NCAH

ANNUAL PROGRESS REPORT

2022 - 2023

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

Date – 30 July 2023

FORWORD

It is with great pleasure that I introduce the Annual Progress Report of the National Centre for Animal Health (NCAH) for the Financial Year 2022 – 2023. This report serves as a comprehensive reflection of our journey, accomplishments, and insights while fulfilling the vital mission of providing animal health services across the nation.

NCAH plays a pivotal role in bolstering diverse animal health initiatives within the livestock sector. Our overarching aim remains the enhancement of livestock production and fortification of food security in the country.

I extend my gratitude on behalf of the management of the Centre to the Director and the Chiefs of various Divisions within the Department of Livestock. Their unwavering guidance and support have been instrumental in our progress.

My heartfelt appreciation extends to the Officiating Regional Director of the Regional Livestock Development Centre, Kanglung, the Program Directors of Central Programs and Research Centres, the Regional Veterinary Officers of the Regional Veterinary Hospital and Epidemiology Centres, the Dzongkhag Livestock Officers across all Dzongkhags, the Farm Managers of Government Farms, and the dedicated Veterinarians and Veterinary Paraprofessionals. Their continuous commitment has ensured the successful execution of animal health programs within their respective domains.

Acknowledgment is also due to our partners at the Department of Public Health, Bhutan Food and Drug Authority, Department of Forests and Park Services, and other stakeholders. Their collaboration has been essential in the efforts to prevent and control animal diseases. We also extend gratitude to our international partners whose technical and financial support has been invaluable in implementing animal health activities within our nation.

Lastly, I wish to express my sincere thanks to the entire staff at NCAH. Their dedication and contributions have been pivotal in realizing the center's mandates. Their meticulous documentation of our endeavors have culminated in the publication of this report, a testament to our collective commitment to transparency and progress.

Thank you for your steadfast support and engagement as we stride forward in our pursuit of excellence in animal health and welfare.

Tashi Delek!

Officiating Program Director

EXECUTIVE SUMMARY

In the fiscal year 2022-2023, the National Centre for Animal Health (NCAH) has demonstrated exceptional dedication and achievements in safeguarding animal health, promoting veterinary research, and enhancing public awareness. This annual progress report highlights the key accomplishments that have further solidified NCAH's position as a leading institution in animal healthcare and research.

NCAH's relentless efforts in disease surveillance and control have yielded significant results. Through advanced diagnostic techniques and strategic collaboration with national and international partners, the center successfully monitored and managed several potential disease outbreaks. The implementation of innovative rapid response protocols has contributed to minimizing the impact of diseases on animal populations and human health.

In the pursuit of cutting-edge solutions, NCAH has made substantial strides in integrating technology into animal healthcare. The development of novel diagnostic tools has enabled early detection and more precise treatment of various ailments. These advancements have not only improved animal welfare but have also streamlined the diagnostic process for veterinarians.

The NCAH's commitment to advancing veterinary science is evident in the remarkable research breakthroughs achieved during this fiscal year. The center's researchers have published influential studies in prestigious journals, contributing valuable insights into emerging diseases, antimicrobial resistance, and zoonotic transmissions. These findings have not only expanded the global knowledge base but have also influenced policy decisions for better animal and public health outcomes.

Recognizing the importance of a skilled workforce, NCAH invested significantly in capacity building initiatives. The center organized specialized training programs, workshops, and seminars for veterinarians, researchers, and animal health professionals. By nurturing expertise and promoting knowledge exchange, NCAH has played a pivotal role in enhancing the nation's overall veterinary capabilities.

NCAH's commitment to public engagement and awareness has flourished during this fiscal year. Through educational campaigns, workshops, and outreach events, the center has effectively communicated the significance of responsible pet ownership, disease prevention, and the critical link between animal and human health. These endeavors have fostered a sense of collective responsibility and empowered communities to actively participate in animal healthcare.

Collaboration remains a cornerstone of NCAH's success. Throughout the year, the center forged and strengthened partnerships with governmental agencies, research institutions, international organizations, and industry stakeholders. These collaborations have facilitated the exchange of knowledge, resources, and expertise, resulting in more comprehensive and effective approaches to tackling complex animal health challenges.

In conclusion, the National Centre for Animal Health's performance in the fiscal year 2022-2023 has been exemplary. The center's dedication to disease control, technological innovation, research excellence, capacity building, community engagement, and collaboration underscores its pivotal role in advancing animal healthcare. As NCAH continues to evolve, its contributions are not only shaping the welfare of animals but are also positively impacting human health and the broader ecosystem.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

1. BACKGROUND

The National Centre for Animal Health (NCAH), Serbithang, is located about 12 kilometres 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 Nations 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). In 2005, RVEC was renamed as National Centre for Animal Health (NCAH) and is one of the central programmes under the Department of Livestock (DoL), Ministry of Agriculture and Forests (MoAF). The Centre is responsible for animal disease diagnosis, disease prevention and control programme, and providing technical backstopping to Dzongkhags and livestock commodity centres. The Centre has a campus area of 8.8259 acres. The Centre provides an excellent environment for aspiring leaders in animal health in Bhutan.

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
- 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 disease surveillance and 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 a one-health approach
- Implement, monitor, and evaluate the management of veterinary medicines, vaccines, and equipment at the national level
- Coordinate and implement stray dog population management programmes in the country

1.3. Organogram

The main functional units under the Centre are:

- Laboratory Services Unit (LSU)
- Disease Prevention and Control Unit (DPCU)
- Drug, Vaccines and Equipment Unit (DVEU)
- Biological Production Unit (BPU)
- Dog Population Management Unit (DPMU)

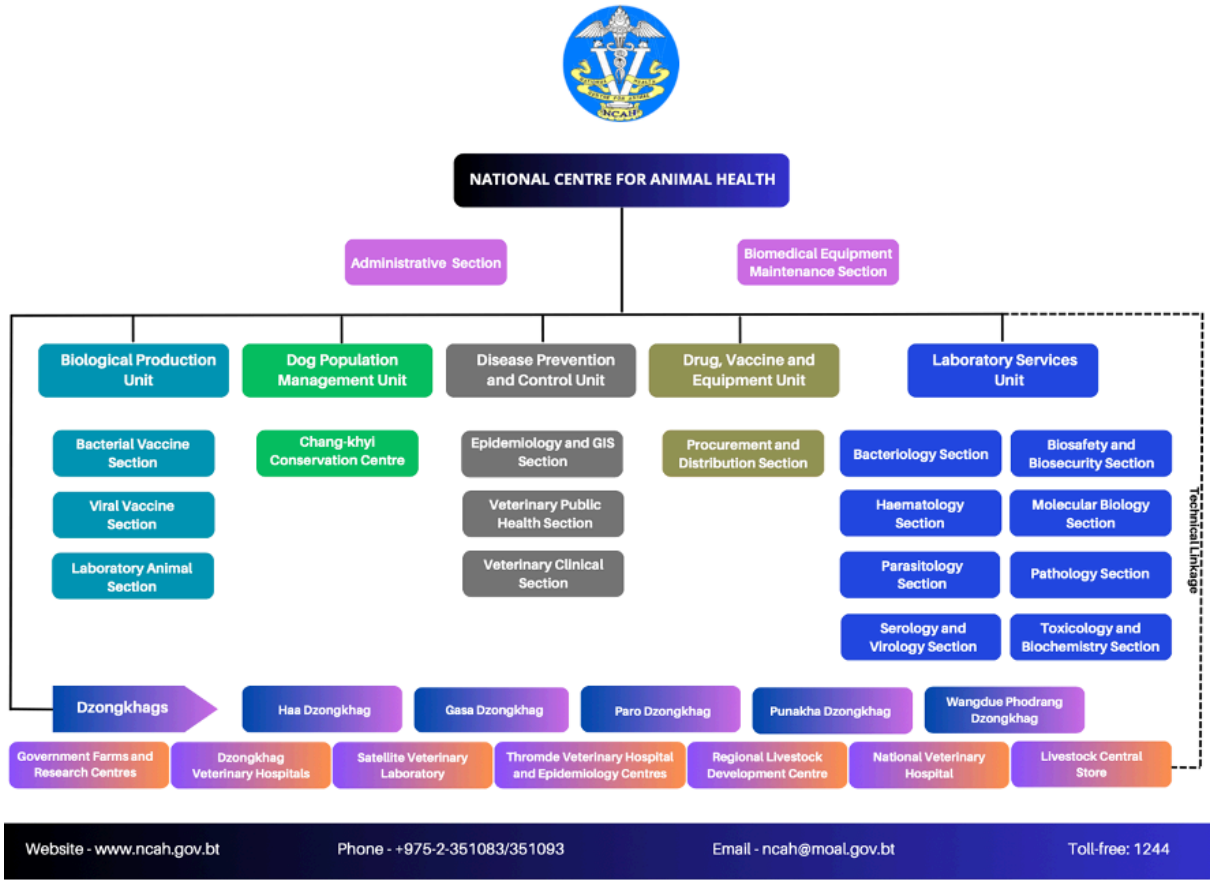


Figure 01: Organogram of NCAH

1.4. Human Resources

There were 43 officials serving in various technical sections of the centre as shown in the following figure for the fiscal year 2022 – 2023.

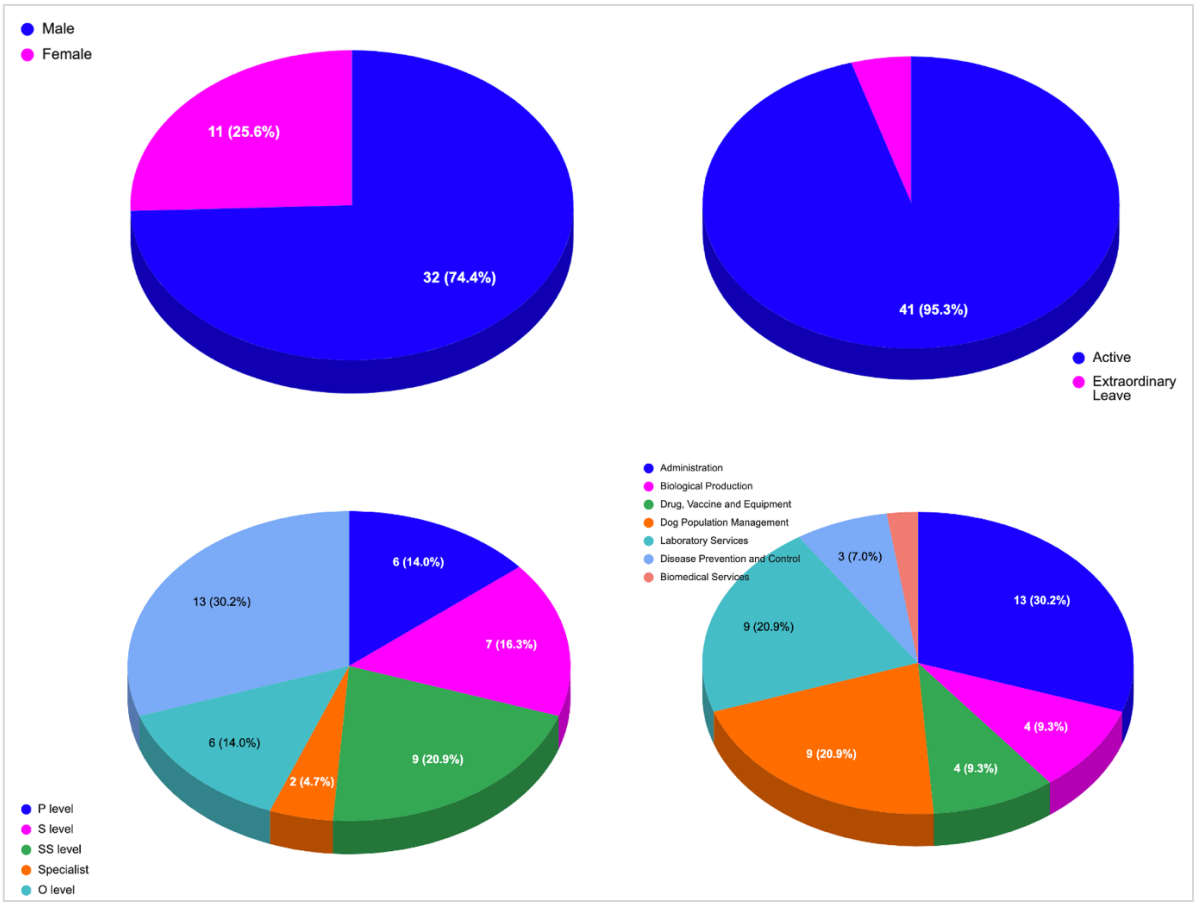


Figure 02: Staff profile of NCAH: sex (left top), service status (top right), position level (bottom left), section (bottom right)

2. KEY ACHIEVEMENTS

The National Centre for Animal Health, Serbithang under the guidance of the Animal Health Division, Department of Livestock and through the support of Regional Livestock Development Centre (RLDC), Regional Veterinary Hospital and Epidemiology Centre (RVH&ECs), Satellite Veterinary Laboratory, Dzongkhag Livestock Sectors, Livestock Commodity Centres, and other stakeholders achieved the following milestones during the FY 2022 – 2022.

2.1. Establishment and strengthening of laboratory diagnostic capacity

2.1.1. Introduction and validation of new tests

During the financial year 2022-23, new diagnostic tests were introduced and validated as follows:

- Real time PCR for detection of Lumpy skin disease virus with new primers and probes procured from Thermo Fisher Scientific, India
- Bacteria identification and AMR detection using VITEK 2 Compact machine, the latest technology for rapid detection of bacterial isolates and AMR.
- Lateral flow assay (LFA) for Marek's Disease for poultry-Marek's disease virus antigen rapid test kit was procured and introduced in the lab for rapid diagnosis of Marek's disease in poultry. The kit is being manufactured by QuickVet, China.
- Lateral flow assay for Avian Leukosis Complex- Avian Leukosis Virus antigen test kit was procured and introduced in lab for rapid diagnosis of ALC in chicken. The kit is manufactured by Abbexa, UK

2.1.2. Biomedical equipment maintenance

- The Centre conducted a need assessment of microbiology equipment at NFTL, BAFRA, RLDC, Khangma and Tsimasham, and NCAH Serbithang.
- Conducted calibration of Biosafety Cabinets with the technical support from the MoH and fund support from the Fleming Fund Country Grant.

2.2. Strengthened Disease Prevention and Control Program in the country

2.2.1. Development of national disease prevention and control plans and guidelines

The Centre, in collaboration with other stakeholders, reviewed the following important animal health and disease prevention and control plan documents:

- National African Swine Fever Prevention and Control Plan
- Generic Animal Disease Outbreak Management System

2.2.2. Coordination of major disease outbreak investigations and containment

In collaboration with other stakeholders, the Centre coordinated in responding to the rapid containment of the following notifiable and emerging animal disease outbreaks in the country:

- African swine fever (ASF)
- Avian leucosis complex (ALC)
- Black quarter (BQ)
- Haemorrhagic septicaemia (HS)

- Highly pathogenic avian influenza (HPAI)
- Infectious bursal disease (IBD)
- Lumpy skin disease (LSD)
- Newcastle disease (ND)
- Rabies

2.2.3. Strengthened animal disease information system

- Maintained validated data on notifiable and emerging animal disease outbreaks reported in Bhutan and submitted as immediate and six-monthly reports to the World Organization for Animal Health (WOAH) through the WAHIS interface.
- Conducted data collation, analysis and compilation of report on the annual status of notifiable animal diseases in Bhutan, 2022 – 2023
- Management of Veterinary Information System (VIS), data validation and compilation of veterinary case profile of Bhutan, 2016 – 2022
- Conducted data collation, analysis and compilation of report on the annual status of gid in yaks in Bhutan, 2022

2.3. Strengthened veterinary medicine, vaccine and non-drug item procurement, distribution and management system

2.3.1. Veterinary medicine and non-drug items procurement and distribution

- Timely indent collection and quantification of veterinary medicines including non-drug items (Consumables)
- Tender upload and evaluation of veterinary medicines including non-drug items for FY 22-23 as per the procurement cycle
- Tender awarding and supply order of Veterinary medicines including non-drug items for FY 22-23
- Technical Verification of Veterinary medicines including non-drug items for FY 22-23
- Coordinate preparation, packing and distribution of Veterinary medicines including non-drug items for FY 22-23

2.3.2. Veterinary medicine information management system

- Conducted refresher hands-on training on G2C system and officially rolled out the system for online indentation of medicines and vaccines

2.3.3. Vaccine procurement and distribution

- Procured 123.08 million doses of 9 livestock and poultry vaccines against Rabies, Foot and Mouth Disease, Haemorrhagic Septicaemia, Black Quarter, Classical Swine Fever, Fowl pox, Infectious Bursal Disease, Marek's Disease, New Castle Disease (B1) and New Castle Disease (R2B) worth Nu. 9.4195 million
- A total of 5,275,783 doses of different livestock and poultry vaccines were distributed to twenty dzongkhags and central agencies in the country
- A total of 12308000 doses of livestock and poultry vaccines were procured out of which 5275483 doses were distributed during 2022-23 with an overall distribution rate of

42.86% of the vaccine doses procured during the year which means more than 57.14% of the procured vaccine remains in the BPU vaccine bank for use during 2023-24

- Disposed expired vaccines, chemicals and unserviceable items worth Nu. 1.02009 million. The expired vaccines and chemicals were procured since 2008 with worth value of Nu. 0.73323 million while the original worth value of unserviceable items was Nu. 0.28686 million with depreciated value of Nu. 0.04368 million as of 30th June 2023. These items were disposed after seeking approval from the Department of Livestock followed by Ministry of Agriculture and Livestock as per the rules and regulations.

2.4. Dog population management and mass dog vaccination program

- Implemented combing campaign across 20 Dzongkhags to neuter the illusive dogs which could not be caught and neutered during the nationwide and mopping phase of the program.
- Vaccinated around 95 per cent of the dogs (owned and unowned) neutered during the combing campaign.
- Constructed a dog shelter at Nakulu to manage aggressive dogs in the town and Changkhyi Conservation Centre (CCC) at Yusipang for the conservation of the Changkhyi breed.
- Conducted assessment of sterilization coverage in Dzongkhags and Thromdes in line with the SOP for application, assessment and endorsement of self-declaration of freedom from unneutered free-roaming dogs in a jurisdiction.

2.5. Disease surveillance and animal health research

Following animal disease surveillance and research activities were conducted:

- Priority highland diseases: Taeniids, Brucellosis, Foot-and-mouth disease, Infectious bovine rhinotracheitis, Peste des petits ruminants and Bovine viral diarrhoea
- Nationwide surveillance for Brucellosis and AMR organisms in cattle
- LSD seromonitoring in naturally infected cattles of Samtse, Dagana and Sarpang
- PCV-2 serosurveillance in all the government pig farms
- Antimicrobial resistance in indicator Escherichia coli from poultry in Bhutan
- Antimicrobial resistance surveillance in poultry in Bhutan
- Published three research articles

2.6. One Health activities

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

- Coordinated the observation of the World Rabies Day 2022 in Bhutan.
- Coordinated the observation of the World Antimicrobial Awareness Week 2022 in Bhutan.

2.7. Capacity building

Following trainings were imparted to the field veterinarians and veterinary paraprofessionals during the FY 2022 – 2024:

- Hands-on training on Veterinary Information System (VIS), Dog Population Management and Mass Dog Vaccination mobile application and G2C system for EVDP

- Refresher hands-on training on VIS and G2C system for essential veterinary drug program
- Hands-on training on Laboratory Information Management System (LIMS)
- Refresher training on culture, identification and AST; Updating SOPs, LQA manual
- Training on Enhanced Laboratory Information Management System (LIMS)
- Advance Training on microbiology, laboratory quality assurance, Advanced training on Campylobacter microbiology
- Cascading training on Biosafety & Biosecurity
- Hands-on-training on advance microbiology techniques (Culture, Identification and Antibiotic Susceptibility Testing, Enterococci, Salmonella and E. coli and Isolate preservation, Vitek 2 compact)
- Troubleshooting and training on ELISA at RLDC, Kanglung
- Developed SOP and training documents for Biosafety cabinets

2.8. Financial achievement

- During the FY 2022 – 2023, the Centre was allocated with a total budget of 66.622 million Ngultrums, of which 66.507 million Ngultrum was utilised, translating to the total annual budget utilisation of 99.83 per cent.

3. LABORATORY SERVICES UNIT (LSU)

The Laboratory Services Unit (LSU) is one of the technical units under NCAH and functions as National Veterinary Referral Laboratory. The overall mandates are the following:

- To cater the referral diagnostic services for animal diseases in the country
- Conduct laboratory-based research
- Support disease surveillances to implement control programs

LSU has Bio-safety level 2 plus diagnostic facilities for safe handling and processing of high-risk pathogens in the laboratory. In addition, the unit is also responsible for implementing, monitoring and evaluating Bio-safety activities in the veterinary laboratories in the country.

The unit is also responsible for coordinating and collaboration of advance level diagnostic research with international reference laboratories and institutes. The lab is also the national referral lab for the Antimicrobial Resistance (AMR) in animal health.

3.1. Mandates

The main mandates of the LSU are:

- Provide referral laboratory diagnostic services for animal diseases
- Provide quality laboratory diagnostic services to support clinical services, animal health programs and One-Health activities in the country
- Conduct advanced/confirmative diagnostic tests for the referred samples from the field
- Conduct laboratory-based research/ Disease Surveillance/Survey
- To lead/coordinate and conduct laboratory-based animal health research
- Laboratory Quality Management & Safety
- Strives for efficient laboratory quality management
- Implementation of Biosafety and Bio-security programs in all the animal health laboratories in the country.
- Implement and monitor bio-safety measures and good laboratory practices in the animal health laboratories in the country
- Strengthening and enhancement of laboratory diagnostic capacities
- Serve as referral laboratory for antimicrobial resistance monitoring in animals in the country
- Participate in regional proficiency testing for specific diagnostic methods
- Conduct proficiency testing for specific diagnostic methods for the RLDCs
- Technically backstop regional, satellite and district laboratories in the country
- Introduction and validation of new diagnostic tests/upgradation of diagnostic tests for the emerging and re-emerging diseases in the country
- Coordinate in developing and establishing the electronic record system of laboratory activities e.g., LIMS
- Laboratory networking
- Liaise, collaborate and establish laboratory networks with the outside agencies like 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;

- Establish laboratory networks with the international reference laboratories such as OIE and WHO Referral Laboratories and also other institutes (NIID Tokyo, NIAD, Bangkok, AAHL Geelong, FMD Laboratory, Pirbright etc.)
- Human resource capacity development in the field of Laboratory technology
- Conducting the diploma course in laboratory technology in collaboration with other relevant institutions.
- Enhancement of laboratory skills by conducting refresher course and up-gradation courses for laboratory technicians
- Conduct training on laboratory biosafety and biosecurity

3.2. Human resources and diagnostic capacities

The followings are the available human resource in the Laboratory Services Unit as of 30th June 2023 (Table 1).

Table 01: Overall human resource capacity of LSU

S.N.	Name	Position Title	Position Level	Responsibilities
1	Dr N.K. Thapa	Specialist II (Head)	ES II	Head, Postmortem, Histopathology
2	Ms Puspa Maya Sharma	Dy. Chief Laboratory Officer	P2A	Molecular biology, Bacteriology, Mycology, Biosafety & Biosecurity
3	Mr Purna Bdr. Rai	Sr. Laboratory Technician II	SS3A	Biochemistry, Toxicology, Histopathology
4	Mr Tenzinla	Sr. Laboratory Technician II	SS3A	Bacteriology, Mycology, Postmortem
5	Mr Dawa Tshering	Sr. Laboratory Technician II	SS3A	Molecular Biology
6	Ms Tshewang Dema	Asstt. Laboratory Technician I	S1 A	Parasitology, Hematology
7	Mr. Karma Tsheten	Sr. Laboratory Technician II	SS3A	Serology, Virology
8	Mr Phub Namgay	Laboratory Attendant	ESP	Attendant

3.2.1. Bacteriology Section

The section provides routine diagnostic testing services for bacterial & fungal diseases in the livestock through culture & identifications. The section has capacity for second stage bio-chemical tests and identification of important bacterial pathogens. like *Salmonella, B. Anthracis,* serotyping of *E. coli* etc.

3.2.1.1. Diagnostic capacities

- Bacterial culture and identification using sheep blood agar, MacConkey agar and other selective media and various bio-chemical tests
- Fungal culture and identification using Sabouraud agar; Lactophenl cotton blue stain

- Staining techniques - Grams, Giemsa, Methylene blue, Ziehl-Neelsen/Acid fast, Leishman, Spore staining and Capsule staining for bacteria
- Species identification of important bacterial pathogens in Bhutan – Salmonella sp., E. coli, Staphylococcus spp., Bacillus anthracis, Clostridium sp., Pasteurella, Pseudomonas sp., Erysipelas rhusiopathiae, Brucella sp., Aeromonas hydrophila and Streptococcus sp.
- 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).
- MIC using Vitek machine

3.2.1.2. Human resources

- Ms. Puspa Maya Sharma, Dy. Chief Laboratory Officer
- Mr. Tenzinla, Sr. Laboratory Technician

3.2.2. Biochemistry and Toxicology Section

The section conducts basic tests for clinical biochemistry in serum, mineral estimation in serum and also qualitative analysis of urine to support the clinical diagnosis. The section also conducts basic toxicological tests especially, screening of important mycotoxins in the animal feeds like Aflatoxin, Ochratoxin and Zearalenon toxins

3.2.2.1. Diagnostic capacities

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

3.2.2.2. Human resources

- Dr. NK Thapa, AHS II
- Mr. Purna Bahadur Rai, Sr. Laboratory Technician

3.2.3. Biosafety and Biosecurity Section

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

3.2.3.1. Main activities

- Planning, Implementation and Coordination Biosafety and Bio-security activities
- Technical monitoring of Biosafety and Biosecurity measures
- In house training on biosafety and Biosecurity
- Reporting and Monitoring
- Compilation of routine and research laboratory test kits, reagents, consumables procurement
- Monitoring on the functionalities of the equipment

3.2.3.2. Human resources

- Ms. Puspa Maya Sharma, Dy. Chief Laboratory Officer

3.2.4. Haematology Section

The section conducts basic tests for haematological parameters to support clinical diagnosis in the animals. In addition, the section also carries out examination of blood parasites like microfilaria and *Trypanosomes* etc.

3.2.4.1. Diagnostic capacities

- 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 – MCV, MCHC and MCH
- Erythrocyte Sedimentation Rate (ESR)
- Wet film examination for blood parasites like microfilaria and trypanosome

3.2.4.2. Human resources

- Dr. NK Thapa, AHS-II
- Ms. Tshewang Dema, Laboratory Technician

3.2.5. Molecular Biology, Serology and Virology Section

- The section performs tests on both routine basis and also on the samples referred by the Regional/District/Satellite Laboratories in the country.
- The sections have the capacity to undertake rapid diagnosis of emerging diseases including the highly pathogenic avian influenza, IBD, NCD, Marek's Disease, Canine Distemper, Canine Parvo virus, African Swine Fever and Rabies etc. The molecular biology section is equipped with advanced diagnostic facilities such as real time PCR.

3.2.5.1. Diagnostic capacities

- Rapid antigen detection tests for Avian Influenza type A, H5, Newcastle disease (ND), Infectious Bursal Disease (IBD), Foot and Mouth Disease (FMD), Rabies, Canine distemper, Canine parvo, Marek's disease

- 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, FMD serotyping
- Real-time PCR for AI Type A, (H5, N1, H7, N8) FMD, CSF, ASF, PRRS (EU and NA), LSD, Pigeon Paramyxovirus (PPMV) and ND
- Agglutination tests - HA/HI for ND and H7N9
- Slide agglutination test for Salmonella and Mycoplasma
- Rose Bengal plate test (RBT) for Brucella

3.2.5.2. Human resources

- Ms Puspa Maya Sharma, Senior Laboratory Officer
- Mr. karma Tsheten, Senior Laboratory Technician
- Mr Dawa Tshering, Senior Laboratory Technician

3.2.6. Post-mortem and Pathology Section

The section has Post-mortem section to conduct necropsy diagnosis in both livestock and wildlife including aquatics. The Histo-pathology section provides histo-pathological diagnosis for the tissue samples submitted from the dzongkhags and central farms.

3.2.6.1. Diagnostic capacities

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

3.2.6.2. Human resources

- Dr. NK Thapa, Animal Health Specialist – II
- Mr. Tenzinla, Sr Laboratory Technician
- Mr. Purna Bahadur Rai, Sr Laboratory Technician

3.2.7. Parasitology Section

The section carries out basic parasitological diagnostic tests for parasitic diseases and also screening of helminths in the government livestock farms, dzongkhags and private livestock agencies. It also provides other professional backstopping to RLDC, RVH & ECs, SVLs and DVHs/DVLs. Besides the routine activities, the section regularly conducts research and surveillance pertaining to parasitic diseases in collaboration with government farms, RLDCs and the Dzongkhags. The section is also responsible to provide refresher/in-service courses

for field staffs and trainings to the farmers with regard to parasitic diseases and control programs.

3.2.7.1. Diagnostic capacities

- Identification of parasites through direct technique
- Identification of parasites through qualitative tests (Sedimentation and Floatation methods)
- Quantification of parasitic eggs 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 blood (modified Knott's method)
- Worm staining & preservation
- Isolation and identification of Taeniid eggs from faeces and soil samples

3.2.7.2. Human resources

- Ms. Tshewang Dema, Laboratory Technician

3.3. Diagnostic services provided

The total samples received/collected, and tests performed for each section during this financial year is shown in the following table.

Table 02: Summary of sample received, and test performed during 2022 – 2023

Sections	No. of sample processed	No. of Tests conducted
Parasitology	819	3242
Hematology	144	387
Bio-chemistry &Toxicology	130	130
Bacteriology	748	5883
Mycology	24	54
Serology	3037	3379
Virology	50	110
Molecular Biology	597	813
Post-mortem	175	175
Histo-Pathology	600	1200
International referral		884
Aquatic and wildlife	63	63
Total	6387	16320

A total of 6,387 various laboratory samples were processed and 16,320 various laboratory tests were performed for disease screening, surveillance and research during the year.

All the referral samples received by the Centre were tested and results shared within the test-specific turn-around-time as shown in the following table.

Table 03: Turn-around Time (TAT) for Laboratory Tests

Section	No. of clinical, referral and outbreak samples tested	No. of tests performed within the standard test-specific TAT	No. of tests performed beyond the standard test-specific TAT	% of tests performed within the test-specific standard TAT
Bacteriology	1062	1062	0	100%
Biochemistry-Toxicology	51	51	0	100%
Hematology	144	144	0	100%
Histopathology	148	148	0	100%
Molecular Biology	582	582	0	100%
Mycology	28	28	0	100%
Parasitology	747	747	0	100%
Post-mortem	161	161	0	100%
Serology-Virology	538	538	0	100%
Total/Average	3461	3461	0	100%

3.3.1. Bacteriology section

The section received/collected 748 samples and carried out 8 different types of tests as described in following tables.

Table 04: Sample type received in Bacteriology section

Type of specimen	Numbers received
Stomach fluid	1
Swab	82
Water	6
Scrap	1
Whole blood	31
Organs	10
Lymph nodes	2
Lyophilized culture	45
Blood smear	10
Semen	9
Urine	1
Impression smear	1
Culture	108

Caeca	172
Isolates	233
Rectal swab	36
Total	748

Table 05: No. of tests performed in Bacteriology section

Type of tests	Number of Tests conducted
Cultured	1451
Gram stain	189
Motility	136
Bio-chemical tests	3244
Sensitivity Test	386
Archival	468
Methylene Blue Stain	6
Acid Fast Stain	3
Total	5883

Significant findings

- Important findings in Bacteriology include Aeromonas spp., E. coli, Streptococcus spp. and Staphylococcus intermedius
- Important findings from AMR surveillance include Campylobacter jejuni, Enterococcus spp., Salmonella spp. & E. coli from caeca samples of poultry

3.3.2. Mycology section

The section received/collected 25 samples and carried out 2 different types of tests as described in following table.

Table 06: Sample type and the tests conducted in Mycology Section

Type of specimen	Numbers received	Type of tests	Number of Tests conducted
Skin Scraping	22	Culture	27
Organs	3	LPCB Stain	27
Total	25		54

Significant findings

- Important findings from mycology include Aspergillus niger and Rhizopus spp. from skin scraping of canine

3.3.3. Parasitology Section

A total of about 819 samples were received and 3,242 different tests were performed by the section. The details of tests performed by this section are shown in following table.

Table 07: Sample and test performed in Parasitology section

Type of specimen	Numbers received	Type of tests	Number of Tests conducted
Faecal samples	793	Direct examination, Sedimentation, Stoll's dilution, Floatation	3168
Dog environmental samples	15	Floatation/Sieving technique by using 1:1 sugar solution.	60
Soil Samples	1	Floatation/Sieving technique by using zinc sulphate (1:1)	4
Intestinal content	10	Direct smear	10
Total	819		3242

Significant findings

During the year, the commonly detected parasitic infestations through the microscopic detection are:

- Eggs of B. coli, Strongyles, & Coccidia in Swine
- Taeniid eggs in Environment samples from Highland areas
- Ascarids and Tape worms in poultry

3.3.4. Clinical Pathology & Hematology Section

About 144 whole blood samples were processed and 387 different tests were conducted during the year. Details of samples and tests conducted in these sections are presented in the following table.

Table 08: Sample type and the tests conducted in Clinical pathology/ Haematology section

Type of tests	Number of Tests conducted
PCV	107
Hb	107
DLC	67
TRCC	30
TWCC	30
Knott's test	0
Direct smear examination	46
Total	387

Significant findings

- Detection of Dirofilaria, also known as heartworm larva: Out of 48 samples, 8 samples were positive for Heartworm.

3.3.5. Molecular biology

The section received/collected 597 samples and conducted 813 different types of tests as described below.

Table 09: Sample type and the tests conducted in Molecular Biology section

Type of specimen	Numbers received	Type of tests	Number of Tests conducted
Whole Blood	394	ASFV, PRRS, CAPV, PCV 2, LSDV, CSFV	485
Ocular swab	1	CaPV, PPR, HS, MCCP	6
Serum	32	ASFV, CSFV, LSDV	47
Organs	11	ASFV, CSFV, PRRS- EU, NCD	16
Tracheal swab	32	AI Type A, NDV, LSDV, PCV 2	39
Feces	30	AIV, H5, N1, PPMV	40
Tissue	12	CAPV, PRRS, LSDV	11
Meat	3	ASFV	5
Bone marrow	3	ASFV	6
Fresh Fecal droppings	16	AIV	18
Lyophilized sample Avian (PT)	35	AIV, H5, NDV, H7	79
Lyophilized sample Swine (PT)	22	ASFV	42
DNA template	16	ASFV	18
Total	597		813

Significant findings

Important findings in molecular biology includes:

- ASFv in pigs from Sarpang, Dagana, Chukha, and Samdrup Jongkhar Dzongkhags
- PCV-2 in pigs of NNPBC Yusipang and RPBC Gelephu
- LSDv in cattle and yaks from most of the Dzongkhags

3.3.6. Biochemistry & Toxicology

The section received/collected 130 samples and conducted 130 tests as described below.

Table 10: Sample type and the tests conducted in Biochemistry & Toxicology section

Type of specimen	Numbers received	Type of tests	Number of Tests conducted
Feed	60	Aflatoxin	60
Serum	60	Mineral biochemistry	60
Urine	10	Urine biochemistry	10
Total	130		130

3.3.7. Histopathology

The section received/collected 60 samples and conducted 1,200 tests as described below.

Table 11: Sample type and the tests conducted in Biochemistry & Toxicology section

Type of specimen	Numbers Received	Type of tests	Number of Tests conducted
Tissue	600	Haemotoxin Eosin test	1200
Total	600		1200

3.3.8. Serology section

The section received/collected 3,037 serum samples and conducted out 3,379 tests as described in the table below.

Table 12: Sample Type and test conducted in Serology section

Type of tests conducted	Number of tests conducted
PPR ELISA	837
Mycobacterium avium complex	120
CCHF	1671
Brucella	373
PCV-2	105
IBR	120
BVDV	120
RBT	4
ALC	3
IBD	5
Monkey Pox	1
RAPINA	15
Total	3379

Significant findings

Important findings in serology includes:

- Brucella antibody from cattle in NJBC, Samtse, RCBC, Wangkha and Lhuntse.
- PCV 2 from RPBC Lingmethang and NNPBC Yusipang.
- Rabies virus from Samtse and Chukha.
- IBD in poultry from Sarpang.
- The section also performed proficiency testing for RBT for Brucellosis with National Institute of Animal Health, Bangkok and within regional laboratories of RLDC and RVH & ECs.

3.3.9. Virology section

The section received/collected 50 samples and carried out 110 different types of tests as shown in the following table.

Table 13: Sample type and the tests conducted in Virology section

Type of specimen	Numbers received	Type of tests	Number of tests conducted
Brain	4	FAT	4
Serum	14	FMD NSP(Rapid)	14
Swab	32	Rapid AI	30
		Rapid NDV	30
		Rapid IBD	30
		CPV	1
		CDV	1
Total	50		110

3.3.10. Postmortem section

The section received/collected 175 carcasses and carried out post-mortem examination in large and small animals as described below.

Table 14: Carcass received and the post-mortem examination preformed

Type of specimen	Numbers received	Type of tests	Number of tests conducted
Carcass	175	Postmortem examination	160
		Unfit for Post-mortem examination	15
Total	175		175

Significant findings

- Important findings post-mortem examination includes IBDV, ALC, CPV, roundworm infestations, NDV, liver fluke, enterotoxaemia and coccidiosis.

3.3.11. Aquatic and wildlife samples

A total of 63 samples were received from aquatic and wildlife species for disease diagnosis. Important findings in fish included infection with Aeromonas spp., Aspergillus spp. and Rhizopus spp. Feces from Takin, Bear, Deer showed infection with parasite mainly Strongyloides.

Table 15: Aquatic and wildlife samples tested

Aquatic and wildlife Species	No. of samples received	Type of sample received
Fish	9	Carcase(9)
Takin	45	Carcase (1), Feces (44)
Deer	3	Carcase(1), Feces (2)

Monkey	1	Feces(1)
Bear	4	Feces(4)
Goral	1	Feces(1)
Total	63	

3.3.12. International referral

During the year various samples were referred to international laboratories for confirmation and/or molecular analysis. The details are as tabulated below.

Table 16: Sample referred to international laboratories

Species	Specimen type	Referral laboratories	No. of samples
Swine	DNA template	Australian Centre for Disease Preparedness	190
	Soil	Anthrax Reference Institute of Italy	84
Canine	Serum	National Institute of Infectious Diseases, Japan	265
Canine	Serum	National Institute of Animal Health; Thailand	1
Canine	Eye swab	University of Melbourne; Australia	90
	Serum	University of Melbourne; Australia	92
	Whole blood	University of Melbourne; Australia	95
	Faeces	University of Melbourne; Australia	67
		Total	884

3.4. Laboratory Quality Assurance

3.4.1. Asia Pacific Terrestrial Regional Proficiency Testing Program

3.4.1.1. Avian diseases PCR

The laboratory services unit participated with Asia-Pacific Terrestrial PT Program for Avian diseases PCR for the test period, 20 February 2023 – 11 March 2023, round code: AT23R01 Avian diseases. The goal of this PT panel was to determine the performance of individual laboratories using real-time or conventional PCR for the detection of:

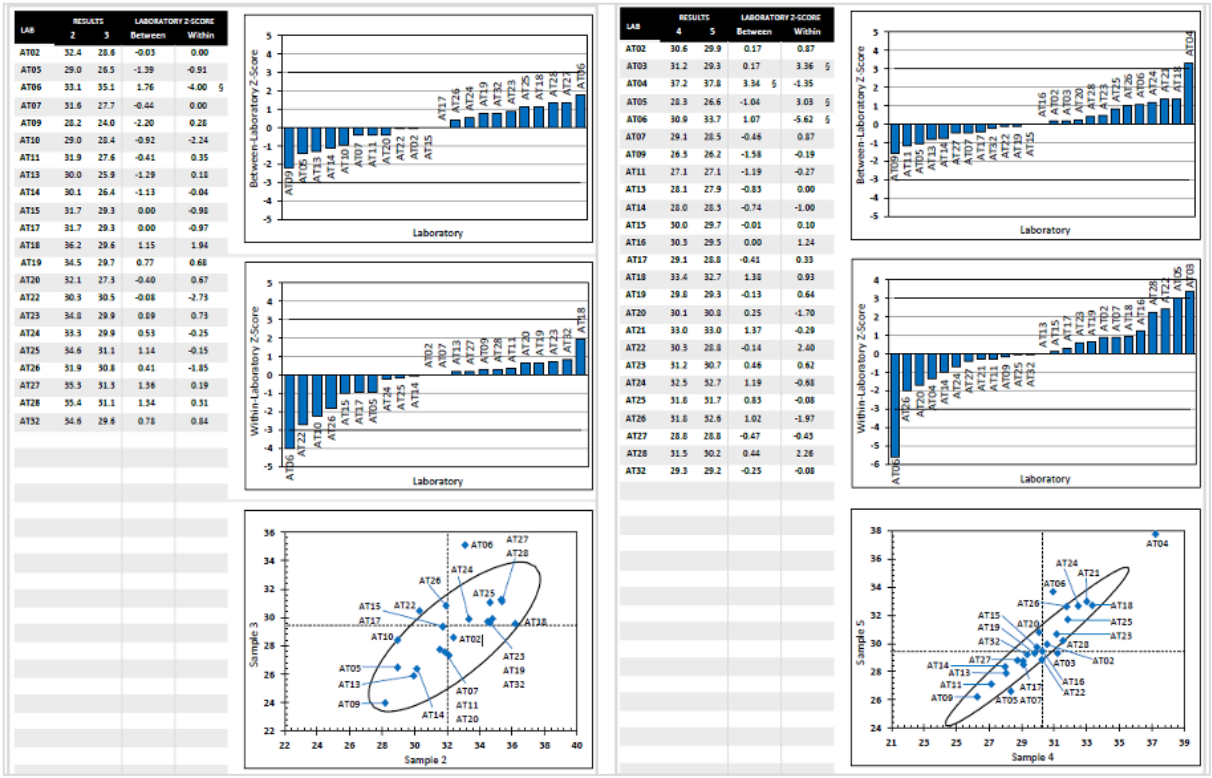
- Influenza A including H subtyping, and
- Avian paramyxovirus type 1

All proficiency testing items were treated in the same manner as that of samples for routine testing. The ID code for the AT23R01 **Avian diseases round** of the 2023 Asia Pacific Terrestrial PT program for Bhutan was **AT19**.

A summary result is displayed in this report. A detailed report is available at the molecular section.

Summary Statistics and Paired Analysis

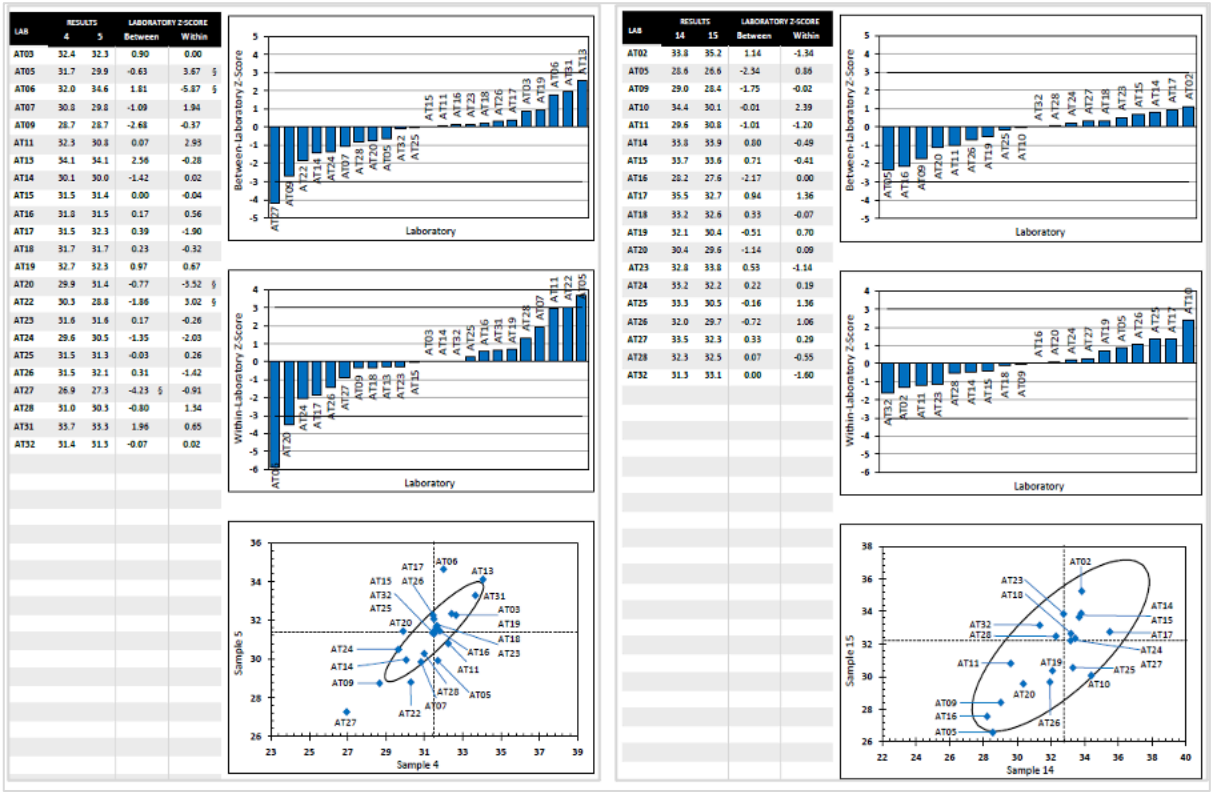
Statistical analyses performed on AIV matrix PCR - split sample pair 2 & 3, AIV matrix PCR - identical sample pair 4 & 5 for AT19.



LAB	RESULTS 2	RESULTS 3	LABORATORY Z-SCORE Between	LABORATORY Z-SCORE Within
AT02	32.4	28.6	-0.03	0.00
AT05	29.0	26.5	-1.39	-0.91
AT06	33.1	35.1	1.76	-4.00 §
AT07	31.6	27.7	-0.44	0.00
AT09	28.2	24.0	-2.20	0.28
AT10	29.0	28.4	-0.92	-2.24
AT11	31.9	27.6	-0.41	0.35
AT13	30.0	25.9	-1.29	0.18
AT14	30.1	26.4	-1.13	-0.04
AT15	31.7	29.3	0.00	-0.98
AT17	31.7	29.3	0.00	-0.97
AT18	36.2	29.6	1.15	1.94
AT19	34.5	29.7	0.77	0.68
AT20	32.1	27.3	-0.40	0.67
AT22	30.3	30.5	-0.08	-2.73
AT23	34.8	29.9	0.89	0.73
AT24	33.3	29.9	0.53	-0.25
AT25	34.6	31.1	1.14	-0.15
AT26	31.9	30.8	0.41	-1.85
AT27	35.5	31.3	1.36	0.19
AT28	35.4	31.1	1.34	0.31
AT32	34.6	29.6	0.78	0.84

LAB	RESULTS 4	RESULTS 5	LABORATORY Z-SCORE Between	LABORATORY Z-SCORE Within
AT02	30.6	29.9	0.17	0.87
AT03	31.2	29.3	0.17	3.36 §
AT04	37.2	37.8	3.34 §	-1.35
AT05	28.3	26.6	-1.04	3.03 §
AT06	30.9	33.7	1.07	-5.62 §
AT07	29.1	28.5	-0.46	0.87
AT09	26.3	26.2	-1.58	-0.19
AT11	27.1	27.1	-1.19	-0.27
AT13	28.1	27.9	-0.83	0.00
AT14	28.0	28.3	-0.74	-1.00
AT15	30.0	29.7	-0.01	0.10
AT16	30.3	29.5	0.00	1.24
AT17	29.1	28.8	-0.41	0.33
AT18	33.4	32.7	1.38	0.93
AT19	29.8	29.3	-0.13	0.64
AT20	30.1	30.8	0.25	-1.70
AT21	33.0	33.0	1.37	-0.29
AT22	30.3	28.8	-0.14	2.40
AT23	31.2	30.7	0.46	0.62
AT24	32.5	32.7	1.19	-0.68
AT25	31.8	31.7	0.83	-0.08
AT26	31.8	32.6	1.02	-1.97
AT27	28.8	28.8	-0.47	-0.43
AT28	31.5	30.2	0.44	2.26
AT32	29.3	29.2	-0.25	-0.08

Figure 03: AIV Matrix PCR: split sample pair 2&3 (left); identical sample pair 4&5 (right)



LAB	RESULTS 4	RESULTS 5	LABORATORY Z-SCORE Between	LABORATORY Z-SCORE Within
AT03	32.4	32.3	0.90	0.00
AT05	31.7	29.9	-0.63	3.67 §
AT06	32.0	34.6	1.81	-5.87 §
AT07	30.8	29.8	-1.09	1.94
AT09	28.7	28.7	-2.68	-0.37
AT11	32.3	30.8	0.07	2.93
AT13	34.1	34.1	2.56	-0.28
AT14	30.1	30.0	-1.42	0.02
AT15	31.5	31.4	0.00	-0.04
AT16	31.8	31.5	0.17	0.56
AT17	31.5	32.3	0.39	-1.90
AT18	31.7	31.7	0.23	-0.32
AT19	32.7	32.3	0.97	0.67
AT20	29.9	31.4	-0.77	-3.52 §
AT22	30.3	28.8	-1.86	3.02 §
AT23	31.6	31.6	0.17	-0.26
AT24	29.6	30.5	-1.35	-2.03
AT25	31.5	31.3	-0.03	0.26
AT26	31.5	32.1	0.31	-1.42
AT27	26.9	27.3	-4.23 §	-0.91
AT28	31.0	30.3	-0.80	1.34
AT31	33.7	33.3	1.96	0.65
AT32	31.4	31.5	-0.07	0.02

LAB	RESULTS 14	RESULTS 15	LABORATORY Z-SCORE Between	LABORATORY Z-SCORE Within
AT02	33.8	35.2	1.14	-1.34
AT05	28.6	28.6	-2.34	0.86
AT09	29.0	28.4	-1.75	-0.02
AT10	34.4	30.1	-0.01	2.39
AT11	29.6	30.8	-1.01	-1.20
AT14	33.8	33.9	0.80	-0.49
AT15	33.7	33.6	0.71	-0.41
AT16	28.2	27.6	-2.17	0.00
AT17	35.5	32.7	0.94	1.36
AT18	33.2	32.6	0.33	-0.07
AT19	32.1	30.4	-0.51	0.70
AT20	30.4	29.6	-1.14	0.09
AT23	32.8	33.8	0.53	-1.14
AT24	33.2	32.2	0.22	0.19
AT25	33.3	30.5	-0.16	1.36
AT26	32.0	29.7	-0.72	1.06
AT27	33.5	32.3	0.33	0.29
AT28	32.3	32.5	0.07	-0.55
AT32	31.3	33.1	0.00	-1.60

Figure 04: Left - AIV H5 PCR - identical sample pair 4 and 5; Right - APMV-1 M-gene PCR - identical sample pair 14 and 15

Conclusion

The results provided for the targeted assays overall demonstrated acceptable sensitivity and repeatability for most participating laboratories. Laboratories incorrectly reporting results for their target assay are recommended to review their procedures with aim of improving specificity and sensitivity. Laboratories that were identified as statistical outliers may wish to review their results.

3.4.1.2. Swine diseases PCR

The laboratory service unit participated with Asia-Pacific Terrestrial PT Program for Swine diseases PCR for the test period 6 March 2023 – 25 March 2023, round code: AT23R02 Swine diseases. The goal of this PT panel was to determine the performance of individual laboratories using real-time or conventional PCR for the detection of:

- African swine fever virus (ASF)
- Classical swine fever virus (CSF)
- Porcine reproductive and respiratory syndrome virus; EU (PRRS-E) and SEA (PRRS-S) strains

All proficiency testing items were treated in the same manner as that of samples for routine testing. The ID code for the AT23R02 **Swine diseases round** of the 2023 Asia Pacific Terrestrial PT program for Bhutan was **AT19**.

A summary result is displayed in this report. A detailed report is available at the molecular section.

Summary Statistics and Paired Analysis

Statistical analyses were performed on:

- ASF PCR - identical sample pair 3 & 4
- CSF PCR - split sample pair 6 & 7

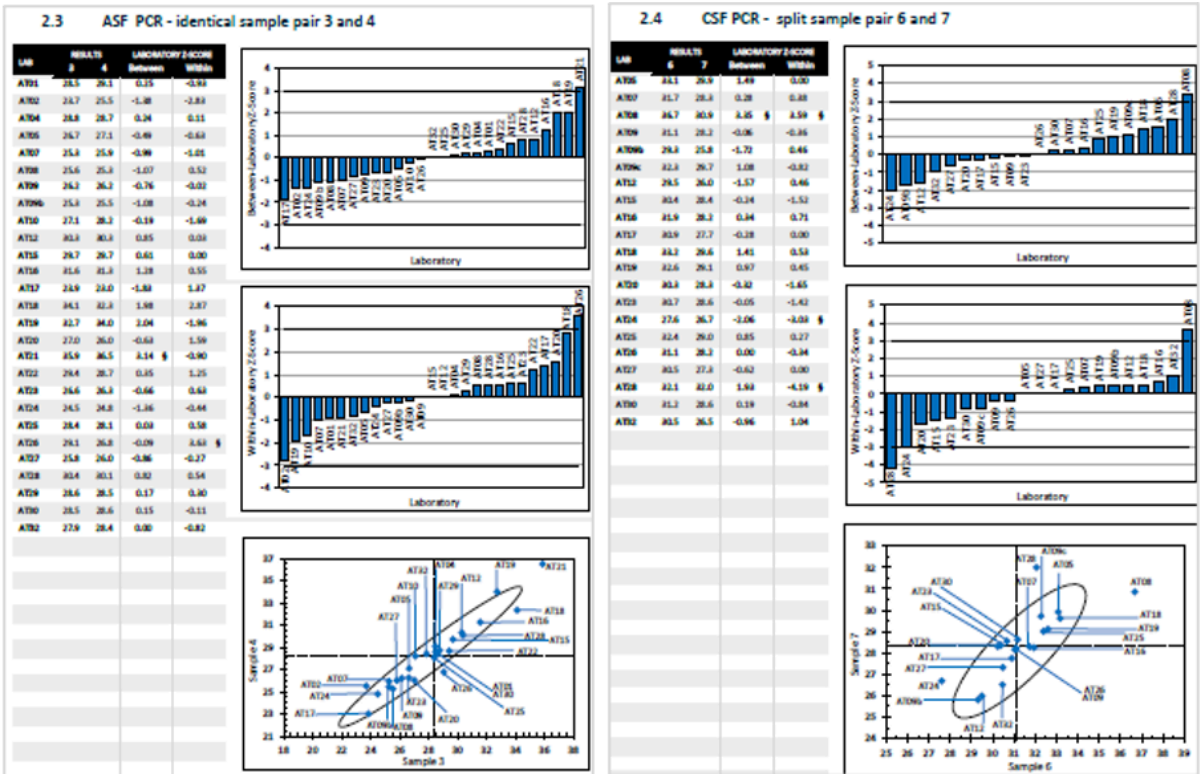


Figure 05: Left - ASF PCR- identical sample pair 3 and 4; Right - CSF PCR - split sample pair 6 and 7

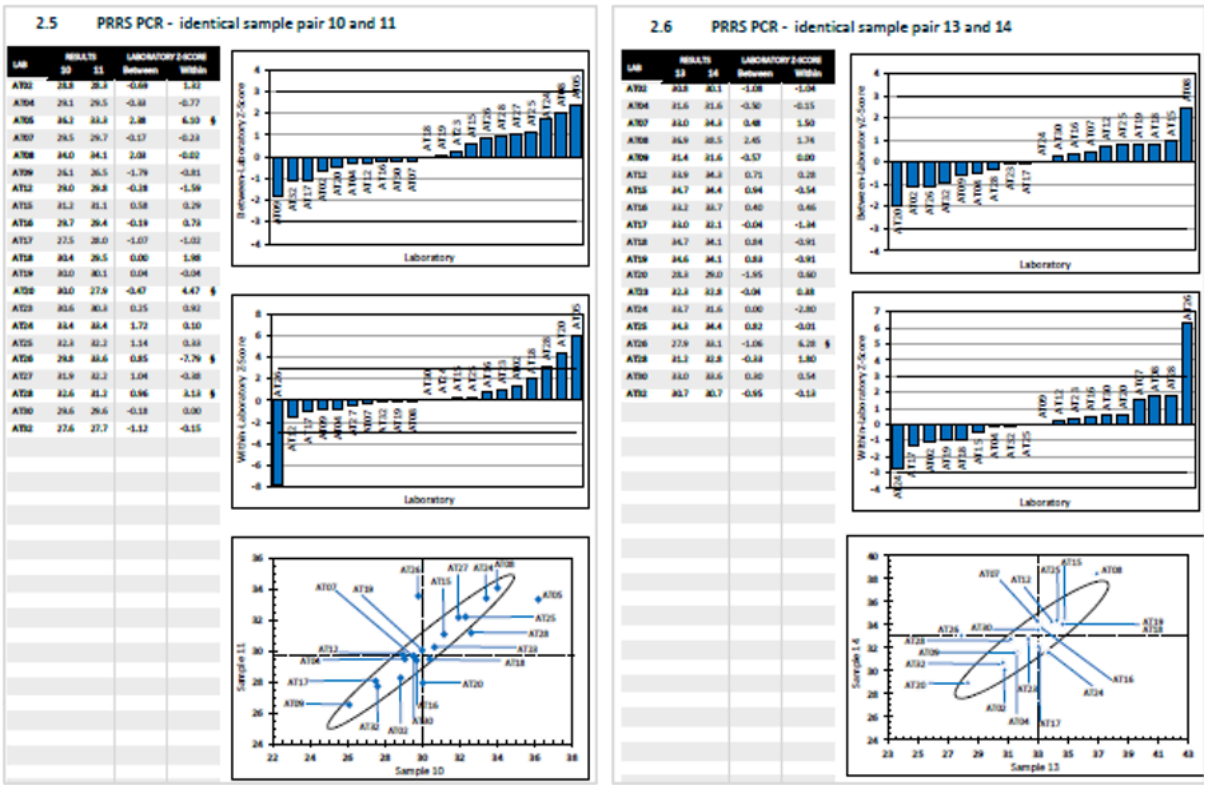


Figure 06: Left – PRRS PCR – identical sample pair 10 and 11; Right – PRRS PCR – identical pair 13 and 14

Conclusion

The results provided for the targeted assays overall demonstrated acceptable sensitivity and repeatability for most participating laboratories. Laboratories incorrectly reporting results for

their target assay are recommended to review their procedures with aim of improving specificity and sensitivity. Laboratories that were identified as statistical outliers may wish to review their results.

3.4.2. External Quality Assurance System (EQAS) with EQAsia project for Bacteriology Diagnostics.

Participation in internal and external quality assurance systems is a useful tool for production of reliable laboratory results of consistently good quality. The overall aim of the EQAsia project is to improve the quality of bacteriology diagnostics for antimicrobial susceptibility testing (AMR) in the Asian region. The EQAsia project is supported by the Fleming fund (UK aid programme).

The bacteriology laboratory participated in two rounds of EQA (5 and 6) in the current financial year 2022-2023. EQASIA EQA5 was conducted in September 2022 for identification and AMR of *Streptococcus pneumoniae*; and EQA6 was conducted in June 2023 for Identification and AMR of *E.coli* and *Pseudomonas aeruginosa*.

3.4.3. National External Quality Assessment Scheme (NEQAS) with RCDC for bacteriology diagnostics.

The bacteriology laboratory participated in third round of NEQAS in October 2022 and received PT panels for the fourth round in June 2023. Three unknown lyophilized samples were received, bacteriology identification and AST were performed. The report was submitted online via RCDC NEQAS. The results and scores are as shown in the following table.

Table 17: Identification & Grouping Score for Panel Round 3

Site	Sample ID	Exp. Idn	Obt. Idn	Idn Score	Grp Score	ABST Score
National Centre for Animal Health	BAC223 010	Salmonella e nteritidis	Salmonella ty phimurium	0.50	0	20/21
	BAC223 011	Aeromonas H ydrophilia	Aeromonas Hydrophilia	1.00	1	18/36
	BAC223 012	Shigella speci es	Shigella flexn eri	0.50	0	26/45
Total Score				2/3	1/3	64/102

3.4.4. Participated in proficiency testing scheme for Brucella for LSU and Regional Laboratories with NIAH Bangkok.

Serology section at LSU participated in PT for Brucella identification with National Institute of Animal Health (NIAH), Bangkok through RBT and ELISA. A total of 21 PT samples were received on 15th February 2023 and were tested for RBT and ELISA. 14 PT samples were found positive through ELISA and 6 PT samples were found positive through RBT. The results were submitted online using the link provided by NIAH for Lab code LC 77.

A similar set of PT for brucella identification were shipped to RVH&EC Gelephu, Phuentsholing, Dewathang and RLDC Kanglung on February 2023 for participation in RBT brucella. The results were submitted independently through the online website via each laboratory. The analysed reports are yet to be received.

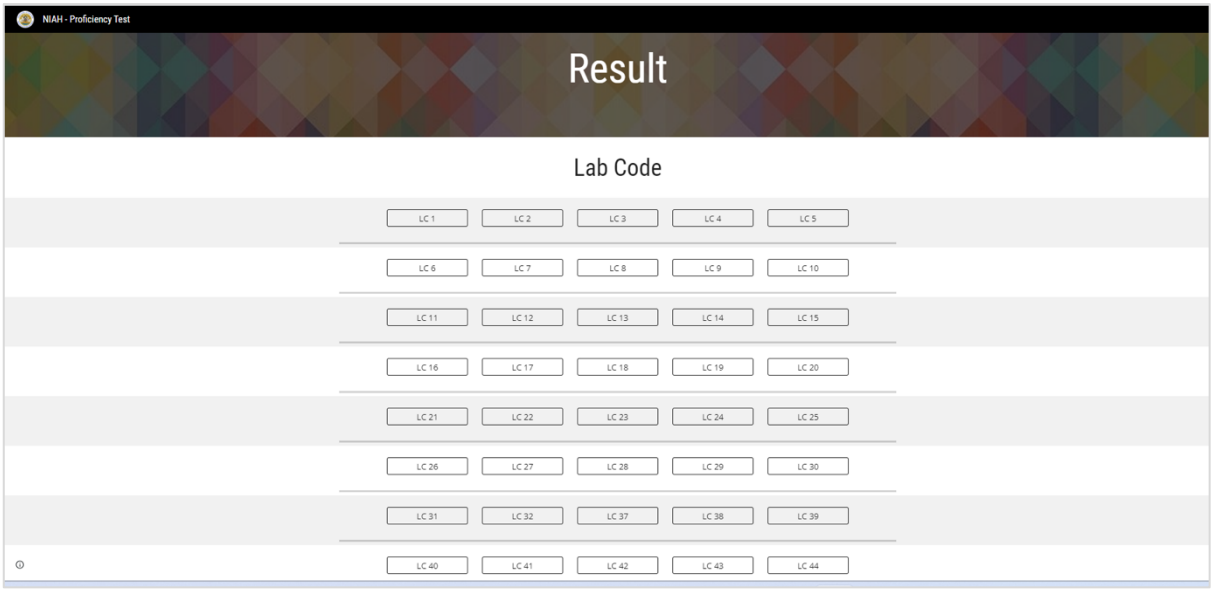


Figure 07: PT result submitted online

4. DISEASE PREVENTION AND CONTROL UNIT (DPCU)

4.1. 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 and guidelines for transboundary emerging animal diseases.
- To plan and implement zoonotic disease prevention and control programmes through the One-Health approach, in collaboration with the Ministry of Health.
- To maintain the notifiable and emerging livestock disease information in the country through the online database system, analyse, and communicate to the relevant stakeholders.
- To maintain the animal health information in the country through the Veterinary Information System (VIS) database, analyse, and communicate to the relevant stakeholders.
- To act as the focal agency for contact with international organizations such as the 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.

4.2. Human resources

- Dr Pelden Wangchuk, Senior Veterinary Officer
- Mr Kinzang Namgay, Senior Livestock Health Supervisor
- Ms Sonam Deki, Livestock Health Supervisor

4.3. Review of animal diseases prevention, control plans and guideline

The Disease Prevention and Control Unit coordinated, in collaboration with other stakeholders, the reviewing of the following important documents which shall guide field professionals and other stakeholders to implement various animal disease prevention and control programmes in the country:

- National African Swine Fever Prevention and Control Plan
- Generic Animal Disease Outbreak Management System of Bhutan

4.3.1. National African Swine Fever Prevention and Control Plan 2023

In light of a series of reported outbreaks of African Swine Fever (ASF) within the country throughout the fiscal year 2022-2023, a proactive response was initiated in accordance with the guidelines set forth in the 2021 National ASF Prevention and Control Plan (NASFPCP). This entailed subjecting the plan document to a comprehensive testing process at the operational level, conducted in the field.

However, as the implementation of the NASFPCP progressed, several challenges were encountered, which prompted a reevaluation of the plan's effectiveness. Input and feedback were collected from professionals actively engaged in field operations, allowing for a more informed perspective on the practical implications of the plan. Taking these insights into consideration, necessary amendments were identified to enhance the efficacy of the NASFPCP.

The resultant modifications to the plan were focused on addressing the identified shortcomings and improving the overall response strategy. Key revisions included:

- Strengthening the existing farm biosecurity standards and accompanying checklist to provide a more robust defence against ASF transmission.
- Introducing a compensation framework based on the principles of farm biosecurity, thereby incentivizing adherence to preventive measures.
- Expanding the organizational framework involved in responding to ASF outbreaks to incorporate local government leaders, fostering a collaborative and well-coordinated approach.
- Establishing a structured disinfection schedule following the disposal, disinfection, and decontamination (3-D) operations until the process of restocking takes place.
- Implementing a farm biosecurity-centered approach to restocking, which aimed to either rehabilitate affected farms or establish new facilities while maintaining high biosecurity standards.
- Formulating a Standard Operating Procedure (SOP) for culling using chemical methods as an alternative solution when conventional culling methods are unavailable.
- Designing a disposal pit sketch or design that offers a standardized and effective approach to the safe disposal of ASF-infected materials.
- Incorporating an SOP for disinfection that utilizes easily accessible bleaching powder, streamlining the decontamination process.
- Updating the nomenclature of various organizations involved to align with the structural reforms undertaken by the Regulatory and Supervisory Compliance System (RSCS).

In its current state, the revised plan has taken shape in the form of a final draft, poised for further refinement. Comments and insights are eagerly awaited from the African Swine Fever (ASF) experts associated with the FAO's Emergency Management Centre. Their valuable input will play a pivotal role in fine-tuning the plan, ensuring its alignment with global best practices and expert recommendations. Once these comments are received and evaluated, the final adjustments will be incorporated, culminating in the ultimate version of the plan. This definitive document will then undergo the finalization process and receive official endorsement, solidifying its role as a comprehensive and effective tool in the ongoing battle against ASF.

4.3.2. Generic Animal Disease Outbreak Management System of Bhutan 2023

In anticipation of the potential introduction of exotic zoonotic ailments such as Crimean Congo Haemorrhagic Fever (CCHF), Japanese Encephalitis, Nipah virus, and other emerging terrestrial animal diseases, a comprehensive generic animal disease management system was conceived in 2021. This initiative was undertaken as an integral facet of Bhutan's preparedness and response strategy to counteract the outbreak of these diseases. Despite its conception, the document remained in the preliminary draft stage.

The core objective of this document is to delineate the framework for managing animal disease outbreaks. It establishes a clearly defined chain of command, decision-making protocols, and delineates the roles and responsibilities of various committees, each comprising pertinent

agencies operating at different tiers. Notably, this disease control command structure is harmonized with existing guidelines and control plans in place.

The scope of this generic guideline is broad, encompassing all animal diseases for which specific control plans have yet to be devised. These include diseases that exert a substantial impact on public health and/or socio-economic dimensions. The guideline mandates the coordinated implementation of outbreak control measures.

Given the occurrence of exotic disease outbreaks such as Lumpy Skin Disease, African Swine Fever, and Capripox since 2020, it has become evident that the likelihood of encountering other exotic diseases is imminent. This concern is particularly pronounced in the southern districts, which consistently remain at a heightened risk of transboundary animal disease incursions.

Leveraging insights garnered from the deployment of response measures against African Swine Fever, Lumpy Skin Disease, and Highly Pathogenic Avian Influenza in recent years, a comprehensive review and refinement of the generic disease management system were undertaken. The resultant adjustments to the plan encompassed several crucial aspects, including:

- Restructuring the organization's response framework.
- Establishing criteria for activating committees and organizations at different levels.
- Enhancing stakeholder engagement strategies.
- Developing a versatile technical response structure that can be tailored to specific scenarios.

This iterative evolution of Bhutan's animal disease management system underscores the nation's proactive approach in strengthening its capability to manage and mitigate the impacts of diverse disease outbreaks efficiently.

4.4. Strengthening of Animal Disease Surveillance and Reporting System

4.4.1. The status of the notifiable animal diseases in Bhutan, 2022 – 2023

Notifiable animal disease is any animal disease that upon suspicion or detection must be immediately notified to the nearest animal health center or relevant agencies. In context to Bhutan, notifiable animal diseases are those zoonotic or non-zoonotic diseases listed by the Department of Livestock, Ministry of Agriculture and Forests, as depicted in the Livestock Rules and Regulations of Bhutan 2017, and that, as soon as detected or suspected, must be reported to the nearest animal health centre by the fastest means of communication. The emerging diseases – causing a significant impact on animal or public health resulting from a change of a known pathogenic agent or spread to a new geographic area or species; or a previously unrecognized pathogenic agent or disease diagnosed for the first time – of national importance as declared by the Department of Livestock should also be notified to the concerned veterinary authorities for immediate response and actions. As per the Livestock Rules and Regulations (LRR) of Bhutan 2017, the notifiable animal diseases in Bhutan comprise 18 non-zoonotic and 19 zoonotic animal diseases.

In this report, considering the small geographical area and the epidemiolocal relationships shared by the animals/herds in the sub-district, locally known as Gewog, an outbreak is

defined as an occurrence of one or more confirmed disease-specific cases in a gewog within a month's period.

The report presents a brief descriptive analysis of the reported notifiable animal diseases during the calendar year 2020, January to December, and the trend of outbreaks since 1996. The data used for analyses in this report were retrieved from the Veterinary Information System, 1996 to 2010; the online Transboundary Animal Disease Information System (TADinfo), 2011-2020; and the real-time disease outbreak information 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 from the field.

During the fiscal year 2022 – 2023, as shown the following table, outbreak of 9 different notifiable diseases were reported affecting swine, avian, bovine, canine and caprine species.

Table 18: Notifiable diseases and species affected, 2022 – 2023

S.N	Disease Name	Species Affected
1	African Swine Fever (ASF)	Swine
2	Avian Leucosis Complex (ALC)	Avian
3	Black Quarter (BQ)	Bovine
4	Hemorrhagic Septicaemia (HS)	Bovine
5	Highly Pathogenic Avian Influenza (HPAI)	Avian
6	Infectious Bursal Disease (IBD)	Avian
7	Lumpy Skin Disease (LSD	Bovine
8	Newcastle Disease (ND)	Avian
9	Rabies	Canine, Caprine, Bovine

Table 19: Dzongkhag and disease-specific no. of outbreaks, 2022 – 2023

S.N	Dzongkhag Name	ASF	ALC	BQ	HS	HPAI	IBD	LSD	ND	Rabies	Total
1	Chhukha	1		1			1	7		3	13
2	Dagana	2						15		2	19
3	Haa				1			5			6
4	Lhuentse							3			3
5	Monggar							9			9
6	Paro			1			1	12			14
7	Pema Gatshel							13		1	14
8	Punakha			2				9			11
9	Samdrup Jongkhar	2						8	1	3	14
10	Samtse	1						14		1	16
11	Sarpang	9					1	11		3	24
12	Thimphu						1	4			5
13	Trashigang			1				8			9
14	Trongsa							6			6
15	Tsirang		1				1	15			17
16	Wangdue Phodrang				1			8			9
17	Zhemgang							6			6

Grand Total	15	1	5	2	5	153	1	13	195

As shown in table above, except for Bumthang, Gasa and Trashi Yangtse, all the Dzongkhags have reported at least one outbreak of notifiable diseases during the FY 2022 – 2023.

Sarpang reported the highest no. of outbreaks (n=24), followed by Dagana (n=19), Tsirang (n=17), Samtse (n=16) and others.

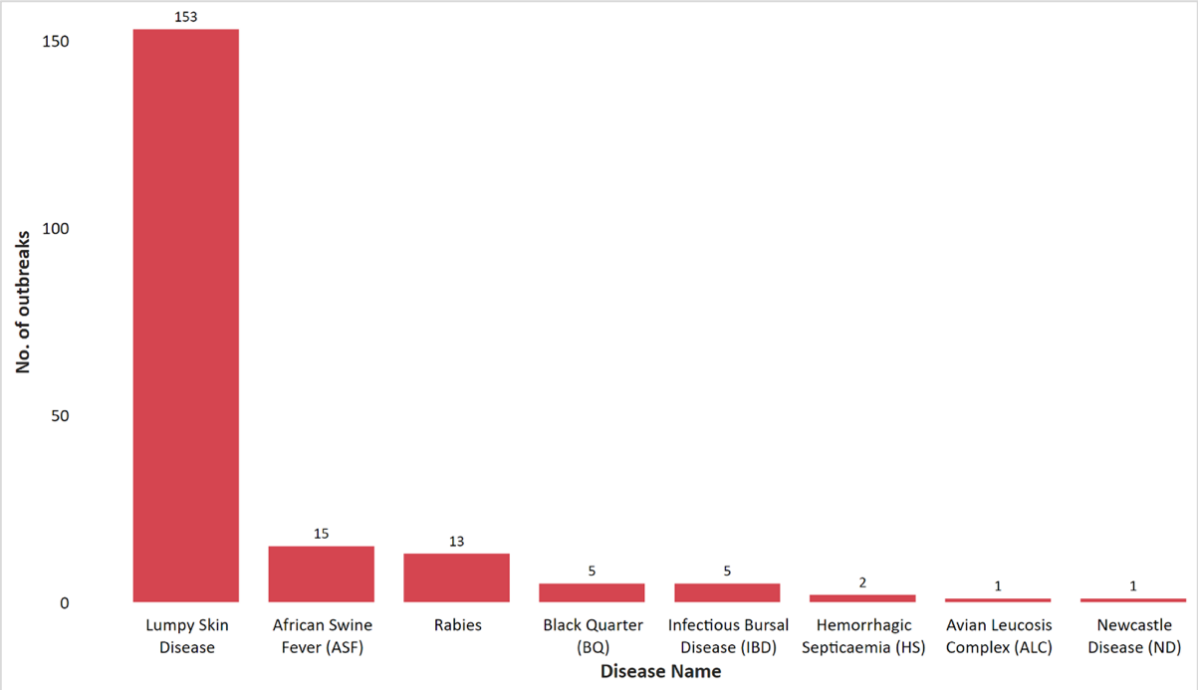


Figure 08: Disease-specific no. of outbreaks, 2022 – 2023

Lumpy skin diseases (n=153), African swine fever (n=15) and Rabies (n=13) were the major diseases reported.

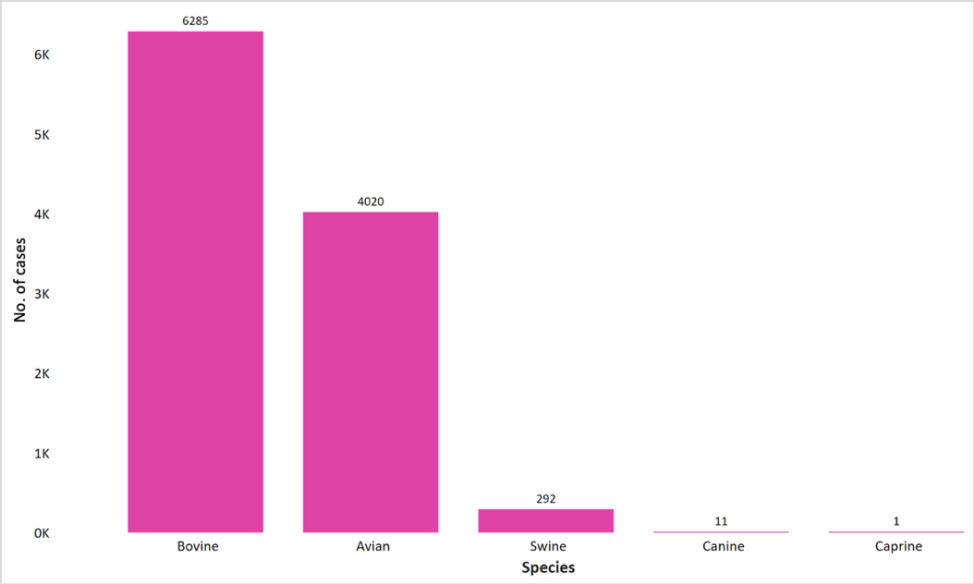
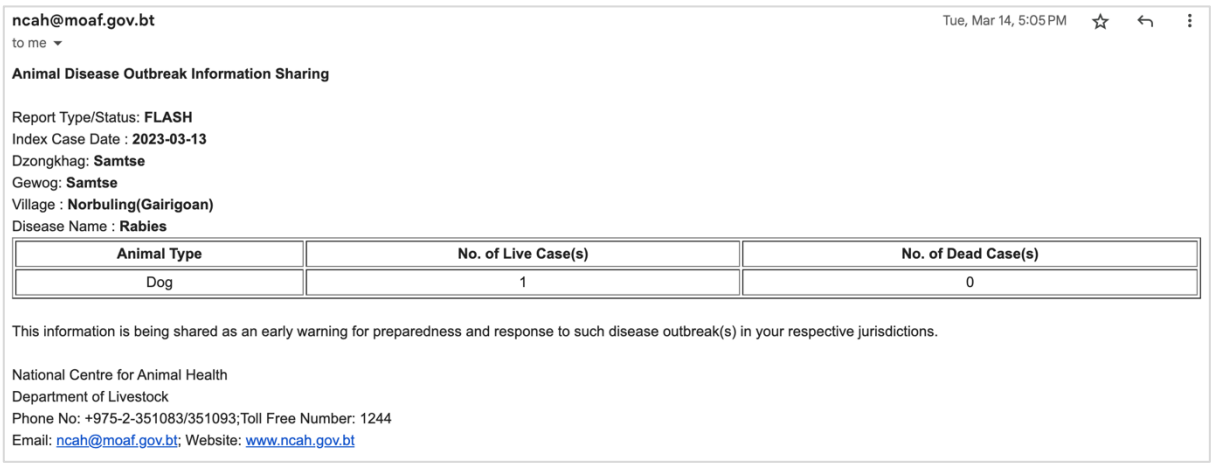


Figure 09: Species-specific cases reported, 2022 – 2023

4.4.2. Animal disease outbreak information sharing

To keep the field professionals and relevant stakeholders updated about the animal disease situations in the country, the Centre shares animal disease outbreak information on a real-time basis on the official website under the section of Disease Outbreaks. The Centre also shares disease outbreak information through emails linked to the Veterinary Information System (VIS) to relevant officials.



ncah@moaf.gov.bt Tue, Mar 14, 5:05 PM

to me

Animal Disease Outbreak Information Sharing

Report Type/Status: **FLASH**
Index Case Date : **2023-03-13**
Dzongkhag: **Samtse**
Gewog: **Samtse**
Village : **Norbuling(Gairigoan)**
Disease Name : **Rabies**

Animal Type	No. of Live Case(s)	No. of Dead Case(s)
Dog	1	0

This information is being shared as an early warning for preparedness and response to such disease outbreak(s) in your respective jurisdictions.

National Centre for Animal Health
Department of Livestock
Phone No: +975-2-351083/351093;Toll Free Number: 1244
Email: ncah@moaf.gov.bt; Website: www.ncah.gov.bt

Figure 10: Disease outbreak information sharing through automated email linked to VIS

Figure 11: Disease outbreak and related information sharing on the web page

As an OIE member country, the Centre, on behalf of the country's delegate to the World Organization for Animal Health (OIE), notifies OIE regarding the outbreak of OIE-listed diseases. During the fiscal year 2022 – 2023, immediate notifications were sent during the reported outbreaks of African swine fever and highly pathogenic avian influenza (HPAI) in the country. As required, two six-monthly reports were also submitted to the OIE sharing information about all the OIE-listed disease outbreaks recorded in the country during the reporting period.

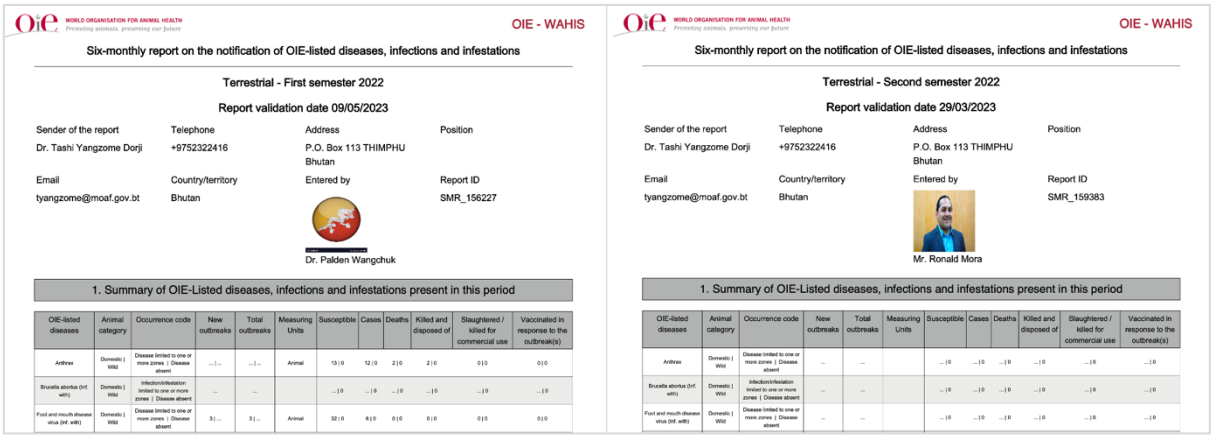


Figure 12: Six-monthly reporting to WOAH

4.5. Response to major animal disease outbreaks in the country

The DPCU, LSU and other technical units of the NCAH, in collaboration with the RLDC, RVH&EC, Dzongkhag Livestock Sectors, and other relevant stakeholders, coordinated

outbreak investigation and containment of some major animal disease outbreaks reported in the country.

Following are the list of notifiable and emerging diseases reported in the country during the FY 2022 – 2023, and intervened by the Centre in various capacities to timely control and prevent the further spread into other parts of the country:

- African Swine Fever (ASF)
- Avian Leucosis Complex (ALC)
- Black Quarter (BQ)
- Haemorrhagic Septicaemia (HS)
- Highly Pathogenic Avian Influenza (HPAI)
- Infectious Bursal Disease (IBD)
- Lumpy Skin Disease (LSD)
- Newcastle Disease (ND)
- Rabies

In terms of scale, socio-economic impact and zoonotic importance of the disease outbreaks, and the intensity of response measures implemented, ASF, HPAI and LSD were the major disease outbreaks reported in the country during the fiscal year.

4.5.1. African Swine Fever

15 ASF outbreaks were reported and NCAH, under the guidance of AHD, DoL, coordinated the implementation of response measures through operation of Incident Operation Centres (IOC) in all the outbreak areas. Nu. 11.4 million was spent in responding to the outbreaks as listed in the following table.

Table 20: ASF outbreaks reported

Outbreak Date	Dzongkhag	Gewog	Village/Farm	No. of cases (including deaths)	No. of pigs culled
6-Nov-2022	Samdrup Jongkhar	Pemathang	Luminang	4	4
20-Nov-2022	Samdrup Jongkhar	Dewathang	Gayzor	15	4
2-Dec-2022	Samdrup Jongkhar	Phuentshothang	Minjegang	20	18
29-Nov-2022	Sarpang	Gelephu	Choekorling, Namkhaling, Pelrithang Khatoed, Pemathang	70	161
3-Dec-2022	Sarpang	Samtenling	Lekithang	5	15
13-Dec-2022	Sarpang	Dekiling	Dekiling	24	59
5-Jan-2023	Sarpang	Samtenling	Chhoekhorling	24	101
24-Jan-2023	Samtse	Tading	Sherubling, Tobchenthang	48	101
25-Feb-2023	Dagana	Lhamoidzingkha	Doragaon	11	11
29-Mar-2023	Sarpang	Chhuzangang	Dawathang	13	8

6-Apr-2023	Sarpang	Gelephu Throm	NDCA	10	23
10-Apr-2023	Sarpang	Gelephu Throm	NPiDC	20	655
14-Apr-2023	Chhukha	Samphelling	Phurbaling	3	10
21-Apr-2023	Sarpang	Shompangkha	Dargaythang	9	144
25-Apr-2023	Sarpang	Singye	Shariphu	4	51
25-Apr-2023	Sarpang	Samtenling	Samtenthang, Dumidara	10	34
28-Apr-2023	Dagana	Lhamoidzingkha	Majigaon	6	7
Total				296	1406

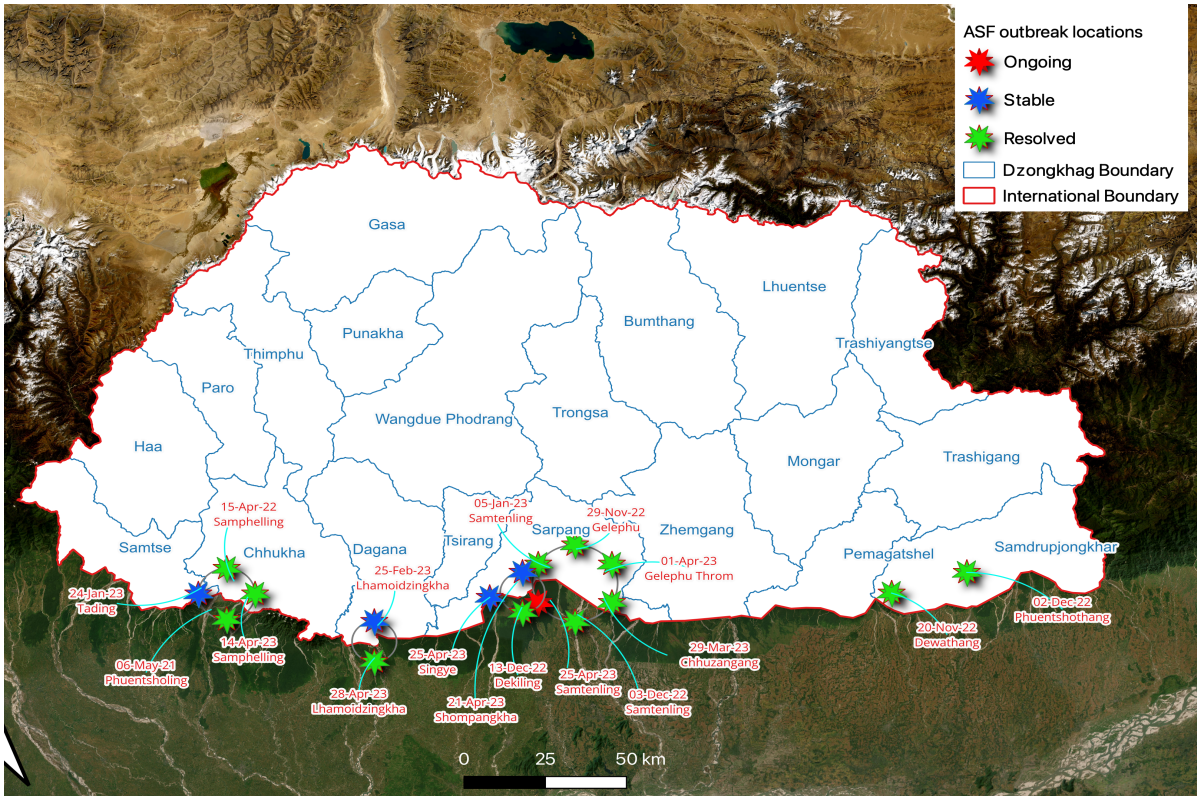


Figure 13: Map showing ASF outbreak locations

Since all the outbreaks were reported from the areas located close to Indo-Bhutan border as shown in the following figure, awareness and education campaign for pig farmers were held between 14 – 29 January 2023. The Centre held a coordination with regional and dzongkhag offices first, followed by virtual raining of resource personnel and implementation in the target areas.

40 resource persons conducted the awareness and education campaign in 66 gewogs of 8 dzongkhags as shown in the following figure. A total of 2294 pig-rearing farmers and local government leaders attended the program. Total budget of Nu. 507,272 was spent for this activity.

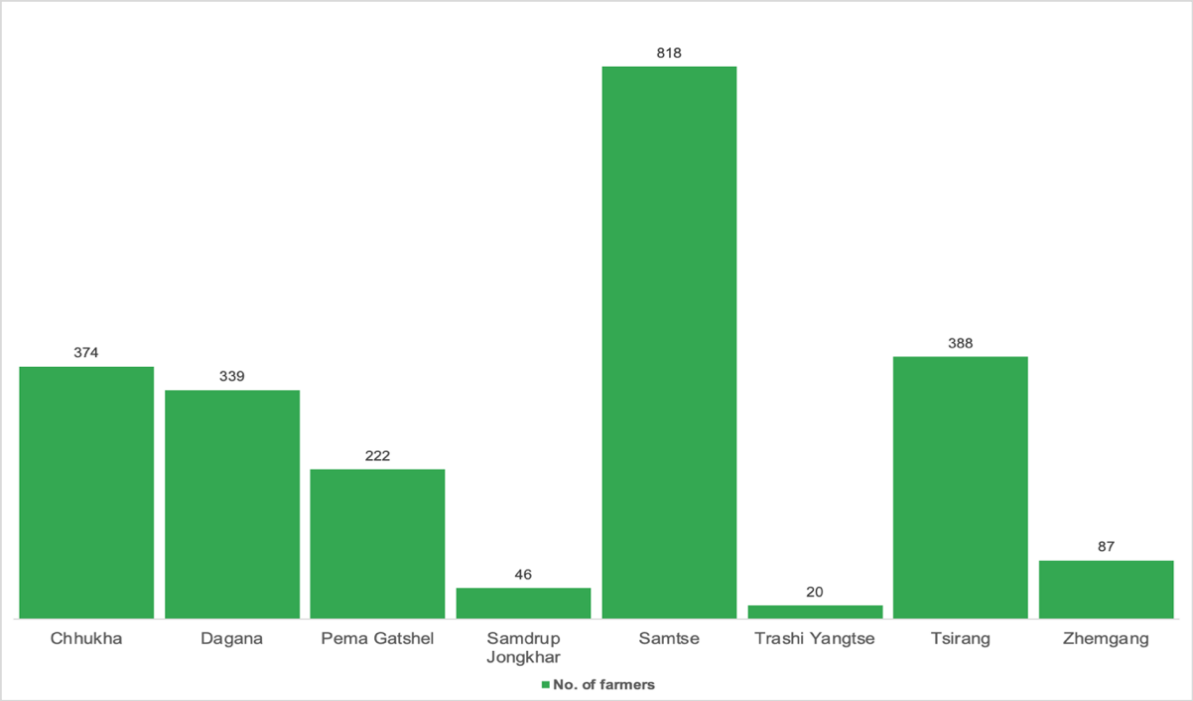


Figure 14: ASF awareness and education program and coverage

Figure 15: ASF awareness and education program field pictures

4.5.2. Highly Pathogenic Avian Influenza

Figure 16: A one-health approach: IOC members comprising officials from DoL, MoH, BFDA, DoFPS, RBP and LG

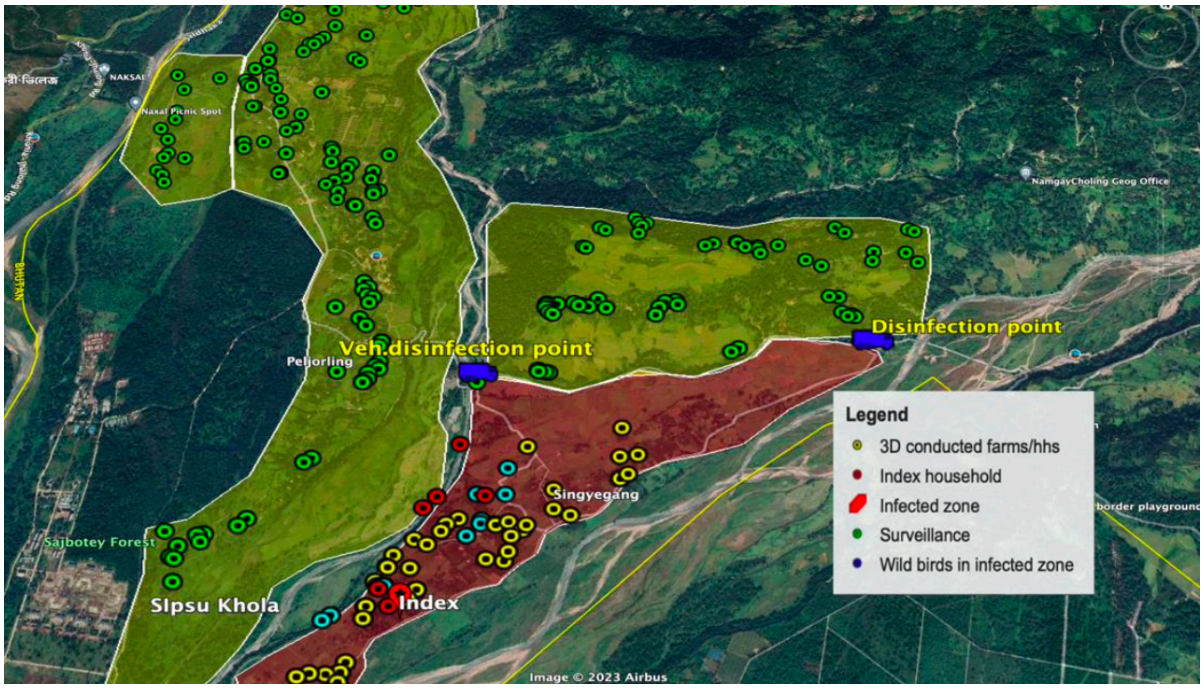


Figure 17: Risk assessment and zonation conducted by the IOC

Following confirmation of highly pathogenic avian influenza (HPAI) H5N1 outbreak in free ranging local poultry and wild birds at Singaygang under Tashicholing Geog, Samtse on 12 March 2023, the Centre, under the guidance of AHD, DoL and in line with the National Influenza Pandemic Preparedness Plan and SOPs 2020, coordinated NICC convention

following which the Incident Operation Centre was established, led by RVH&EC, Phuentsholing, and implemented the required response measures.

A total of 40 number of poultry birds died due to H5N1 and some carcasses of (wild birds) Oriental pied hornbill, red jungle fowl, Blue whistling thrush & Laughing thrush were spotted. 2,831 poultry birds and 13 Red jungle fowls were culled and disposed along with 144 chicken eggs and 13 Red Jungle fowl eggs. Ngultrum 2.3 million was incurred for the implementation of the outbreak containment, including compensation for poultry birds culled and feed disposed.

4.5.3. Lumpy Skin Disease

A wave of LSD outbreaks has been reported in the country starting from January and no. of cases increasing rapidly since March and April with the increase in ambient temperature and fly activity.

17 Dzongkhags were affected by LSD outbreaks between January and June 2023. Samtse reported highest no. of clinical cases (n=1076) and Sarpang reported the highest no. of dead cases (n=135).

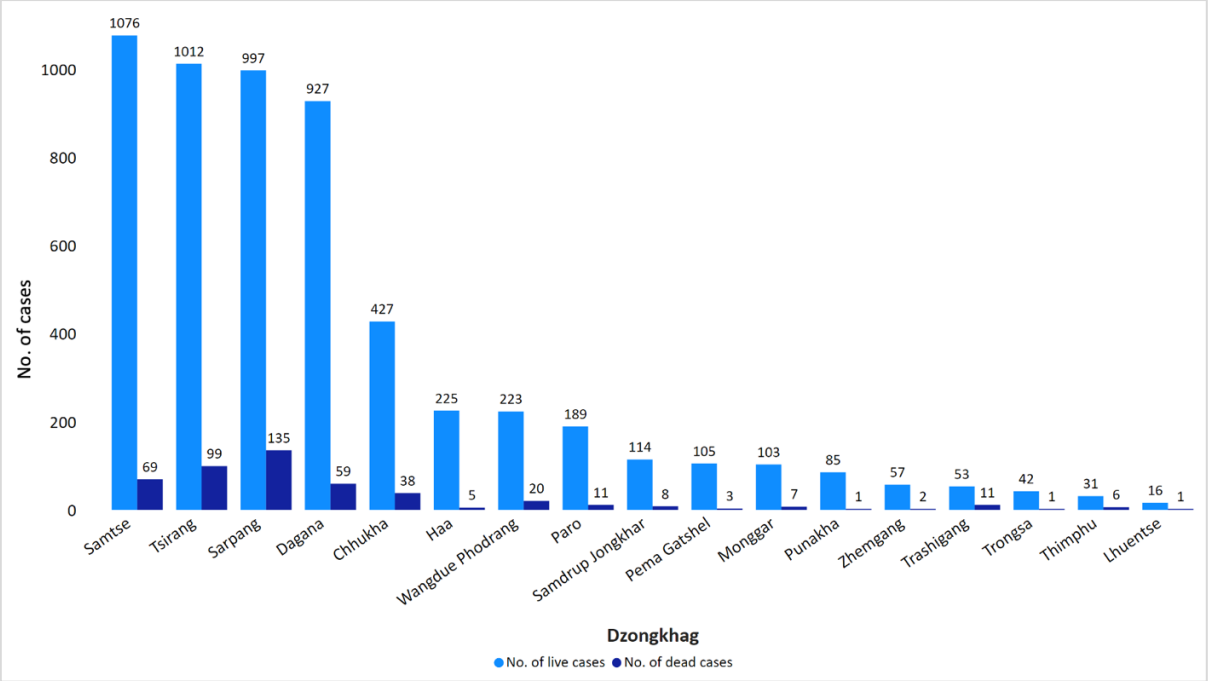


Figure 18: LSD outbreak status, FY 2022-2023

In response to these outbreaks, the Centre sent out various advisory to manage the outbreak and cases and arranged to distribute emergency medicines for the symptomatic treatment of cases.

4.6. National Highland Development Program

4.6.1. Procurement and distribution of medicines

4.6.1.1. Deworming medicines

Deworming medicines requirement for highland gewogs were calculated based on the population of young yaks and yak watchdogs of 2021 as submitted in their annual reports.

A total of 200 jars of praziquantel tablets, for deworming of yak watchdogs, were procured and distributed to 18 highland gewogs as shown in the following table.

Table 21: Praziquantel tablets procured and distributed

S.N.	Gewog	No. of yak watchdogs	Total Praziquantel Jars	Total Cost (Nu.)
1	Bji	46	9	945
2	Boomdeling	10	2	210
3	Chhoekhor	59	12	1260
4	Dakarla	42	8	840
5	Doteng	8	2	210
6	Gangteng	0	0	0
7	Kar-tshog	32	6	630
8	Kazhi	0	0	0
9	Khoma	7	1	105
10	Laya	114	23	2415
11	Lingzhi	117	23	2415
12	Lunana	31	6	630
13	Merag	58	12	1260
14	Naro	43	9	945
15	Nubi	4	1	105
16	Phobji	0	0	0
17	Saephu	19	4	420
18	Sagteng	199	40	4200
19	Soe	46	9	945
20	Tsento	26	5	525
21	Uesu	14	3	315
22	Additional	125	25	2625
Total		1000	200	21000

For deworming of 15,528 young yaks of less than 3 yrs of age, a total of 12,942 strips of albendazole tablets were procured and distributed to 21 gewogs as shown in the following table.

Table 22: Albendazole tablets procured and distributed

S.N.	Gewog	No. of young yaks	Total Albendazole Strips	Total cost (Nu.)
1	Bji	517	431	9482
2	Boomdeling	148	123	2706
3	Chhoekhor	992	827	18194

4	Dakarla	1845	1538	33836
5	Doteng	117	98	2156
6	Gangteng	69	58	1276
7	Kar-tshog	434	362	7964
8	Kazhi	668	557	12254
9	Khoma	134	112	2464
10	Laya	903	753	16566
11	Lingzhi	1012	843	18546
12	Lunana	1264	1053	23166
13	Merag	1438	1198	26356
14	Naro	833	694	15268
15	Nubi	143	119	2618
16	Phobji	106	88	1936
17	Saephu	764	637	14014
18	Sagteng	1134	945	20790
19	Soe	366	305	6710
20	Tsento	1464	1220	26840
21	Uesu	177	148	3256
22	Additional	1000	833	18326
Total		15528	12942	284724

4.6.1.2. Other medicines

With the report of gastrointestinal and external parasites infestation in yaks from the highland gewog extension offices, prophylaxis and treatment medicines of worth Nu. 193810.00 were procured as described in the following table.

Table 23: Additional medicines procured

S.N.	Generic Name	Composition/ Strength	Presentation	Unit	Quantity	Rate	Total Cost (Nu.)
1	Levamisole + Oxyclozanide susp.	Levamisole 3.0% + Oxyclozanide 6% w/v	1L Jar	Jar	217	550	119,350
2	Flumethrin 1% pour-on solution	1%	100ml bottle	Bottle	510	146	74,460
Total (Nu.)							193,810

4.6.2. Awareness and education

4.6.2.1. Laya

Following activities were implemented during the visit by a technical team comprising officials from NCAH, Serbithang; NHDC, erstwhile NHRDC, Bumthang; and LEC, Laya:

- Sample collection: 30 serum and 40 fecal samples from yaks.
- Demonstration of deworming of young yaks (80 yaks dewormed) and yak watchdogs.

- Dispensing of albendazole for yaks and praziquantel for watchdogs for one year.
- Raised awareness among the yak herders on gid and other important yak diseases including algae poisoning, hypodermosis and pyrollizidine poisoning.

Figure 19: Prophylaxis for Hypodermosis and information recording

4.6.3. Merag, Sakteng and Saephu

Figure 20: Awareness program in Merag and Sakteng

Following a proposal from the gewog in-charge of Merag and Sakteng requesting for support to conduct advocacy and surveillance program for gid and other yak diseases, a technical team comprising officials from NHDC, Wangdue; NCAH, Serbithang; and RLDC, Kanglung visited these gewogs and implemented the following activities:

- Awareness and education program on gid and priority highland animal diseases was attended 227 yak herders and 19 local government.
- Demonstration of deworming of young yak deworming and yak watchdogs, including explanation on deworming schedule and their importance.
- Blood and fecal sample collection from yaks and watchdogs

4.6.3.1. Dakarla

A team comprising officials from NCAH and DLS, Thimphu visited the gewog and implemented the following activities:

- Conducted awareness on gid and other important yak diseases. The program was attended by 30 yak herders in two batches.
- Deworming medicines for young yaks and yak watchdogs were dispensed.
- For priority yak disease screening, 30 blood samples were collected. 15 fecal samples from yaks and 2 fecal samples from yak watchdogs were collected to examine for Taeniids and other gastrointestinal parasites.
- Syndromic surveillance was conducted to validate the absence of gid in the gewog as reported during the annual reporting for 2021 and 2022. No active clinical case of gid was encountered.

Figure 21: Awareness program for yak herders of Dakarla

4.6.3.2. National Integrated Yak Farm, Haa

A technical team comprising officials from NHDC, NCAH and DLS, Haa visited to yak farm in Chanaphu, Bji, Haa and implemented the following activities:

- Advocacy on prevention and control of gid and other important yak diseases in the farm.
- Sample collection from yaks and watchdog for screening of important highland diseases: blood sample from 15 yaks and fecal samples from 30 yaks and one yak watchdog were collected and shipped to NCAH for testing.

Figure 22: Integrated yak farm, Chanaphu, Haa

4.7. Veterinary Clinical Services

In supplementation to the veterinary clinical services provided by Dzongkhag Veterinary Hospital (DVH), Thimphu, and the 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.

The table below shows the details regarding veterinary clinical services rendered by the Centre during the FY 2022 – 2023.

Table 24: Veterinary clinical services rendered

S.N	Service Type	No. of animals	Species/ Animal Type	Remarks
1	Vaccination	32	Dogs and Sheep	HS-BQ, ARV and DHPPi+L
2	Sterilization	13	Cats, Dogs and Pigs	Open method
3	Treatment	645	Cattle, Dogs, Poultry, Cats	
4	Deworming	18	Cats and Dogs	

4.8. Compilation of major annual reports

4.8.1. Annual Status of Gid in Yaks in Bhutan, 2022

Coenurosis, commonly known in Bhutan as **GID**, is caused by the larval stage, *Coenurus cerebralis*, of *Taenia multiceps*, a dog tapeworm. The adult form of the parasite is found in the intestines of carnivores (definitive host), especially dogs, while the larval stage, which causes coenurosis, is found in herbivores (intermediate host) that have ingested eggs or gravid proglottids of *T. multiceps*. *Coenurus cerebralis* forms bladder-like cysts in the central nervous system and they are mostly seen in the midportion of the cerebral cortex. Around the world, this disease is a common cause of neurological disease in young sheep. In Bhutan, among livestock diseases, gid is one of the primary causes of mortality in young yaks, and it's

considered a priority livestock disease with a potential threat to the livelihood of highlanders in the country.

This report presents a descriptive analysis of the situation of gid in yaks in the country reported during the calendar year 2022. In addition, the report describes the distribution of yak-rearing households, gid susceptible yak population and yak watchdogs in the country, and the prevention and control measures implemented as prescribed in the National Gid Prevention, Control and Elimination Plan for Bhutan, 2021. To assess the progress made thus far concerning prevention and control of gid in the highland areas of the country, gid prevalence data are presented in comparison with the baseline gid prevalence established in 2020 and 2021 as reported by the field offices.

The following table presents a summary of the status of gid in yaks in Bhutan, associated risk factors and the prevention and control measures implemented in the field.

Table 25: Summary of annual gid report

Parameters	Value
Total no. of households rearing yaks	658
Total no. of adult yaks	21345
Total no. of young yaks (susceptible to gid)	15173
Total no. of yaks (young + adult)	36518
Total no. of live gid cases	210
Total no.of yaks died of gid	489
Total no. of yaks affected of gid (live + dead)	699
Total no. of yak watchdogs	740
Total no. of young yaks dewormed	17405
Total no. of yak watchdogs dewormed	695
Average prevalence of gid in yaks	4.61%
Average case fatality rate (apparent)	69.96%
Deworming coverage in yak watchdogs	93.92%

Over the past two years, a remarkable decline in the occurrence of gid among yaks in the highland areas of the country has been accomplished through the effective implementation of diverse prevention and control measures outlined in the National Gid Prevention and Control Plan 2021. The initial nationwide survey conducted in all highland districts and sub-districts of the country in 2020 revealed a baseline national gid prevalence of 14.31 percent.

However, with the dedicated efforts and strategies employed, the prevalence of the disease witnessed a substantial decrease to 5.89 percent in 2021. This positive trend continued, albeit with a slight decline, resulting in a further reduction to 4.61 percent in 2022. These outcomes serve as a testament to the efficacy and success of the implemented measures in combating gid and safeguarding the health of yaks in the highland regions.

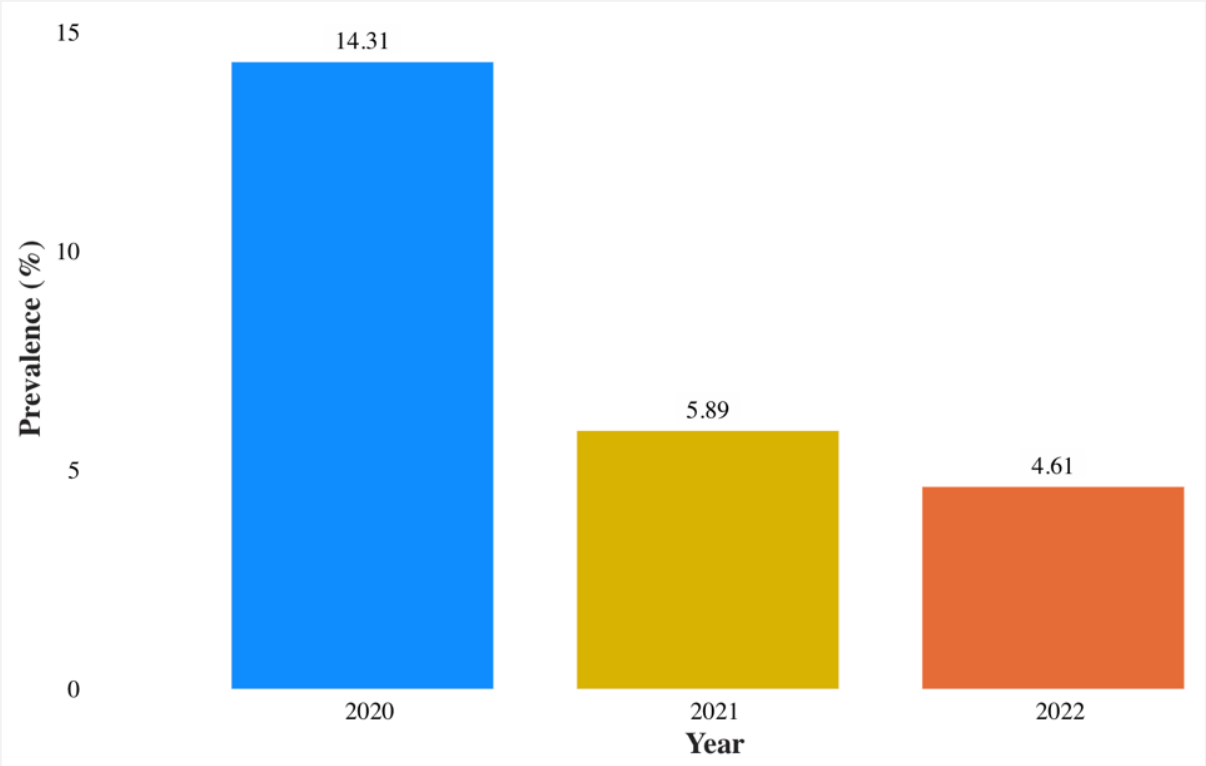


Figure 23: National prevalence of gid in yaks in Bhutan: 2020, 2021 and 2022

At the regional level, a reduction in the prevalence rate was observed in West-Central, West and East-Central region, however, increase in prevalence from 0.32 % in 2021 to 1.88 % in the East region was reported in the calendar year 2022.

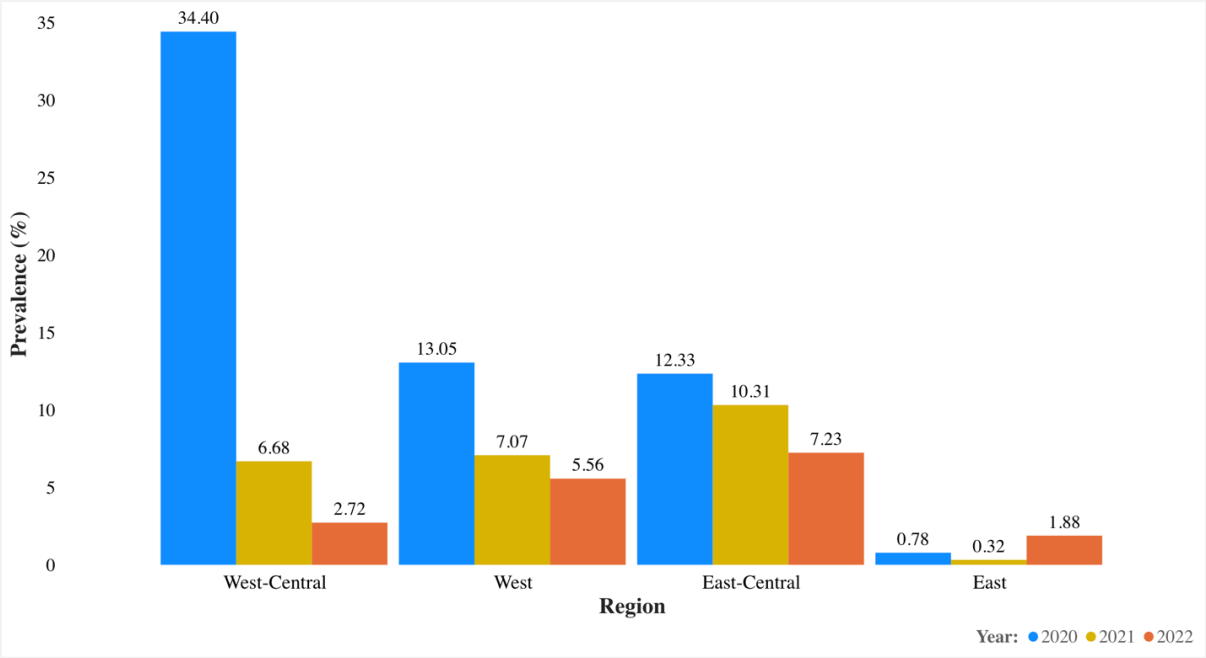


Figure 24: Regional prevalence of gid in yaks in Bhutan: 2020, 2021 and 2022

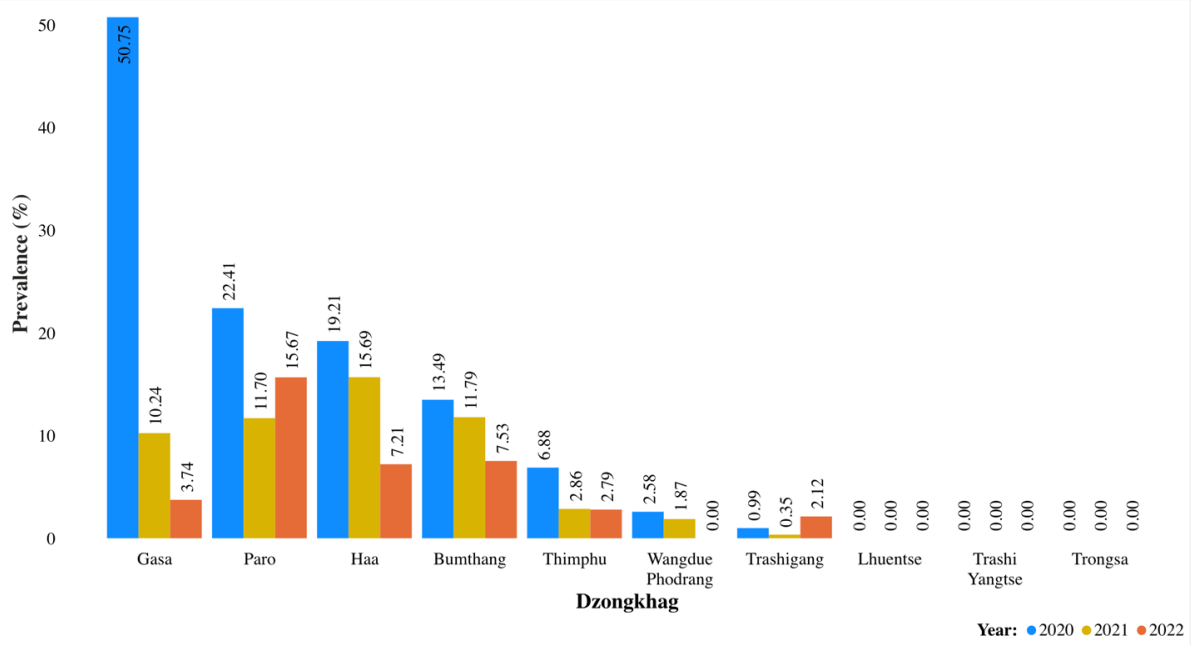


Figure 25: Dzongkhag-specific prevalence of gid in yaks in Bhutan: 2020, 2021 and 2022

In comparison to 2021, in 2022, all the highland dzongkhags such as Gasa, Haa, Bumthang, Thimphu and Wangdue Phodrang observed a decline in the prevalence of the disease at different rates; however, Paro and Trashigang reported a rise of gid prevalence. A significant reduction in gid prevalence was observed in Gasa dzongkhag, from 10.24 per cent in 2021 to 3.74 per cent in 2022. Wangdue Phodrang reported zero gid case in 2022.

Lhuentse, Trashiyangtse and Trongsa were the districts with no gid cases reported in 2020 and 2021. These districts could successfully maintain the status quo regarding the prevalence of gid in yaks in their respective jurisdictions over the past 12 months of the calendar year 2022 through the implementation of preventive measures in line with the National Gid Prevention, Control and Elimination Plan 2021.

At the gewog level, most of the gewogs achieved a reduction in gid prevalence in 2022, as compared to the prevalence recorded in 2021.

Lunana, Laya, Bji, Doteng, Lingzhi, Chhoekhor, Kar-tshog and Saephu were the gewogs which reported reduction in gid prevalence in 2022 in comparison to the previous year. Saephu gewog reported zero gid cases from a prevalence of 3.93 per cent in 2021.

Tsento (14.38 %), Soe (4.60 %), Sakteng (15.79 %) and Merag (1.94 %) reported increase in prevalence.

In 2022, Boomdeling, Gangteng, Khoma, Nubi and Phobji could maintain the status of zero per cent gid prevalence as reported in 2020. In addition, from the gid prevalent gewogs as reported in 2021, Kazhi reported no gid cases during the calendar year 2022, thus entering the group of gid non-prevalent highland gewogs of the country.

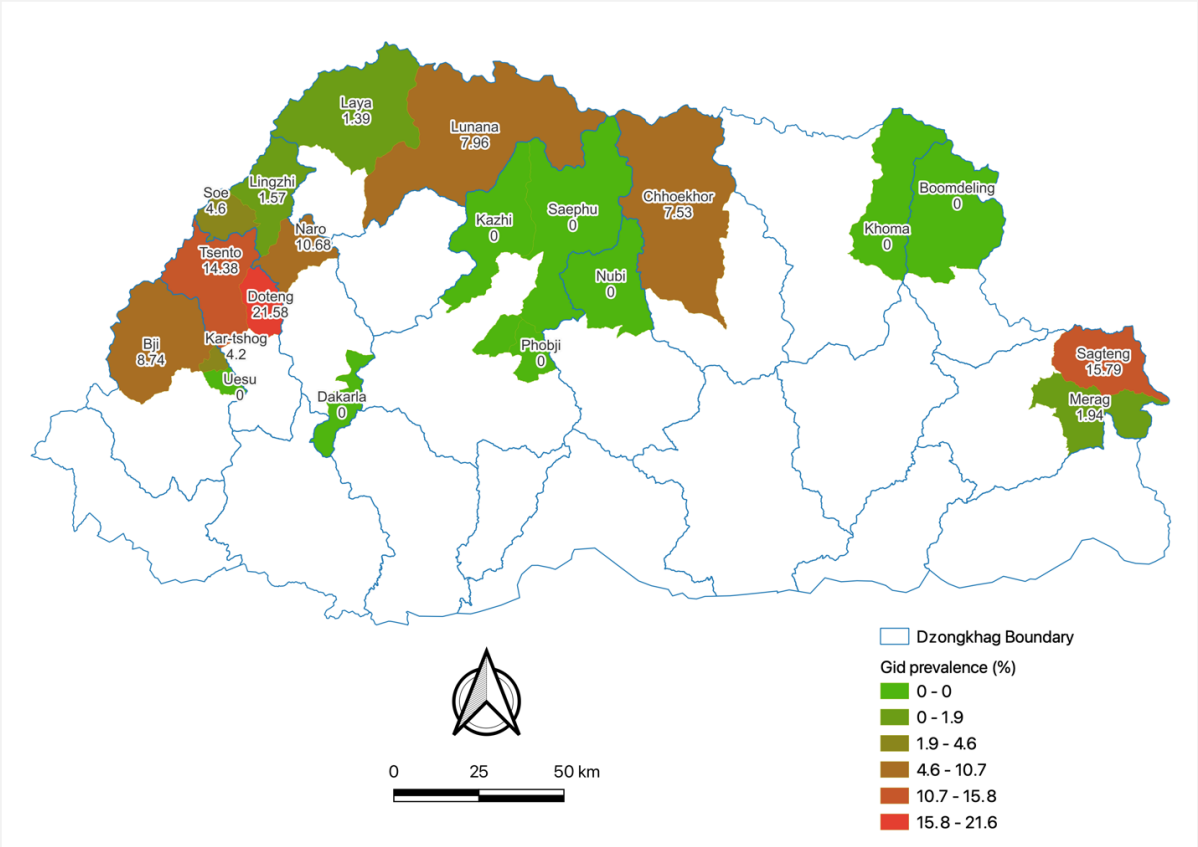


Figure 26: Map showing gewog-specific distribution of gid prevalence in Bhutan, 2022

4.8.2. Veterinary Clinical Case Profile of Bhutan, 2016 – 2022

This report presents a visual description of veterinary clinical cases attended and recorded in veterinary hospitals, government farms and gewog extension centres spread across 20 dzongkhags (district) and 205 gewogs (sub-district). It describes the spatial and temporal distribution of clinical cases; top ten clinical conditions; and species-specific distribution of cases recorded between July 2016 and December 2021. The data used for analyses and visualization were retrieved from the Veterinary Information System (VIS), the online animal health database management system of Bhutan to record data concerning various animal health services delivered: clinical cases, deworming, vaccination and sterilization.

Data extraction, analyses and visualization were based on the geographical jurisdictions; it is presented as the national and dzongkhag-specific status of clinical cases recorded in the respective jurisdictions.

For this report, different animal types were grouped; thus, categorized into six animal types: large ruminant, small ruminant, pet animal, horse, pig and poultry. Large ruminants comprise cattle, yak and buffalo, small ruminants comprise sheep and goat; pet animals comprise dog and cat, and poultry comprises chicken and turkey.

A total of 8,916,627 livestock clinical cases were attended in the country, poultry constituting to 73.9 % of the total followed by large ruminants (20.68%), pet animals, pigs, small ruminants and horses. Diarrhoea/Enteritis is the most commonly reported cases. August month reported the highest no. of cases, followed by July, September and others.

Dzongkhag-wise distribution of species-specific clinical cases, 2016-2022

Dzongkhag	Large Ruminants	Small Ruminants	Horse	Poultry	Pig	Pet Animals	Total cases
Bumthang	52999	7121	1061	36915	10	1487	99593
Chhukha	87029	7160	185	177404	5333	28805	305916
Dagana	62711	8080	151	128584	10229	3226	212981
Gasa	26588	6	5665	8255	0	1856	42370
Haa	40786	1	1300	145601	111	1418	189217
Lhuentse	47465	82	946	18997	408	1328	69226
Monggar	124153	303	525	346973	15512	9067	496533
Paro	151564	7	2128	299235	3814	21926	478674
Pema Gatshel	51985	27	418	55608	1548	3661	113247
Punakha	87342	780	1958	211584	2093	10899	314656
Samdrup Jongkhar	134130	2912	649	42835	3120	6458	190104
Samtse	180068	29193	238	891867	16452	12947	1130765
Sarpang	116361	4371	264	1016393	58052	12066	1207507
Thimphu	78929	95	8045	391529	15329	42930	536857
Trashi Yangtse	41884	92	986	19222	181	1494	63859
Trashigang	147277	396	443	93519	4895	4789	251319
Trongsa	106592	47	164	50656	61	3745	161265
Tsirang	99486	16926	63	2444795	45174	6932	2613376
Wangdue Phodrang	150196	4892	804	119409	4443	8433	288177
Zhemgang	55987	131	717	90189	2499	1462	150985
Total cases	**1843532**	**82622**	**26710**	**6589570**	**189264**	**184929**	**8916627**

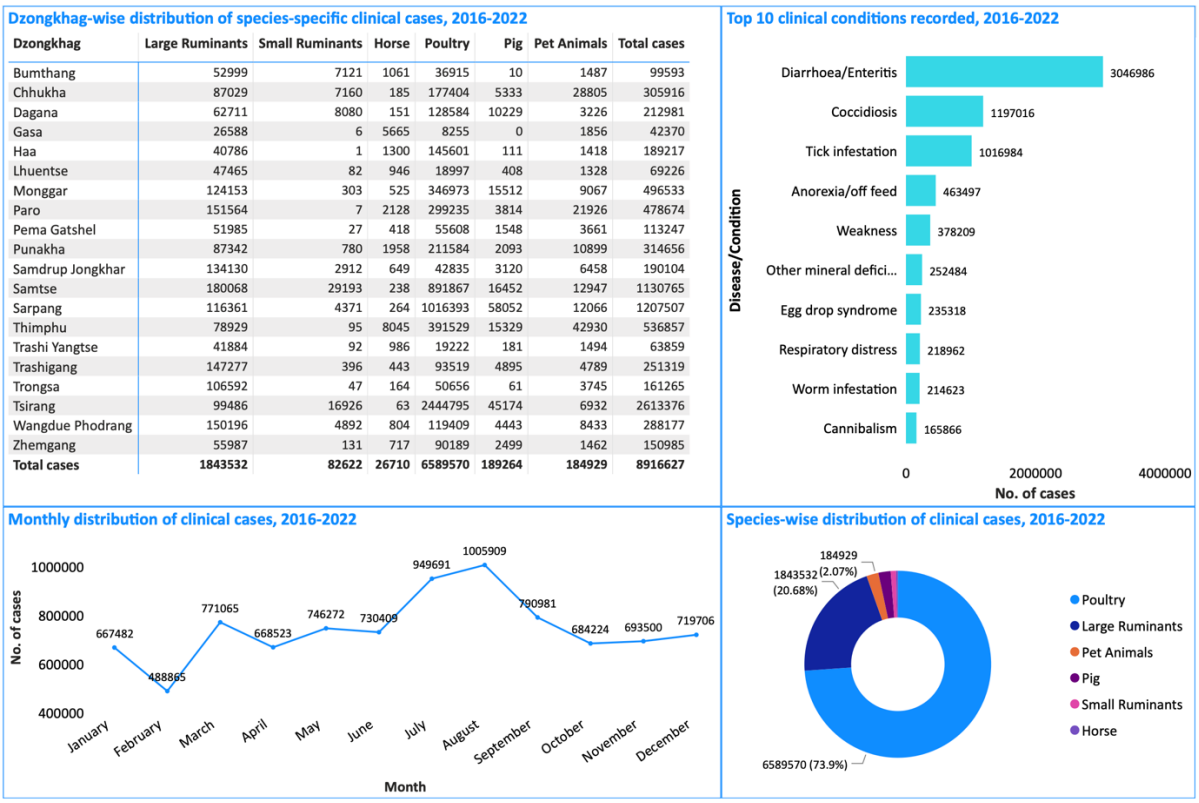


Figure 27: Veterinary clinical case profile, 2016 – 2022

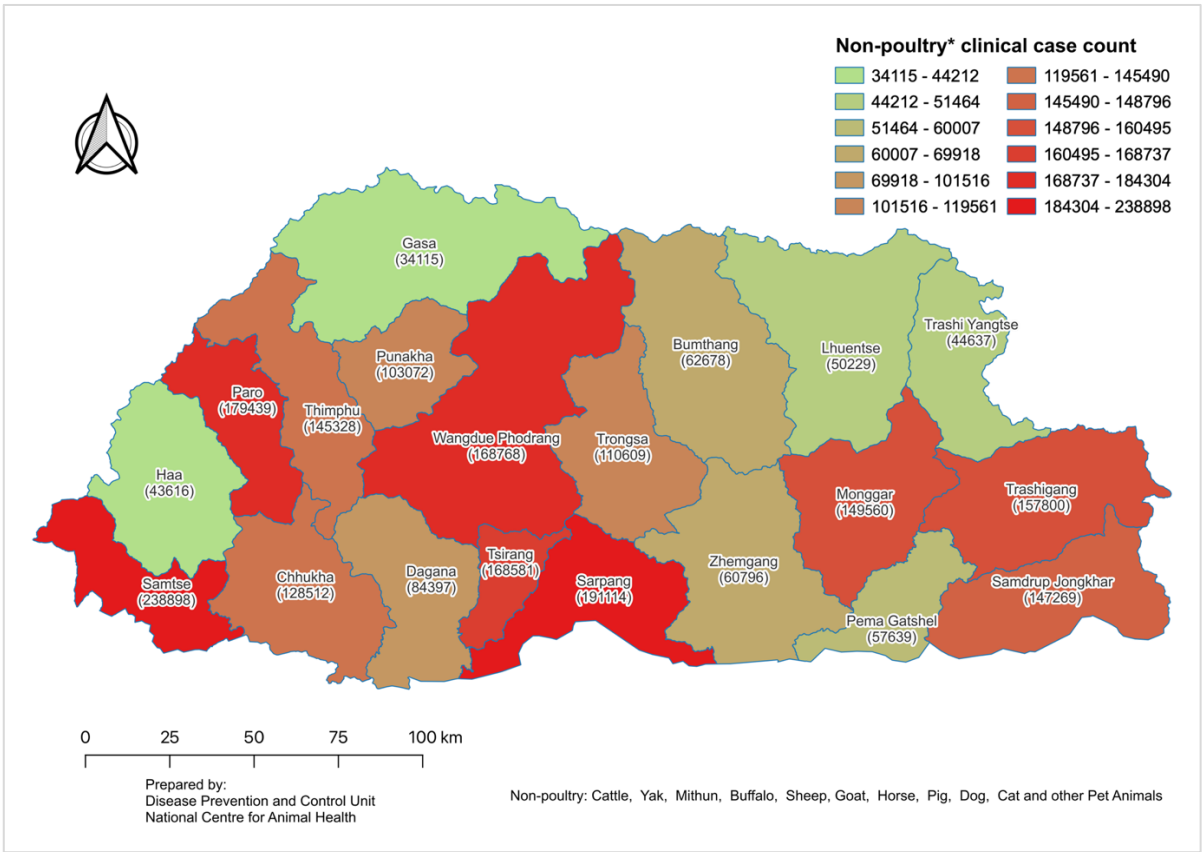


Figure 28: Non-poultry clinical cases attended

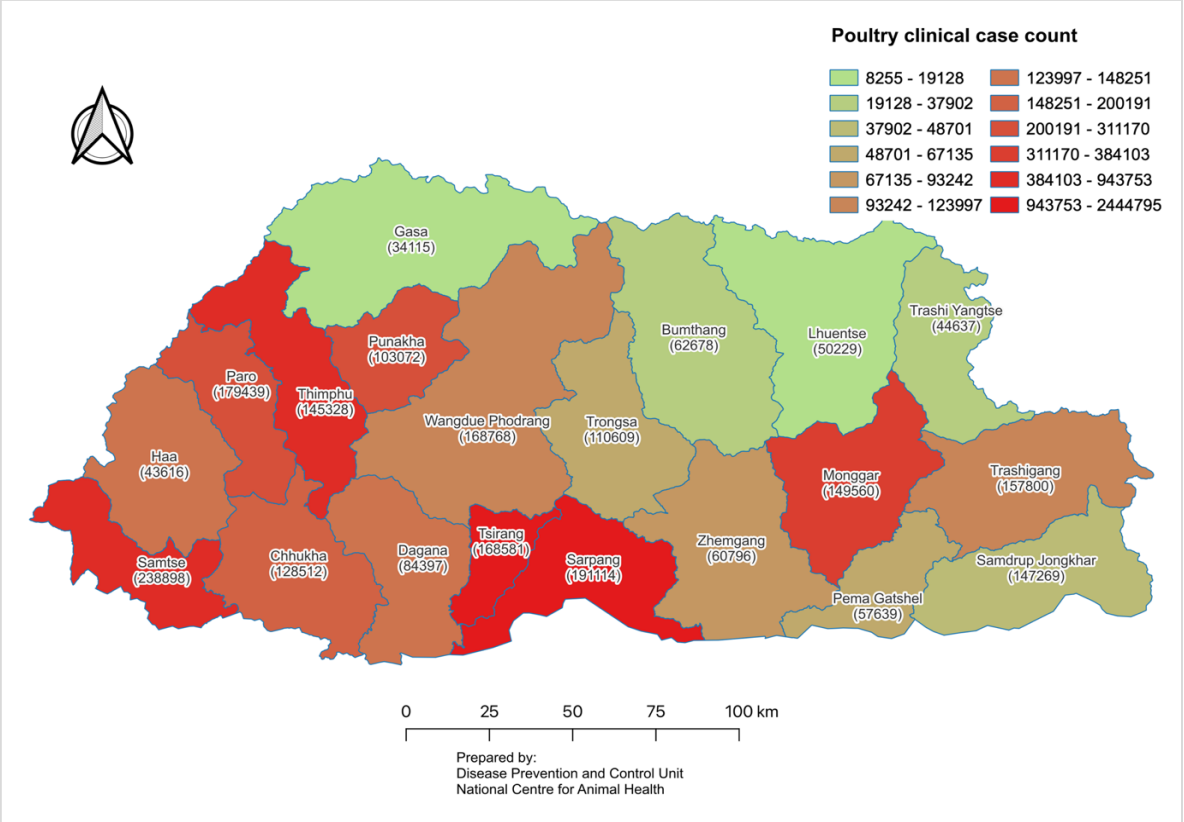


Figure 29: Poultry clinical cases attended

4.9. Monitoring and assessment of livestock vaccination

At the forefront of preventing and managing a spectrum of livestock diseases, particularly the challenging transboundary animal diseases, lies the pivotal strategy of livestock vaccination. This strategy harmonizes seamlessly with meticulously tailored plans for the prevention and control of specific diseases. To ensure the efficacy of this approach, the rigorous monitoring of livestock vaccination implementation has been upheld through the veterinary information system (VIS).

The evaluation of the comprehensive vaccination coverage has been undertaken diligently by the Centre, drawing insights from both the preceding VIS data (spanning July to December 2022) and the enhanced VIS data (spanning January to June 2023). Within the fiscal year 2022 – 2023, a substantial tally of 3,406,149 doses of diverse livestock vaccines has been administered across various livestock species. Notably, poultry vaccines claimed the maximum portion, amounting to 3,260,117 doses, which remarkably constitutes 96 percent of the cumulative total. Cattle vaccinations, numbering 105,246 doses, took the subsequent slot, followed by vaccinations for other livestock species.

For in-depth breakdown, annexure 13.3.1, 13.3.2, and 13.3.3 offer comprehensive insights into the progress at the crossroads of Dzongkhag-species, vaccine-species, and Dzongkhag-vaccine specifics, respectively. These annexures provide an intricate view of the strategic advancements made in the domain of livestock vaccination, pivotal to safeguarding the well-being of livestock populations and the industries reliant upon them.

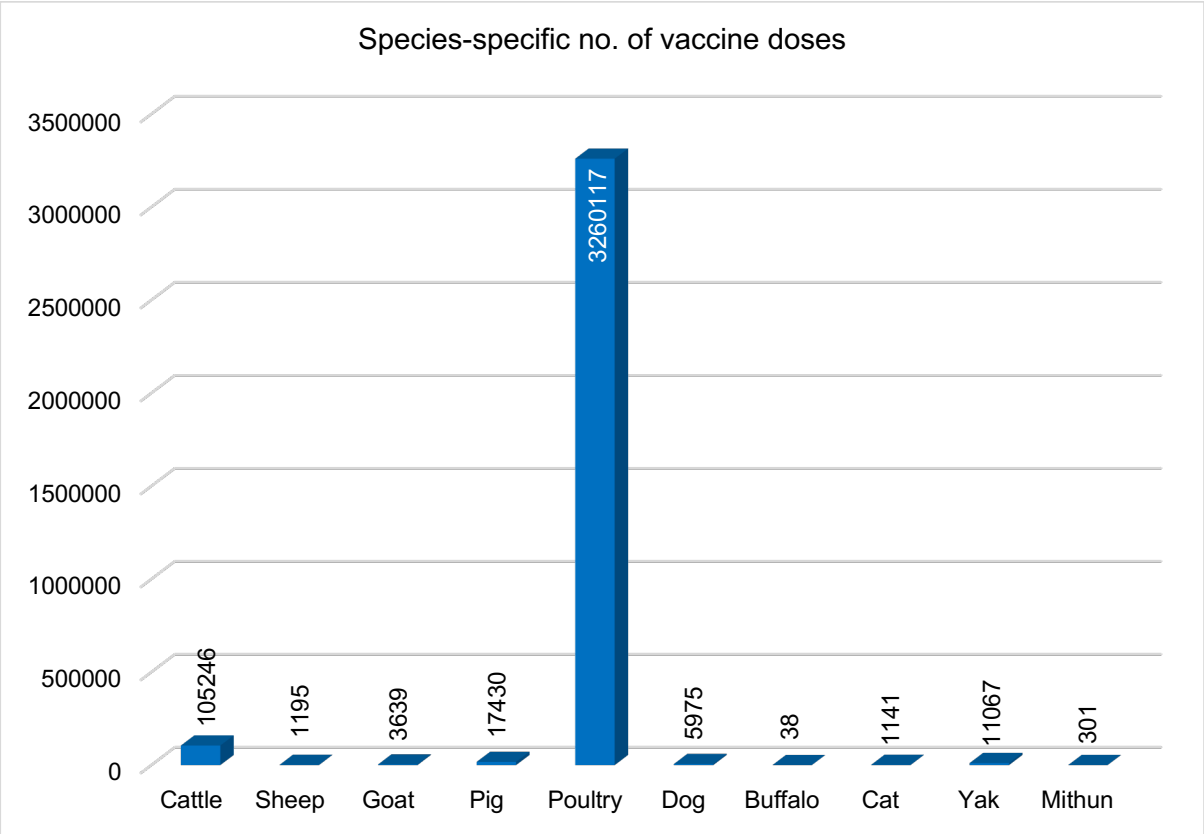


Figure 30: Species-specific no. of vaccine doses administered

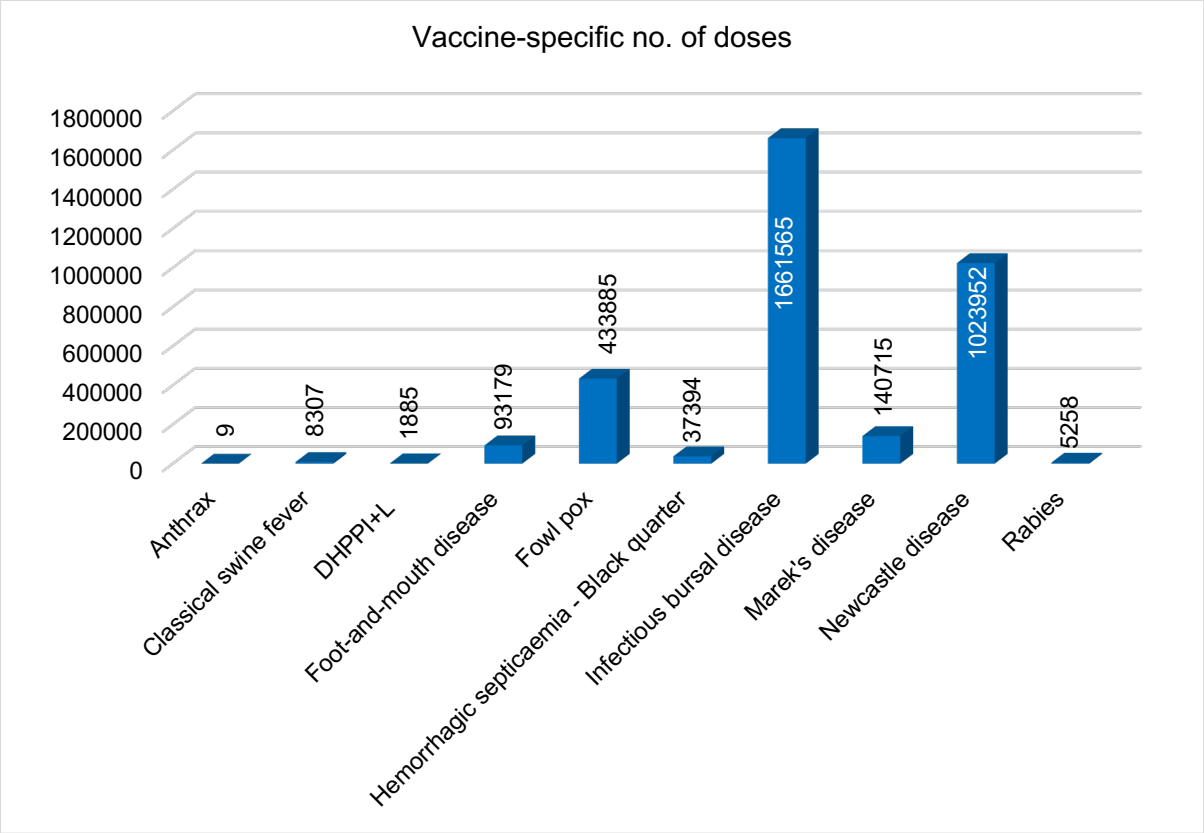


Figure 31: Vaccine-specific no. of doses administered

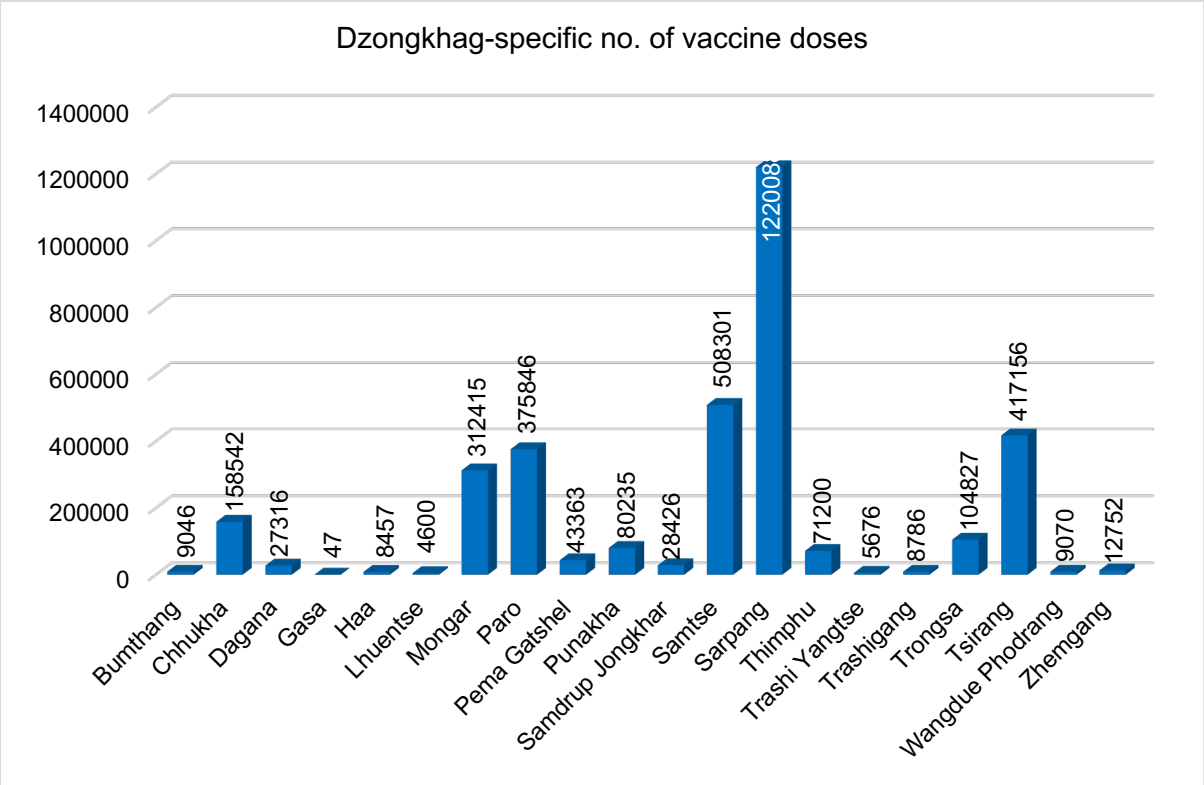


Figure 32: Dzongkhag-specific no. of vaccine doses administered

5. DRUGS, VACCINES AND EQUIPMENT UNIT (DVEU)

The National Centre for Animal Health (NCAH) in Serbithang is one of the central programs under the Department of Livestock (DoL), Ministry of Agriculture and Livestock (MoAL). It is the national focal agency for all matters related to animal health in the country and coordinates all national level animal health programs in collaboration with the one Regional Livestock Development Center (RLDC), Three Regional Veterinary Hospital & Epidemiology Center (RVH&EC), Central Agencies/Farms and the Dzongkhags. It carries out its mandates and functions through four major units and Drugs, Vaccines and Equipment unit (DVEU) is one of the units under NCAH.

5.1. Mandates

The main mandate of the DVEU is to look after the overall management and co-ordination of Essential Veterinary Drug Program (EVDP) in the country. This mandate is implemented through various functions and activities such as:

- Timely procurement, distribution& storage of veterinary medicines, vaccines & equipment and non-drug items
- Monitoring of drugs, vaccines and equipment supply, stock position, storage at LCS and field levels
- Maintenance of veterinary equipment & cold chain equipment
- Ensure quality control and quality assurance through testing of drugs at the DRA approved laboratories
- Co-ordinate/organize trainings/meetings related to EVDP
- Organize/co-ordinate NVMC meetings
- Liaise with DRA and take follow-up action in regard to drug inspection reports

5.2. Human resources

- Dr. Ugyen Namgyel, Head, DVEU (on EOL)
- Ms. Karma Pelden Zangmo, Pharmacist
- Mr. Namgay Dorji, Sr. Livestock Health Supervisor

5.3. Tender evaluation and awarding of veterinary non-drug and consumables for FY 2022-23

The tendering process for veterinary non-drug and consumables is done on 14th November - 20th November 2022, we have uploaded 38 items of consumables in e-GP system and selected 100% that quoted by 10 local suppliers. We have procured 13 items of consumable items using Ministry of Health's tender quotation; therefore, we have selected 51 items of non-drug & consumables for FY 2022 – 2023.

Table 26: Tender evaluation and awarding of veterinary non-drug and consumables

Category	Total Tendered		Total Selected		Total for Re-tender	
	Number	%	Number	%	Number	%
Medicines	38	100%	38	100	0	0

Table 27: Summary of Tender Items Selected (Nos) for each supplier (consumables)

S.N.	Name of the Suppliers	Total items with Quote selected (Items)	
		Number	%
1	Bhutan Mercentile	1	2.63
2	Druk Wangmo	9	23.68
3	DSA Enterprise	1	2.63
4	KMT PMS	3	7.89
5	Lee Enterprise	2	5.26
6	MenLha Sci-Med	1	2.63
7	Paruna PMS	5	13.63
8	Pema Family Mart	3	7.89
9	SD Enterprise	8	21.05
10	Sersang Agency	5	13.16
Total items		38	100

Table 28: Summary of Tender Items Selected (Nos) for each supplier (medicines and vaccines)

S.N.	Name of the Suppliers	Total items with Quote selected (Items)	
		Number	%
1	M/S Druk Horticulture	1	0.7
2	M/S Karma PMS	35	13.9
3	M/S KMT PMS	20	6.45
4	M/S Paruna PMS	62	43.1
5	M/S Tsampaka PMS	8	5.6
6	M/S Kuenphen PMS	1	0.7
7	M/S Vetline PMS	16	11.1
8	M/S Karma and Paruna PMS	1	0.7
Total items		144	100

5.4. Verification and Inspection of veterinary medicines and Consumable Items

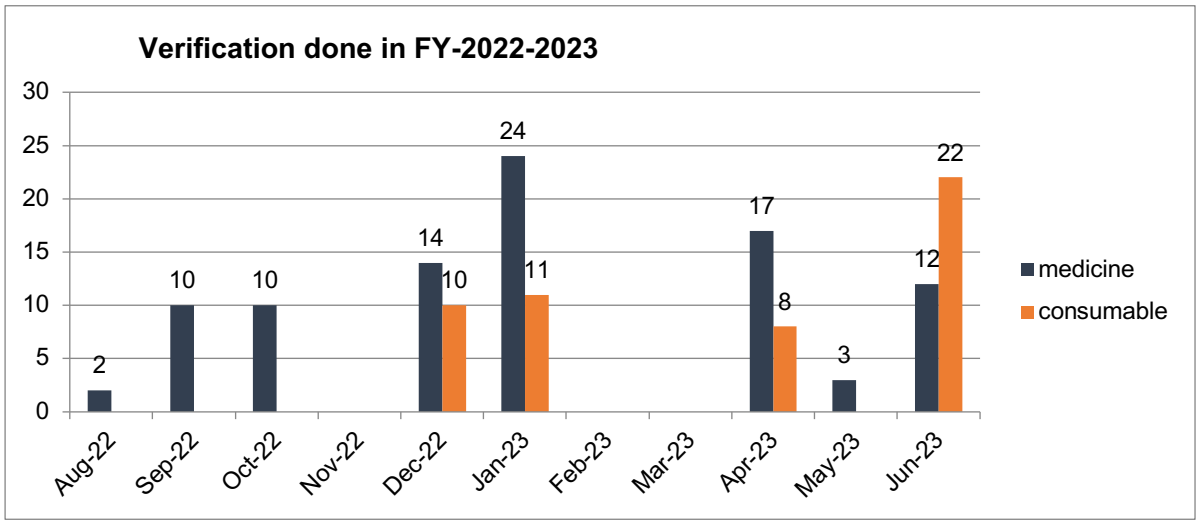


Figure 33: Medicines and consumables verified

During the 8 rounds of verification, a total of 92 medicines and 51 consumable items were verified at LCS, Phuentsholing for the FY 2022-2023.

5.5. Unsupplied/incomplete Supply

In this FY 2022-2023, 20 items of medicines and 3 items of consumable Items were not supplied, and 3 items of Consumables were incomplete supply.

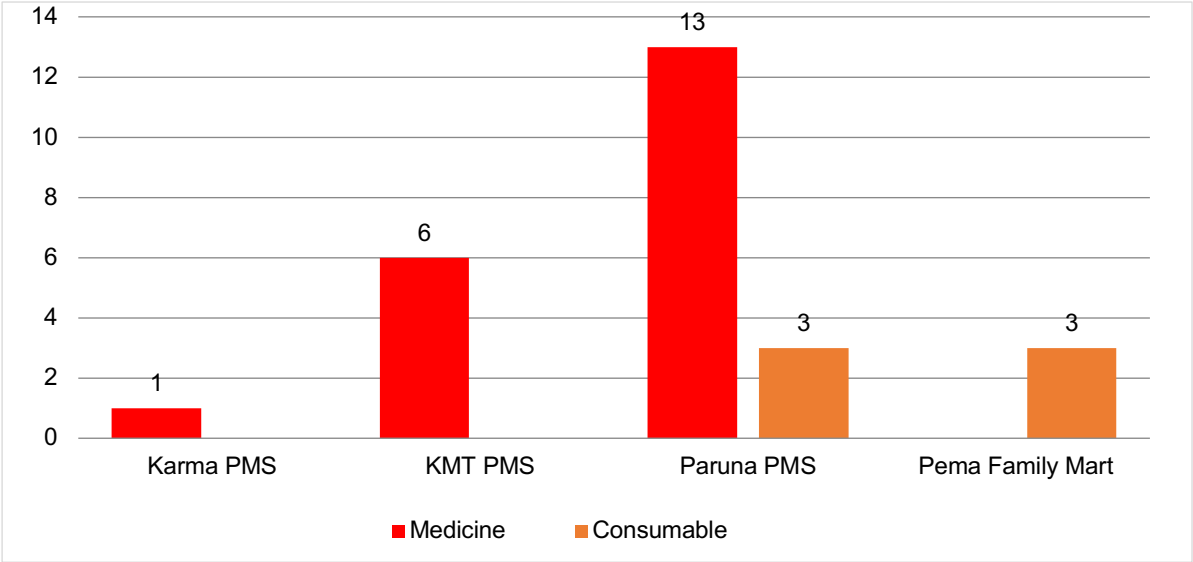


Figure 34: Unsupplied or incomplete supply of medicines and consumables

5.6. Penalty Recovered for unsupplied medicines & consumable items

The total penalty recovered from the suppliers for unsupplied items of medicines and consumables was Nu.246046.60

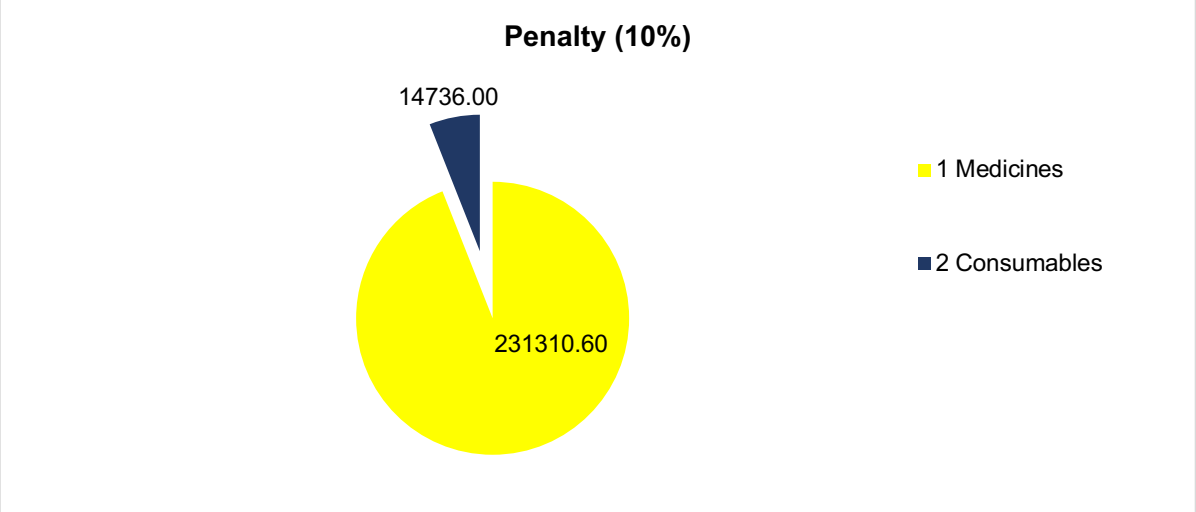


Figure 35: Penalty recovered

5.7. Packing and distribution of medicines and consumable Items

Medicines and consumables of worth Nu. 22.24 million were distributed: Nu.17.43 millions for medicines and for Nu.4.81 million for consumables.

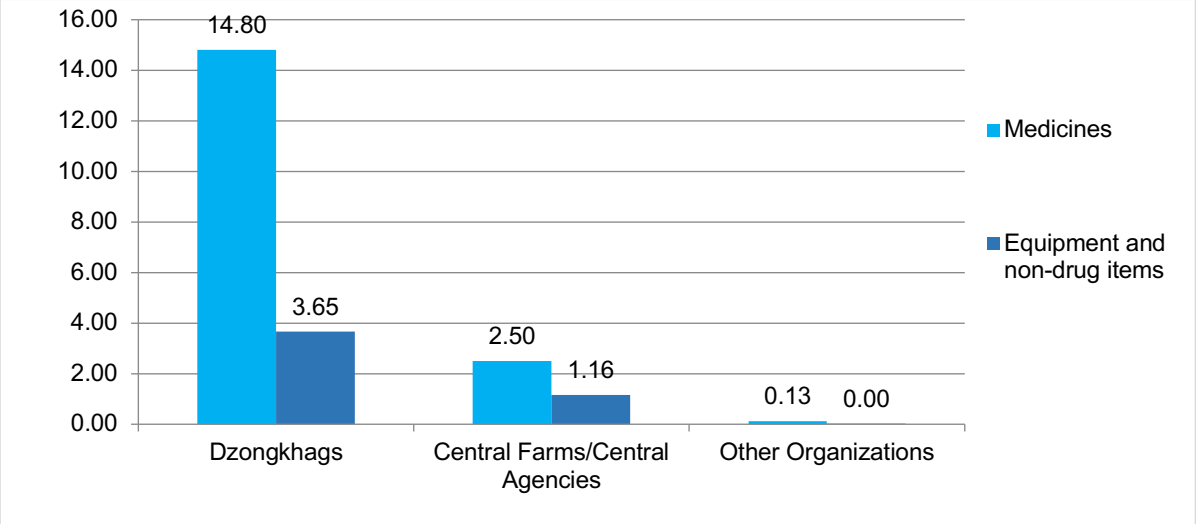


Figure 36: Distribution of medicines and equipment

The first lot mass packing and distribution of medicines & consumable items for FY 2022-2023 is done from 25th Jan to 12th Feb 2023, A total of Nu.8.86 millions of medicines and Nu.2.73 millions of consumables were distributed to Dzongkhags, central agencies/ farms and other organizations.

Table 29: Distribution of medicines and consumables during the first lot distribution

S.N.	User	Medicine (Nu in million)	Consumable (Nu in million)
1	Dzongkhag	7.26	1.99
2	Central Farm & Central Agencies	1.52	0.74
3	Other Organization	0.08	0.003
	Total	8.86	2.73

The second lot mass packing and distribution of medicines & consumable items for FY 2022-2023 is done from 19th May – 4th June 2023. A total of Nu.8.57 millions of medicines and Nu.2.08 millions of consumables were distributed to Dzongkhags, central agencies/ farms and other organizations.

Table 30: Distribution of medicines and consumables during the second lot distribution

S.N	User	Medicine (Nu in million)	Consumable (Nu in million)
1	Dzongkhag	7.54	1.66
2	Central Farm & Central Agencies	0.98	0.42
3	Other Organization	0.05	0.00
	Total	8.57	2.08

5.8. Budget support for Consumable Items for FY 2022-2023

A total of Nu.7.31 millions were paid for veterinary consumables and from that Nu. 4.0 million was paid by Nationwide Accelerated Dog Population Management & Rabies Control Program (NADPM&RCP) and Nu.3.27 million from Royal Government of Bhutan.

6. BIOLOGICAL PRODUCTION UNIT (BPU)

Biological Production unit (BPU) was established in 1984 under the UNDP/FAO technical and financial assistance to meet the country's demand for veterinary vaccines. The first production of bacterial vaccines like *Black Quarter* (BQ), *Haemorrhagic Septicaemia* (HS) and *Anthrax spore* was successfully started from early 1985 followed by subsequent production of Oral E. coli vaccine for pigs during the middle of 1994, Classical Swine Fever vaccine (CSF) from the beginning of 1995-96 and Newcastle disease thermostable I-2 vaccine since 2002 through AusAID project. However due to the low-quality infrastructure based on the recommendations of Bhutan Food and Drug Authority, the local production of these vaccines was stopped during the latter half of 2021-22. This was done basically to upgrade the infrastructure and undertake the production of biologicals using the tissue culture methods in line with the good manufacturing Practises and also considering the animal welfare aspect.

The unit now procures all the livestock and poultry vaccines required for the country.

6.1. Mandates

The main mandates of BPU comprises of the following:

- To procure important veterinary vaccines of animal species viz, Cattle, pigs, poultry, goat and dogs
- To meet the demand of vaccines for the whole nation by procurement from 3rd Country through the competent supplier
- To distribute the vaccine timely based on the annual indents submitted by Dzongkhags, Big Ticket Initiatives (BTI) Farms and Private farms
- To monitor the cold chain of vaccines and equipment in order to maintain the quality and potency of the supplied vaccines & Biologicals throughout the supply chain in respective Dzongkhags and Central Farm/units
- Support and facilitate proper vaccination of livestock as per standard protocol developed.

The unit distributes the vaccines and biologicals to the Dzongkhags and central agencies including private firms through the requisitions either projected annually or on ad-hoc bases based on the emergencies especially during the outbreaks.

The procurement is done through the award of the supply order based on the lowest evaluated rate as per the government system. Once the vaccines are received the lot release approval of the consignment is done jointly with BFDA (erstwhile DRA).

The unit also has the additional responsibility to maintain the chain right from the dispatch of the vaccines and biologicals from the manufacturing companies till it is used in the field. Therefore, the use of the data loggers has been made mandatory in the cold chain management and storage of vaccines and biologicals. In order to supply the potent vaccines, twice a year distribution of the vaccines had been the case in the past. However due to COVID-19 this has not been done seriously during the year which will be seriously implemented during 2022-34.

6.2. Human resources

The unit has currently five manpower including one ESP to cater the quality and potent livestock and poultry vaccine procurement, distribution and monitoring in the dzongkhags and central farms in the country. The unit is currently staffed with following officials:

- Dr. Basant Sharma, Animal Health Specialist – II
- Ms. Menuka Rai, Sr. L.H.S-I
- Mr.Migma, Sr. Lab. Technician.
- Ms.Karma Choki, Lab.Technician
- Mr.Sangay Nidup, ESP/ Lab attendant

6.3. Indenting of vaccines

The collection of the vaccine indent for the year was done on ad hoc basis either through the joint approach with the ident collection for medicines and equipment or through the ad hoc process in bits and pieces. This had resulted in the non-uniformity in the indenting and distribution. It was also not possible from the dzongkhags and central agencies to do proper projection of the vaccine indent which was mainly due to the non-projection of annual targets for the livestock commodities and livestock inputs. However, attempts were made to procure the following livestock and poultry vaccine with details as shown in following table.

Table 31: List of vaccines procured during 2022-23 and their international suppliers

S.N	Name of Vaccine	Company
1	Anti- rabies vaccine	Indian Immunological
2	FMD	Indian Immunological
3	HS-BQ	Indian Immunological
4	CSF	Indian Immunological
5	Fowl Pox	Venkateshwara Hatcheries Pvt Limited
6	IBD	Venkateshwara Hatcheries Pvt Limited
7	MAREKS	Venkateshwara Hatcheries Pvt Limited
8	ND B1	Hester Bio science
9	ND R2B	Hester Bio science

With the initiation of G2C (EVDP) web-based system, which is on the verge of complete implementation, the authentic indenting of the vaccines is likely to take place during the coming years. However, unless the field implementers make proper planning of the projection for the livestock and poultry commodities through the cyclic production process, the BPU is unlikely to receive the accurate indent in future too. In order to provide effective and efficient service delivery in the procurement, distribution and application in the field, BPU has to properly plan the procurement through the past records with 5 to 10% provision on these figures.

6.4. Procurement of vaccines through e-GP

The BPU is responsible for the procurement and distribution of potent vaccines for livestock and poultry including pet animals in the country. It is done jointly with the Drug Vaccine and Equipment Unit (DVEU) unit especially in terms of tendering, evaluation, and procurement as per the existing government procurement system which comprises of electronically managed

tendering system. The indent collection is still a major problem due to the unpredictable nature of the input due to the variation in the production projection of the livestock commodities and inputs in different dzongkhags and central programs. The evaluation of the medicines and vaccines are done by the EVDP committee with specific roles for each member as per the tender document of the unit. The tendering, evaluation and award for vaccines for the year was done jointly with DVEU with the recording of evidence of the process.

6.5. Quality assurance in vaccine procurement

The terms and conditions in the procurement system clearly mentions the need for the cold storage management of the vaccines which is managed between 2 to 8 deg C. This applies the process right from the manufacturing location though the transportation till it is received at BPU followed by the distribution of the vaccines to the field users. As there is no facility to monitor the vaccine during the transportation of vaccines from the company till it reaches BPU, the quality assurance of the vaccines once it reaches BPU, is done by BFDA. The consignment of vaccines is inspected at the site of arrival with detail examination of the data loggers, which is packed along with the vaccines right from the company at source. The data from the data loggers are downloaded and analysed to make sure that the vaccines were stored within 2 to 8 deg C on arrival at BPU Serbithang. Once the vaccines are inspected at site and stored in the vaccine storage at BPU, BFDA issues the lot release report which is the basis for the payment to the suppliers. In the BPU store the vaccines are kept at 2 to 8 deg C which is managed though the use of data loggers.

6.6. Annual vaccine procurement

The total budget outlay of Nu, 9.415 million was used to procure 123.08 million doses of nine livestock and poultry vaccines against Rabies, Foot and Mouth Disease, Haemorrhagic Septicaemia-Black Quarter, Classical Swine Fever, Fowl pox, Infectious Bursal Disease, Marek's Disease, New Castle Disease (B1) and New Castle Disease (R2B during 2022-23. The distribution of different doses of livestock and poultry vaccines with its budgetary values shown in the following table.

Table 32: Quantity (doses) of different vaccines procured during 2022-23

S.N	Vaccine against Disease	Patent/Company product Name	No of Vials	Total doses	Total budget (in Million)
1	Rabies	Raksharab	5000	50000	0.925
2	Foot and Mouth Disease	Raksha-Ovac-Trivalent (O, A, Asian1)	3000	150000	2.397
3	Haemorrhagic Septicaemia-Black Quarter (HS-BQ)	Raksha-HS+BQ	3000	90000	0.597
4	Fowl Pox	Fowl Pox-Ventri	3000	3000000	0.525
5	Infectious Bursal Disease	IBD-Ventri	15000	3000000	1.125
6	Marek's Disease	Marek's-Ventri	3000	3000000	1.5
7	New Castle Disease (B1)	ND (B1)-Hester	7500	1500000	0.3375
8	New Castle Disease (R2B)	ND (R2B)-Hester	15000	1500000	0.6
9	Classical Swine Fever	CSF-Raksha-Class	1800	18000	1.413
Total				12308000	9.4195

Among the different vaccines procured maximum budget amongst the nine vaccines was spent for FMD vaccine worth Nu. 2.397 million followed by others as shown in the following figure.

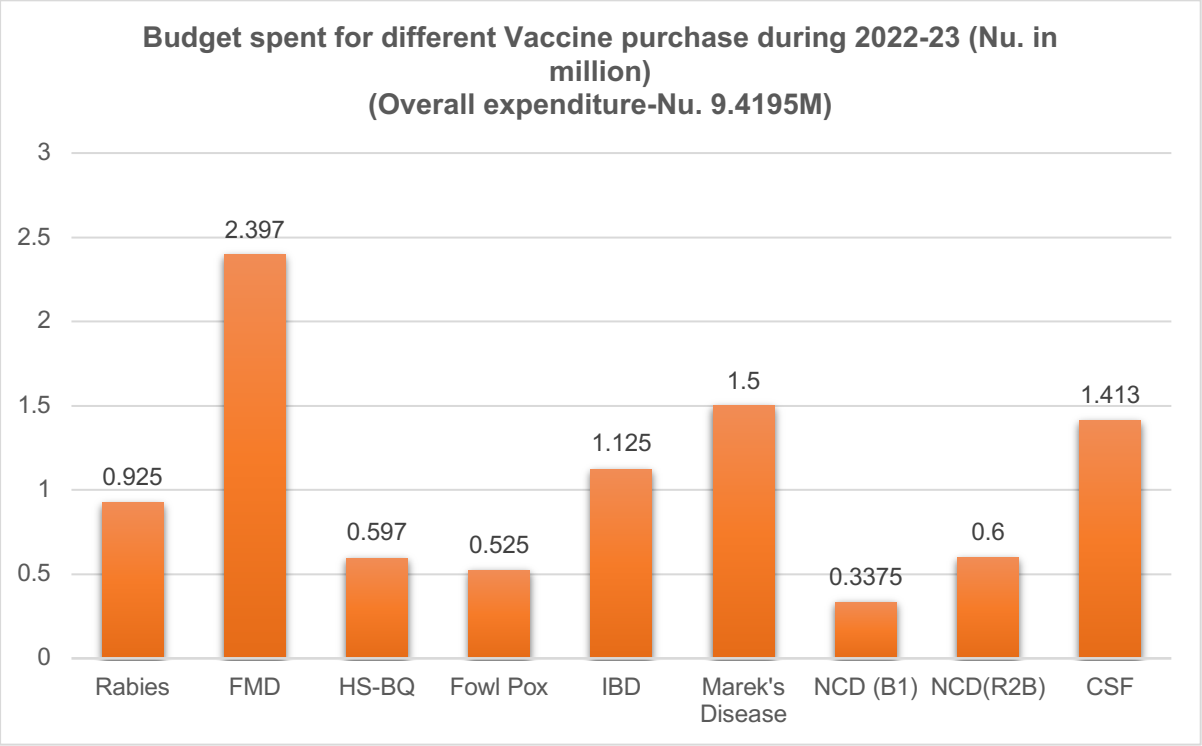


Figure 37: Budget spent for the procurement of different vaccine during 2022-23

However, in terms of the quantity of vaccines procured in poultry, maximum doses of vaccines procured was against New Castle Disease (B1), followed by New Castle Disease (R2B), Marek's Disease, Fowl Pox and Infectious Bursal Disease. Although the maximum doses of poultry vaccines were purchase compared to livestock vaccines especially for cattle, sheep, goat and pigs, the cost was higher for livestock vaccines due to its high cost per dose compared to poultry vaccines. The cost of livestock related disease vaccine is 56.6% more compared to poultry vaccines as shown in the following table.

Table 33: Distribution of Vaccines for Livestock and Poultry for 2022-23 in terms of budget and disease

S.N	Livestock and Poultry	Total Vaccine Doses	Budget (Nu in M)	Weightage (%)	
				Doses	Budget
1	Livestock (FMD, HS-BQ, CSF and Rabies)	308000	5.332	2.5	56.6
2	Poultry (Marek's', IBD, NDB1, ND R2B and Fowl pox)	12000000	4.088	97.5	43.4
Total		12308000	9.420	100	100

6.6.1. Cost of vaccine per dose

The rate per dose of different vaccines against livestock and poultry diseases procured during the year was calculated as per the quotation for each vaccine. The cost per dose of vaccine

for Classical Swine Fever vaccine is high with Nu. 78.5/dose followed by FMD, Rabies and others.

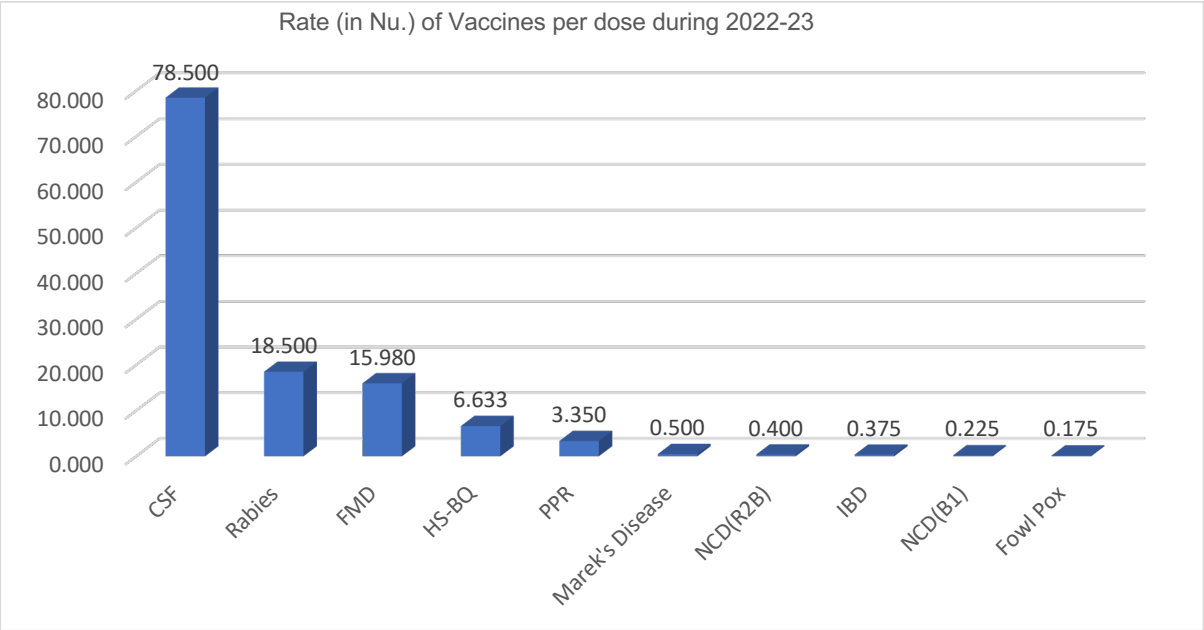


Figure 38: Rate of vaccine per dose for the procurement during 2022-23

6.7. Vaccine distribution

The unit distributed vaccines for livestock and poultry based on the annual and or ad hoc request from the dzongkhags, central farms and other agencies in the country. The vaccines were either distributed using the refrigerator van of the unit or by the respective agencies through their individual private or pool vehicle. This was done to reduce the cost of the transportation as the twice a year distribution of the vaccines as scheduled could not be done due to the COVID-19 post effect lapses in the planning process.

The monthly records of the vaccines distributed to the dzongkhags and agencies were updated in the excel spreadsheet. A total of 5,275,783 doses (approximately five million) of different livestock and poultry vaccines comprising of vaccines against diseases such as Rabies, Foot and Mouth Disease, Haemorrhagic Septicaemia-Black Quarter, Classical Swine Fever, Fowl pox, Infectious Bursal Disease, Marek's Disease, New Castle Disease (B1) and New Castle Disease (R2B) were distributed to twenty dzongkhags and central agencies during 2022-23. The maximum quantity of vaccines supplied was for Infectious Bursal Disease with 40.63% worth 2,142,400 doses followed by New Castle Disease (B1) and other vaccines.

The distribution of different types of vaccines in twenty dzongkhags showed the maximum supply to Samtse dzongkhag with 1064100 doses followed by Sarpang, Tsirang, Chhukha and others.

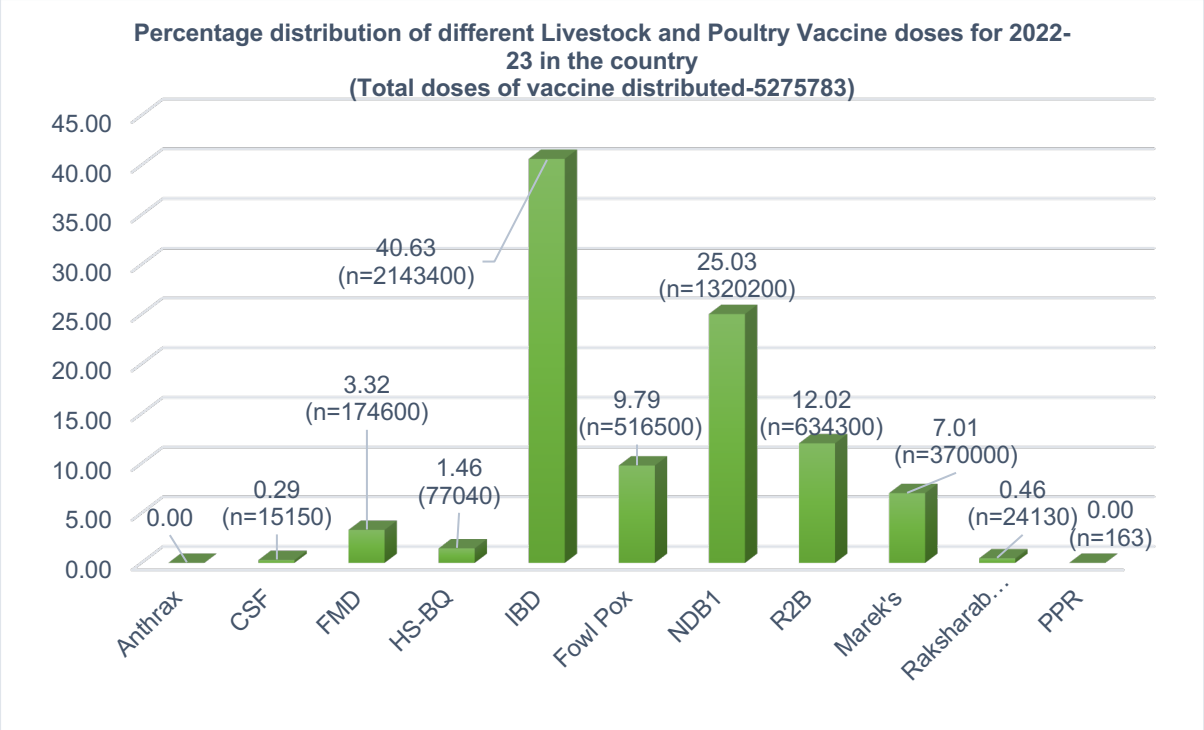


Figure 39: Vaccine distribution for different vaccines during 2022-23 in the field in relation to doses and Percentage amongst the vaccines

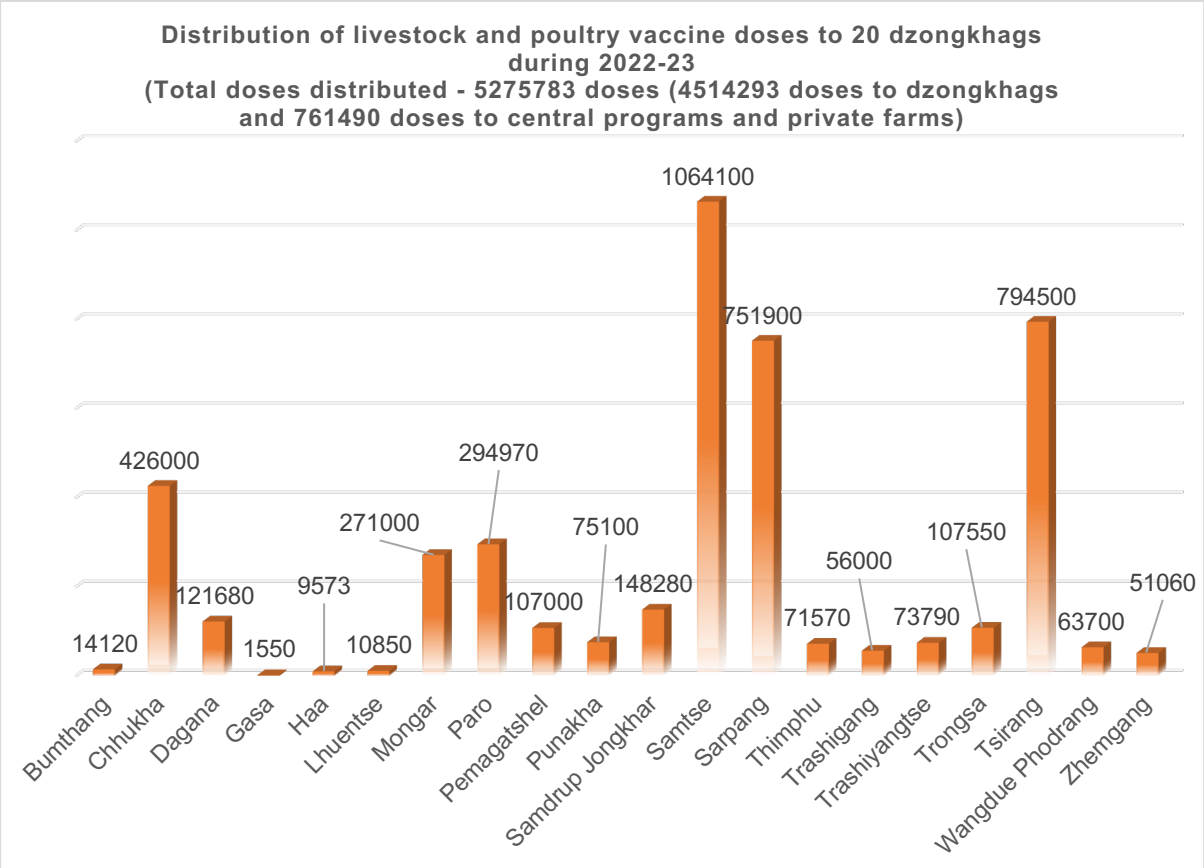


Figure 40: Dzongkhag-wise livestock and poultry vaccine distribution during 2022-23

6.8. Procurement versus distribution of vaccines

A total of 12,308,000 doses of livestock and poultry vaccines were procured out of which 5275483 doses were distributed during 2022-23 with the distribution rate of just 42.86% of the vaccine doses procured during the year which means more than 57.14% of the procured vaccine remain in the BPU vaccine bank for use during 2023-24. Accordingly, the stock balance for different vaccines were verified and found out the balance as of 30th June 2023 as shown in the following table.

Table 34: Stock balance of different vaccine as of 30th June 2023 at BPU

S.N	Name of vaccine	Doses	Vial	Total Doses	Expiry Date
1	CSF	10	1659	16590	All expired on 12/25
2	Fowl pox	1000	900	900000	All expired in Feb /2024
3	Fowl pox	1000	1833	1833000	All expired on 12/2023
4	IBD	200	8111	1622200	All expired in Mar/24
5	Marek's	1000	2668	2668000	All expired in Aug/24
6	Marek's	1000	430	430000	All expired in July/24
7	R2B	100	12387	1238700	All expired in May/24
8	NDB1	200	4905	981000	All expired in April/24
9	ARV	10	3954	39540	All expired on 8/25
10	ARV	10	2	20	All expired in July/24
11	HSBQ	30	982	29460	All expired on 9/24
12	FMD	50	826	41300	All expired on 9/24
13	PPR	100	100	10000	All expired in July/23
	Total doses			9809810	

6.9. Monitoring of cold chain and vaccination coverage in the field

The monitoring of cold chain for vaccine storage right from despatch from BPU Serbithang till the vaccine is administered to the animals is done through the different agencies. The monitoring of the cold chain of vaccines from the production companies till BPU Serbithang is the responsibility of BPU which is done through the lot release report from DRA, BFDA Thimphu. Once the vaccine is verified by DRA, the vaccine consignment is supplied to the dzongkhags and farms either through the refrigerator van or the private cars with clear instruction to maintain the temperate of vaccine between 2 to 8 deg C. The distribution of the vaccines as a schedule was not done during the year due to COVID-19 pandemic and logistic issues.

The monitoring visit to the field which was done especially to the District Veterinary Hospitals and Regional Livestock Centres was done by BPU staff with regards to cold storage facilities such as cool boxes and the refrigerators. The daily temperature recording system with the verification of the data was also done. The random field visit was done in some of the pre-selected sites in Samtse, Sarpang, Mongar, Trashigang, Chhukha and Tashiyangtse. The field trip findings showed evidence of proper cold chain maintenance of vaccines, proper recording of temperature chart and also maintenance of cold chain from the office till it is administered to livestock and poultry through proper follow-up after vaccination.

Some of the evidence of field monitoring of cold chain for vaccine storage is shown in following figures.

Figure 41: Use of Refrigerator for vaccine storage

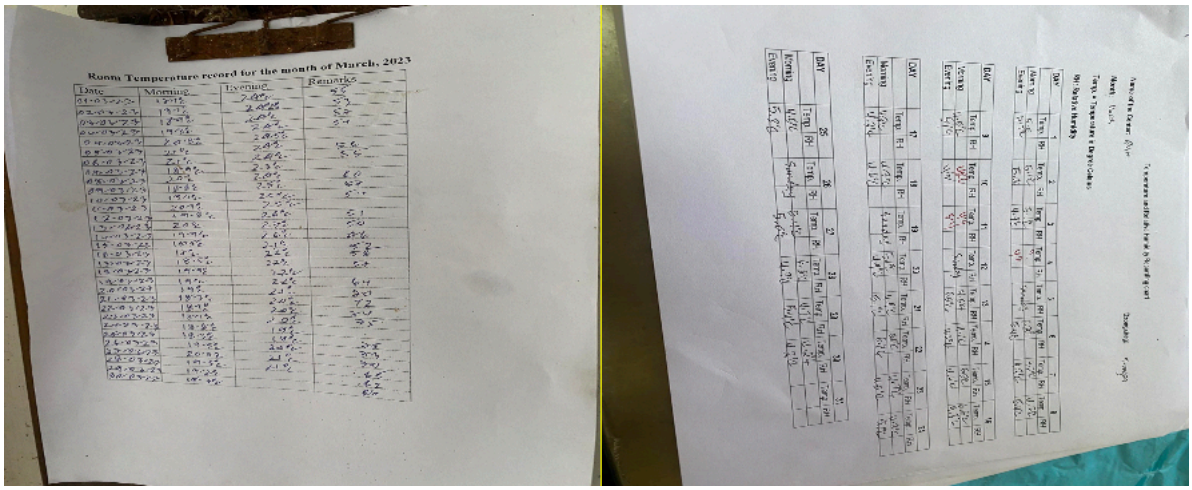


Figure 42: Daily temperature recording chart

The cold chain for vaccines in the dzongkhags were properly maintained with daily recording of the temperature of refrigerates and cold room. During the monitoring visit, inventory of the cold chain equipment was also done.

6.10. FMD vaccine distribution-based coverage

Although the exact vaccination coverage based on the livestock and poultry population cannot be done due to the variable population and inadequate specific data of vaccination coverage, the unit attempted to carry out the vaccination coverage against Foot and Mouth Disease based on the National Foot and Mouth Disease Prevention and Control Plan 2020, taking into consideration the Livestock statistic data of Bhutan for 2021 as per National Statistical Bureau

of Bhutan. As per the livestock statistics for 2021, and also based on the National FMD prevention and Control Plan 2022, which directs the dzongkhags for vaccination based on the risk of the disease, the high-risk zone gewogs should vaccinate the susceptible population twice a year. The frequency of vaccination for medium risk zone is once a year. There is no need for vaccination to livestock in low-risk areas. Therefore, keeping in view the above directives as per the National FMD control plan 2020, Livestock statistics 2021, and also the vaccine distribution from BPU during 2022-23 with the specification on the type of livestock species mentioned for each of the risk zones, the overall vaccination coverage is 40.41% for the country with overall coverage of 39.87% for the dzongkhags followed by 76.97% for the central programs with different vaccination coverage for the dzongkhags and central programs.

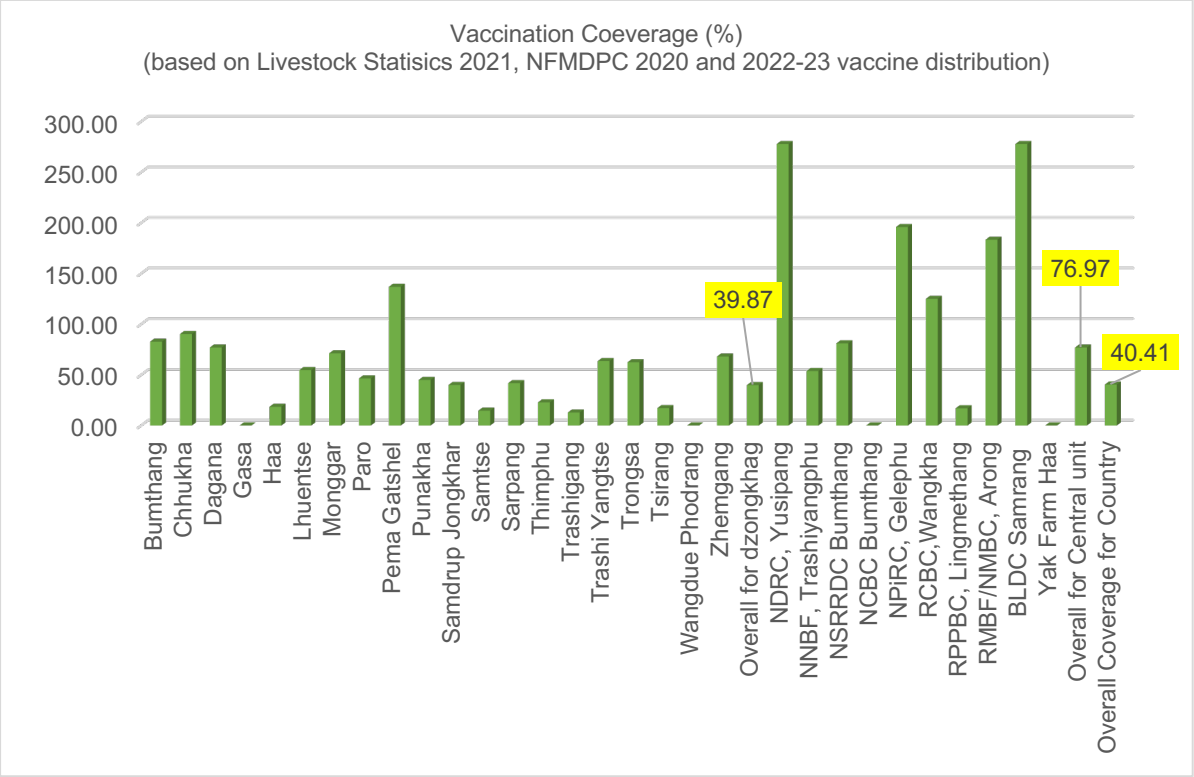


Figure 43: Vaccination coverage against FMD in dzongkhags and central programs based on the NFMDPCP 2020, Livestock Statistics 2021 and Vaccine distributed during 2022-23

However, the actual coverage for vaccination against FMD will be re-calculated keeping in view the past vaccine distribution stock in the dzongkhags and central programs after close collaboration with the DPCU and the respective agencies.

6.11. Cold chain management of vaccines at BPU

All the vaccines & biological consignment are transported and delivered by suppliers at BPU and stored in cold storage room maintained at 2 to 8°C. The daily temperature of the cold storage is managed using the data loggers and the data uploaded in the device is downloaded to record the data for reference. Some of the images of the vaccine storage in BPU.

Figure 44: Cold Storage at BPU

Figure 45: Glimpse of vaccine in cold room

Figure 46: Cold Room

The temperature of the vaccines in the vaccine cold storage at BPU is monitored by using data loggers. The data logger recording finding for the month of February, March and May 2023 as reference evidence for cold storage management is shown in annexure 13.1.

6.12. Other works

The unit also carried out other activities on and above the mandates of BPU Units as followed:

- Participated in Lab sample collection & surveillance for Lumpy Skin Disease and Brucellosis
- Participated in Chadi and Draghi as per official instruction
- As resources person for livestock extension field staff of Eastern six dzongkhags
- Attended the write shop for the generation of Laboratory Quality Manual
- Attended the write shop for data compilation and analysis for Antibiotic Sensitivity Test on the chicken samples
- Write-off for the expired vaccines, chemicals, media and equipment as approved by Hon'ble Director DOL and Hon'ble Dasho Secretary MOAL Thimphu
- Other miscellaneous works assigned by the Management

6.13. Conclusions and Recommendations

The year 2022-23 is the transition phase after COVID-19 pandemic where the activities of the unit has gradually step-up to streamline the vaccine indenting, tendering, procurement and distribution in BPU in the country. There are lots of areas to make changes based on the scarcity of resources including the budget faced by the country. The following are the immediate steps which BPU will take with priority during 2023-24:

- Finalisation of the standard vaccination schedule for livestock and poultry at the national level.
- Development of the SOP for the vaccination program.
- Distribution of the vaccines in the country using the refrigerated van at least twice a year as a schedule using the data loggers.
- Compulsory use of data loggers by the supplier for the procurement of vaccines right from the production company till it reaches BPU.
- Regular monitoring of the cold chain management and vaccination programs in the country.
- Timely monitoring of the stock balance of the vaccines to avoid expiry and also to supply the potent vaccines to the users.
- Annual vaccination coverage especially the FMD vaccination in line with the National Disease Prevention, control and Eradication programs specific to the disease concerned.
- Closely liaise with the RLDC Kanglung, RVH&EC P/ling and Gelephu including the government farms in the monitoring of the vaccination usage and coverages in the field through regular field visits.
- Act as the technical members in the formulation of technical documents and strategy paper development.
- Closely liaise with the DPCU to emulate the vaccine supplied and the vaccination coverage in the field to correlate the actual vaccination progress in the country.

7. DOG POPULATION MANAGEMENT UNIT (DPMU)

Dog Population Management Unit (DPMU) is one of the technical units under National Centre for Animal Health which oversees the implementation of dog population management and rabies prevention program in the country. To combat the issue of free-roaming dogs in the country, the unit has been entrusted in 2020 the task to carry out nationwide dog population management through National Waste Management & Stray Dog Population Control (NWM&SDPC) Flagship Program with an estimated budget outlay of Nu. 115 million.

Since FY 2021 – 2022, the unit has been spearheading the implementation of the Nationwide Accelerated Dog Population Management and Rabies Control Program (NADPM&RCP), a national program target 100 per cent sterilization of free-roaming dogs and digital identification of all the pet dogs in the country.

7.1. Nationwide Accelerated Dog Population Management and Rabies Control Program (NADPM&RCP)

7.1.1. Objectives

- Achieve 100% sterilization coverage of free-roaming dogs within two weeks
- Ensure 100% responsible pet dog ownership through mandatory registration and digital identification
- Eliminate feral dog population and save wild fauna
- Control rabies through intensified vaccination campaigns and achieve the global goal of “0 by 30” - zero human death due to dog mediated rabies

7.1.2. Strategies

- Whole of nation approach by engaging De-suups, civil servants, local governments and general public
- Implementation of catch-neuter-vaccinate-release protocol in dogs
- Selective sheltering of free-roaming dogs
- Digital identification and traceability system in dogs
- Habitat control
- Strengthen stakeholder and public awareness
- Strengthen enforcement of responsible pet ownership provisions of the Livestock Act of Bhutan 2001 and Livestock Rules and Regulations of Bhutan 2017
- Elimination of feral dogs
- Mass dog anti-rabies vaccination in high risk-zones
- Development and conservation of “Chang-Khyi” as a native dog breed of Bhutan.

7.2. Human resources

- Dr. Hiruka Mahat, Principal Livestock Health Officer, Head, Dog Population Management Unit
- Prem Kumar Gurung, Team Leader, Animal Welfare Attendant
- Karma Tenzin, Animal Welfare Attendant
- Nima, Animal Welfare Attendant
- Pema Tashi, Animal Welfare Attendant
- Chimi Dorji, Animal Welfare Attendant
- Pasang Wangdi, Animal Welfare Attendant
- Sangay Wangchuk, Animal Welfare Attendant

- Jamyang Chador, Animal Welfare Attendant
- Choeying Dolma, Community Engagement Officer
- Yeshi Lhamo, Community Engagement Officer
- Tenzin Wangmo, Community Engagement Officer
- Dawa Zam, Community Engagement Officer
- Dawa Dema, Community Engagement Officer

7.3. Dog population management and mass vaccination

Under NADPM&RCP, as of 30 June 2023, a total of 61,430 dogs owned and unowned dogs were neutered across the country. Samtse Dzongkhag alone neutered 7290 dogs followed by Thimphu, Trashigang, Mongar, Paro, etc.

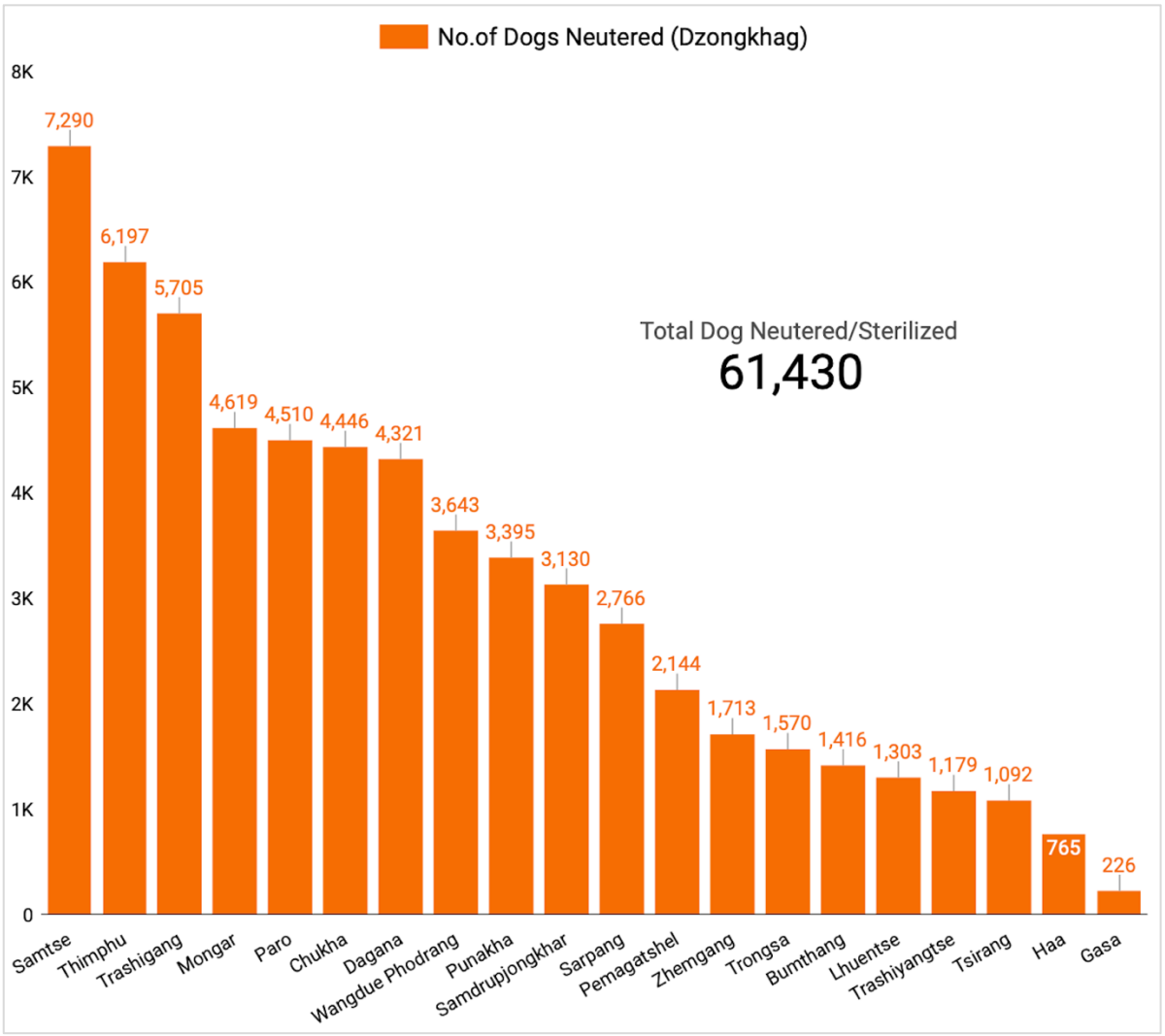


Figure 47: No. of dogs neutered

As shown in the figure below, 91.2 percent of the neutered dogs were unowned and 8.8 percent were owned, and 52.5 percent were male, and 47.5 percent were female.

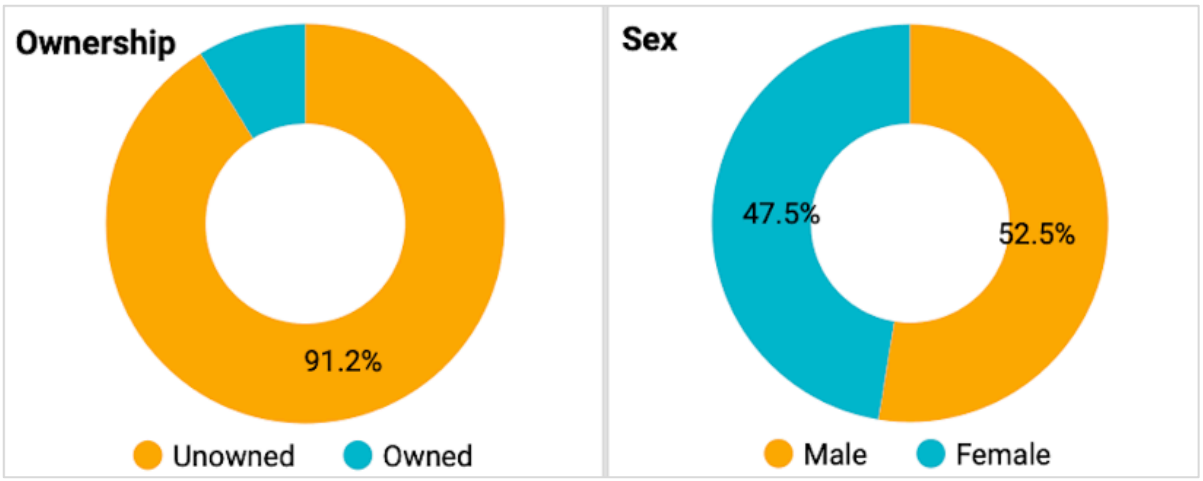


Figure 48: No. of dogs neutered, by ownership status and sex type

58,358 dogs of the total neutered were vaccinated against rabies, thus achieving overall vaccination coverage of 95 percent.

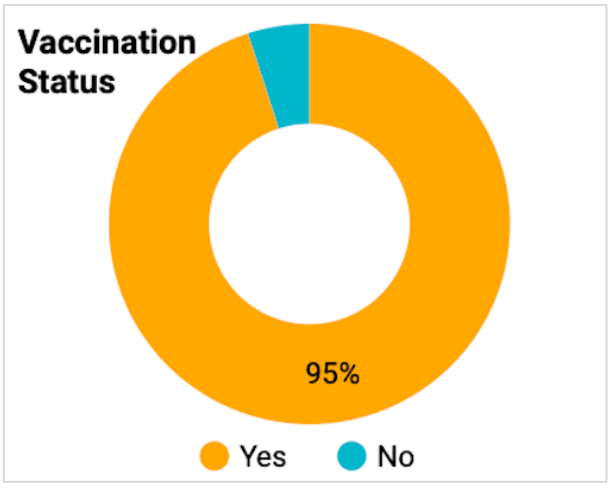


Figure 49: Vaccination (ARV) coverage

7.4. Pet dog microchipping and registration

31,705 pet dogs were microchipped and registered in the country. Thimphu Dzongkhag, including Thromde, registered 8095 pet dogs followed by 3291 in Paro, 2855 in Samtse, 2074 in Tsirang, etc.

71.4 percent of the pet dogs were already neutered at the time of the registration, and 53.4 percent of the registered pets were female.

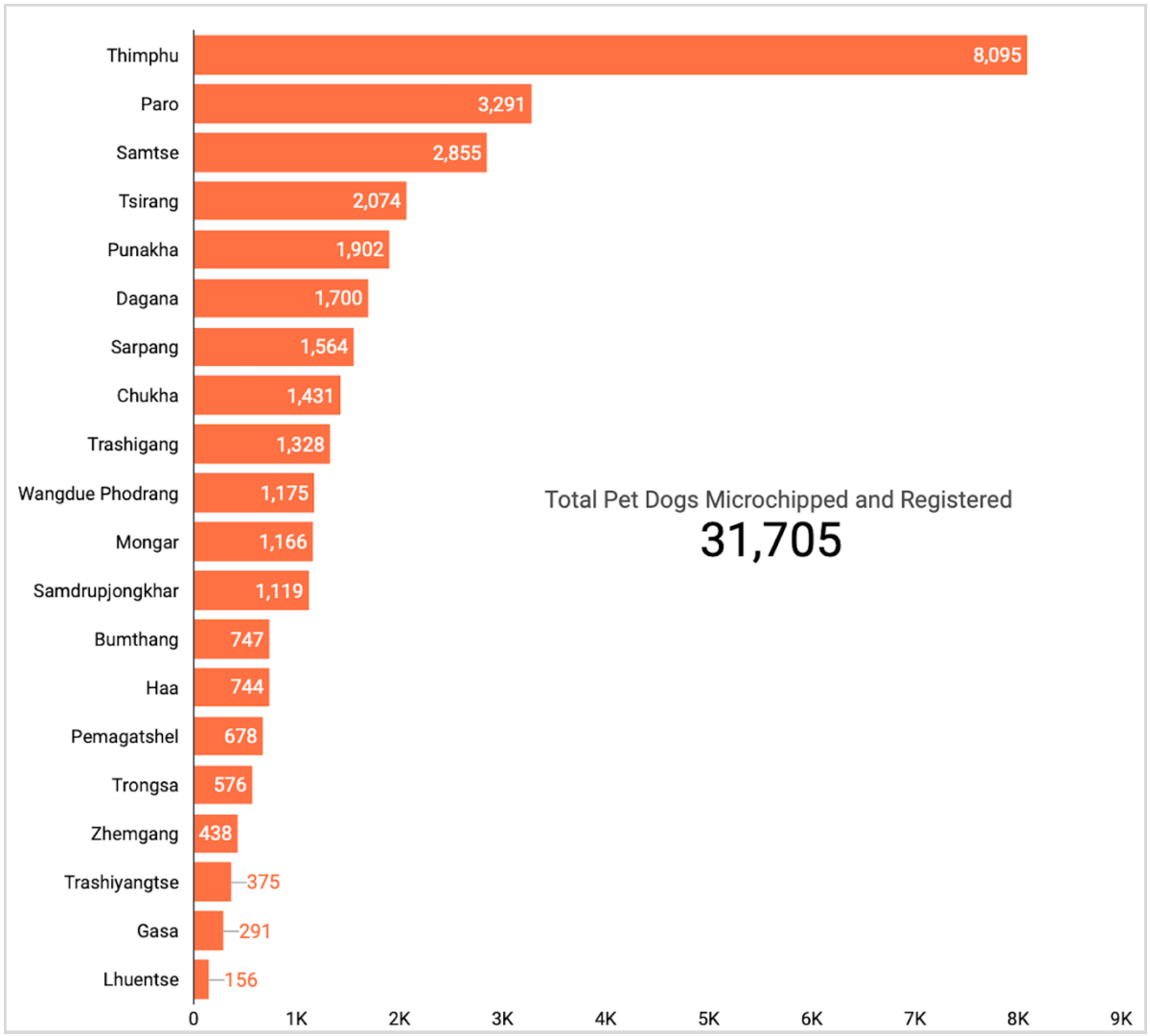


Figure 50: No. of pet dogs microchipped and registered

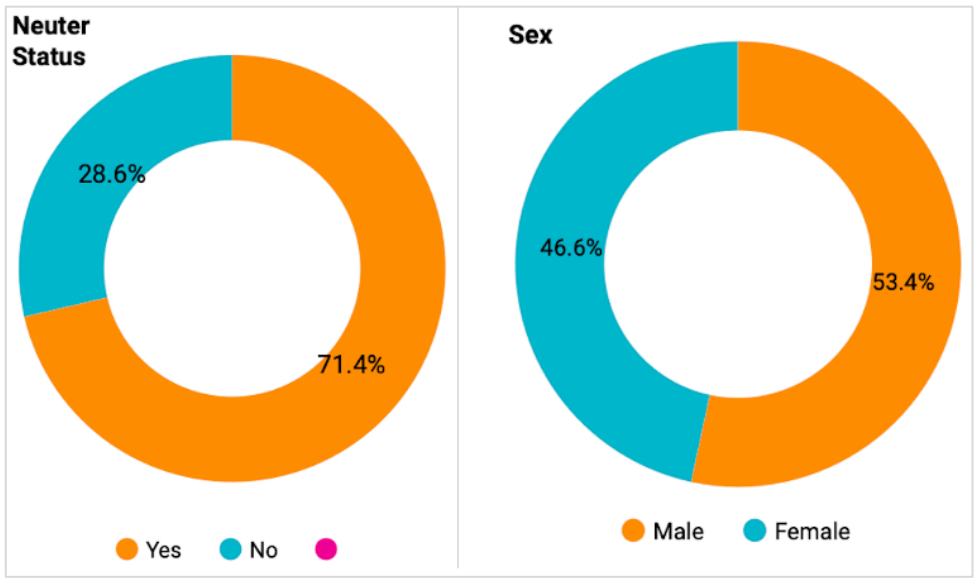


Figure 51: No. of pet dogs registered, by neuter status and sex type

7.5. Changkyi Conservation Centre

The program constructed the Changkhyi Conservation Centre (CCC) at Yusipang, Thimphu to house the Changkyis, a breed unique to Bhutan, conserve and supply to local people if required. The Department took over the Centre on March 4, 2023. The Centre can accommodate 50 adult dogs; and currently 45 dogs (10 male, 21 female and 14 puppies) are kept there. In collaboration with the National Biodiversity Centre, genetic profiling of the dogs in the conservation centre is currently ongoing as a process to develop a pure *Chang-khyi* breed.

Figure 52: Changkhyi Conservation Centre, Yusipang

7.6. Freedom from unneutered free-roaming dogs in a jurisdiction

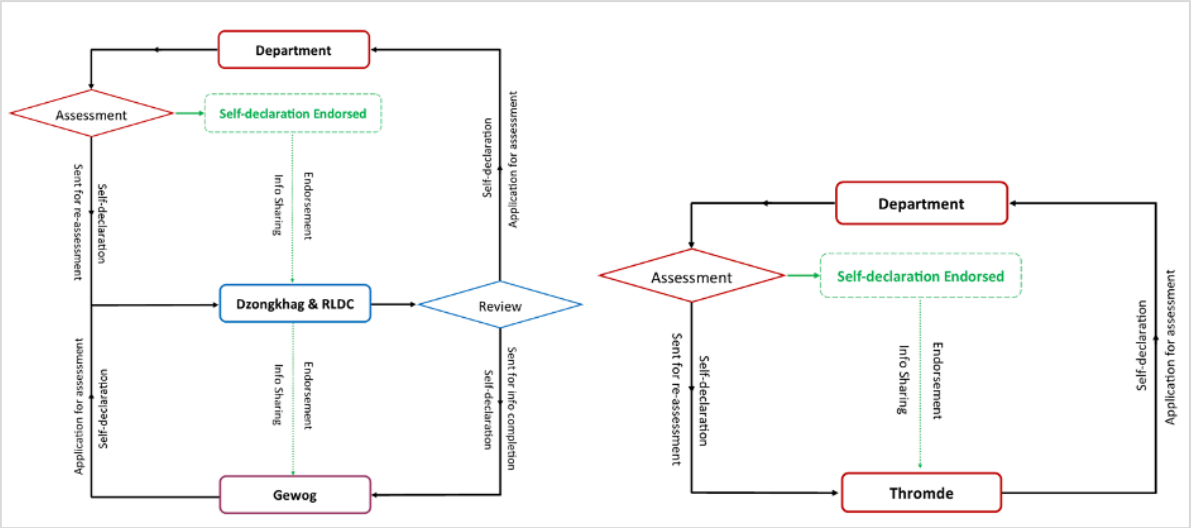


Figure 53: Process of self-declaration application, assessment, and endorsement

Following completion of combing phase of the program, in line with the standard operating procedure for application, assessment and endorsement of self-declaration the Gewogs, Thromdes and Dzongkhags were required to submit the self-declaration report stating that their respective jurisdictions have achieve 100 sterilization coverage.

As of 30 June 2023, all the 20 Dzongkhags and 4 Thromdes submitted their self-declaration of freedom from unneutered free-roaming dogs in their jurisdictions. The self-declaration of 13 Dzongkhags and 3 Thromdes were successfully endorsed by the program.

Table 35: Self-declaration status as of 30 June 2023

Sl. No.	Dzongkhag/Thromde Name	Date of			
		Application	Independent Survey		Endorsement
			From	To	
1	Haa	25-Nov-22	16-Dec-22	27-Dec-23	31-Dec-22
2	Trashi Yangtse	24-Nov-22	16-Dec-22	25-Dec-22	31-Dec-22
3	Lhuentse	13-Jan-23	20-Jan-23	31-Jan-23	03-Feb-23
4	Tsirang	07-Jan-23	17-Jan-23	31-Jan-23	10-Feb-23
5	Trongsa	16-Jan-23	02-Feb-23	20-Feb-23	21-Feb-23
6	Zhemgang	10-Feb-23	08-Mar-23	01-Apr-23	04-Apr-23
7	Punakha	23-Jan-23	07-Mar-23	27-Mar-23	06-Apr-23
8	Gelephu Thromde	30-Mar-23	01-May-23	10-May-23	16-May-23
9	Pema Gatshel	09-Mar-23	01-May-23	10-May-23	16-May-23
10	Sarpang	10-Mar-23	20-Mar-23	18-Apr-23	22-May-23
11	Trashigang	24-Feb-23	01-Apr-23	27-Apr-23	23-May-23
12	Phuentsholing Thromde	07-Mar-23	22-May-23	25-May-23	27-May-23
13	Bumthang	28-Apr-23	22-May-23	28-May-23	02-Jun-23
14	Thimphu	22-May-23	27-May-23	03-Jun-23	05-Jun-23
15	Thimphu Thromde	17-May-23	27-May-23	03-Jun-23	05-Jun-23
16	Paro	29-May-23	09-Jun-23	21-Jun-23	22-Jun-23
17	Dagana	05-Jun-23	25-Jun-23		

18	Samdrup Jongkhar Thromde	05-Jun-23		
19	Wangdue Phodrang	30-May-23	09-Jun-23	24-Jun-23
20	Chhukha	02-Feb-23	17-Feb-23	29-May-23
21	Gasa	27-Mar-23	25-Apr-23	12-May-23
22	Monggar	07-Jun-23	19-Jun-23	
23	Samdrup Jongkhar	18-Jun-23		
24	Samtse	14-Jun-23		

7.7. 12th De-suung Raising Day

On February 14, 2023, during 12th De-suung Raising Day, NADPM & RCP organized a stall at Changlimithang Stadium. The stall was alongside other stalls of projects involving de-suups.

It was a special privilege to present Their Majesties the King and the Gyaltsuen with curated exhibits on the program. It was also an opportunity to share with thousands of visitors the program's objectives, work processes, and progress. The NADPM & RCP also called to action for responsible pet ownership to visiting dignitaries and de-suups. CGMs also attended the program.

7.8. Livestock (Amendment) Rules and Regulations of Bhutan 2022

Enforcement of legislation is an essential component of effective dog population management and protects public health and safety. Considering that legislation provides the necessary legal foundation to ensure relevant stakeholders bear responsibility and accountability, strengthening enforcement of legislation was one of the strategies implemented to reinforce other approaches to achieve the overall goal of the program.

A comprehensive review of relevant sections of the existing livestock legislations (i.e. Livestock Act of Bhutan 2001 and Livestock Rules and Regulations of Bhutan 2017) under the guidance of the Legal Division of the Ministry was conducted. The review findings revealed that the critically needed legal provisions to ensure effective enforcement of legislation were

not adequately covered in the existing legislation. It therefore had resulted in development of additional pet management measures in consultation with relevant stakeholders. The additional pet management measures were then endorsed by the 129th Session of the Lhengye Zhungtshog in line with the exercise of the authority granted by Article 20 Section 8 of the Constitution of Bhutan; and issued for immediate implementation vide Executive Order no. C-4/2022/1400 dated October 3, 2022.

Following the executive order and in exercise of the authority granted by Section 36.1 of the Livestock Act of Bhutan 2001, the Livestock Rules and Regulations of Bhutan 2017 was amended along with insertion of critically required new sections. The Livestock (Amendment) Rules and Regulations of Bhutan, 2022 was then issued through government notification vide letter no. DOL/MoAF/30/2022-2023/330 dated October 27, 2022 for immediate enforcement by the regulatory authority in collaboration with the local government.

Awareness was raised on dog population management legislation, its importance, and the potential consequences of non-compliance to foster understanding and cooperation of the public and collaboration between relevant stakeholders in order to ensure enforcement efforts were more effective. Sensitization programs were conducted through virtual meetings, face-to-face meetings, panel discussions and through dissemination of information using effective information, education and communication materials such as animations, banners, posters, brochures and leaflets. National television, local television, radio, social media platforms were channels used to raise awareness and solicit support for effective enforcement. Legislation enforcement teams consisting personnel from livestock sector, BFDA and local authority conducteds ad hoc monitoring for compliance and imposed fines for non-compliance based on the nature of violation.

The revision and amendment of livestock legislation had resulted in creation of a comprehensive legal tool to ensure responsible pet ownership and address the challenges associated with free-roaming dog population including feral dog population management and control.

7.9. Nakulu Dog Shelter

Figure 54: Nakulu dog shelter: signing of MoU (left) and Inauguration (right)

To provide shelter to aggressive free-roaming dogs posing threat to the city dwellers, school goers and tourists visiting Thimphu city, a dog shelter was built at Nakulu, Thimphu. The shelter was constructed by the Department of Livestock and handed over to the Animal Lover Group after signing a memorandum of understanding (MoU) on January 16, 2023.

According to the MoU, the department would provide technical support such as sterilisation, treatment, and micro-chipping. The shelter bears the cost of vaccination and feeding. At the forefront of the group is Zeus, a dog-feeding organisation.

8. BIOMEDICAL EQUIPMENT MAINTENANCE SECTION

8.1. Mandates

The main mandates of BEMS comprise of:

- Provide biomedical equipment maintenance service to agencies under the Department of Livestock
- Provide biomedical equipment calibration services to the agencies under the Department of Livestock
- Capacity building for technical officials on minor equipment maintenance and calibration

8.2. Human Resource

- Mr Durga Prasad Sharma, Executive Engineer

8.3. Need assessment of microbiology equipment

The Centre conducted a need assessment of microbiology equipment for the National Food Testing Laboratory (NFTL) under Bhutan Agriculture and Food Regulatory Authority (BAFRA), Regional Livestock Development centre (RLDC) Khangma and Tsimasham and NCAH Serbithang, carried out from 7th to 18th September 2022. The spare parts for the same were purchased through Fleming fund and the BEMS is in process of repairing these machines.

Findings of the need assessment are as described in the following tables.

Table 36: Need assessment findings for RLDC, Tsimasham

SN	EQUIPMENT	BREAKDOWN DETAILS	SPARE PARTS REQUIRED	QTY
1.	Microscope	The slides were not seen properly The bulb was not glowing	Lens Bulb(12V,20W)	Set 5 nos
2.	Deep Freezer	Checked and found that the compressor is not working	Compressor	1
3.	Horizontal Autoclave	Checked and found that the there is no heat in the machine	Kettle Element (3KW)	5 Nos
4.	Biosafety Cabinet	There is error in flow of the machine and always there is some tip in the machine	1. SMPS Relay	1 1 1
5.	Deep Freezer	The machine isn't working	1. Compressor 2. PTC relay 3. R134A Gas	1 3 3

Table 37: Need assessment findings for RLDC, Kanglung

SN	EQUIPMENT	BREAKDOWN DETAILS	SPARE PARTS REQUIRED	QTY
1.	Hot Air Oven	Checked and found that there is no heat which is circulating inside the chamber	Fan	1
2.	Double Distillation Plant	The water is not flowing inside the machine	Solenoid Assembly	1
3.	Biosafety Cabinet	Continuous alarm in the machine	Sash connector cable UV light	1 1
4.	Microscope	Blur vision in the machine	Lens	1
5.	CPU	The PCB and the machine is burnt		1

Table 38: Need assessment findings for NFTL, Yusipang

SN	EQUIPMENT	BREAKDOWN DETAILS	SPARE PARTS REQUIRED	QTY
1.	Biosafety cabinet	There is continuous sound when the machine is switched ON as there is some flow error	1. Hepa Filter	1
2.	UPS (6KVA)	UPS not giving proper backup	1. Batteries	20
3.	Laboratory Refrigerator	The machine is not maintaining temperature	1. Compressor 2. PTC Relay	1 3
4.	Biosafety Cabinet	The machine is not switching ON and the Hepa Filter is dirty	1. Main Control Boad	1 1

Table 39: Need assessment findings for NCAH

SN	EQUIPMENT	BREAKDOWN DETAILS	SPARE PARTS REQUIRED	QTY
1.	Refrigerator	Temperature is not maintaining in the machine	1. Compressor 2. PTC relay 3. R134 A Gas	
2.	Microscope	The scope is not switching ON	PCB Assembly	
3.	Deep Freezer	The unit is not maintaining the temperature	1. Compressor 2. PTC Relay 3. R134A gas	
4.	Deep Freezer	The unit is not working	1. Compressor 2.Nipples & connectors 3. PTC relay, 3pin type	Set
5.	Microscope	The bulb is blown out	Bulb	

8.4. SOP and training documents for Biosafety Cabinets

Working principle of BSCs and its types and differences between types

The pretest was followed by a lecture on the working principle of BSCs and different types of BSCs. We have learned that Bio-safety Cabinet (BSCs) is an enclosed, ventilated workspace and used as primary barrier in containment laboratory, in which the infectious microorganism, clinical samples/ agents can be handled safely. BSCs are used for personal, environment and product/specimen protection.

Depending on the level of biological safety, there are three types of BSCs viz. Class I, Class II (further classified as A1, A2, B1 and B2) and Class III. Class II A1 are discontinued from market its plenum is positively charged, which means there are chances of leakages of contaminated air into the workspace. The commonly used are Class II A2, Class II B1 and Class II B2. The differences between the types of BSC are as follows.

Table 40: Difference between the types of BSCs

Class II A1	Class II A2	Class II B1	Class II B2
Non-Ducted	Non-ducted	Hard Ducted	Hard Ducted
70 % recirculation and 30 % exhaustion	70 % recirculation and 30 % exhaustion	30 % recirculation, 70 % exhaustion	100 % exhaustion
+ve pressure in plenum, in case of leakage from the edges or filter , contaminated air released in workspace	-ve pressure in plenum	Not economical (need to maintain temperature as well as pressure)	Not economical (need to maintain temperature as well as pressure)
Blower positioned below the workspace	Blower positioned near the supply filter	Exhaust HEPA not accessible for integrity test	Exhaust HEPA not accessible for integrity test
30 % of aerosols challenged to HEPA (exhaust)	30 % of aerosols challenged to HEPA (exhaust)	70 % of aerosols challenged to HEPA (exhaust)	All aerosols challenged to only one HEPA (exhaust) due to 100 % exhaustion(environmental protection questionable)
Not suitable for handling volatile chemical and radio nuclides.	In case of handling volatile chemical and minute amounts of radio nuclides. Thimble ducting can be used along with Class I A2.	Applicable where toxic chemicals and tracer amounts of radio nuclides are handled	Applicable where toxic chemicals and radio nuclides are handled
No backflow	If thimble ducted and placed in negative pressure room, then damper would be required	Damper required to prevent backflow of air (during off condition) from environment into the negatively pressurized room	Damper required to prevent backflow of air (during off condition) from environment into the negatively pressurized room

8.5. Procurement of lab diagnostic equipment and spare parts

The National Centre of Animal Health had procured the PCR machine, Model: Quant 5 from M/s Dzambala, Bhutan since they are the Authorized Supplier of M/s Thermo Fisher Scientific in our Country. Since, the machine was under breakdown, and we have procured the required spare part they center now needs to fix the machine using those spare parts as well as calibrate the machine after fixing the same. Therefore, the center had asked for the Proforma Invoice for the same from the Authorized supplier from Bhutan as they are only having the calibrator and software to repair the PCR machine. The machine was repaired and handed over to user in the working condition.

8.6. Equipment Calibration

The Bio-Medical Engineering Unit with the help from Department of Bio-medical Engineering Ministry of Health assisted in the calibration of Bio-Safety Cabinets, these projects were through Fleming fund.

The Bio-Medical Unit also assisted the Department of Bio-medical Engineering Ministry of Health assisted in development of Standard Operating Procedures (SoP) and calibration of Weighing balances, Pipettes, Vortex Mixer, and other equipment which is used in laboratory.

9. DISEASE SURVEILLANCE AND ANIMAL HEALTH RESEARH

9.1. Animal disease surveillance and related activities conducted, FY 2022 – 2023

9.1.1. Antimicrobial resistance in indicator Escherichia coli from poultry in Bhutan

Puspa Maya Sharma, Nirmal Kumar Thapa, Tenzinla, Bindu Parajuli, Samdrup Zangmo

Poster presentation at "First Research Conference on Antimicrobial Resistance and Antimicrobial Use in food Animals in Asia and the Pacific" online 6-8 February 2023

Abstract

The emergence and spread of resistant bacteria have been threatening the ability to treat an infection in both human and animals globally. Though Antimicrobial resistance (AMR) was observed in Bhutan in past, it has received due attention only in recent years with the global drive for combating the growing problem. This study was conducted to assess antimicrobial resistance in indicator *Escherichia coli* isolates from poultry farms in Bhutan.

Four hundred and nine ceca samples were collected from commercial and semi-commercial poultry farms from August 2021 to November 2021. The cecal content was processed for isolation and identification of *E. coli* as per the standard operating protocol at national veterinary laboratory. Antimicrobial susceptibility testing was performed using Kirby-Bauer disk diffusion method on Muller Hinton agar. Antibiotic resistance was estimated by measuring the respective zones of inhibition (diameters) around each antibiotic disk and interpreted as per the CLSI guidelines. A multidrug resistant (MDR) strain was defined as one which was resistant to at least three different classes of antimicrobials.

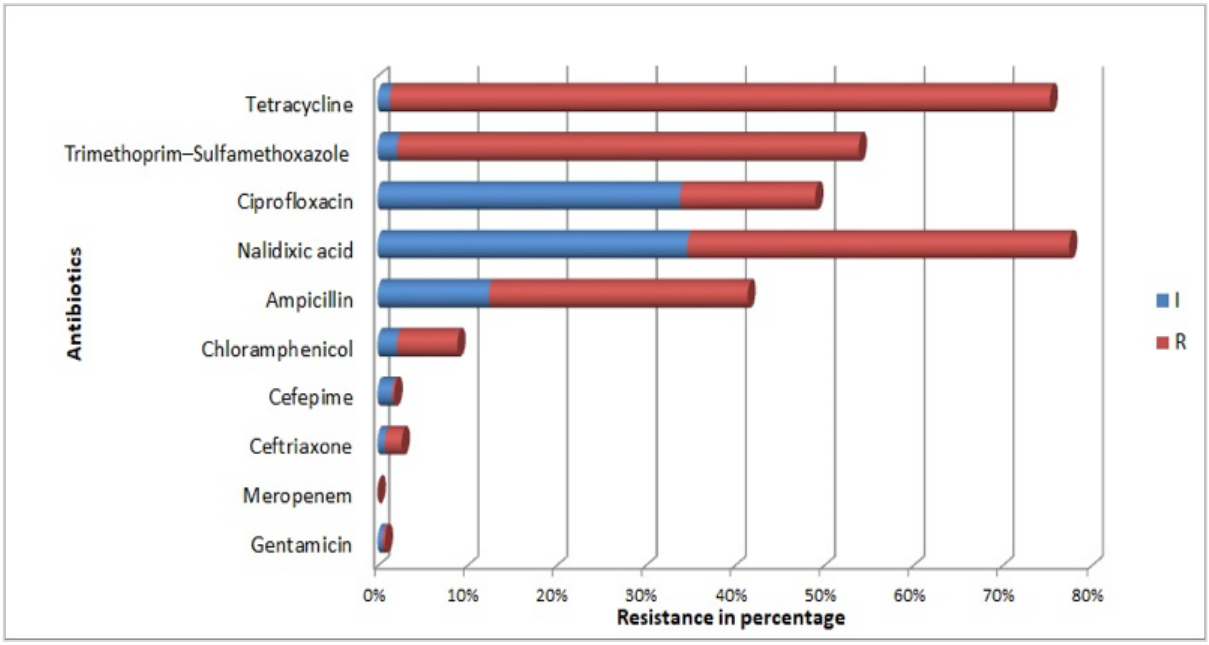


Figure 55: Phenotypical resistance to antibiotics detected in E.coli from poultry

Three hundred and sixty-nine (369) *E. coli* isolates were isolated from 263/409 (64%) layer farms and 106/409 (26%) from broiler farms. In *E. coli* isolates the prevalence of resistance was highest for tetracycline (74%) followed by trimethoprim–sulfamethoxazole (51.8%),

nalidixic acid (42.8%), ampicillin (29%), ciprofloxacin 15.2%, chloramphenicol (6.8%) and ceftriaxone (1.9%). A total of 138 (37%) *E. coli* isolates were detected to be MDR.

Table 41: Number of isolates showing resistance to one or more antibiotics

Resistance	R0	R1	R2	R3	R4	R5	R6	R7
No of Isolate (%)	45 (12%)	75 (20%)	111 (30%)	74 (20%)	36 (10%)	18 (5%)	9 (3%)	1 (0.3%)

9.1.2. Antimicrobial resistance surveillance in poultry in Bhutan

Summary Report

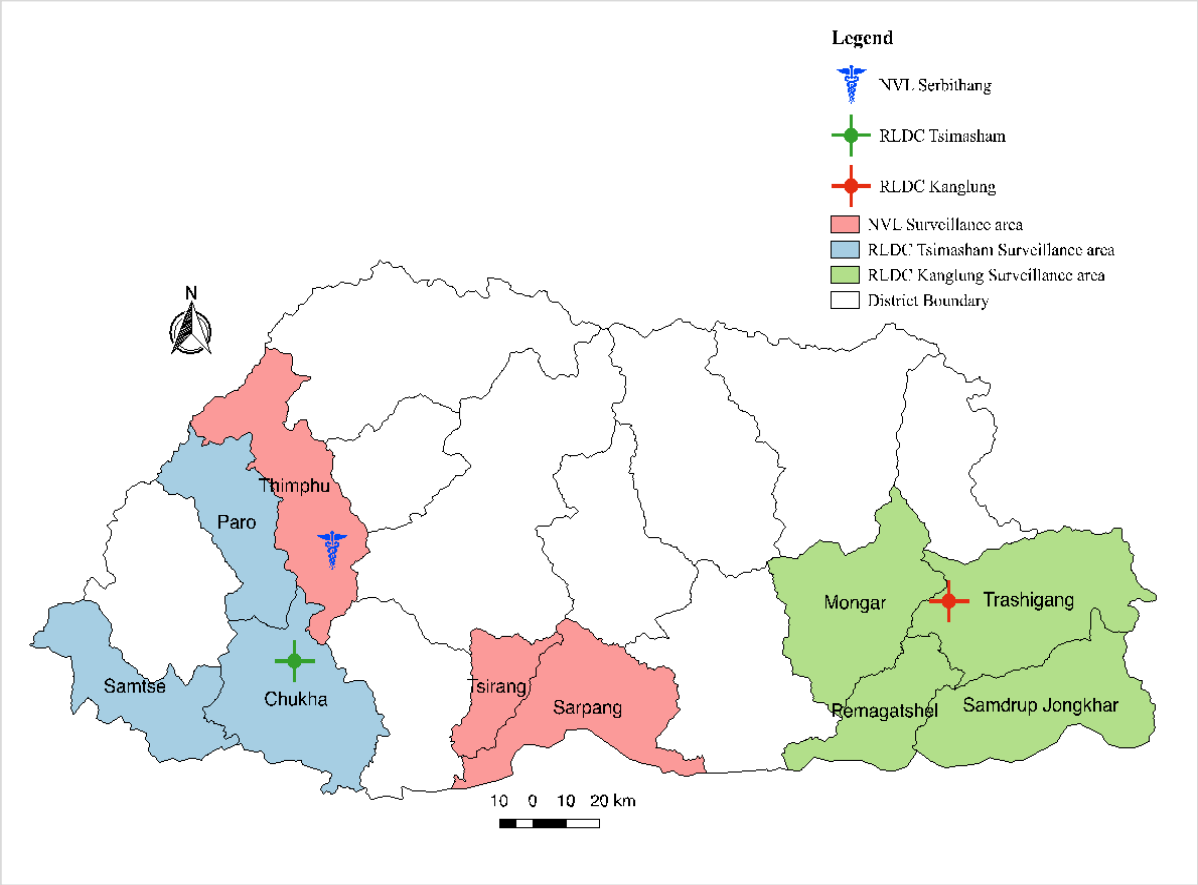


Figure 56: Surveillance areas for each Surveillance site laboratories

Antimicrobial resistance (AMR) is a global health concern as new resistance mechanisms are emerging and resistant infections are spreading globally. Bhutan received the UK government-based Fleming Fund Country Grant during 2019, mainly focusing on building the foundation for AMR and AMU surveillance. Under the current grant, active surveillance of antimicrobial resistance in zoonotic and indicator bacteria from the healthy broiler and layer chicken populations was carried out. It is assumed that the potential risks for contributing to AMR in humans are highest in chickens compared with other livestock species for the country, as chicken is the most commonly farmed species, with over 90 billion tons of chicken meat produced per year with high use of antibiotics in the poultry industry (FAO 2017).

Objectives

The main objective of the study was to detect the prevalence and generate the baseline information on AMR in E.coli, Enterococcus, Salmonella and Campylobacter in chicken against the priority antimicrobials. This group of target bacteria was selected as priority organisms (WHO, WOAH 2018, AGISAR program 2017)

Results

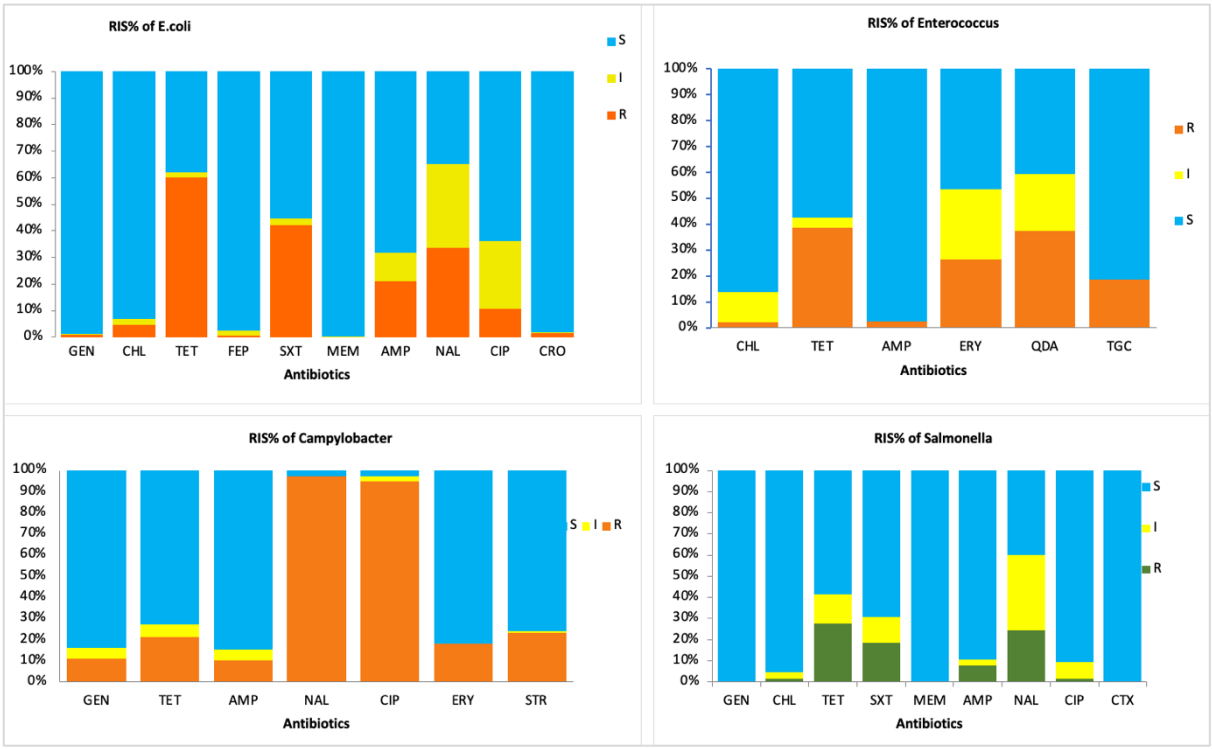


Figure 57: Resistance against target organisms

E.coli

91% *E.coli* isolates (722/792) were identified and tested for resistance against 10 antibiotics with highest resistance detected in tetracyclin (60%), trimethoprim-sulfamethoxazole (42%), nalidixic acid (34%), ampicillin (21%), ciprofloxacin (11%)

Enterococcus

95% *Enterococcus* spp. (756/792) were identified and tested for resistance against 6 antibiotics with highest resistances detected in tetracycline (39%), quinupristin-dalfopristin (38%), erythromycin (27%) and tigecycline (19%).

Campylobacter

15% (117/792) *Campylobacter* spp were identified and tested for resistance against seven antibiotics with highest resistance observed in nalidixic acid (97%) ciprofloxacin (95%), streptomycin (23%)

Salmonella

8% (65/792) *Salmonella* spp were identified and tested for resistance against nine antibiotics with higest resistance detected in tetracycline (28%), nalidixic acid (25%), trimethoprim–sulfamethoxazole (18%).

9.1.3. Highland disease surveillance

Along with the conduct of awareness and education of yak herders on highland livestock diseases, samples were collected from yaks and yak watchdogs in all the gewogs technical teams have visited.

Samples were shipped to NCAH and tested against the target diseases. The serum samples were tested for priority yak diseases such as Infectious Bovine Rhinotracheitis, Bovine Viral Diarrhoea, Peste des petits ruminants and Brucella. The fecal samples collected from yak watchdogs were examined for Taeniids and other gastrointestinal parasites.

9.1.3.1. Taeniids and other parasites

A total of 24 fecal samples collected from yak watchdogs in 4 highland gewogs were examined for different parasites. 4 samples from Merag, Trashigang tested positive for Taeniid species, and the rest were negative. Other parasites found in these samples were Isospora, Ancylostoma, Toxocara, Strongyloides and Coccidia species.

Table 42: Test results for yak watchdog fecal samples

Gewog Name	Isospora spp.	Ancylostoma spp.	Toxocara spp.	Taenia spp.	Strongyloides spp.	Coccidia spp.
Bji		1				
Dakarla		2				
Merag	1			4	3	5
Sakteng	8	5	3			
Grand Total	9	8	3	4	3	5

In addition, 130 fecal samples collected from yaks in 6 highland gewogs were examined for various gastrointestinal parasites. Stronglyloides and Coccidia species were identified in majority of the samples, and other parasites such as Ascaris, Stronglye and Trichuris species were also identified (Table 36).

Table 43: Test results for yak watchdog fecal samples

Gewog Name	Samples tested	Strongyloides spp.	Coccidia spp.	Ascaris spp.	Strongyle spp.	Trichuris spp.
Bji	64	34	25	8	5	
Dakarla	15	11	15	2		
Laya	22	13	20	2		1
Merag	13	7				
Saephu	1	1				
Sakteng	15	7	7	2		
Grand Total	130	73	67	14	5	1

9.1.3.2. Priority yak diseases

Serum samples collected from random yaks of Merag, Sakteng, Saephu and Soe gewogs were tested against priority yak diseases as shown in the following table.

Table 44: Summary of serology tests and results

Name of disease	Test Result		
	Positive	Negative	Total
Infectious Bovine Rhinotracheitis	37	46	83
Bovine Viral Diarrhoea	0	83	83
Bovine Tuberculosis	0	83	83
Peste des petits ruminants	0	83	83
Brucellosis	0	83	83

A total of 415 tests were performed on 83 samples for the above-listed diseases. All the samples tested negative for BVD, Bovine TB, PPR and Brucellosis; however, 37 of them tested positive for IBR.

Table 45: IBR test results

Gewog	Test Result		
	Positive	Negative	Grand Total
Merag	7	23	30
Sakteng	13	15	28
Saephu	16	4	20
Soe	1	4	5
Grand Total	37	46	83

9.2. Research articles published during FY 2022 – 2023

9.2.1. Porcine circovirus-associated disease (PCVAD) investigation in government pig breeding farms

Nirmal Kumar Thapa

Published in Bhutan Journal of Animal Science (BJAS), Volume 7, Issue 1, Page 108-113, March 2023

Abstract

Porcine circovirus type 2 (PCV2) belonging to genus Circovirus is the primary causative agent of several syndromes collectively known as porcine circovirus-associated disease (PCVAD). An investigative study was conducted on the prevalence of PCVAD following a report of various degrees of morbidity and mortality in targeted government pig farms (NNPBC, Yusipang, NPBC, Wangchutaba & RPPBC, Lingmethang). Screening of sera samples conducted during September 2021 detected seroprevalence of PCV2 of 28/29 (96.5%) at RPPBC Lingmethang, 11/11(100%) at NNPBC Yusipang and 5/5 (100%) at NPBC

Wangchutaba. From the same serum samples screened also detected seroprevalence of PRRSV as 7/29(24.1%) at RPBC Lingmethang, 1/11(9%) at NNPBC Yusipang indicating coinfection. However, from the clinical samples of NNPBC, Yusipang 5/10 (50%) tested positive to PCV2 through rtPCR during September 2021, whereas from the clinical samples of outbreak at RRPBC, Lingmethang during September 2022, 11/11(100%) sera tested positive in ELISA to PCV2 antibodies; 11/11(100%) of vaginal swab samples and 5/5(100%) of organ samples tested positive to PCV2 in PCR. All the clinical samples from RRPBC, Lingmethang tested positive to PCV2. As the prevalence of disease is quite evident, a strict biosecurity control measures at the farms should be implemented to stop further spread of the virus. Besides, vaccination of pigs like in other countries may have to be explored and adopted in these government farms if found feasible. Furthermore, a detailed study needs to be conducted in all the government and private pig farms with larger sample size to clearly understand the real status of the disease in the country for devising an appropriate intervention.

9.2.2. Understanding the impact of climate change and resilience among highlanders in northern parts of Bhutan: A case study in Gasa district

Tshering Dorji [1,2], Deki Yangzom[3], Nima Norbu [1], Sangay Rinchen[4], Jambay Dorjee[2], Tenzin Tenzin [4,5]*

1 District Livestock Sector, Gasa District Administration, Khatoed, Bhutan, 2 Department of Livestock, Regional Livestock Development Center, East Central Region, Zhemgang, Bhutan, 3 College of Natural Resources, Royal University of Bhutan, Lobesa, Bhutan, 4 National Center for Animal Health, Department of Livestock, Thimphu, Bhutan, 5 World Organisation for Animal Health, Sub Regional Representation for Southern Africa, Gaborone, Botswana

Abstract

Mountainous regions are affected the most by climate change across the world. The livelihood of highlanders primarily depends on livestock farming and natural resources. In Bhutan, yak farming and sale of *Cordyceps sinensis* (caterpillar fungus)remain the main source of income for most highlanders. We conducted a study to understand the impact of climate change on the community livelihoods in Bhutan. A cross-sectional survey was conducted and interviewed 132 household heads, two focus group discussions of 20 respondents (10 in each group), and key informant interviews (n = 5) in two highland communities (i.e., Laya and Lunana) of Gasa district in northern Bhutan between August 2019 and February 2020. The study revealed that the caterpillar fungus (78.8%) is the major source of income for highland communities which overtook the yak farming practices since its legalization in 2004. More than 80% of households have abandoned yak farming due to its poor economic return because of the decreased utility of yak for meat purposes and other socio-cultural related practices. The majority of the respondents (91%) expressed concern that climate change is posing a threat to the growth and subsequent harvest of caterpillar fungus. The highland people reported emergence of insects/vectors in their community and mosquitoes were the most frequently reported (85%) insect. A small proportion of respondents (1.5%) were concerned about the grazing habitat of the yaks due to the change in the botanical composition of the rangeland. Given that there is a decrease in caterpillar fungus, which is the main source of income for highland communities, this study calls for a climate-resilient community-based economic

opportunity for the sustainable livelihood of highland communi- ties. Furthermore, we recommend a detailed study of the negative impacts due to climate change on freshwater resources, the distribution of vectors and vector-borne diseases, and rangeland ecology in the highland.

9.2.3. Antimicrobial Consumption in the Livestock Sector in Bhutan: Volumes, Values, Rates, and Trends for the Period 2017–2021

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2.Asia-Pacific Centre for Animal Health, Melbourne Veterinary School, Faculty of Science, University of Melbourne, Parkville, VIC 3010, Australia
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†These authors contributed equally to this work.

Abstract

Data on the use of antimicrobials in humans and livestock may provide evidence to guide policy changes to mitigate the risk of antimicrobial resistance (AMR). However, there is limited information available about antimicrobial use in livestock in low- and middle-income countries, even though these nations are most vulnerable to the impact of AMR. This study aimed to assess the consumption of veterinary antimicrobials in Bhutan and identify areas for improvement to reduce the use of antimicrobials in livestock. National data on livestock numbers and annual procurement of veterinary antimicrobials over five years (2017–2021) were used to calculate rates of antimicrobial consumption and annual national expenditure on veterinary antimicrobials in Bhutan. The rate of antimicrobial consumption in Bhutan was 3.83 mg per population correction unit, which is lower than most countries in Europe, comparable with the rates of consumption in Iceland and Norway, and approximately 120-fold lower than published rates of antimicrobial consumption in South Asian countries, including Nepal and Pakistan. The low rates of antimicrobial consumption by the animal health sector in Bhutan could be attributable to stronger governance of antimicrobial use in Bhutan, higher levels of compliance with regulation, and better adherence to standard guidelines for antimicrobial treatment of livestock.

10. HUMAN RESOURCE AND CAPACITY BUILDING

10.1. Refresher training on culture, identification and AST; Updating SOPs, LQA manual (activity codes 3.2.2, 3.2.8, 3.2.9)

Summary

Standard Operating Procedures (SOPs) for culture, identification and antimicrobial susceptibility tests (AST) for Salmonella & E. coli were developed and are being used for the AMR surveillance. However, as anticipated, there may be need for updating/revising these SOPs based on the field experiences. Following the development of SOPs, the technicians of the surveillance laboratories were trained on the culture, identification and AST for Salmonella & E. coli. The techniques were used for the AMR surveillance. It was also anticipated that, the technicians will encounter issues on the methods. Hence, the refresher training was proposed based on the revised or updated SOPs.

One of the important activities in DTiP is developing the laboratory quality assurance manual. Hence, the drafting was carried out. One of the activities in DTiPs, was conducting the internal quality assurance system (IQAS) in their respective labs. The IQAS was demonstrated by the technicians from NCAH during the visit. Hence, there is a need to review and discuss on the IQAS followed by each surveillance laboratories. Since all the activities are related, the workshop was carried out together. The resource was provided by NCAH and RCDC and the participants were from NCAH, RLDC Tshimasham/Kanglung/Wangdi/Zhemgang and BAFRA.

10.1.1. Revision on SOPs (activity code 3.2.2)

Based on the discussion, not much updating was required. However, some minor updates were carried out on the following SOPs:

- SOP on Internal quality control and maintenance of ATCC reference strains
- SOP on handling samples for Campylobacter isolation at regional laboratories
- SOP on bacterial isolate transportation
- SOP on detection of ESBL-producing Enterobacteriaceae.
- SOP on CLSI disk diffusion susceptibility testing
- SOP on isolation and identification of Escherichia coli
- SOP on isolation and identification of Salmonella spp.
- SOP on isolation and identification of Enterococcus spp.
- SOP on Isolation and identification of Campylobacter spp.

10.1.2. Development of Laboratory Quality Assurance Manual (Object 3.2.8)

To generate the quality AMR data, there is a need for producing quality laboratory results. For ensuring the laboratory quality in the bacteriology section, development of quality manual is very much essential.

Quality is the concept elaborated and international consensus obtained through the efforts of the International Organization for Standards (ISO). According to ISO, quality is defined as the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs.

In animal health laboratory facility, a report is the analysis of the material received by the laboratory and processed by the laboratory technician to obtain accurate diagnosis.

The main benefits of good quality assurance of a laboratory are:

- Delivering accurate, reliable and timely laboratory results.
- Helping the veterinary clinician establish proper and rapid diagnosis,
- Creation of a good reputation for the laboratory
- Motivation factor for staff to work better
- Mandatory requirement for accreditation
- Prevention of legal suits and associated complications
- Efficient utilization of resources
- Cost-saving on account of wrong/over/under treatment
- Assuring safety of patients, staff, visitors, community and environment

In order to implement quality assurance system, manual is required to guide the activities. Hence, the LQA manual was drafted during the workshop and the main aim of this manual is to meet the QA & QC requirements and assure that all the data generated for analysis are valid, comparable with precision and accuracy.

10.2. Training on Enhanced Laboratory Information Management System (LIMS) (3.8.4)

LIMS is the online database system designed to efficiently manage information of all the veterinary laboratory activities in the country. The data base has the features for online entry of owner's details, animal details, sample details, test result, diagnosis and recommendation. The system helps the veterinary laboratories to track samples from submission to testing and reporting. This database also enables real time tracking of sample testing status through a paperless system. Besides, data storage and test result dissemination. The system is being used by all the laboratory facilities under the Department of Livestock (DoL) viz. National Veterinary Laboratory under National Centre for Animal Health (NCAH), National Veterinary Hospital (NVH), Regional Livestock Development Centres (RLDCs), Satellite Veterinary Laboratories (SVLs) and Dzongkhag Veterinary Laboratories (DVLs). The additional advantage of the system is that it can be remotely accessed by any authorized personnel.

A three-day hands-on training on enhanced laboratory information management system (LIMS) was conducted in two batches: Punakha from 12 to 14 of December 2022, Paro from 10 to 12 of April 2023. The training was being conducted by National Centre for Animal Health (NCAH) in collaboration with Project Management Unit, Ministry of Health and ICTD, MoAF.

The first batch of the training program was attended by 39 laboratory officials from RLDC, TVH & SL, NVH; DVH: Thimphu, Paro, Chhukha, Wangdi, Bumthang, Zhemgang, Lhuentse, Monggar, Tsirang, Trashigang, Trashi Yangtse, Gasa, Trongsa, Haa.

The second batch of training program was attended by 34 officials from NCAH, RLDC, NVH, RVH & EC, SVL, DVH and central farms: Samtse, Dagana, Gasa, Lhuntshe, Monggar, Tsirang, Trashigang, Trongsa & Gasa.

Figure 58: Hands-on training on LIMS (first batch - left; second batch - right)

10.3. Advance Training on microbiology, laboratory quality assurance, Advanced training on Campylobacter microbiology (Activity code: 3.2.5, 3.2.8, 3.4.1)

Date: 19 – 23 December 2022

Summary

The surveillance laboratories were trained to carry out culture, identification and AST. The initial plan to train laboratory staff on advance microbiology at international laboratory couldnot be achieved due to covid 19 pandemic. Hence, the activity under DTIP, FF was conducted using local expertise. A five-day long hands-on-training on advance microbiology i.e. culture & isolation of *Campylobacter*, AST, PCR for *E. coli,* and *Salmonella spp*. was conducted at (NCAH), Serbithang and RCDC from 19-23rd of December, 2022. About 26 participants representing the bacteriology labs from Department of Livestock (National Veterinary Laboratory, Regional Laboratories of Regional Livestock Development Centre, National Veterinary Hospital) and BAFRA (National Food Testing Laboratory) and also Royal Centre for Disease Control (RCDC) were involved. The training was conducted by senior laboratory technician from NCAH, Serbithang and resource person from RCDC, Serbithang.

The training was funded by the Fleming Fund Country grant.

The main objectives of the training were to 1. upgrade the skills of lab technicians on advance microbiological techniques, on AST using Vitek machine, molecular analysis of *E. coli, Campylobacter and Salmonella.* 2. To sensitize surveillance laboratories on Laboratory Quality Management System and 3. Laboratory Quality Assurance in bacteriology Laboratories.

The following activities were carried out:

Topics of presentations	Topics of practical
Phenotypic testing of ESBL, Amp C/carbapenemase	Topics of practical Culture of Salmonella & E. coli
Conducting of AST in Vitek Machine	Culture of Campylobacter

Quality Assessment Schemes (NEQAS, EQAS)	AST reading in Vitek machine, biochemical test & AST for E. coli
Laboratory Quality Management System	Culture for Salmonella & E. coli
Management of documents	DNA extraction of E. coli
SOPs	Reading of AST result
Laboratory Quality Assurance in Bacteriology Lab	PCR multiplex for E. coli
Quality control of bacteriological techniques &	Gel running (PCR for E. coli)
Quality control of Laboratory Materials	Running conventional PCR for E. coli
Validation & quality control of equipment	
Quality Assurance in AST	
Quality control of Sterilization & Disinfection	

10.4. Cascading training on Biosafety & Biosecurity (3.5.2)

Summary

As per the DTiP for the Fleming Fund country grant, RCDC has conducted TOT on biosafety & biosecurity during November2022. The focal persons from NCAH attended the TOT. Hence, the NCAH conducted the cascade training on biosafety and biosecurity for the laboratory staff on 16/12/2022 at NCAH.

About 12 participants attended the training. Resources persons were from NCAH and RCDC and were funded by Fleming Fund project.

Methodology

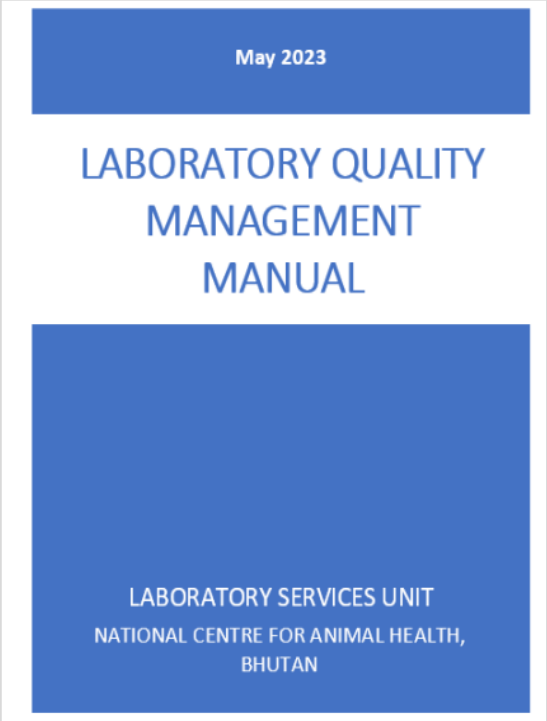
The methodology used was through series of presentations on following topics: Fundamentals of Biosafety, *Laboratory Biosafety Manual,* Putting biosafety measures in place , Risk assessment Frameworks, Developing Risk Control Strategies, Developing Risk Control Strategies, Biological Risk Assessment in Veterinary Laboratories,

10.5. Finalization of the Laboratory Quality Management Manual 3.2.8

Date: 22 to 26th May 2023; Venue, Paro

Summary

Main motto of any laboratory is to provide quality laboratory diagnosis. Further, for any diagnosis, surveillance and trade, valid laboratory results are very much essential. Such results can be achieved only by the use of good laboratory management practices, valid test and calibration methods, proper techniques, quality control and quality assurance, all working together within a quality management system. Laboratory quality management includes technical, managerial and operational elements of testing and the interpretation of test results. A quality management system enables the laboratory to demonstrate both competency and an ability to generate consistent technically valid results that meet the needs of its clients.



The laboratories under animal health follow quality assurance system partially. There is lack of proper manual for implementation and monitoring of laboratory quality management system (LQMS). AMR surveillance is being carried out by the National Centre for Animal Health, Regional Livestock Development Centers under DoL and National Food Testing Laboratory, BAFRA. Hence, we need to produce quality microbiology results at par with the international standards. The first draft on LQM was developed during 2022. Hence, the finalization of the Laboratory quality management system (LQMS) manual was carried out by the team representative experts from MOH, Bhutan FDA, and JDWNRH Thimphu, and NCAH Serbithang through the fund support from Fleming fund w.e.f, 22nd to 26th May 2022 at Tiger Nest and Resort Paro. The representation from the field representatives from RVH&EC P/ling, Gelephu and Deothang and RLDC Kanglung also attend the training. This was based on the MOAL HRD HRC note sheet approval vide award letter no. MOAL/HRD/DOL/3(c)2023/386 dated 17th May 2023.

Way Forward

- With finalization of the LQM, a next level of workshop is required to develop the missing procedures, SOPs and forms linking the LQM and procedures.
- The Microbiology LQ Assurance manual needs further deliberations in sperate sitting after the completion of LQM manual.

10.6. Monitoring of Enhanced Laboratory Information Management System, Assessment of Laboratories using FAO Laboratory Mapping Tool at RVH & EC, RLDCs & SVL

Summary

The monitoring on the use of Enhanced Laboratory Information Management System and Assessment of Laboratories using FAO Laboratory Mapping Tool were carried out at RVH & ECs, RLDC & SVL during the month of June 2023 as per the DTiP of the Fleming Fund country grant. LIMS was being used smoothly by all the laboratories with not much major issues. Minor issues like addition of tests were done on site and explained. The common issue was observed in the result print lay out where it can be downloaded or printed only in landscape format which needs to be rectified. The NCAH letter head for the result might have to be replaced by Department of Livestock letter head.

As per the FAO LMT assessment, almost all the labs do not meet the requirement of Infrastructure, equipment and general supplies especially for the RVH & ECs and SVL. In addition, biosafety & biosecurity and also laboratory quality management are lacking. To take up the microbiology activities, by these labs except, RLDC, there is a need for proper

infrastructure or refurbishment. The equipment transferred from the then RLDCs at RVH & ECs, SVL needs installation, validation and calibration for which biomedical engineering support is required.

10.7. Training on data analysis workshop

Date: 26 – 30 December 2022

A five days' workshop on data analysis is under way at Gelephu. The training is being conducted by National Centre for Animal Health in collaboration with Felming Fund, Project Management Ministry of Health. The training is being conducted from 26 to 30 of December 2022) and resources persons are from, DoL, NFTL, BAFRA, MOAF and JDWNRH, MoH.

Under the Detailed technical implementation plan (DTiP) of the Fleming Fund Country Grant Project (FFCG)*, data analysis training* of key officials from animal health (DoL) and food safety (BAFRA) sectors and producing quality report were being identified as important activities. The data analysis is specifically focussed on the antimicrobial resistance (AMR) and antimicrobial consumption/utilization (AMC/U) in these two sectors. During the workshop, various data collected during the three years' period of Fleming Fund country grant viz: AMR surveillance in healthy chicken, AMR surveillance in frozen chicken, veterinary antimicrobial consumption, KAP survey of poultry farmers, guideline appraisal survey and others will be analysed and preliminary reports generated. These AMR related reports will be first of its kind within the animal health and food safety domains in Bhutan. These reports can in turn be used to guide policy decisions which are aimed at AMR mitigation in the country and also serve as baseline references for similar studies in the future.

The workshop was attended by 18 officials from NCAH, RLDC, NVH, Dzongkhag Veterinary Hospitals (DVH): Paro and Trashi Yangtse under DoL & NFTL, PLQS from BAFRA.

10.8. Development of Antibiotic Panels for Susceptibility testing for small animal, ruminants, poultry, pig, horses

The development of the antibiotic panels for susceptibility testing was aimed to standardize the antibiotic panels tested for bacteria against various animal species with the availability of the drugs with the clinicians and to harmonize the antibiotic susceptibility testing among the veterinary laboratories for routine test.
The antibiotic panel was developed with support from Fleming Fund mentors Professor Glenn Browning, Director, Asia-Pacific Centre for Animal Health, Dr. Mauricio coppo, Fleming Fund fellows Ms. Puspa Maya Sharma, Dy Chief Laboratory Officer, Dr Pema Tshewang, Dy Chief Veterinary Officer, Dr Basant Sharma, Animal Health specialist, Dr. Meena, Dy. Chief Veterinary Officer and Mr. Tenzinla Sr. laboratory Technician. Antibiotic panels are specific for animal species and selected based on antibiotic available for prescription.

10.9. Hands-on-training on advance microbiology techniques (Culture, Identification and Antibiotic Susceptibility Testing, Enterococci, Salmonella and E. coli and Isolate preservation, Vitek 2 compact)

Date: June 19 – 23, 2023; Venue: National Veterinary Laboratory, National Centre for Animal Health, Serbithang

Owing to reformations and restructuring of the regional livestock development centers recently and mobilization of the laboratory technicians to new RVH&ECs, there is a need to upskill on microbiological techniques including antibiotic susceptibility testing methodologies. Therefore, through the support of Fleming Fund, NCAH is planning to train the laboratory technicians of RVH&EC and National Food testing Laboratory, Yusipang on the microbiological techniques so that the trained expertise can continue with microbiology testing at their facilities.

Hence, five days long hands-on-training on microbiology techniques for culture, identification and antibiotic susceptibility testing of *Enterococci, Salmonella* and *E. coli* from cattle was conducted at (NCAH), Serbithang from 19th June – 23rd June 2023. The participants were laboratory technologist/technicians from Department of Livestock (RVH&EC Phuentsholing, Gelephu and Dewathang, SVL Nganglam, National Veterinary Laboratory, National Diary Research and Development Centre) and BFDA (National Food Testing Laboratory). The training was conducted by microbiologist/Deputy Chief Laboratory Officer from NCAH.

Training achievements

- Officials trained on bacteriological methods for media preparation and sterilization, culture and identification of bacteria E. coli, Salmonella and Enterococcus, CLSI method of performing and interpreting antibiotic susceptibility testing, isolate preservation, Vitek II and ESBL detection, Standardize protocol AST for animal species.
- 36 rectal swabs from cattle were cultured and identified for E. coli, Salmonella

Figure 59; Pictures demonstrating the laboratory works (media preparation, ABST, Vitek II preparations, ABST plates and result interpretations)

10.10. Troubleshooting and training on ELISA at RLDC, Kanglung

As per the request letter no. RLDC/K/AH/8/2022-2023/1248 dated 29, May 2023 from RLDC Kanglung, an expert team from LSU were deputed to identify and trouble shoot the problem on 14th June 2023. The team installed and validated the existing ELISA plate reader and successfully provided a three-day hands-on training on Brucellosis ELISA for laboratory technicians and Veterinary officer from RVH&EC Dewathang. A total of 720 serum samples from five eastern dzongkhags were tested for Brucella.

Results

It was observed that out of 720 samples, five were detected positive for Brucella through ELISA and RBT. Those samples were referred to LSU for further confirmation.

10.11. Hands-on training on Veterinary Information System (VIS)

A total of 489 users were trained to use Veterinary Information System for animal health data management including antimicrobial usage data.

Following table shows the no. of officials trained on VIS in respective Dzongkhags, including regional offices and government farms located within.

Table 46: Officials trained on VIS

Dzongkhag	Training Phase			
	Master Training-of-Trainers	Dzongkhag-level Training	Refresher Training	Grand Total
Bumthang	5	21	4	30
Chhukha	4	11	5	20

Dagana	1	20	1	22
Gasa	3	10	2	15
Haa	3	16	3	22
Lhuentse	2	22	2	26
Mongar	2	23	2	27
Paro	2	18	2	22
Pema Gatshel	2	17	2	21
Punakha	1	15	1	17
Samdrup Jongkhar	3	20	3	26
Samtse	2	22	1	25
Sarpang	5	21	5	31
Thimphu	20	26	9	55
Trashi Yangtse	1	14	2	17
Trashigang	3	26	2	31
Trongsa	2	6	1	9
Tsirang	1	20	1	22
Wangdue Phodrang	2	23	2	27
Zhemgang	3	20	1	24
Total	67	371	51	489

Figure 60: VIS training: left top - cohort 1; left bottom - cohort 2; right - refresher

11. MAJOR ONE HEALTH ACTIVITIES

11.1. World Rabies Day 2022

World Rabies Day is an international awareness campaign coordinated by the Global Alliance for Rabies Control, a non-profit organization with headquarters in the United States. It is a United Nations Observance and has been endorsed by international human and veterinary health organizations such as the World Health Organization, the Pan American Health Organization, the World Organisation for Animal Health and the US Centres for Disease Control and Prevention. World Rabies Day takes place each year on September 28, the anniversary of the death of Louis Pasteur who, with the collaboration of his colleagues, developed the first efficacious rabies vaccine.

The first World Rabies Day campaign took place on 8 September 2007 as a partnership between the Alliance for Rabies Control and the Centres for Disease Control and Prevention, Atlanta, USA, with the co-sponsorship of the World Health Organization, the World Organisation for Animal Health and the Pan American Health Organization. In 2009, after three World Rabies Days, the Global Alliance for Rabies Control estimated that rabies prevention and awareness events had taken place in over 100 countries, that nearly 100 million people worldwide had been educated about rabies and that nearly 3 million dogs had been vaccinated during events linked to the campaign.

A 2011 review by a network of international government agencies, academics, NGOs and vaccine manufacturers identified World Rabies Day as a useful tool to assist with rabies prevention, targeting at-risk communities, animal health workers, public health practitioners, governments, key opinion leaders and experts.

In the years following the review, World Rabies Day has also been used by governments and international agencies as a day on which to announce policies, plans and progress on rabies elimination. For example, in 2013, the Food and Agricultural Organization of the UN, the World Health Organization and the World Organisation for Animal Health first called for the global elimination of canine-mediated rabies in a joint statement released on World Rabies Day. At the first Pan-African Rabies Control Network meeting in 2015, the 33 African countries represented their recommended consideration of World Rabies Day as an opportunity for rabies advocacy. It has been included in the Association of Southeast Asian Nations Rabies Elimination Strategy.

WRD 2022 – "*Rabies: One Health, Zero Deaths*"

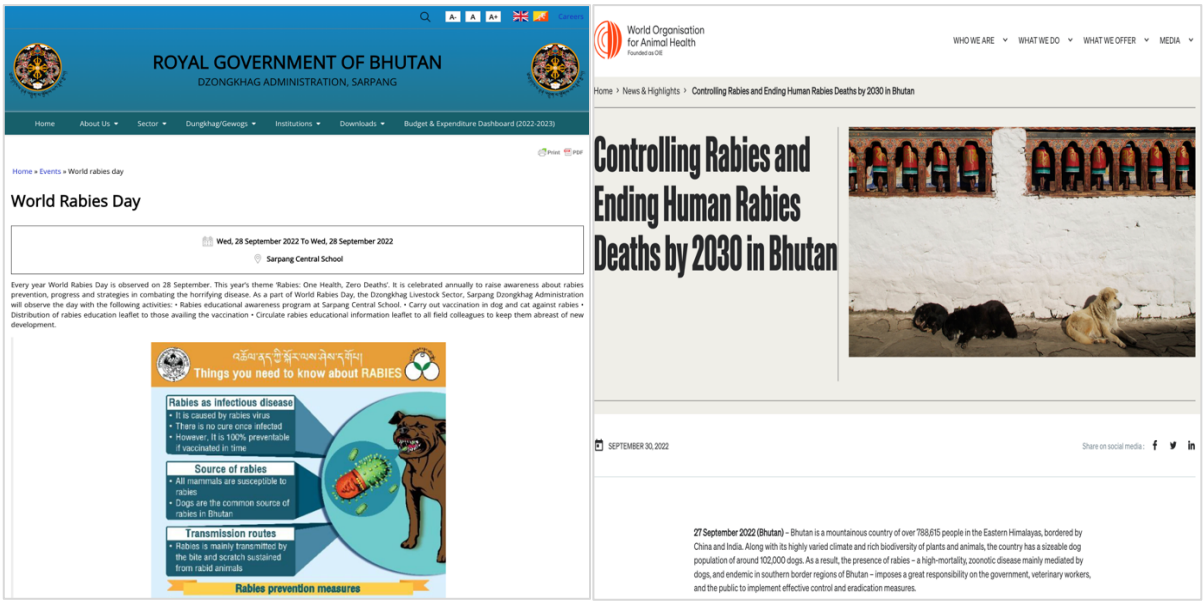
The theme for the 16th WRD was "***Rabies: One Health, Zero Deaths***" and it called upon all stakeholders to take action using one-health approach to address the disease. The theme also reiterated the global target of reducing dog-mediated human rabies cases to zero by the year 2030.

Since the Nationwide Dog Population Management and Rabies Control Program (NADPM&RCP) was being implemented throughout the country in full swing, it was not necessary to observe the WRD like the Department did in previous years. Nevertheless, the day was observed through the implementation of the following activities:

- Representatives from the Department of Livestock (DoL), MoAL and the Department of Public Health (DoPH), MoH participated in a panel discussion – which was broadcasted

on the national television, BBS – to highlight the importance of the day, and create awareness on rabies and its preventive measures.

- For wider coverage, infographics, important links, and messages about the day and rabies disease were shared through relevant websites, social media handles, and newspapers.
- Information sharing with WOAH regarding the rabies prevention and related activities implemented in the country.
- Observation of the event in schools of rabies high-risk areas.



11.2. World Antimicrobial Awareness Week 2020

World Antimicrobial Awareness Week (WAAW) is a global campaign to raise awareness and understanding of antimicrobial resistance (AMR) and promote best practices among One Health stakeholders to reduce the emergence and spread of drug-resistant pathogens. WAAW is observed every year from 18 to 24 November. The theme of WAAW 2022 is "**Preventing Antimicrobial Resistance Together**". AMR is a threat to humans, animals, plants, and the environment. It affects us all. That is why this year's theme calls for cross-sectoral collaboration to preserve the efficacy of these important products. The overall slogan for raising awareness on AMR during WAAW remains the same as in previous years – **Antimicrobials: Handle with Care.**

Antimicrobials (Antibiotics, Antivirals, Antifungals, Antiparasitics) are the essential medicines used to treat infection with microorganisms like bacteria, viruses, fungi, and parasites in humans, animals, and plants. These agents used to reduce the burden of diseases in humans, animals, and plants in the past are becoming ineffective due to the development of resistance by the microorganisms known as antimicrobial resistance (AMR).

AMR occurs by microorganisms changing naturally and is also triggered by inappropriate use, misuse, or overuse whereby they no longer respond to treatment with antimicrobials. In the animal sector, AMR endangers animal health and welfare, as well as food production and also economies. Resistant microorganisms circulate through humans, animals, and the

environment. Further, these resistant microorganisms do not have boundaries. Hence, AMR is a health and global issue.

The World Organisation for Animal Health (WOAH), Food and Agriculture Organization of the United Nations (FAO), World Health Organization (WHO) and United Nation Environment Programme (ENEP) collectively called quadripartite is supporting the global movement. To curb AMR effectively, all sectors must use antimicrobials prudently and adopt other preventive measures. The following actions can help reduce the need for antimicrobials and minimize the emergence of AMR:

- strengthen infection prevention and control in health facilities, farms, and food industry premises
- ensure access to clean water, sanitation and hygiene, and vaccines
- implement best practices in food and agricultural production
- minimize pollution and ensure proper waste and sanitation management

Hence, the Department of Livestock being the focal agency for AMR under MoAL called the concerned agencies to support/participate in the awareness week.

12. ADMINISTRATIVE SECTION

12.1. Mandates

- Implement HR initiatives in the areas of organizational and professional development, and change management in alignment with organizational strategy
- Data management concerning Human Resource requirement, leave records, encashment, transfer details of employees, etc.
- Assist in organizing workshops/seminars/ conferences
- Drafting letter/correspondence related to HR activities

12.2. Human resources

- Dr Ratna Bahadur Gurung, Programme Director
- Ms Karma Dekar, Sr Adm. Assistant
- Ms Phuentsho Choden, Adm. Assistant
- Mr Rinzin Dorji, Storekeeper
- Ms Pemo, Sr Telephone Operator
- Mr Tashi Gelay, Driver
- Mr Pema Wangdi, Driver
- Mr Sangay Tshering, Driver
- Mr Tshewang Rinzin, Driver II
- Mr Tandin Wangchuk, Driver II
- Ms Tshering Dekar, ESP
- Mr Karna Kumar Tamang, ESP
- Ms Sangay Nidup, ESP
- Mr Phub Namgay, ESP
- Ms Kencho Dema, ESP

12.3. Achievements

- Ensured that all the eligible officials have completed their asset declarations in time
- Provided timely administrative services to facilitate seamless implementation of technical activities
- Timely information sharing with the Centre's staff regarding administrative and HR reforms as communicated from the RCSC and the Ministry's HR office
- Implemented staff welfare reforms as decided during the annual staff meeting

13. ACCOUNTS SECTION

13.1. Mandates

- Exercise accounting procedures and internal control systems are always exercised
- Manage funds utilization according to the budget appropriations
- Uphold the financial integrity of the organisation
- Coordinate and facilitate auditing through the production of all records and evidence
- Ensure that funds are spent and managed according to our government plans and policies
- Ascertain and evaluate the financial projection and financial progress reports for the agency

13.2. Human resources

- Ms Pari Chhetri, Accounts Assistant II
- Ms Pema Choden, Accounts Assistant II

13.3. Financial achievements

During the FY 2020 – 2022, the Centre was allocated a total budget of BTN 57.569 million, of which the Centre utilized BTN 57.5473 million, translating to the total budget utilization of 99.833 per cent. The detailed budget expenditure statement is as shown in the following table.

Table 47: Budget expenditure statement, FY 2022 – 2023

OBC	TITLE	BUDGET	EXPENDITURE	BALANCE	%
	LIVESTOCK SERVICES				
	LIVESTOCK HEALTH SERVICES				
	DIRECTION SERVICES NCAH				
	PERSONNEL EMOLUMENTS				
	RGOB Financing				
01.01	Pay and Allowances	12.396	12.396	0.000	0.00
02.01	Other Personnel Emoluments	0.859	0.859	0.000	0.02
11.03	Travel - (LTC/Leave Travel Concession)	0.511	0.512	-0.001	-0.18

OBC	TITLE	BUDGET	EXPENDITURE	BALANCE	%
24.03	Contributions - Provident Fund	1.525	1.524	0.001	0.03
25.01	Retirement Benefits	1.193	1.190	0.003	0.23
	TOTAL OF FIC 0001	16.484	16.481	0.003	
	TOTAL OF SAct 01	16.484	16.481	0.003	
	OPERATION & MANAGEMENT SERVICES				
	RGOB Financing				
12.01	Utilities -Telephones, Telex, Fax, E-mail, Internet	0.118	0.117	0.001	0.68
12.03	Utilities - Electricity, Water, Sewerage	0.383	0.376	0.007	1.78
14.01	S & M - Office Supplies, Printing, Publications	0.110	0.110		
14.02	S & M - Medicines & Laboratory Consumables				
14.06	S & M - Uniforms, Extension Kits, Linens	0.050	0.050	0.000	0.30
15.02	Maintenance of Property - Vehicles	0.510	0.509	0.001	0.16
15.09	Maintenance of Property - Water supply, Sewerage, Playfield	0.010	0.010		
17.02	Op. Exp. - Taxes, Duties, Royalties, Fees, Handling Charges, Bank Charges	0.269	0.269	0.000	0.02
	TOTAL OF FIC 0001	1.450	1.441	0.009	
	TOTAL OF SAct 02	1.450	1.441	0.009	
	PROVIDE ADMINISTRATION				

OBC	TITLE	BUDGET	EXPENDITURE	BALANCE	%
	SERVICES AND STAFF MOBILITY				
	RGOB Financing				
11.01	Travel - Incountry	0.780	0.777	0.003	0.36
	TOTAL OF FIC 0001	0.780	0.777	0.003	
	TOTAL OF SAct 03	0.780	0.777	0.003	
	ANIMAL FEEDS				
	RGOB Financing				
14.05	S & M - Animal Feeds	0.150	0.137	0.013	8.83
	TOTAL OF FIC 0001	0.150	0.137	0.013	
	TOTAL OF SAct 04	0.150	0.137	0.013	
	TOTAL OF Act 001	18.864	18.837	0.027	
	DRUGS VACCINES AND EQUIPMENT UNIT DVEU				
	PROCUREMENT DISTRIBUTION AND MANAGEMENT OF VETERINARY MEDICINE AND VACCINE				
	RGOB Financing				
14.02	S & M - Medicines & Laboratory Consumables	31.791	31.772	0.019	0.06
	TOTAL OF FIC 0001	31.791	31.772	0.019	
	TOTAL OF SAct 01	31.791	31.772	0.019	
	TOTAL OF Act 002	31.791	31.772	0.019	
	LABORATORY SERVICE UNIT				

OBC	TITLE	BUDGET	EXPENDITURE	BALANCE	%
	STRENGTHENING AND ENHANCEMENT OF LABORATORY DIAGNOSTIC CAPACITIES				
	Livestock Enterprise Development in Bhutan				
52.06	Plant & Equipt. - Livestock	5.540	5.540	0.000	0.00
	TOTAL OF FIC 5190	5.540	5.540	0.000	
	TOTAL OF SAct 04	5.540	5.540	0.000	
	TOTAL OF Act 003	5.540	5.540	0.000	
	DISEASE PREVENTION AND CONTROL UNIT				
	COLLABORATIVE STUDIES ON RISK ANALYSIS OF TRANS BOUNDARY ENVIRONMENT				
	"Collaborative studies on risk analysis of trans-boundary and environmental zoonoses"				
45.02	Training - Others	1.374	1.325	0.049	3.59
	TOTAL OF FIC 4694	1.374	1.325	0.049	
	TOTAL OF SAct 11	1.374	1.325	0.049	
	TOTAL OF Act 004	1.374	1.325	0.049	
	TOTAL OF SPrg 027	57.569	57.473	0.096	
	TOTAL OF Prg 045	57.569	57.473	0.096	
	TOTAL OF FO 20	57.569	57.473	0.096	
	TOTAL OF Dept 03	57.569	57.473	0.096	

OBC	TITLE	BUDGET	EXPENDITURE	BALANCE	%
	TOTAL OF AU 204.01	57.569	57.473	0.096	
	GRAND TOTAL	57.569	57.473	0.096	

14. ANNEXURE

14.1. Reading of Data Logger for March – April 2023

Monitoring temperature record by use of data logger at cold room for the month of March, April and May 2023 – Reading in Data Logger installed in BPU cold storage

BPU,NCAH,SERBITHANG
THIMPHU

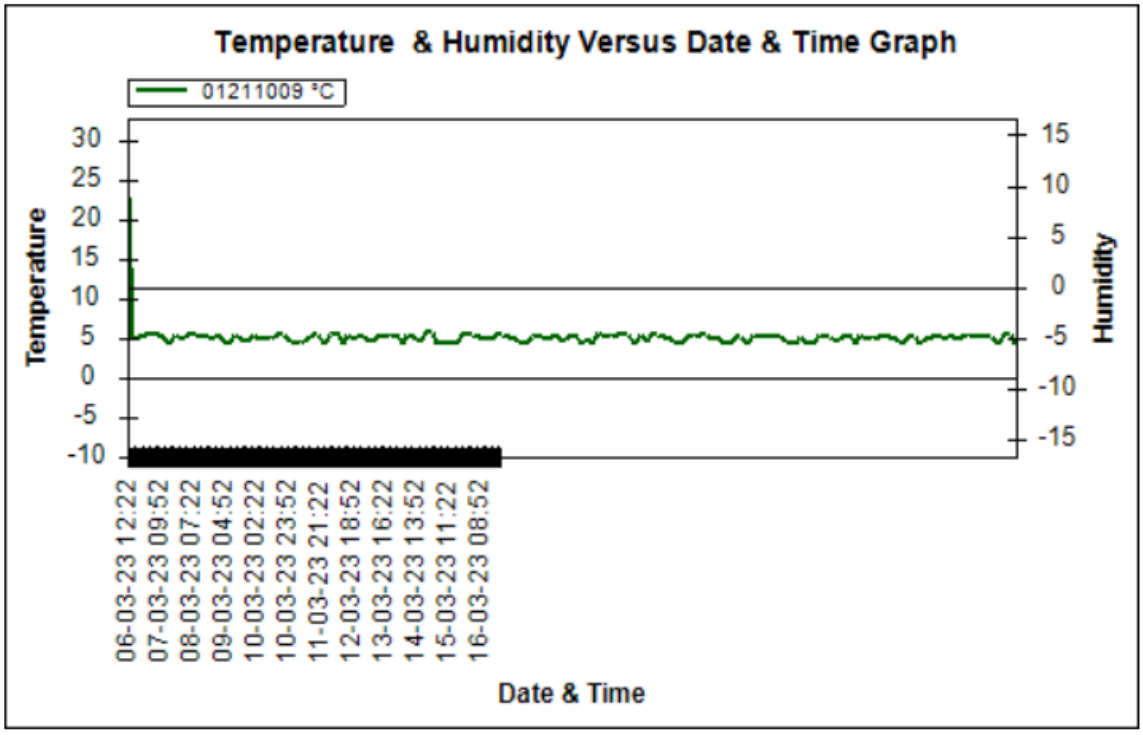
Data Report

From Date & Time :06-03-2023 12:22 To Date & Time :31-03-2023 12:00
Print Date & Time :06-04-2023 11:00

Device Information

Device Name / Serial No	BPU,NCAH / 01211009	BPU,NCAH / 01211009
Operating Range	0.0 - 8.0 °C	30.0 - 35.0 %RH
Transaction Count	150	150
	Temperature °C	Humidity %RH
Minimum	4.2	58.5
Maximum	22.9	97.7
Average	5.10	90.39
MKT	13.55	-

Chart Report



BPU,NCAH,SERBITHANG
THIMPHU

Data Report

From Date & Time :06-04-2023 12:22

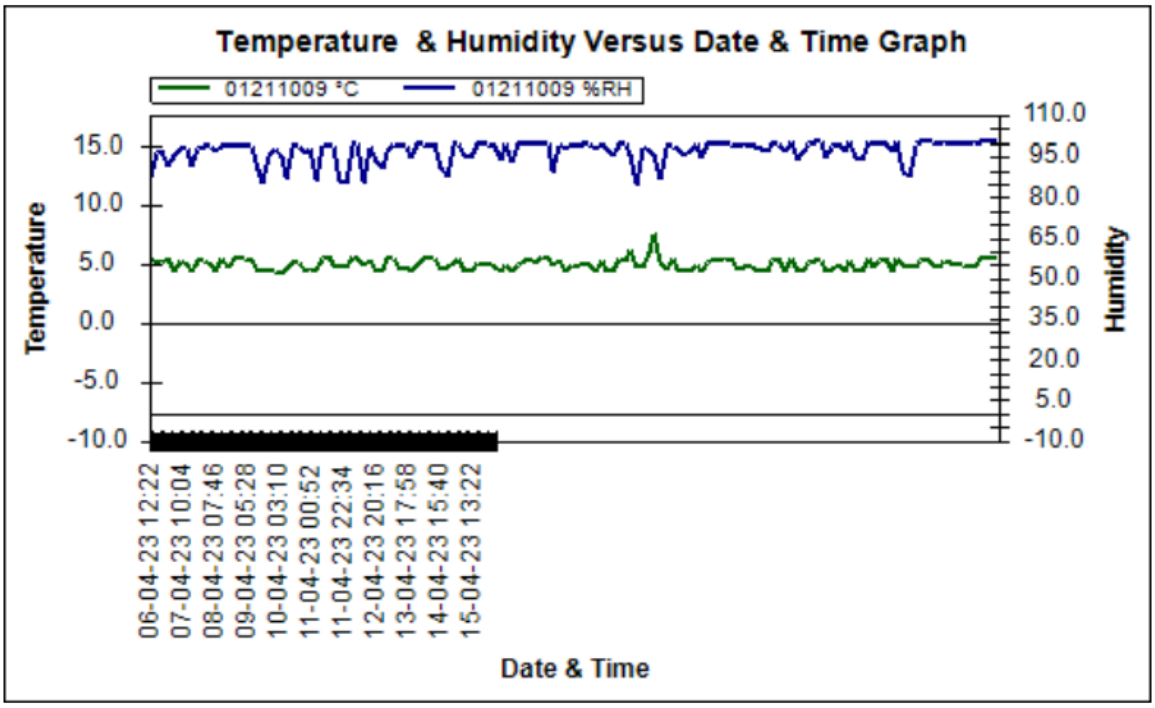
To Date & Time :30-04-2023 12:00

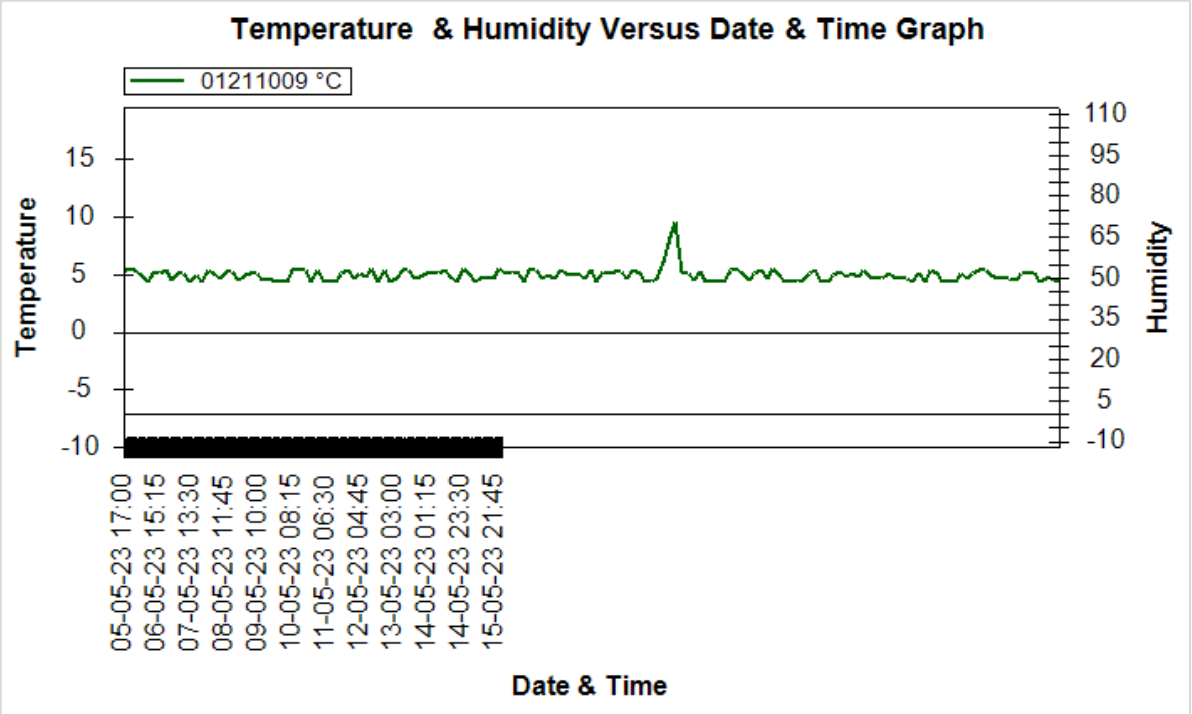
Print Date & Time :05-05-2023 16:17

Device Information

Device Name / Serial No	BPU,NCAH / 01211009	BPU,NCAH / 01211009
Operating Range	0.0 - 8.0 °C	30.0 - 35.0 %RH
Transaction Count	144	144
	Temperature °C	Humidity %RH
Minimum	4.2	84.8
Maximum	7.6	100.2
Average	4.97	97.10
MKT	5.90	-

Chart Report





14.2. Revision of National Vaccination Schedule for livestock and Poultry for Bhutan

The unit reviewed the national vaccination schedule for livestock and poultry and put to the department for approval. Although we are still waiting for the approval, the procurement of vaccines is based on this for the next financial year. The draft copy of the schedule is shown in below.

14.2.1. Vaccination schedule against Poultry

Vaccine	Dosage	Route	Primary (First) vaccination	Booster	Re-vaccination	Remarks
Mareks	0.2 ml	S/C, at lower neck region	Day old	Not required		Government and private Parent and grandparent farms with Day Old Chicks (DOC) production
Infectious Bursal Disease (IBD) (Gumboro)	0.03 ml (1 drop using the standard dropper)	Intra-ocular	3 days old	14 days old in drinking water	28 days old in drinking water	Booster at 31-35 days old may be an optional unless there is high incidence of the disease in older birds
New Castle Disease (B1)	0.03 ml (1 drop using the standard dropper)	Nasal /Eye drop	7 days old		Revaccination at 2 week and 18 weeks age is optional and company recommends mandatory vaccination in endemic areas.	
Fowl Pox	0.02 ml	- Wing web	6 weeks old	14 weeks		

	0.2 ml	- I/M			In recurrent Fowl Pox problematic flocks, vaccination by I/M route is preferred
New Castle Disease (R2B)	0.5 ml	S/C or I/M	8 weeks old	16 weeks old	Annually

14.2.2. Vaccination schedule for livestock (Cattle, Yak Sheep, Goat and Pig)

Vaccine	Species	Dosage	Route	Primary (First) vaccination	Booster	Re-vaccination	Remarks
Anthrax spore vaccine (live)	Cattle, buffalo, Sheep, goat & pigs	1 ml	S/C	Vaccinate above 3 months old in endemic areas	Not required	Annually during March-April in endemic areas for the next three years (Page No. 7 of Anthrax Guidelines 2003)	
Raksha HS+BQ combined vaccine	Cattle, buffalo, Yaks & calves	3 ml	S/C (mid-neck region)	3 months and above	Not required	Annually (Do at least 21 days before migration in Cattle and Yaks and or in April in farms before the onset of monsoon or in Spring season).	Annual vaccination for next three years in disease outbreak confirmed herds/areas.
Foot and Mouth Disease vaccine (RakshaOvac)	Cattle, buffalo, Yaks & pig Sheep & Goats	2 ml 1 ml	I/M I/M	3 months and above	1 month after primary vaccination (calfhood Vaccination)	Biannual vaccination in High Risk zones in Cattle, Yak, Buffaloes, Pig, Sheep and Goats during September-October and March-April; Annual vaccination in cattle, yak, and buffaloes during September -October in Medium risk zones as per the NFMDPCP 2020.	Follow the NFMDPCP 2020 document. (Annexure 2; Page 51 for risk based vaccination at the dzongkhag and gewog wise; 7.4 Vaccination program- Page 29-32.)
Classical Swine Fever	Pigs	1 ml	S/C	After weaning (45-60 days)	Not required	Annually	Standard as per company protocol.
Peste des Petits Ruminants (PPR)	Sheep & Goat	1 ml	S/C (mid-neck region)	4 months	Not required	Vaccination only during outbreak. No mass vaccination.	Follow NPPR-PCCCEP 2020 document.

14.2.3. Vaccination schedule for pet and utility dogs

Vaccine	Species	Dosage	Route	Primary (First) vaccination	Booster	Re-vaccination	Remarks
Anti-rabies vaccine (Raksharab)	Dogs and cats	1 ml	S/C or I/M	4 weeks and above	After 4 weeks (one month) and 3 months of primary vaccination in pups	Annually	For Post Exposure Prophylaxis (PEP) for cattle and dog (Day 0,3,7,14 and 28 @ 1ml S/C or I/M) under strict biosafety precautions

For Anti-Rabies vaccination follow the brief reference as per NRPCP 2017:

- Minimum of 70% of the total dog population in high-risk zone annually in pet and stray Refer- 3.2. Prevention strategy and 3.2.2. V vaccination program-page no. 29 to 34 of NRPCP 2017).
- As per NRPCP 2017, 1-month primary, two boosters after 1 month and three months and then annually; minimum 70% coverage in owned, stray dogs and cats).
- For Post Exposure Prophylaxis (PEP) for cattle and dog (Day 0,3,7,14 and 28 @ 1ml S/C or I/M) under strict biosafety precautions.

Vaccine	Species	Dosage	Route	Primary (First) vaccination	Booster	Re-vaccination	Remarks
DHPPi+L		1 ml	S/C or I/M	More than 45 days	After 3 weeks (21 day)	Annually	To be purchased by the owner

14.2.4. Vaccination schedule for pet cats

Vaccine	Species	Dosage	Route	Primary (First) vaccination	Booster	Re-vaccination	Remarks
Nobivac® Riocat Trio against Feline panleucopaenia virus (FPLV), Feline herpes virus (FHV) and Feline calicivirus (FCV).	Cats	Full dose of Reconstituted one vial of vaccine with one vial of Nobivac Diluent.	S/C	6 weeks of age onwards but best at 8-9 weeks of age.	Booster at 12 weeks of age or 3-4 weeks apart of primary	Every three years after the completion of primary and booster vaccination.	To be purchased by the owner

Note:

Abbreviation: I/M – Intramuscular and S/C – Sub Cutaneous

Revised by Biological production Unit, NCAH, Serbithang on 17th April 2023.

"As we bid adieu to the challenges and triumphs of FY 2022-2023, we embrace the dawn of FY 2023-2024 with hope in our hearts. May this new fiscal year be blessed with good health for all animals and a resounding prayer for a year free from diseases, fostering a brighter and healthier future for our beloved creatures"

NATIONAL CENTRE FOR ANIMAL HEALTH
DEPARTMENT OF LIVESTOCK