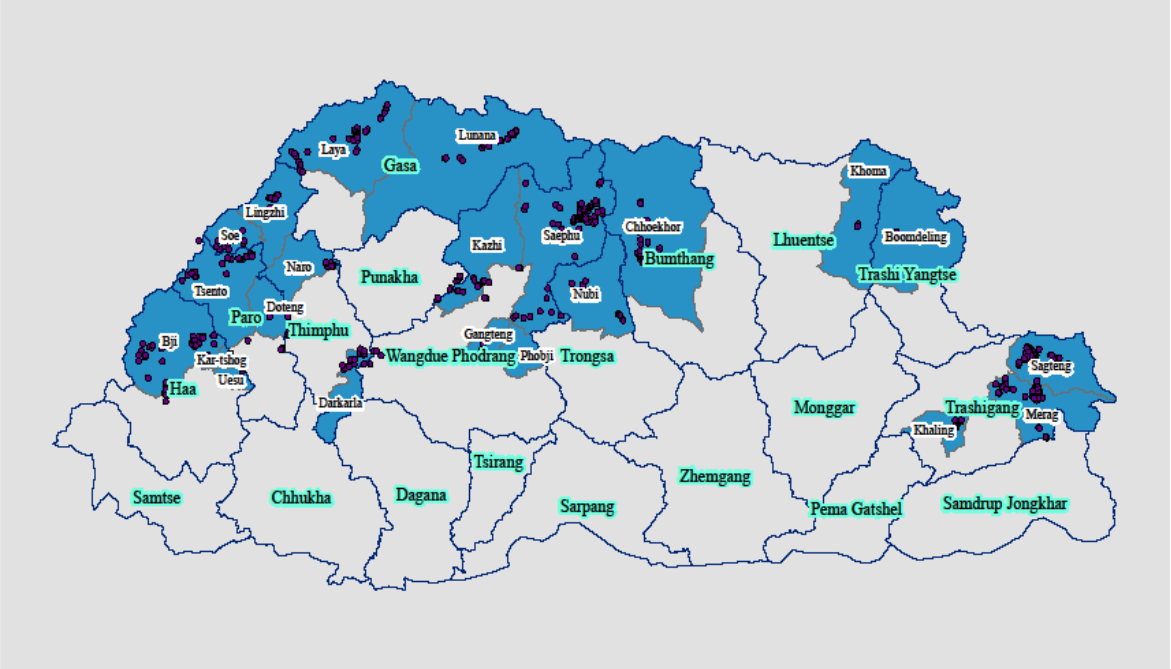


Figure 54: Showing yak health and management study area.

Study Design

A cross-sectional study was carried out and the information was collected using a semi-structured questionnaire through face to face interviews. The questionnaire consisted of questions designed to collate information in the demography of the yak herders, herd characteristics, dog population, causes of yak mortality, and herders' perception of gid and prevalent risky practices.

Sample size

Sampling Strategy

According to livestock census (2018) 41463 number of yaks and 9581 Zo/Zom (Hybrid) in the country. The total number of herds across the country was 879 herds in the highland Dzongkhags. Initially, the study was carried out targeting to cover the entire herd, however, due to the migration of herd to the higher altitude, we could only reach out to 656 herds (75%)

Sample collection for laboratory analysis

A total of 962 samples including faecal and soil of herd dogs, stray dogs, and wild canids was collected from the study area during winter residential time. Before the collection of samples, unpretentious samples collection guidelines were developed and briefed to officials involved in their respective Dzongkhags.

About 10-15 gm of freshly dropped dog faecal sample was collected. Where available, the scat sample was also collected in a faecal vial. When fresh samples were not available for collection, dry faeces (dogs/wild canids) were collected and the whole mass was put into zip lock dispensing plastic. After completing the sample collection form the samples were stored into a cool box maintaining the cold chain until they were delivered to the laboratory. The vials were labelled properly with a detailed sample identity. Faecal samples were examined for the presence of *Taenia* egg at the National Centre for Animal Health (NCAH).

At the laboratory, about three gm of faecal matter was drawn from the individual sample, weighed, and placed in a 50 ml centrifuge tube. It was added with 45 ml of 1:1 sugar solution, then vigorous shaking of content was done before centrifuging it 10 minutes at 2500 rotation per minute. After centrifugation, the content was poured into the container containing sieve of 100 µm, 40 µm and 21 µm filters. Sequential sieving was done. Faecal content was washed and flushed several times with water till the sample was clean for examination. Then the 100 µm and then 40 µm sieves were removed from the filtrated jar. The sample was taken from the 21 µm sieve by the Pasteur pipette and it was placed on the slide to observe Taenid egg presence. The processed samples were examined under a microscope using 10 X and 40 X objective lens.

Statistical Analysis

Data were entered into Epi-info 7 and R-statistical software was used for analysis. Prevalence of Gid in the Yak and Taenid eggs was calculated using cross-tabulation and frequency analysis and expressed in percentage. Prevalence of Gid was calculated for yaks in the country, district-level prevalence, Gewog-level prevalence, and prevalence in claves below three years old stratified by the village.

Results

Socio-demographic characteristics

In total 656 households were interviewed covering 27 Gewogs under 10 highland Dzongkhags. The coverage was 75% of the total herd number of 879. Forty-six percent (303) of the respondents were female while the rest were male. The mean age of the respondent was 44.5 years. The mean age of the female respondents was 42.9 while that of male respondents was 45.9. A total of 350 respondents have attained formal education of which 221 at primary, 97 at junior high school (class seven to ten), and 32 at high school level (above class ten). Yak products (601) and the Cordyceps (392) were the most cited common source of income followed by non-wood products (180), tourism (46), and agriculture (45). Most of the yak herders have been rearing yak for about 100 years and more.

Yak population

Thimphu Dzongkhag had the highest number of yaks (7954) followed by Trashigang (6869), Gasa (4534), Bumthang (3557), Paro (3377), Haa (1040), Trashi Yangtse (513), Trongsa (327) and Lhuentse (250). The total number of yaks including zo and zom in

the study area was 31,044 with mean yak per household of 47 (CI: 44-50). The total yak population alone was 27,461 with mean yak per house of 42 (CI: 39-45) and the total zo-zom population was 3583 with a mean population per household of 5.4 (CI:4-6). Based on the mean yak per household, the projected population of yak including zo and zom in the study area was 41,313 (CI: 38,676-43,950).

Dog population

The total number of dogs in the study area was 756 with a mean dog per household of 1.15 (CI: 1.04-1.27). The number of sterilized and unsterilized dogs was 197 (124 males and 73 females) and 448 (141 males and 307 females) respectively. Based on the mean dog per household, the projected population of the dog in the study area was 1010 (CI: 914-1116). Trashigang Dzongkhag had the highest dog population (222) followed by Thimphu (137), Gasa (121), Haa (93), Paro (84), Bumthang (52), Wangdue (24), Trongsa (13), Trashi Yangtse (7 and Lhuentse (3). The ratio of yak per yak dog as per our study was 41:1.

Yak mortality and reported causes

The highest mortality of yak was reported from Gasa followed by Thimphu during the year 2018-2019. The highest mortality was reported due to depredation by wild animals and dogs (1560) followed by gid (1193), accidents (300), chudhug (281), starvation (154), and plant poisoning (147). Gid was reported to be prevalent in eight highland dzongkhags except for Trashi Yangtse and Lhuentse. The prevalence of gid based on the report of the respondents for the year 2018-2019 is provided in the table below.

Table 37Dzongkhag wise prevalence of gid based on the report of the respondents

Dzongkhag	Prevalence rate
Bumthang	0.829
Gasa	2.85
Haa	3.53
Paro	0.997
Thimphu	0.712
T/gang	0.0873
Trongsa	0.305
Wangdue	0.304

Gid is commonly called as “guyoom” but based on the region it is also referred by names such as gonay, sernay, mernay, zashey, lakhor, leygor, leyney, yokho, merphe, zaa, zado, gugorm, zayue, gugun and girgirla. Gid was reported to be commonly affecting the yaks and zo-zom between 2-3 years of age.

Conclusion

We observed that the herder lacked knowledge about gid although it was widely prevalent in the highland communities. In this regard, there is a need to enhance awareness about gid in these communities. As dogs are responsible for maintaining the transmission chain of gid, there is a need to manage the dog population, advocate responsible dog ownership, and implement controlled deworming programmes. To prevent the introduction of gid and other important yak and dog diseases, there is a need to strictly regulate the movement of yaks and dogs from one place to another. Furthermore, this study recommends timely updates and strict implementation of the gid control program.

10. ON-GOING SURVEILLANCES AND RESEARCH

10.1 Initiated collaborative studies on an important zoonotic disease like Anthrax, Rabies, Crimean-Congo haemorrhagic fever (CCHF), and bat-mediated zoonotic diseases

A collaborative research studies on anthrax, rabies, brucellosis, Crimean-Congo Haemorrhagic Fever (CCHF) and bat derived zoonoses was initiated between three institutions: National Institute of Infectious Diseases, Japan; Royal Centre for Disease Control, Department of Public Health, Ministry of Health and National Centre for Animal Health, Department of Livestock, Ministry of Agriculture and Forests. This collaboration was established between these three institutes to improve the health of the people and animals in the two countries based on the practical implementation of the "One Health Concept". To initiate this collaborative research and as per planned activity, two batches of Bhutanese laboratory staff were trained at National Institute of Infectious Diseases, Japan, on culture and identification of anthrax organism, culture and identification of *Brucella* organism, the immuno-fluorescence assay for CCHF and serum neutralization test (SNT) for rabies. The SNT technology included hands-on training on cell culture that included maintenance of cell lines, cell passage and virus titration. Similarly, two batches of Japanese team from National Institute of Infectious Diseases and National Institute of Animal Health visited the National Centre for Animal Health, Serbithang to establish a diagnostic facility for anthrax, *Brucella*, CCHF and rabies.

As a part of the study on anthrax, about 56 soil samples were collected from the burial sites and the control from the outbreak areas of Samtse, Chhukha, Zhemgang, Dagana, Tsirang, Monggar & Lhuentse Dzongkhags. Culture & isolation of Anthrax will be carried out from these samples.

For the sero-titre study against Rabies, 106 sera samples from stray dogs were collected from Thimphu city. The samples will be analysed for antibody titre against Rabies.

CCHF- A retrospective study with a total of 234 serum samples from goats collected from Samtse and Sarpang districts were tested against CCHFV antibody detection system using recombinant nucleoprotein (NP). A total of 116/234 (49.6 %) serum samples were detected positive for CCHFV antibody. CCHF virus is found to be endemic in Sarpang (50.6%) and Samtse (43.8%) in Bhutan. Since this is an on-going study and

more serum samples will be collected from goats and human from the southern parts of the country.

For the bat derived zoonoses component, a study on bat habitat and ecology has been carried out. For further, activities, a team from Japan was expected for sampling, detection of any zoonotic agent in Bhutanese bats.

10.2 Study on antimicrobial resistance pattern of Contagious pathogens in milk from mastitis cases at NJBC, Samtse

Puspa M Sharma[1], Tenzinla[1], Arpana Rai[2], Tshering Dem[2], Kiran gurung[2], Pema Wangchuck[2], Durga Maya Dhakal[2], Purna Bdr. Rai[1], N.K Thapa[1]

[1]NCAH, Serbithang; [2]NJBC, Samtse

Summary

Mastitis in dairy cattle is a clinical condition that causes significant economic losses and is being considered one of the largest constraints to the dairy industry worldwide. Contagious pathogens infection occurs from the milk of the other infected animals. This infection can be prevented with proper milking hygiene including post-milking teat disinfection, milking infected animals last and effective management of clinical cases.

The contagious pathogens in milk include gram-positive *Streptococcus agalactiae, Stretococcus uberis, Staphylococcus aureus* and others like *Mycoplasma* sp. and *Protheca* sp. *Staph. aureus* has been reported to be one of the most relevant causative agents of this condition being responsible for contagious intra-mammary infection in dairy herds. The bacterium causes clinical and subclinical mastitis in dairy cattle and is of potential health concern to humans too. Also, the emergence of antimicrobial-resistant bacteria has been a global threat. The objective of this study is to provide insights to the contagious pathogens (*S. agalactiae, S. uberis* and *Staphylococcus aureus*) present in the udder tissues of the cattle and perform antimicrobial resistance susceptibility testing (ABDT) in these isolated pathogens.

Materials & Methods:

Milk sample collection

A total of 48 udder raw milk samples from all 15 lactating cattle were collected from NJBC farm located in the south-western part of the country. The subclinical and clinical mastitis was pre-examined by Californian Mastitis Test (CMT) (Figure 1). All the milk samples were tested against CMT. Those samples that were positive for CMT were collected for culture and isolation and performing ABST.

Figure 55: A and B: Performing CMT tests in the field, C. Observation of CMT results

Phenotypic Identification and AST

A 20ul of milk samples were plated in SBA and MacConkey agar, incubated at 37^0C up to 24 hours. The bacterial isolates that were gram-positive, cocci shaped were further examined using biochemical tests (Haemolysis, catalase test, oxidase test, coagulase test, CAMP tests, Aesculin tests, mannitol tests). The antimicrobial susceptibility tests will be conducted according to the CLSI guidelines.

Results

Prevalence of Contagious Pathogen

Out of 48 milk samples, 11 samples were positive for *S. agalactiae* (22.9%), 30 samples were positive for *Staphylococcus species (62.5%)* that includes both coagulase-positive and coagulase-negative *staphylococcus* species. Out of 20 milk samples analyses, 3 were positive for *S. uberis (10%)*. Further tests are still under process.

10.3 Retrospective sero-surveillance of Crimean-Congo haemorrhagic fever virus (CCHFV) in Bhutan

Summary

Introduction

Crimean-Congo haemorrhagic fever (CCHF) is a highly infectious disease caused by a tick-borne virus (*Nairovirus*) belonging to the *Bunyaviridae* family. In humans, the overall case-fatality rate of CCHF is ≈30%, but in severe and hospitalized patients, fatalities may be up to 80%. CCHF is widespread in various countries in Africa, Asia, and Europe; the virus had been identified in humans in China, Pakistan, Afghanistan and India. The hosts of the CCHF virus include a wide range of wild and domestic animals such as cattle, sheep and goats. Animals get infected by the bite of infected ticks and the virus remains in their bloodstream for about one week after infection, allowing the tick-animal-tick cycle to continue when another tick bites. The CCHF virus is transmitted to

people either by tick bites or through contact with infected animal blood or tissues during and immediately after slaughter.

Bhutan has very little recorded data on the prevalence of CCHFV in the country. However, an earlier study indicated the presence of CCHFV IgG in 31/81 (38.2%) goats from the central-southern part of the country which shares a porous border with India. In this study, the presence of CCHFV antibodies will be determined from the goat's serum as well as from the human serum living from the same locality.

Material and Methods

The risk of CCHFV infection and serious human disease will be assessed by surveillance in the region with a risk of CCHFV by detection of CCHFV antibodies in animals, detection of CCHFV antibodies in humans and detection of CCHFV in ticks by RT-PCR.

A retrospective study with a total of 234 serum samples from goats collected from Samtse and Sarpang districts were tested against CCHFV antibody detection system using recombinant nucleoprotein (NP).

No human samples and ticks are collected to date.

Results

A total of 116/234 (49.6 %) serum samples were detected positive for CCHFV antibody. CCHF virus is found to be endemic in Sarpang (50.6%) and Samtse (43.8%) in Bhutan. Since this is an on-going study and more serum samples will be collected from goats and human from the southern part of the country.

11. HUMAN RESOURCE AND CAPACITY DEVELOPMENT

Following the advice of travel restrictions and mass-gather avoidance amidst COVID-19 pandemic; the Centre, unlike in past years, could not conduct capacity-building training and workshops as planned. However, some important training, as listed below, were conducted:

- Training of Trainers on Dog Population Management and Mass Dog Vaccination Apps and Community Engagement;
- Training-workshop on tick identification using morphological keys;
- Master Trainer's Training on the use of G2C database;
- Refresher Training on Laboratory Biosafety & Biosecurity

12. ACHIEVEMENTS OF ADMINISTRATIVE SECTION

Besides routine activities, the administrative section carried out the following activities:

- Office furniture procurement of worth of BTN 253, 786.00
- Office automation equipment of worth BTN 2,396,320.00
- Infrastructure development of worth BTN 2,865,294.00
- Laboratory supplies of worth BTN 929,000.00

13. FINANCIAL ACHIEVEMENTS

98.85 per cent (40.07M) of the total approved budget of 40.538M was utilized during the FY 2019-2020, as shown in the following table.

Table 38: Budget utilisation, in brief, FY 2019-2020

Unit	Budget (M)	Expenditure (M)	Balance (M)
Operation and management services	3.679	3.678	0.001
Drug, vaccine, and equipment Unit	27.432	27.431	0.001
Laboratory Services Unit	3.35	2.903	0.447
Disease Prevention and Control Unit	0.9	0.9	0
Biological Production Unit	4.05	4.035	0.015
Dog Population Management Programme	1.127	1.123	0.004
Total	40.538	40.07	0.468
Overall budget utilisation efficiency (%)	98.85		

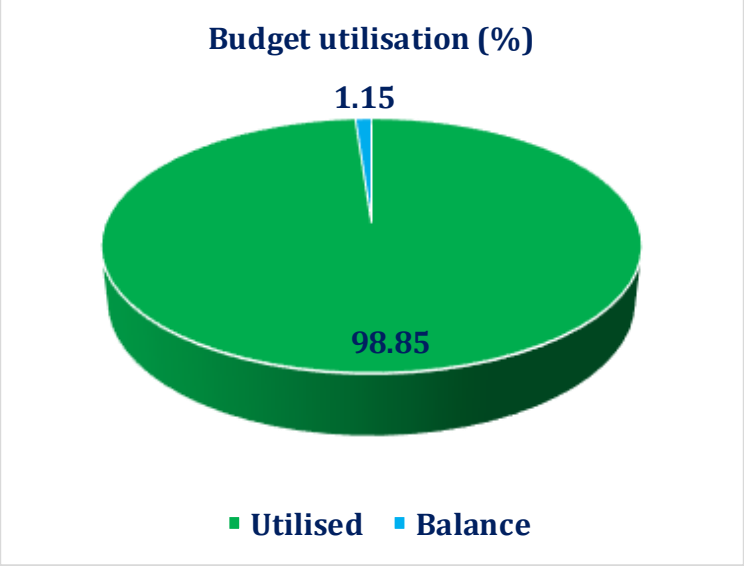


Figure 56: Budget utilization(percentage), FY 2019-2020

ANNEXURE

Annexure 1: List of staff at NCAH during the FY 2019-2020

Sl. No.	Name	Position Title	EID No.	Position Level	Remarks
1	Dr Kinzang Dukpa	Programme Director	9603005	P1	EOL
2	Dr N.K. Thapa	Specialist III (Animal Health)	9302007	ES III	
3	Dr R B Gurung	Specialist III (Animal Health)	9603028	ES III	Programme Director, since October 2019
4	Dr Tenzin	Principal Livestock Health Officer	2001032	P1	EOL
5	Dr Hiruka Mahat	Dy Chief Veterinary Officer	200501113	P2 A	
6	Dr Pelden Wangchuk	Sr Veterinary Officer	20140103307	P3 A	
7	Dr Sangay Rinchen	Sr Veterinary Officer	201201011	P3 A	
8	Dr Ugyen Namgyel	Sr Veterinary Officer	201201012	P3 A	
9	Puspa Maya Sharma	Sr Laboratory Officer	20140103185	P3 A	
10	Dechen Wangmo	Laboratory Officer	20150105019	P3 A	
11	Karma Pelden Zangmo	Pharmacist	202001163 41	P4 A	
12	Purna Bdr. Rai	Sr Laboratory Technician I	8806138	SS2 A	
13	Harka Bdr. Tamang	Sr Livestock Health Supervisor II	8307007	SS3 A	
14	Kinzang Namgay	Sr Livestock Health Supervisor	8604131	S1 A	
15	Namgay Dorji	Sr Livestock Health Supervisor II	200208011	SS3 A	
16	Sonam Deki	Livestock Production Supervisor II	20150905895	S2 A	
17	Migma	Sr Laboratory Technician II	9801103	SS3 A	
18	Tenzinla	Sr Laboratory Technician II	9901013	SS3 A	
19	Dawa Tshering	Sr Laboratory Technician II	9901014	SS3 A	
20	Ugyen Pema	Laboratory Technician	2109009	S1 A	
21	Kelzang Lhamo	Laboratory Technician	200310013	S1 A	
22	Tshewang Dema	Laboratory Technician	200407360	S1 A	
23	Karma Choki	Laboratory Technician	2108008	S1 A	
24	Pasang Bida	Laboratory Technician	2109008	S1 A	
25	Pari Chhetri	Accounts Assistant I	9709069	SS2 A	

26	Tshewang Dakpa	Accounts Assistant II	8712024	SS3 A	
27	Karma Dekar	Sr. Administrative Assistant III	9507009	SS4 A	
28	Rinzin Dorji	Store Keeper	9910107	S4 A	
29	Pemo	Sr. Telephone Operator II	9904051	O1 A	
30	Phuntsho Choden	Administrative Asst II	200712003	S4 A	
31	Penjor	Driver	9906003	O1 A	
32	Tashi Gayleg	Driver	2006039	O1 A	
33	Pema Wangdi	Driver	2106032	O1 A	
34	Sangay Tshering	Driver	9902017	O1 A	
35	Tshewang Rinzin	Driver II	201108012	O3 A	
36	Tandin Wangchuk	Driver II	20120300163	O3 A	
37	Karna Kumar Tamang	Sweeper		ESP	
38	Sangay Nidup	Helper (Lab Utility)		ESP	
39	Tshering Dolkar	Night Guard		ESP	
40	Kencho Dema	Helper (Lab Utility)		ESP	
41	Phub Namgay	Lab. Attendant		ESP	
42	Pema Choden	Accountant		S1 A	
Total Staff Strength:					**42**

Annexure 2: Essential Service Personnel (ESP) records, FY 2019-2020

1. Man Bir Lama, ESP (Voluntarily resigned)
2. Pub Namgay, ESP (Newly appointed)
3. Chimi Wangmo, ESP (Voluntarily resigned)

Annexure 3: Staff transferred (to and from NCAH), resigned, or superannuated

1. Dr Sangay Rinchen, Sr Veterinary Officer (Transferred in)
2. Dr Ugyen Namgyel, Sr Veterinary Officer (Transferred in)
3. Ms Sonam Deki, LHS (Transferred in)
4. Mr Tshewang Dakpa Accountant, (Transferred Out)
5. Ms Karma Pelden Zangmo, Pharmacist (New Appointment)
6. Ms Pema Choden, Accountant (Transferred in)
7. Ms Phuntsho Wangmo (Transferred out)

Annexure 4: Staff promotion acquired during the FY 2019-2020

1. Dr Pelden Wangchuk, Disease Prevention and Control Unit
2. Ms Dechen Wangmo, Laboratory Services Unit
3. Mr Purna Bdr Rai, Laboratory Services Unit
4. Ms Karma Chuki, Biological Production Unit
5. Ms Tshewang Dema, Laboratory Services Unit
6. Ms Ugyen Pema, Laboratory Services Unit
7. Ms Passang Bida, Laboratory Services Unit
8. Ms Kelzang Lhamo, Laboratory Services Unit

Annexure 5: Visitors to NCAH during the FY 2019-2020

1. Dr Susan CorkJuan: University of Calgary
2. Dr Rangsiya Prathan: FAO, Bangkok
3. Dr Pattrarat Chanchaithong: FAO, Bangkok
4. Dr Lin Yueh Nuo: FAO, Bangkok
5. Dr Shawan Ting: FAO, Bangkok
6. Dr Joseph John Bove: ATC-USA
7. Dr Yoshihiro Kaku: NIID Japan
8. Dr Akiko Okutani: NIID Japan
9. Dr Makoto Osaki: NIID Japan
10. Dr Atushi Nakamoto: NIID Japan
11. Dr Shigeru Morikawa: NIID Japan
12. Dr Shrikant: HSI India
13. Mr Faizan Jalil: HSI India
14. 35 BSc-Food Science students, 3rd Year, CNR, Lobesa

Annexure 6: List of NCAH staffs who have attended ex-country training, workshops, or meetings during the FY 2019-2020

Name	Position Title	Course title	Country	Funding Agency
Dr Nirmal Kumar Thapa	Specialist III	Southeast Asian regional Symposium on Microbial Ecology	Nepal	Fleming Fund & ISME
MsPuspa Maya Sharma	Sr. Laboratory officer	AMR Laboratory	Australia	UK, Government, Fleming Fellowship
Dr Ugyen Namgyel	Sr Veterinary Officer	AMR Laboratory	Australia	UK, Government, Fleming Fellowship
Ms Dechen Wangmo	Sr.Laboratory Officer	Environmental and Health Risk Assessment and Management of Toxic Chemicals	Thailand	TICA Fellowship in collaboration with Chulabhorn Research Institute
Mr.Migmar	Sr Laboratory Technician		India	

Annexure 7: Details of infrastructure

Sl. No	Class of Building	No. of Unit
1	Office building (Administrative Block)	1
2	Laboratory	2
3	Vaccine Production building	1
4	Old Laboratory building (Store)	1
5	Generator House	1
6	Refrigerator Workshop	1
7	Small animal house	1
8	Sheep shed	1
9	Garage	1
10	Animal potency test	1
11	Guard house	1
12	Res. Quarter, Class II	3
13	Res. Quarter, Class III	1
14	Res. quarter, Class IV	4
15	Drivers quarter	2
16	Res. quarter, old hostel	5

Annexure 8: Detail of Vehicles, and expenditure for maintenance and spare parts

Sl. No.	Type of vehicle/ Machinery	Make/Model	Date of purchase	Registration No.	Stationed at	Present condition
1	Eicher Bus	Indian/2010	2009	BG-1-A0612	NCAH	Running
2	Scorpio Pick up	Indian/2008	2008	BG-1-A1601	NCAH	Running
	(Double cabin)					
3	Bolero Pick up	Indian/2008	2008	BG-1-A1602	NCAH	Off Road
4	(Single cabin)					
	Scorpio Pick up	Indian/2008	2008	BG-1-A1603	NCAH	Off Road
5	(Double cabin)					
	Bike (Bajaj pulsar)	Bajaj Co.2008	2008	BG-2-A0217	NCAH	Off Road
6	Toyota Hilux (Refrigerator Van)	Japan/2010	2010	BG-1-A1887	NCAH	Running
7	Toyota Hilux	Bangkok	2013	BG-1-A2290	HSI Project	Running
	(Virgo)					
8	Toyota Hilux	Bangkok	2013	BG-1-A2291	HSI Project	Running
	(Virgo)					
9	Bolero	Mahindra, India	2011	BG-1-A1952	HSI Project	Running
10	Expenditure for maintenance and spare parts: BTN 1,529,000.00					

Annexure 9: Construction and renovation works

Name of work	Funding	Cost Nu.
Construction and Installation of Reverse Osmosis Plant	Fleming	1641200.00
Retaining Wall at RO Plant site	Fleming	250000.00
Emergency Shower	Fleming	65500.00
Biological and Non-Biological Pits	RDCCRP	831094.00
Water tank 5000 Litres Double layer	Fleming	77500.00

Annexure 10: Purchase of office equipment and items

1. Desktop Computer Dell
2. Laptop High End Dell
3. Laptop Mid End Dell
4. Multifunctional Heavy duty HP LaserJet copier
5. Projector Epson wall mount
6. Projector XGimi portable
7. MF Printer HP
8. Television Screen 65" Samsung UHD
9. Lamination Hot & Cold
10. Air Conditioner (Hot and Cold)
11. Public Address System
12. Wireless Net working
13. Extension kits
    - 13.1 Campaign Tents Dome 2 men's
    - 13.2 A Shape Tent
14. Office furniture

Particulars	Quantity	Cost	Fund source
Revolving Chairs	4 Nos	28,600.00	Fleming
Directors table	4 Nos	6830.00	Fleming
Conference table	13 Nos	77,000.00	Fleming
Bookshelf	1 No	3028.00	Fleming
Visitors Chair	30 Nos	65,040.00	Fleming
Computer table	8 Nos	22,400.00	Fleming
Steel Almirah Small	2 Nos	108,88.00	Fleming

Annexure 11: Details of vaccines (Produced and Imported) distributed during the FY 2019-2020

Sl.No	Dzongkhags/ Central Units	Locally produced		Imported									
		Anthrax	CSF	FMD Oil	HS-BQ	IBD	Fowl Pox	NDB_1	ND R_2B	MD	ARV	DHPPi + L	PPR
	Dzongkhags												
1	Bumthang			5500	2500						800		
2	Chhukha		350	9000	600	170200	14000	89900	10000		2250		1500
3	Dagana		950	14800	5800	44800	2000	41800	3000		1650		
4	Gasa										300		
5	Haa			4000	1390	3000		2000					
6	Lhuentse			5000	6500	9000		9000	9000	8000	600		
7	Monggar			5000	6000	54000	24000	53000	18000		1000		
8	Paro		80	15350	900	94600	29000	52400	45000		1000		
9	Pemagatshel			3000		20000		10600	11000		1500		
10	Punakha			19000	4000	21000	5000	14000	14000		1400		400
11	Samdrup Jongkhar			5000		20000		20000	10000	20000	1800		300
12	Samtse		300	23000	8000	305000		200000	100000	30000	1400		700
13	Sarpang		1070	25000	8750	670000	210000	282000	250000		3500		
14	Thimphu			5200	510	70600	26000	29800	24500		1700		
15	Trashigang			5000	1500	15000		10000	10000		1100		
16	Trashiyangtse			5000		20000		7000	7000		550		
17	Trongsa			700	1500	3000	4000	3000	3800		300		
18	Tsirang		850	11000	2200	300000	80000	195000	110000		2700	25	
19	Wangdue Phodrang		260	10500	2300	72600		28600	24000		1200	2	150
20	Zhemgang			1000	7000	20000	7000	5600	9500		200		
	Central Units												
21	NDRDC, Yusipang			100									
22	BSF, Bumthang												
23	NJBC, Samtse												

24	NNBF, Trashiyangphu												
25	NPoDC, Sarpang					57400	24000	23000	18800	194000			
26	NPBC, Yusipang		2410	1300									
27	NSBC, Bumthang			300									
28	NPiDC, Gelephu		2350	1300									
29	Calf Rearing Centre, Wangkha			200	400								
30	RPPBC, Lingmethang		1450	1000		9600	6000	3400	3500	90000			
31	RMBF, Arong												
32	RMBF, Wangdigang			200	200								
33	RPBC, Paro									200000			
34	National Animal Hospital					200				500	3300		
35	Private Poultry Farm					11400		9600	3600	55000			
36	Commercial Layer Farm, Sarpang			200	200	90000	40000	30000	50000	20000			
37	BLDC, Samrang			200		20000		18000	10000				100
38	Sertsham Farm, Lhuentse			650	200	1800	1000	1400	1800	1500			
39	RLDC Wangdue										400		
40	RLDC Tsimasham										6000	12	
41	RLDC Zhemgang												
42	RLDC Kanglung	150						20000			8900		
43	NDPM&RCP										3450		
44	CNR, Lobesa							600					
45	Local Use / Campaign											6	
46	NHDRC, Jakar											16	
	Total doses distributed	**150**	**10070**	**177500**	**60450**	**2103200**	**472000**	**1159100**	**746500**	**619000**	**47000**	**61**	**3150**

Annexure 12: Approved Budget and Expenditure statement for NCAH, for FY 2019-2020

Printed Date: 02/07/2020																
4. REVISED BUDGET/EXPENDITURE																
ADMINISTRATIVE UNIT:							204.01		MINISTRY OF AGRICULTURE & FORESTS							
DEPARTMENT:							03		DEPARTMENT OF LIVESTOCK							
FIELD OFFICE:							20		NATIONAL CENTRE FOR ANIMAL HEALTH, SERBITHANG							
PRG	**SPRG**		**ACT**		**SACT**	**FIC**		**OBC**		**TITLE**	**BUDGET**	**EXPENDITURE**	**BALANCE**	**%**		
	027									LIVESTOCK HEALTH SERVICES						
			001							DIRECTION SERVICES (NCAH)						
					01					PERSONNEL EMOLUMENTS						
						0001				RGOB Financing						
								01.01		Pay and Allowances	12.303	12.294	0.009	0.07		
								02.01		Other Personnel Emoluments	0.797	0.795	0.002	0.20		
								24.03		Contributions - Provident Fund	1.538	1.537	0.001	0.10		
								25.01		Retirement Benefits	0.019	0.019	0.000	0.53		
										TOTAL OF FIC 0001	14.657	14.645	0.012			
										TOTAL OF SAct 01	14.657	14.645	0.012			
					02					OPERATION & MANAGEMENT SERVICES						
						0001				RGOB Financing						
								11.01		Travel - Incountry	1.541	1.541				
								12.01		Utilities -Telephones, Telex, Fax, E-mail, Internet	0.312	0.312	0.000	0.04		
								12.02		Utilities -Telegram, Wireless Transmission, Postage	0.003	0.003	0.000	-7.47		
								12.03		Utilities - Electricity, Water, Sewerage	0.301	0.301	0.000	0.12		
								12.05		Utilities - Fuelwood	0.023	0.023	0.000	0.05		

									14.01		S & M - Office Supplies, Printing, Publications	0.200	0.200			
									14.06		S & M - Uniforms, Extension Kits, Linens	0.008	0.008			
									15.01		Maintenance of Property - Buildings	0.072	0.072			
									15.02		Maintenance of Property - Vehicles	0.968	0.968	0.000	0.04	
									15.07		Maintenance of Property - Computers	0.050	0.050			
									15.09		Maintenance of Property - Water supply, Sewerage, Playfield	0.006	0.006	0.000	5.58	
									17.01		Op. Exp. - Advertising	0.045	0.045	0.000	0.22	
									17.02		Op. Exp. - Taxes, Duties, Royalties, Fees, Handling Charges, Bank Charges	0.120	0.120			
									18.01		Hospitality & Entertainment	0.030	0.030			
											TOTAL OF FIC 0001	3.679	3.678	0.001		
											TOTAL OF SAct 02	3.679	3.678	0.001		
											TOTAL OF Act 001	18.336	18.323	0.013		
			002								DRUGS, VACCINES AND EQUIPMENT UNIT (DVEU)					
					01						PROCUREMENT, DISTRIBUTION AND MANAGEMENT OF VETERINARY MEDICINES, VACCINES & EQUIPMENT					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.600	0.600			
									14.02		S & M - Medicines & Laboratory Consumables	26.732	26.732			
									17.01		Op. Exp. - Advertising					
									17.03		Op. Exp. - Transportation	0.100	0.099	0.001	1.34	
											TOTAL OF FIC 0001	27.432	27.431	0.001		
						0003					Adjustment of Previous Year's Advances					
									11.01		Travel - Incountry	0.002	0.002			
									14.02		S & M - Medicines & Laboratory Consumables	0.631	0.631			
									17.01		Op. Exp. - Advertising	0.004	0.004			

									17.03		Op. Exp. - Transportation	0.022	0.022			
									52.07		Plant & Equipt. - Hospital/Lab. Equipment	0.001	0.001			
											TOTAL OF FIC 0003	0.660	0.660			
						4599					Rural Development and Climate Change Response Programme					
									52.07		Plant & Equipt. - Hospital/Lab. Equipment	3.350	2.903	0.447	13.34	
											TOTAL OF FIC 4599	3.350	2.903	0.447		
											TOTAL OF SAct 01	31.442	30.994	0.448		
					02						STRENGTHENING & ENHANCEMENT OF DRUGS, VACCINES AND EQUIPMENT DELIVERY SERVICES					
						0001					RGoB Financing					
									11.01		Travel - Incountry	0.100	0.100			
									17.08		Op. Exp. - Incountry Meetings and Celebrations	0.100	0.100			
											TOTAL OF FIC 0001	0.200	0.200			
											TOTAL OF SAct 02	0.200	0.200			
											TOTAL OF Act 002	31.642	31.194	0.448		
			003								LABORATORY SERVICE UNIT					
					01						TEST KITS VALIDATION AND TEST STANDARDIZATION FOR SEROLOGY AND MOLECULAR					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.120	0.120			
									14.02		S & M - Medicines & Laboratory Consumables	0.020	0.020	0.000	0.00	
											TOTAL OF FIC 0001	0.140	0.140	0.000		
											TOTAL OF SAct 01	0.140	0.140	0.000		
					02						EMERGENCY FIELD VISITS AND SAMPLE COLLECTION					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.120	0.120			

									14.06		S & M - Uniforms, Extension Kits, Linens	0.030	0.030			
											TOTAL OF FIC 0001	0.150	0.150			
											TOTAL OF SAct 02	0.150	0.150			
					03						PROVIDING REFERRAL LABORATORY DIAGNOSTIC SERVICES TO CLIENTS					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.300	0.300			
									14.01		S & M - Office Supplies, Printing, Publications	0.005	0.005			
									14.02		S & M - Medicines & Laboratory Consumables	0.350	0.350			
											TOTAL OF FIC 0001	0.655	0.655			
											TOTAL OF SAct 03	0.655	0.655			
					04						STRENGTHENING AND ENHANCEMENT OF LABORATORY DIAGNOSTIC CAPACITIES					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.200	0.200			
									14.01		S & M - Office Supplies, Printing, Publications	0.005	0.005			
									14.02		S & M - Medicines & Laboratory Consumables	0.200	0.200			
											TOTAL OF FIC 0001	0.405	0.405			
											TOTAL OF SAct 04	0.405	0.405			
					05						MAJOR LIVESTOCK DISEASE SURVEILLANCE/SURVEY					
						0001					RGoB Financing					
									11.01		Travel - Incountry	0.280	0.280			
									14.01		S & M - Office Supplies, Printing, Publications	0.005	0.005			
									14.02		S & M - Medicines & Laboratory Consumables	0.100	0.100			
									17.08		Op. Exp. - In-country Meetings and Celebrations	0.070	0.070			
											TOTAL OF FIC 0001	0.455	0.455			

											TOTAL OF SAct 05	0.455	0.455			
					06						LABORATORY COORDINATION & SKILL ENHANCEMENT					
						0001					RGOB Financing					
									17.08		Op. Exp. - In-country Meetings and Celebrations	0.120	0.120			
											TOTAL OF FIC 0001	0.120	0.120			
											TOTAL OF SAct 06	0.120	0.120			
					07						COORDINATION AND IMPLEMENTATION OF BIOSAFETY AND BIO-SECURITY PROGRAMMES					
						0001					RGOB Financing					
									14.01		S & M - Office Supplies, Printing, Publications	0.005	0.005			
									14.02		S & M - Medicines & Laboratory Consumables	0.020	0.020			
									15.05		Maintenance of Property - Equipment	0.015	0.015			
											TOTAL OF FIC 0001	0.040	0.040			
						4599					Rural Development and Climate Change Response Programme					
									51.08		Exp. on Structure - Others	0.850	0.832	0.018	2.14	
											TOTAL OF FIC 4599	0.850	0.832	0.018		
											TOTAL OF SAct 07	0.890	0.872	0.018		
					08						MONITORING AND REPORTING AND CERTIFICATION OF BIOSAFETY CABINETS, FUME HOODS AND ISOLATORS.					
						0001					RGOB Financing					
									12.02		Utilities -Telegram, Wireless Transmission, Postage	0.005		0.005	100.00	
									17.02		Op. Exp. - Taxes, Duties, Royalties, Fees, Handling Charges, Bank Charges	0.025	0.009	0.016	64.26	
											TOTAL OF FIC 0001	0.030	0.009	0.021		

						4599				Rural Development and Climate Change Response Programme						
								55.01		Professional Services	0.200	0.173	0.028	13.75		
										TOTAL OF FIC 4599	0.200	0.173	0.028			
										TOTAL OF SAct 08	0.230	0.181	0.049			
					09					ESTABILISHMENT OF CELL CULTURE FACILITY						
						4599				Rural Development and Climate Change Response Programme						
								52.07		Plant & Equipt. - Hospital/Lab. Equipment	1.000	0.813	0.187	18.75		
										TOTAL OF FIC 4599	1.000	0.813	0.187			
										TOTAL OF SAct 09	1.000	0.813	0.187			
					10					COLLABORATIVE STUDIES ON RISK ANALYSIS OF TRANS BOUNDARY AND ENVIRONMENTAL ZOONOSES						
						4694				"Collaborative studies on risk analysis of trans-boundary and environmental zoonoses"						
								11.01		Travel - Incountry	0.313	0.312	0.001	0.21		
								14.02		S & M - Medicines & Laboratory Consumables	0.100	0.035	0.065	64.91		
								17.08		Op. Exp. - Incountry Meetings and Celebrations	0.075	0.075	0.000	0.22		
								17.09		Op. Exp. - Survey/Census	0.160	0.160				
										TOTAL OF FIC 4694	0.648	0.582	0.066			
										TOTAL OF SAct 10	0.648	0.582	0.066			
										TOTAL OF Act 003	4.693	4.373	0.320			
			004							DISEASE PREVENTION AND CONTROL UNIT						
					01					NATIONAL FOOT AND MOUTH DISEASE PREVENTION & CONTROL						
						0001				RGOB Financing						
								11.01		Travel - Incountry	0.130	0.130				

									17.08		Op. Exp. - Incountry Meetings and Celebrations	0.040	0.040			
									17.09		Op. Exp. - Survey/Census	0.040	0.040			
											TOTAL OF FIC 0001	0.210	0.210			
											TOTAL OF SAct 01	0.210	0.210			
					02						NATIONAL AVIAN INFLUENZA (BIRD FLU) PREVENTION & CONTROL					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.080	0.080			
											TOTAL OF FIC 0001	0.080	0.080			
											TOTAL OF SAct 02	0.080	0.080			
					03						NATIONAL GID DISEASE PREVENTION & CONTROL					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.100	0.100			
											TOTAL OF FIC 0001	0.100	0.100			
											TOTAL OF SAct 03	0.100	0.100			
					04						NATIONAL RABIES PREVENTION & CONTROL					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.100	0.100			
									17.08		Op. Exp. - Incountry Meetings and Celebrations	0.050	0.050			
									17.09		Op. Exp. - Survey/Census	0.050	0.050	0.000	0.00	
											TOTAL OF FIC 0001	0.200	0.200	0.000		
											TOTAL OF SAct 04	0.200	0.200	0.000		
					05						ANIMAL HEALTH RESEARCH ON ZOONOTIC DISEASES					
						0001					RGOB Financing					
									17.08		Op. Exp. - Incountry Meetings and Celebrations	0.050	0.050			
									17.09		Op. Exp. - Survey/Census	0.070	0.070	0.000	0.00	
											TOTAL OF FIC 0001	0.120	0.120	0.000		

											TOTAL OF SAct 05	0.120	0.120	0.000		
					06						ANIMAL HEALTH INFORMATION SYSTEM					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.040	0.040			
											TOTAL OF FIC 0001	0.040	0.040			
											TOTAL OF SAct 06	0.040	0.040			
					07						NATIONAL PESTICIDES RUMINENTS PREVENTION & COUNTROL					
						0001					RGOB Financing					
									17.09		Op. Exp. - Survey/Census	0.050	0.050			
											TOTAL OF FIC 0001	0.050	0.050			
											TOTAL OF SAct 07	0.050	0.050			
					08						NATIONAL BRUCELLOSIS PREVENTION & COUNTROL					
						0001					RGOB Financing					
									17.09		Op. Exp. - Survey/Census	0.100	0.100			
											TOTAL OF FIC 0001	0.100	0.100			
											TOTAL OF SAct 08	0.100	0.100			
											TOTAL OF Act 004	0.900	0.900	0.000		
			005								BIOLOGICAL PRODUCTION UNIT					
					01						PRODUCTION OF ANIMAL VACCINES					
						0001					RGOB Financing					
									14.02		S & M - Medicines & Laboratory Consumables	0.215	0.215	0.000	0.00	
									14.05		S & M - Animal Feeds	0.095	0.095			
											TOTAL OF FIC 0001	0.310	0.310	0.000		
											TOTAL OF SAct 01	0.310	0.310	0.000		
					02						PROCUREMENT AND DISTRIBUTION OF ANIMAL/POULTRY VACCINES					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.100	0.100	0.000	0.37	
									14.02		S & M - Medicines & Laboratory Consumables	3.409	3.409			

											TOTAL OF FIC 0001	3.509	3.509	0.000		
											TOTAL OF SAct 02	3.509	3.509	0.000		
					05						PROCUREMENT OF LABORATORY ANIMALS FOR FOR VACCINE PRODUCTION					
						4599					Rural Development and Climate Change Response Programme					
									52.06		Plant & Equipt. - Livestock	0.200	0.186	0.014	7.23	
											TOTAL OF FIC 4599	0.200	0.186	0.014		
											TOTAL OF SAct 05	0.200	0.186	0.014		
					06						MAINTENANCE OF PROPERTYS					
						0001					RGOB Financing					
									15.05		Maintenance of Property - Equipment	0.031	0.031	0.000	0.65	
											TOTAL OF FIC 0001	0.031	0.031	0.000		
											TOTAL OF SAct 06	0.031	0.031	0.000		
											TOTAL OF Act 005	4.050	4.035	0.015		
			006								NATIONAL DOG POPULATION MANAGEMENT & RABIES COUNTROL PROGRAM					
					01						OPERATIONAL AND MANAGEMENT SERVICE					
						0001					RGOB Financing					
									12.01		Utilities -Telephones, Telex, Fax, E-mail, Internet	0.005	0.002	0.003	65.80	
									14.01		S & M - Office Supplies, Printing, Publications	0.005	0.005			
									15.02		Maintenance of Property - Vehicles	0.561	0.561			
											TOTAL OF FIC 0001	0.571	0.568	0.003		
											TOTAL OF SAct 01	0.571	0.568	0.003		
					02						MASS RABIES VACCINATION CAMPAIGN					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.020	0.020	0.000	0.16	
									14.02		S & M - Medicines &	0.010	0.010	0.000	2.60	

											Laboratory Consumables					
									17.08		Op. Exp. - Incountry Meetings and Celebrations	0.020	0.020			
											TOTAL OF FIC 0001	0.050	0.050	0.000		
											TOTAL OF SAct 02	0.050	0.050	0.000		
					03						OBSERVATION OF WORLD RABIES DAY AND AWARENESS CAMPAIGN					
						0001					RGOB Financing					
									17.08		Op. Exp. - Incountry Meetings and Celebrations	0.095	0.095			
											TOTAL OF FIC 0001	0.095	0.095			
											TOTAL OF SAct 03	0.095	0.095			
					04						IMPLEMENTATION OF CABC					
						0001					RGOB Financing					
									11.01		Travel - Incountry	0.300	0.300			
									14.02		S & M - Medicines & Laboratory Consumables	0.050	0.050	0.000	0.01	
											TOTAL OF FIC 0001	0.350	0.350	0.000		
											TOTAL OF SAct 04	0.350	0.350	0.000		
					05						KAP SURVEY AND M&E FOR CNVR					
						0001					RGOB Financing					
									17.08		Op. Exp. - Incountry Meetings and Celebrations	0.010	0.010			
									17.09		Op. Exp. - Survey/Census	0.051	0.051			
											TOTAL OF FIC 0001	0.061	0.061			
											TOTAL OF SAct 05	0.061	0.061			
											TOTAL OF Act 006	1.127	1.123	0.004		
											TOTAL OF SPrg 027	60.748	59.948	0.800		
											TOTAL OF Prg 045	60.748	59.948	0.800		
											TOTAL OF FO 20	60.748	59.948	0.800		
											TOTAL OF Dept 03	60.748	59.948	0.800		
											TOTAL OF AU 204.01	60.748	59.948	0.800		
											GRAND TOTAL	**60.748**	**59.948**	**0.800**		

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NCAH