NATIONAL CENTRE FOR ANIMAL HEALTH
Department of Livestock, MoAL,
Thimphu, Bhutan

Financial Year 2024 - 2025

ANNUAL REPORT

National Center for Animal Health
Annual Progress Report (2024–2025)

Foreword

It gives me great pleasure to present the Annual Report of the National Centre for Animal Health (NCAH) for the fiscal year 2024–2025. This report encapsulates the collective efforts and achievements of our technical teams, regional and district counterparts, and collaborative partners in ensuring the health and well-being of Bhutan's livestock and the communities that depend on them.

The year under review was marked by significant challenges, particularly with recurring outbreaks of transboundary animal diseases such as African Swine Fever (ASF), Avian Influenza, and Rabies. However, through timely surveillance, rapid diagnostic services, and coordinated field responses, we successfully mitigated their impact on animal health and the livelihoods of farmers. Our robust emergency preparedness, supported by incident operations centres and veterinary contingency plans, proved critical in managing outbreaks efficiently.

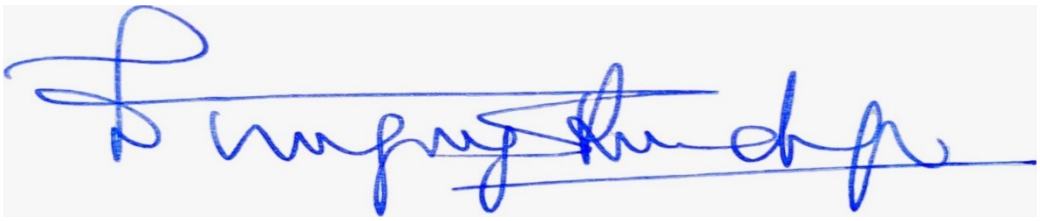
We are particularly proud of the progress made in preventive health measures, including the nationwide vaccination against Lumpy Skin Disease (LSD), which achieved a commendable 69.3% coverage. Additionally, the launch of Bhutan's first comprehensive surveillance for Peste des Petits Ruminants (PPR) marks a crucial step toward achieving PPR freedom status by 2027, aligning with global eradication goals.

The Laboratory Services Unit continued to be the backbone of disease confirmation and surveillance, processing thousands of diagnostic tests and introducing advanced testing platforms. We also expanded our antimicrobial resistance (AMR) surveillance work under the Fleming Fund, with a strong focus on mastitis in dairy cattle—generating critical evidence to inform treatment practices and reduce reliance on high-priority antibiotics.

Our work in veterinary supply chain management has also matured, with annual stock reconciliation at livestock central store, improved procurement efficiency, stock mobilization, and vendor monitoring. This year saw increased in low volume medicines procured through the Ministry of Health tender, further optimizing public resource utilization.

These accomplishments would not have been possible without the unwavering commitment of our staff, the support from the Department of Livestock, and our valued development partners. I extend my deepest appreciation to all field veterinarians, laboratory professionals, livestock staff, and administrative teams who have worked tirelessly—often under difficult circumstances—to uphold the integrity and responsiveness of our animal health system.

As we move forward, we remain committed to strengthening disease surveillance, laboratory diagnostics, supply chain resilience, and One Health collaboration to ensure a healthier, safer, and more productive livestock sector for Bhutan.



(Dr. Sangay Rinchen)
Program Director Offtg.

Executive Summary

The National Centre for Animal Health (NCAH), under the Department of Livestock, continued to deliver on its mandate to safeguard animal health and support the livestock sector through comprehensive disease surveillance, diagnostics, veterinary supply management, and antimicrobial resistance (AMR) initiatives during the fiscal year 2024–2025.

A total of 8 notifiable disease outbreaks were recorded, with African Swine Fever (ASF) emerging as the most widespread, affecting nine Dzongkhags. The Centre responded swiftly through activation of Incident Operations Centres (IOCs), implementation of 3D operations (Depopulation, Disposal, and Disinfection), and containment strategies, incurring Nu. 6.38 million in emergency interventions. Meanwhile, the successful rollout of the national Lumpy Skin Disease (LSD) vaccination campaign achieved 69.3% coverage, and the first nationwide surveillance for Peste des Petits Ruminants (PPR) was launched to support Bhutan's ambition to achieve PPR-free status by 2027.

The Laboratory Services Unit (LSU) processed over 7,300 diagnostic tests from 4,045 samples and introduced new diagnostic tools, including rapid kits, ELISA, and RT-PCR assays. The unit played a pivotal role in timely outbreak confirmations, including ASF and Avian Influenza, and strengthened its quality standards through active participation in international proficiency testing programs. Additionally, the unit led AMR surveillance activities focused on mastitis pathogens in dairy cattle, generating crucial data to support rational antibiotic use and guide national policy through the funding support of Fleming Fund.

The Drugs, Vaccine, and Equipment Unit (DVEU) ensured the availability and efficient distribution of essential veterinary supplies nationwide. Improvements in procurement planning, vendor performance tracking, and stock mobilization led to notable cost savings. Innovations included better synchronization with the Ministry of Health tender for low volume medicines and digitization through ANIMUSE training for antimicrobial consumption data management.

The Biological Production Unit (BPU) managed the procurement and distribution of vaccines, monitored cold chain systems, and addressed gaps in indent versus supply trends. Efforts were made to forecast disease-specific vaccine demand, minimize wastage, and initiate collaboration with suppliers on vaccine pack size optimization.

Significant capacity-building initiatives were undertaken under the Fleming Fund Phase II, including workshops on biosafety, AMR data management, and laboratory strengthening. A nationwide mastitis surveillance program provided actionable insights into pathogen prevalence and AMR patterns, contributing to revised treatment guidelines and practitioner training.

Through its integrated programs and collaborative efforts with national and international partners, NCAH has reinforced Bhutan's animal health system, improved preparedness for transboundary diseases, and advanced the One Health approach for antimicrobial stewardship and food safety.

Table of Contents

List of Figures

List of Tables

1. Diseases Prevention and Control Unit (DPCU)

1.1 Notifiable diseases outbreaks

In the financial year 2024-2025, there were outbreaks of 8 notifiable diseases in the country. The outbreaks were reported African Swine Fever (ASF), Avian Leucosis Complex (ALC), Black Quarter (BQ), Foot and Mouth Diseases (FMD), Infectious Bursal Diseases (IBD) or Gomboro diseases, Highly Pathogenic Avian Influenza (H5N1), Hemorrhagic Septicaemia (HS) and Rabies (Figure 1).

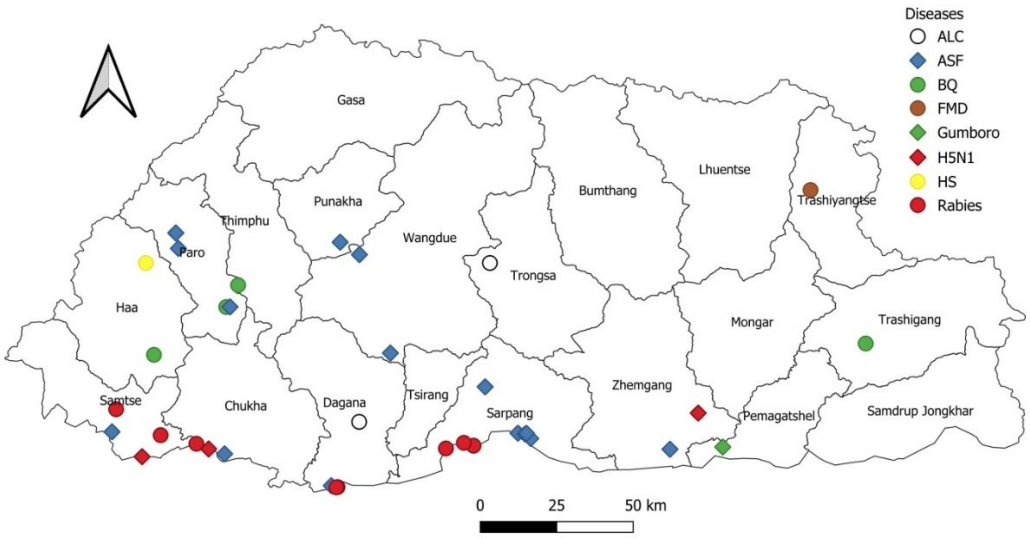


Figure 1. Map showing outbreak locations of notifiable diseases (2024-20250

Maximum of the outbreaks were reported in ASF (n=16), followed by rabies (n=8), BQ (n=4) and H5N1 (n=3). One outbreak each was reported FMD, HS and IBD. There were no reports of the LSD in the country for the FY 2024-2025 (Figure 2).

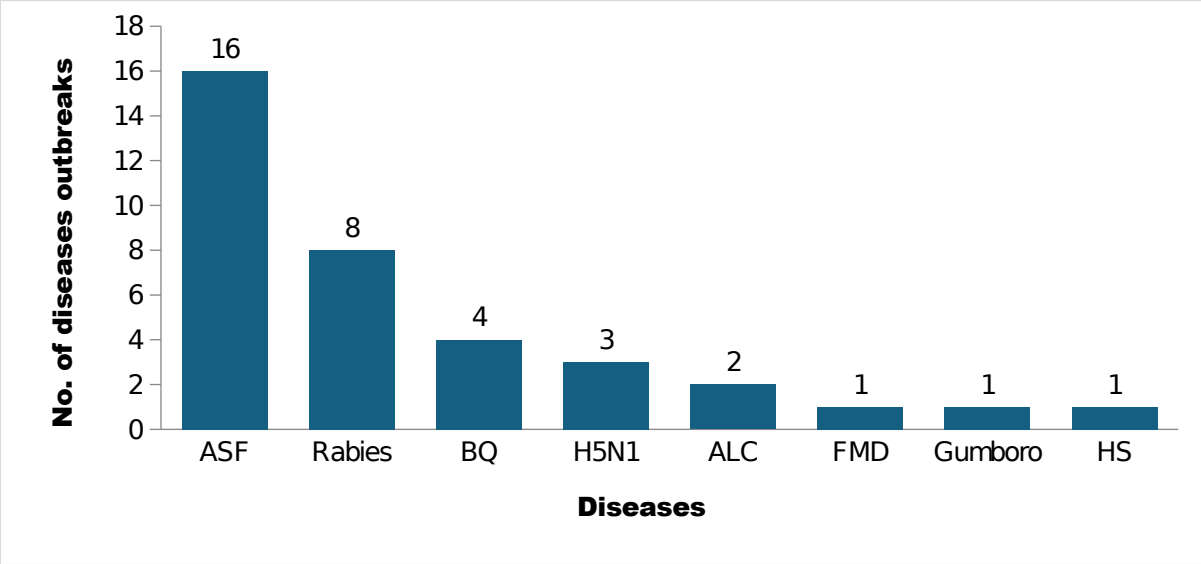


Figure 2. Number of notifiable disease outbreaks (2024-2025)

Overall, most of the notifiable disease outbreaks were reported from Sarpang, Samtse, Dagana and Paro dzongkhag (Figure 3). ASF outbreaks was reported from 9 dzongkhags-Wangdi Phodrang, Paro, Punakha, Samtse, Chhukha, Sarpang, Dagana, Zhemgang and Tsirang dzongkhags. Maximum of the ASF outbreaks was reported from Sarpang dzongkhag (n=5), followed by Paro (n=3) and Wangdue Phodrang (n=2). One each outbreak was reported in Chhukha, Dagana, Punakha, Samtse, Tsirang and Zhemgang dzongkhags. Rabies outbreaks were reported in four dzongkhag-Samtse, Chukha, Dagana and Sarpang. Three outbreaks were reported in Sarpang dzongkhag followed by 2 outbreaks each in Samtse and Dagana dzongkhag. Blackquarter outbreaks were reported from Paro, Punakha and Trashigang dzongkhags. One outbreaks of Highly Pathogenic Avian Influenza were reported from Chukha, Samtse and Zhemgang dzongkhag. FMD outbreaks were reported from Tashi Yangtse and HS was reported from Haa dzongkhag (Figure 3).

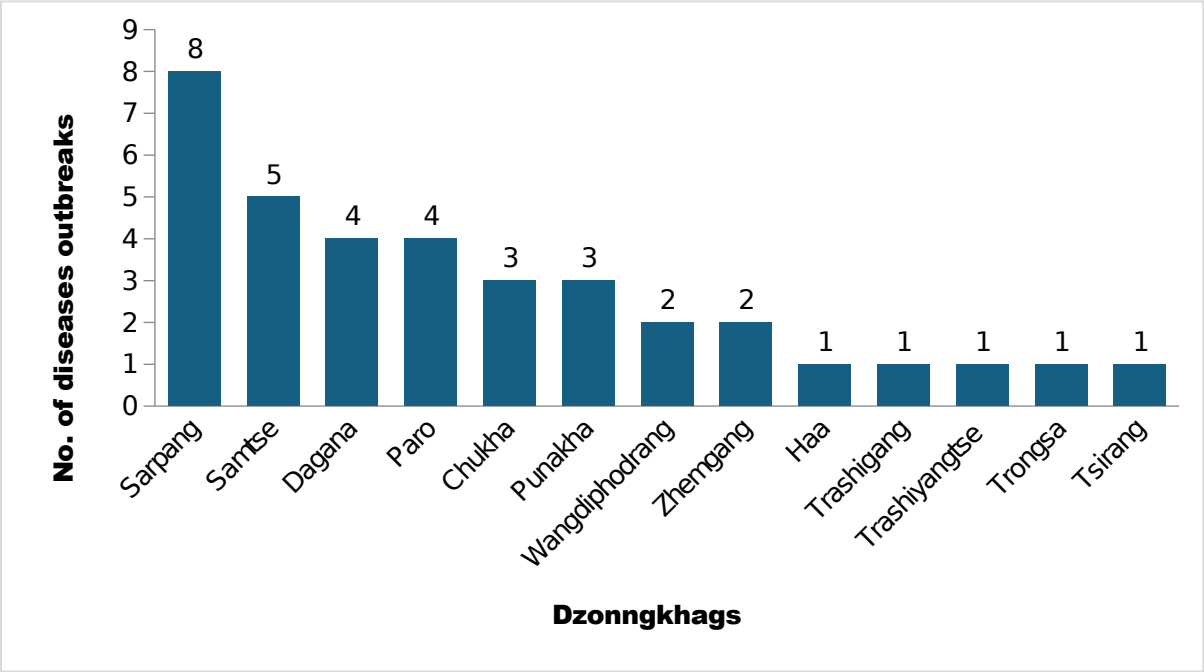


Figure 3. Dzongkhagwise notifiable disease outbreak (2024-2025)

1.3 Priority diseases screening in highland areas

In the Financial Year 2024-2025, together with the GID program, NCAH, Serbithang had also collected various samples – serum, rectal swab, fecal and milk, and screen for other infectious diseases and antimicrobial resistance (AMR) (Table 1). Serum were collected for the screening of infectious diseases like Brucellosis, Bovine Tuberculosis (bTB), Bovine Viral Diarrhea (DVD), Infectious Bovine Rhinotracheitis (IBR) and Peste des petits ruminants (PPR). The rectal swab and milk samples were collected for the presence of AMR in the yaks as part of pandemic fund project. The fecal samples were collected from dogs kept for guarding the yaks and were examination of the presence of *taeniid* eggs.

The milk samples were screen for the mastitis using the California Mastitis Test (CMT) in the field. All the 57 samples from the Thimphu and Trashigang tested negative and samples were not collected for AMR. The 51 rectal swabs from the Soe geog under Thimphu dzongkhags were processed and were examined for E. coli, Salmonella and Enterococcus which were the

target organism for the AMR. The 19 fecal samples dogs from soe geog under Thimphu dzongkhag had been examined with detections of *Isospora* in 7 fecal samples and *Ancylostoma* in 13 fecal samples. The fecal samples from Sakteng geog will be processed in the coming days. The serum samples were not able to test due to shortage of ELIZA test kit. The test will be conducted in next fiscal year (Table 1).

Table 1. Sample collected from Highland dzongkhags (2024-25)

Dzongkhag	Geog	Species	Type of samples			
			Serum	Rectal Swab	Fecal	Milk
Thimphu	Soe	Yak	284	51	0	57
		Dog	0	0	19	0
Trashigang	Sakteng	Yak	303	37	7	0
		Dog	0	0	11	0
Total			**587**	**88**	**37**	**57**

1.4 LSD vaccination

In line with the strategy for vaccinating the whole bovine population in Bhutan for three consecutive years to prevent the possible future outbreaks of LSD in the country, LSD vaccination had been conducted in all 20 dzongkhags in Bhutan. According to the Integrated Annual Livestock Census, 2023 conducted by Bhutan Statistical Bureau (BSB), there was approximately 285017 cattle population in Bhutan. During this financial year 2024-2025, LSD vaccination was provided to 197585 bovine populations which includes four species of animals – cattle, yak, buffalo and mithun.

During the financial year 2024-2025, we achieved the overall percentage of approximately 70% based on the Integrated Annual Livestock Census, 2023. The highest percentage of the coverage was achieved by Paro dzongkhag (109%), followed by Wangdue Phodrang (96.3%), Punakha (92.8%) and Lhuntse (87.8%). The lowest coverge was in Bumthang (8.7%), Samdrup Jongkhar (39.6%) and Trashigang (43.6%). The details of the vaccination coverage in provided Table 2 and Figure 4.

Table 2. Dzongkhagwise vaccination coverage against LSD

Dzongkhag	Total population	Total animal vaccinated	LSD vaccination Coverage
Bumthang	10697	934	8.7
Chukha	17298	11331	65.5
Dagana	17581	12679	72.1
Gasa	6254	4085	65.3
Haa	7863	6185	78.7
Lhuentse	9746	8554	87.8
Mongar	22502	18194	80.9
Paro	9669	10600	109.6
Pemagatshel	6296	5193	82.5
Punakha	8299	7705	92.8
Samdrupjongkhar	12489	4943	39.6
Samtse	36761	26641	72.5

Sarpang	15672	8189	52.3
Thimphu	12660	9229	72.9
Trashigang	33121	14439	43.6
Trashiyangtse	8350	7315	87.6
Trongsa	7667	6621	86.4
Tsirang	11883	7317	61.6
Wangdue Phodrang	21382	20594	96.3
Zhemgang	8827	6837	77.5
Total	**285017**	**197585**	**69.3**

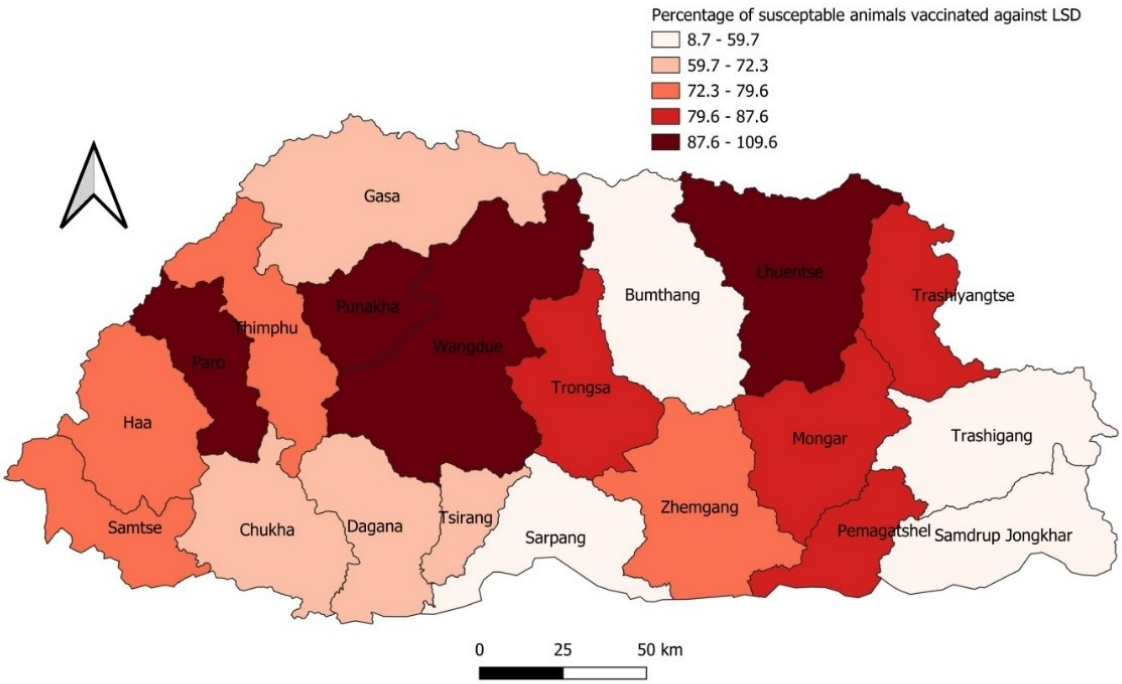


Figure 4. Vaccination coverage against LSD in different dzongkhags (2024-2025)

Among the different species of vaccinated animals, 89.6% were cattle, 10.3% yaks and 0.1% each for buffalo and Mithun (Figure 5).

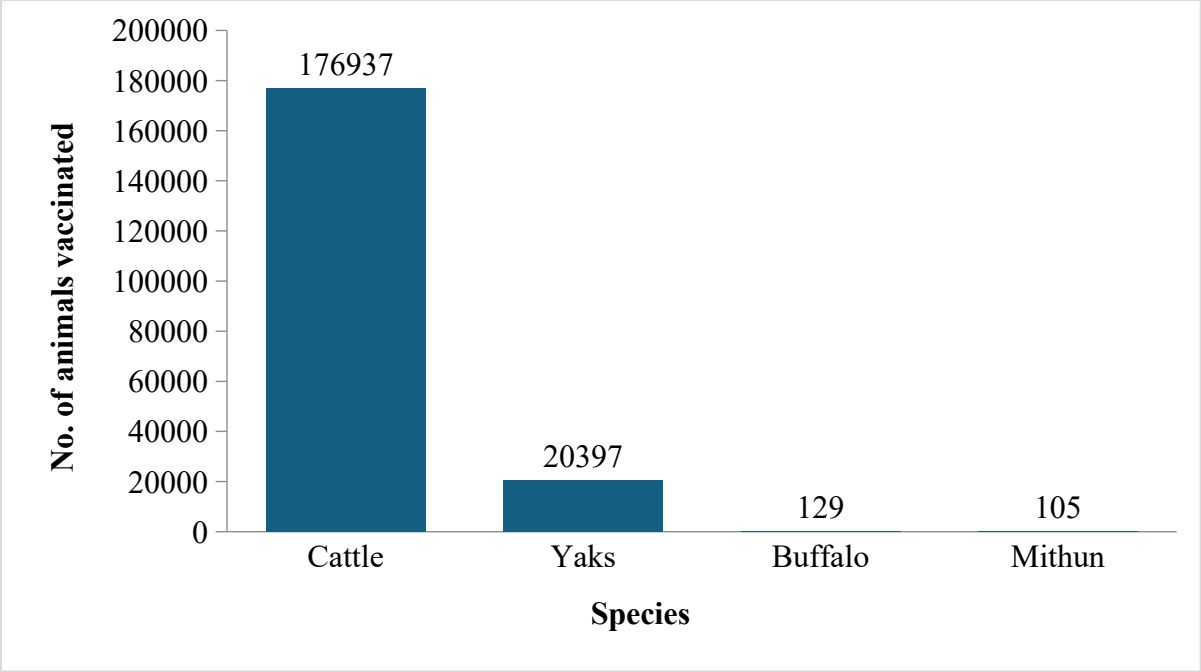


Figure 5. Different animal species vaccinated against LSD (2024-2025)

1.5 Nationwide surveillance of Peste des Petits Ruminants (PPR)

The National Centre for Animal Health (NCAH), Serbithang conducted a detail nationwide surveillance of Peste des Petits Ruminants (PPR) in small ruminants in the country as preparatory plans for achieving the PPR freedom status by 2027. The global target for Peste des Petits Ruminants (PPR) eradication is by 203**0.** Although Bhutan is considered historically free from PPR, first PPR outbreaks were reported in "tshether" goats in Chukha dzongkhag in 2010 with dead of 17 goats out of 84 goats (32.14%). The first PPR virus involved in the 2010 outbreak was found to be lineage 4 which is antigenically related to Nepal and Tibet Autonomous Region of China. Following that sporadic outbreaks had been reported from few districts particularly from southern districts with report of around 10 outbreaks. However, since 2020, no outbreaks had been reported.

The surveillance will be covering all small ruminant populations in the country, as well as suspected PPR from the wild animals. The archive samples from nationwide brucellosis program will also be used for testing for PPR in large ruminants. Samples size was calculated and statistically validated with the training provided to all the sample collection team and data managers. The surveillance will be carried out for two consecutive years with the following objectives -

- To provide evidence that Bhutan is free from PPR in both domestic and wildlife population.
- To meet the WOAH requirements for self-declaration of freedom from PPR.
- To ensure that the absence of PPRV circulation is statistically validated.
- To detect PPRV sero-prevalence at a threshold level (2% at 95% confidence) in domestic ruminant
- To detect the PPV if present in wildlife population combination of serological, clinical and virological surveillance

In this financial year, the first round of nationwide surveillance had been conducted in the small ruminants. A total of 1423 samples had been collected from 13 dzongkhags and 75 geogs in the country (Table 3 & Figure 6). The dzongkhags and geogs were selected depending on the number of samples that need to be collected based proportional sampling and risk-based sampling strategy.

Table 3.Sample size and samples collected for first nationwide PPR surveillance

Dzongkhag	Required samples	Samples collected
Chhukha	152	155
Dagana	237	256
Samdrup Jongkhar	26	47
Samtse	448	477
Sarpang	146	151
Trashigang	24	54
Tsirang	204	208
Bumthang	2	27*
Trongsa	1	3*
Wangdue	5	23*
Zhemgang	1	5*
Mongar	1	2*
Punakha	0	15*
Grand Total	**1247**	**1423**

*Sample collection continuing and is subjected to change depending on the field situations.

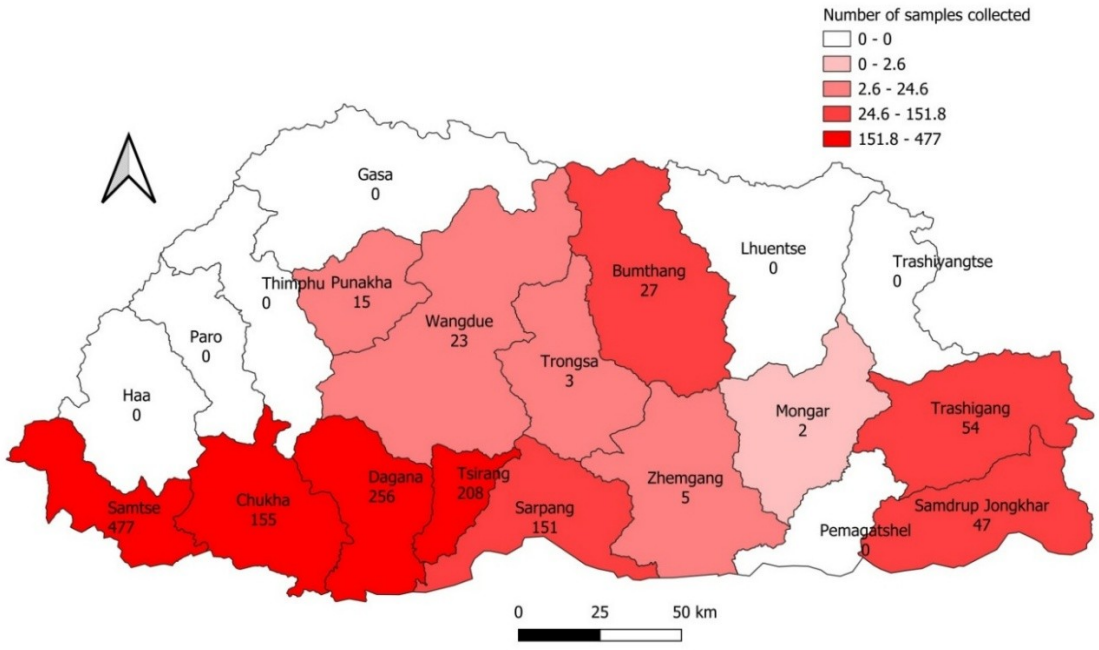


Figure 6. Sample collection sites for first phase of nationwide PPR surveillance

1.6 Outbreaks of African Swine Fever (ASF)

A total of 16 outbreaks of African Swine Fever (ASF) had been reported from 9 dzongkhags in the FY 2024 to 2025. Positive cases were confirmed from Sarpang, Paro, Wangdi Phodrang, Chhukha, Dagana, Punakha, Samtse, Tsirang and Zhemgang dzongkhags (Figure 7).

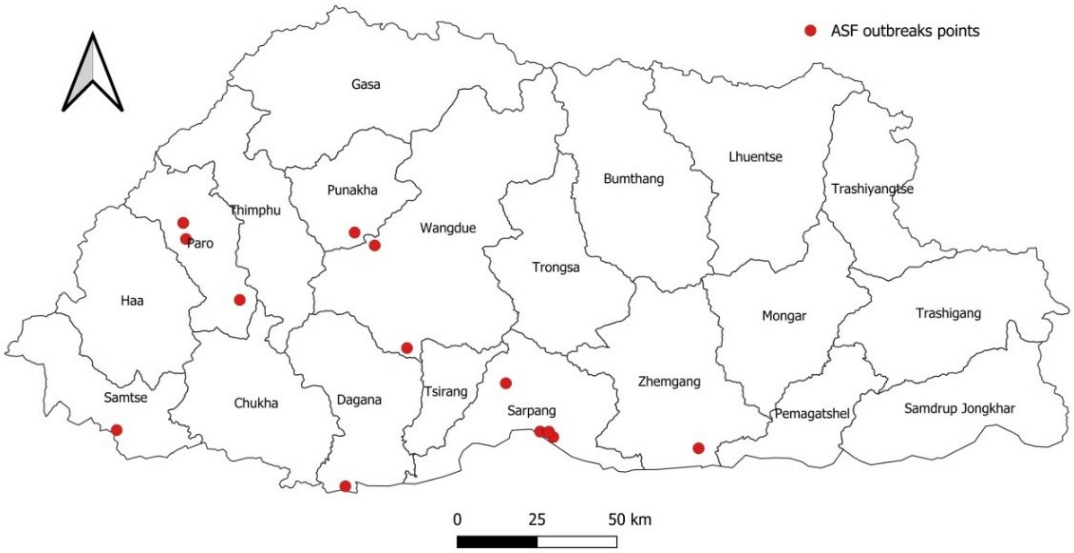


Figure 7. African swine fever outbreak areas (2024-25)

Most of the outbreaks were reported in Sarpang dzongkhag (n=5), followed by Paro (n=3) and Wangdue Phodrang (n=2) dzongkhag. One outbreak each was reported from Chhukha, Dagana, Samtse, Tsirang and Zhemgang dzongkhags (Figure 8).

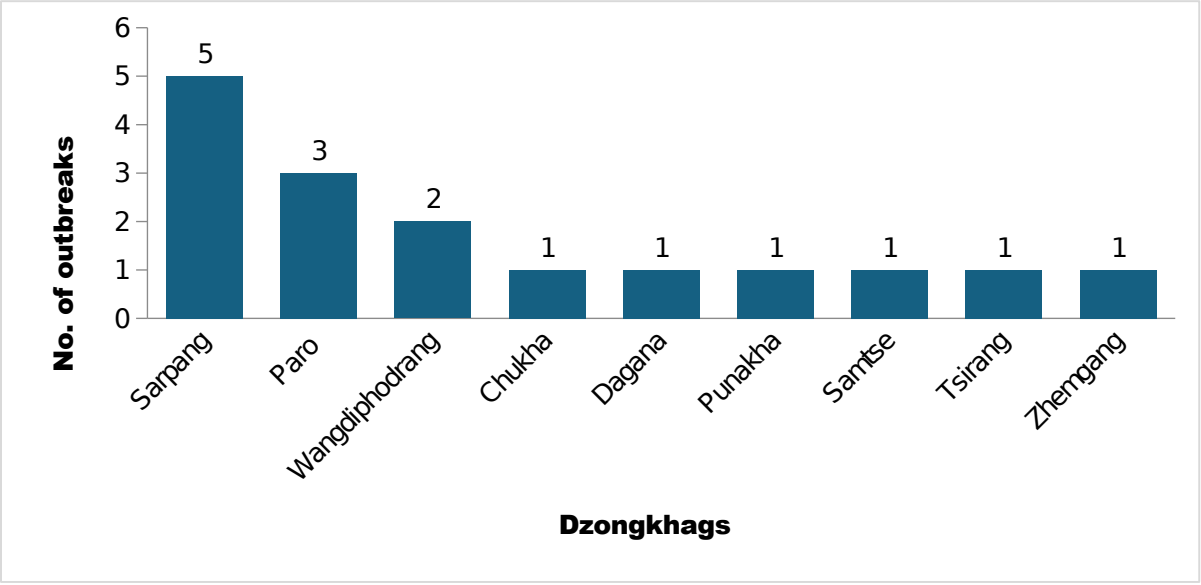


Figure 8. Number of ASF outbreaks in different dzongkhags (2024-25)

Under Sarpang dzongkhags, outbreaks were reported in Chudzom, Samtenling and Gelephu geogs. The samples from Chudzom geog were inconclusive, however, the pigs show clear clinical signs of ASF. Due to logistical and HR shortages, the resampling could not be conducted, and the samples were treated as positive. The ASF positive cases were detected

from Lamgong and Tsento geogs from Paro dzongkhag, Samphelling geog from Chhukha dzongkhag, Kabisa geog from Punakha dzongkhag, Samtenling from Samtse dzongkhag, Pangthang geog from Tsirang dzongkhag, Athang and Rubisa geog from Wangdue dzongkhag and Ngangla geog from Zhemgang dzongkhag (Table 4).

Table 4. Dzongkhag and Geog wise ASF outbreaks (2024-25)

Dzongkhags & Geogs	Number of outbreaks
Chukha	1
Sampheling	1
Dagana	1
Lhamoidzingkha & Nichula	1
Paro	3
Lamgong	1
Tsento	2
Punakha	1
Kabisa	1
Samtse	1
Samteling	1
Sarpang	5
Chudzom	1
Gelephug	2
Samteling	2
Tsirang	1
Pangthang	1
Wangdiphodrang	2
Athang	1
Rubesa	1
Zhemgang	1
Ngangla	1
Total	16

During FY 2024-2025, most of the outbreaks were reported in month of August 2024 February 2025 and April 2025 (Figure 9).

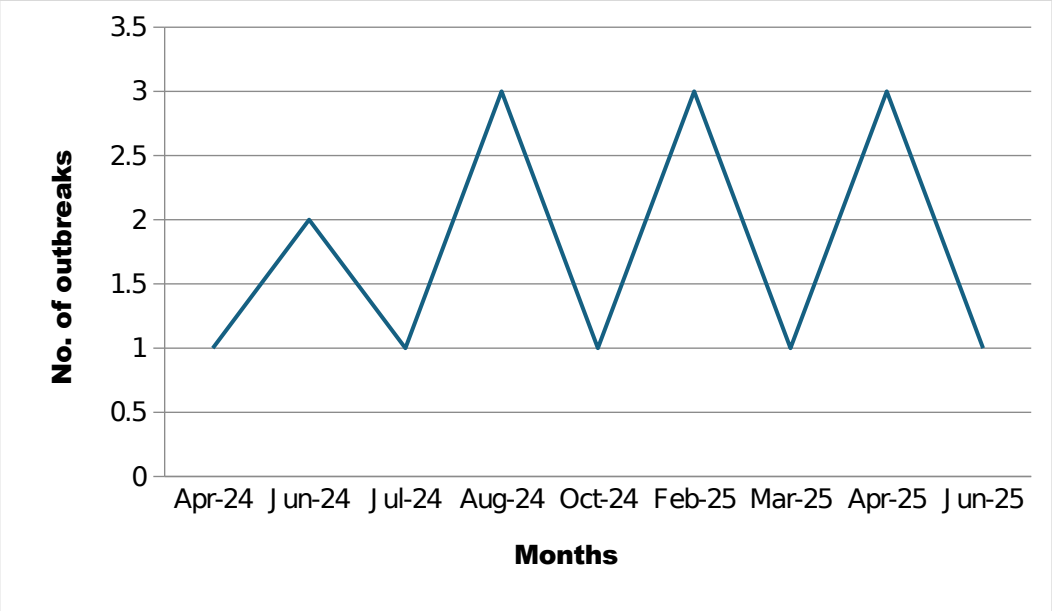


Figure 9. Monthly trend of ASF outbreaks (2024-25)

In the 16 outbreaks reported during the FY 2024-2025, a total of 230 pigs had been reported dead, and 1279 pigs had been culled which included both the positive farms and pre-emptive culling conducted to prevent the further spread of the ASF virus. 100% mortality had been reported in some positive farms due to ASF (e.g Samtse). The containment measures had incurred the total expenditure of Nu. 6381406 **(**Ngultrum Six Million Three Hundred Eighty-One Thousand Four Hundred Six). In order to reduce the cost, the duration of the IOC had been constantly monitored by IOC in collaboration with the Technical Working Group (TWG). In some outbreaks, since there is 100% mortality in the positive farm, IOC was not activated but was monitored by respective DLS for preventing the spread of the virus. In some outbreaks, IOC had to keep for longer duration (55 days in Lhamoidzingkha). On average, the IOCs were activated for approximately 17 days (Table 5).

Table 5. ASF Outbreak Containment Summary: Mortality, 3D Operations, IOC Duration & Cost – FY 2024–2025

Sl	Dzongkhag	Geog	Dead	3D	IOC duration***	Budget (Nu)
1	Wangdiphodrang	Athang	17	152	17	436862
2	Punakha	Kabisa	7	121	16	556643.6
3	Paro	Lamgong	1	1	0	141000
4	Sarpang	Gelephug	26	39	32	
5	Sarpang	Samteling	1	10	17	553000
6	Sarpang	Samteling	7	7	16	
7	Sarpang	Chudzom	0	0	0	
8	Sarpang	Gelephug	1	3	15	223540
9	Paro	Tsento	1	8	7	65281
10	Dagana	Lhamoidzingkha *	17	436	55	1698670.5

11	Zhemgang	Ngangla	16	8	11	118450
12	Paro	Tsento	6	10	13	178000
13	Chukha	Sampheling	28	221	52	2076965
14	Wangdue	Rubesa	14	65	10	332994
15	Samtse	Samtse	4	0	0	0
16	Tsirang	Pangthang**	84	170	26	On-going
	Total		**230**	**1251**	**287**	**6381406.1**

*7 wild pig carcasses encountered in Nichula geog

**As of 26th June 2025

2. Laboratory Services Unit (LSU)

2.1 Overall Performance of Sections under LSU

In the fiscal year 2024–2025, the Laboratory Services Unit (LSU) received a total of 4,045 samples and conducted 7,308 diagnostic tests across its various sections as illustrated in Figure 10. These Figures reflect a sustained level of activity, indicating the lab's continued role as a key national diagnostic and surveillance center. Beyond routine diagnostic referrals, LSU was actively engaged in several priority surveillance programs, including:

- Cattle Mastitis and Antimicrobial Resistance (AMR) surveillance
- Peste des Petits Ruminants (PPR) surveillance
- Highland disease screening in yak-rearing regions
- Taeniid egg surveillance in highland and stray dog populations
- Fasciolosis screening in mastitis positive cattle
- Lumpy Skin Disease surveillance

A significant milestone for the reporting period was the timely detection of African Swine Fever (ASF) outbreaks, which was achieved without delay—even during weekends and holidays—demonstrating the unit’s enhanced diagnostic preparedness and commitment.

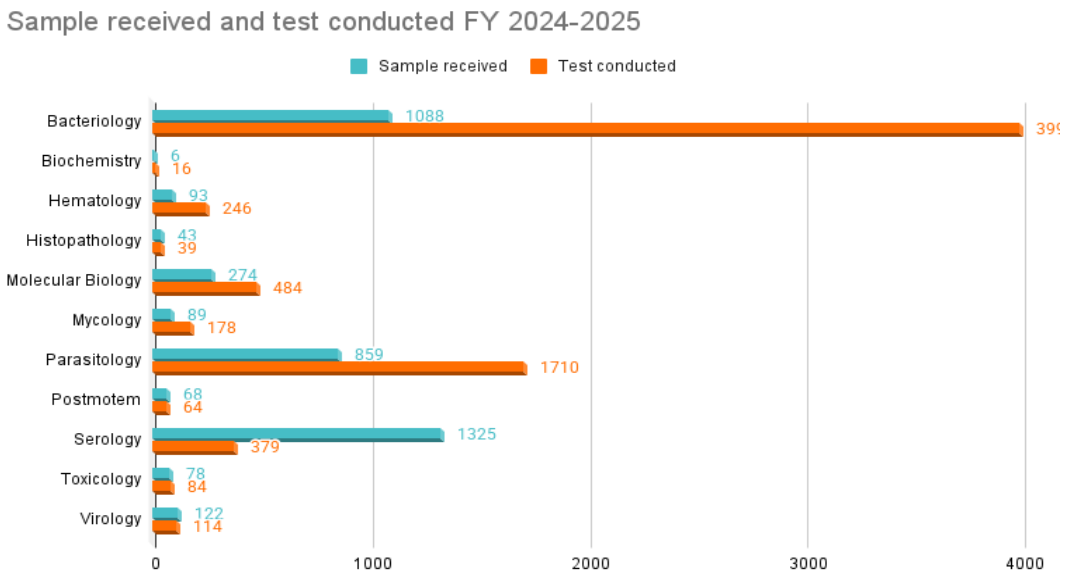


Figure 10. Number of samples processed and tested

2.2 Species/Disease-wise Laboratory Findings

In the fiscal year 2024–2025, major laboratory findings were recorded primarily in the Molecular Biology, Bacteriology, Mycology and Parasitology sections. These findings are presented below, categorized by animal species and disease of significance. Data from other sections were limited for this reporting period

2.2.1 Molecular Biology

In FY 2024–2025, the Molecular Biology section received samples from 12 dzongkhags for disease identification and confirmation. The majority of samples originated from swine, followed by avian species, primarily due to African Swine Fever (ASF) outbreaks and avian influenza (bird flu) events reported during the year as presented in the Figure 11 and 12.

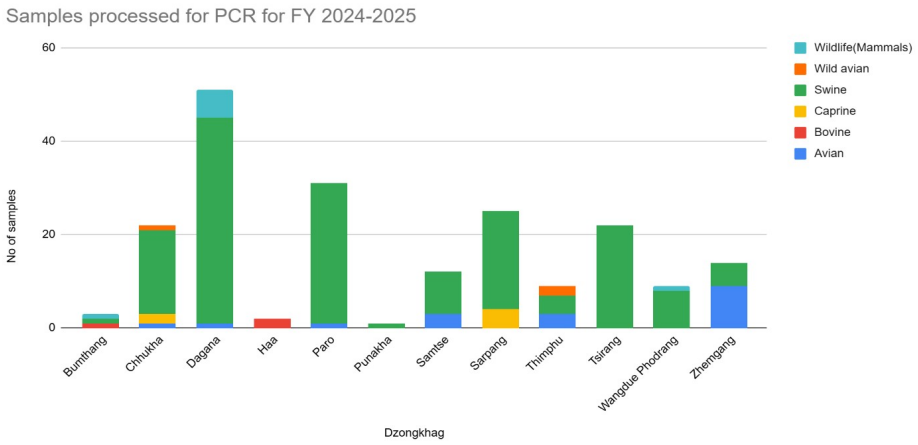


Figure 11. Dzongkhag wise molecular tests conducted

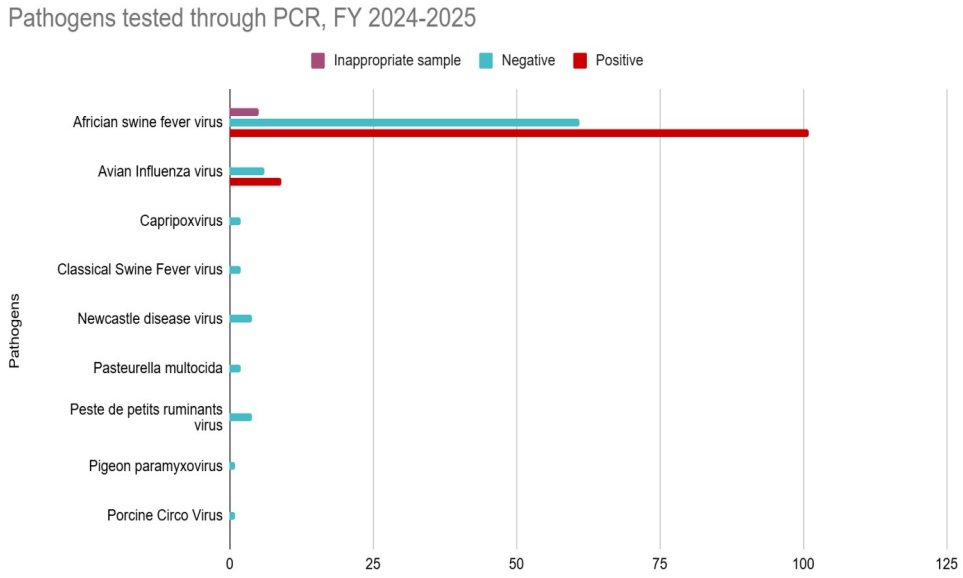


Figure 12. Pathogen wise PCR tests conducted

2.2.2 Bacteriology Section

The Bacteriology section continued to provide bacterial isolation and identification services for referral samples received from across the country. The number of samples processed, categorized by animal species and bacterial isolates, is summarized below. These data were retrieved from the Laboratory Information Management System (LIMS).

During FY 2024–2025, the majority of bacterial isolates were obtained from canine samples, followed by bovine and swine. Among the identified pathogens, *Staphylococcus intermedius* was most frequently isolated, particularly from dogs (n=100), indicating its continued relevance in small animal infections. Other no Table isolates included *Escherichia coli* (from avian and canine samples), *Staphylococcus spp.*, *Staphylococcus aureus*, and *Staphylococcus hyicus*. Occasional isolates such as *Pseudomonas pseudomallei*, *Enterobacter aerogenes*, and *Streptococcus canis* were also identified.

The detailed species-wise distribution of bacterial isolates is presented in Figure 13. Additionally, the section undertook antimicrobial resistance (AMR) surveillance activities involving mastitis milk which is not captured in LIMS and presented as a separate report.

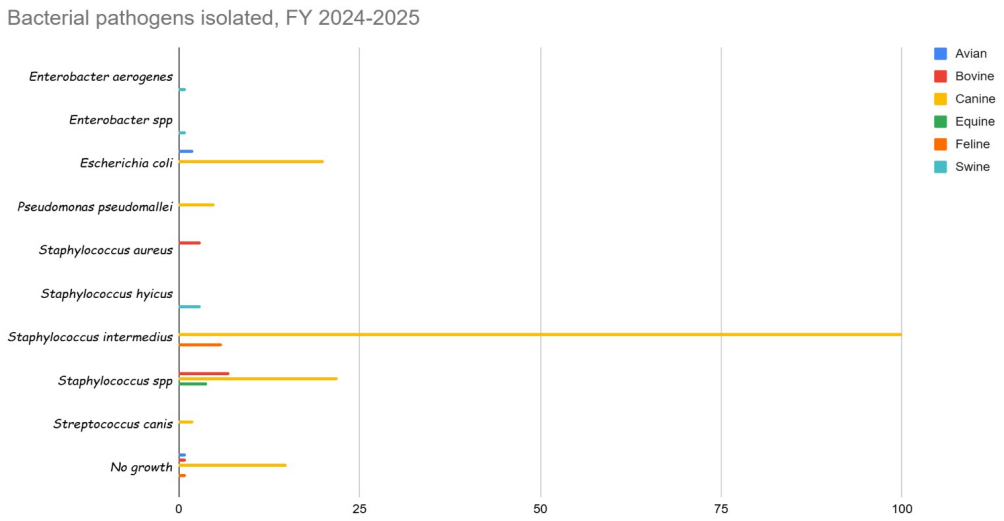


Figure 13. Species wise bacteria isolated

2.2.3 Parasitology Section

In the fiscal year 2024–2025, the Parasitology Section received fecal samples from 10 Dzongkhags for examination, with the majority of samples originating from swine and bovine. The most commonly identified parasites included *Coccidia* spp., *Balantidium coli*, and *Strongyloides* spp (Figure 14). In addition, the section examined canine blood smears from the CCC in Yusipang, specifically for heartworm detection. Out of 54 samples examined, 23 dogs tested positive using the direct smear technique.

Furthermore, in collaboration with the Bacteriology Section's mastitis surveillance program, the Parasitology Section conducted target screening for fasciolosis (liver fluke infestation) in cattle diagnosed with mastitis. This joint effort was aimed at assessing potential co-infections and gaining insights into the parasitic disease burden in affected dairy herds.

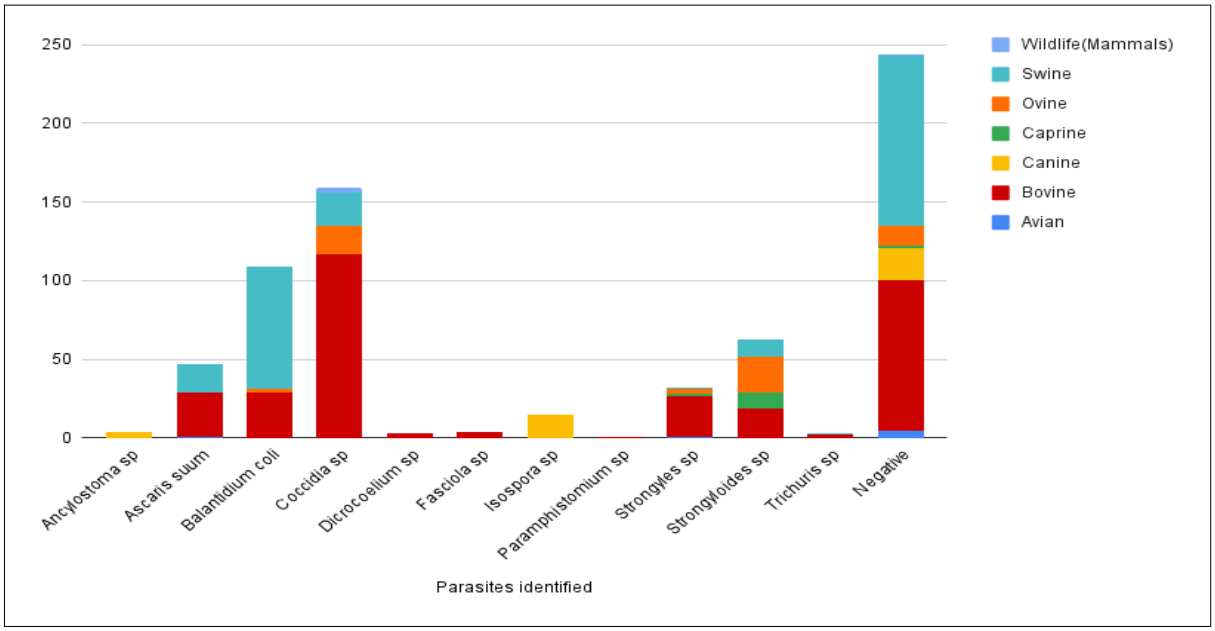


Figure 14. Animal species wise helminths identified

2.3 Sample referral for FY 2024-2025

In the FY 2024-2025, the laboratory referred 348 specimens to international and national institutes for advance testing and confirmation. The details of specimens, type of testing requested and referring centers are listed below in Table 6.

Table 6. Samples referred for advance tests

Specimen	Number	Testing	Institute/Centre
Bacterial Isolates (*E. coli, Streptococcus spp, Staphylococcus spp*)	121	Gene sequencing	Technical University of Demark
Canine Serum	47	Rabies Antibodies titer	National Institute of Infectious Diseases, Japan
Bacterial Isolates (*E. coli, Staphylococcus spp*.)	167	Gene sequencing	University of Melbourne, Australia
Extracted DNA of H5N1	3	Gene sequencing	RCDC, Serbithang, Thimphu
Poultry feed	10	Alfatoxin detection	NDCAN, Bumthang

2.4 Pattern of Tests Across Veterinary Laboratories (FY 2024–2025)

During the fiscal year 2024–2025, veterinary laboratories across the country conducted a wide range of diagnostic tests. This report highlights some of the major tests performed at the regional and Dzongkhag veterinary laboratories such as Parasitological examinations, serological tests and post-mortem examinations. The data presented below were extracted and compiled from the Laboratory Information Management System (LIMS).

2.4.1 Parasitology

The Figures below present the results of parasitological examinations carried out by 14 veterinary laboratories during the fiscal year 2024–2025. Overall, 49% of the fecal samples tested were negative, while 51% were positive for various parasitic infections. The testing was conducted by four regional laboratories, one satellite veterinary laboratory, the National Veterinary Hospital, the National Centre for Animal Health, and seven Dzongkhag veterinary hospitals (Figure 15).

A total of 23 different parasite species were detected across these laboratories. The most commonly identified parasite was *Strongyles* spp (23%), followed by *Coccidia* spp. (17%) and *Balantidium coli* (15%) (Figure 16).

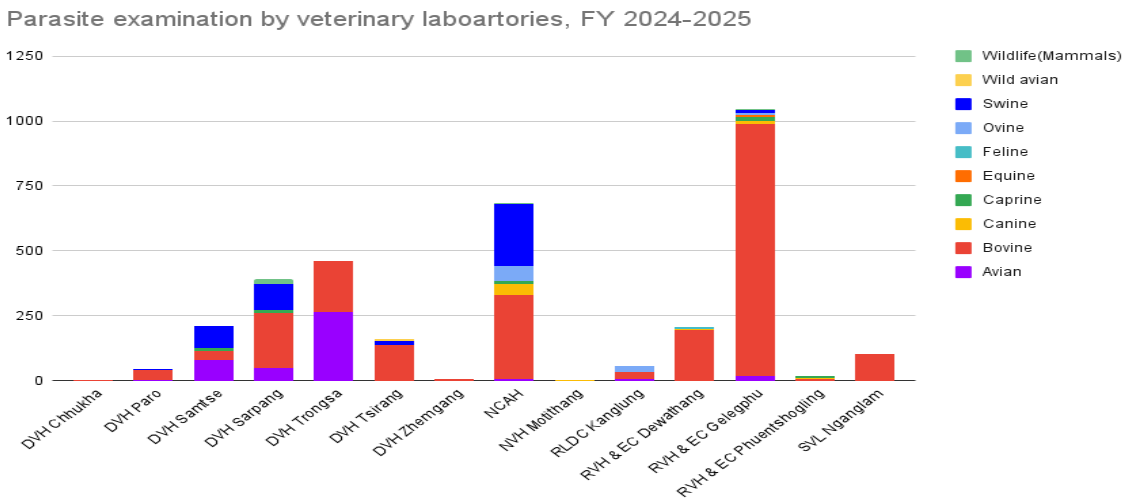


Figure 15. Center wise fecal samples examined for different species of animals

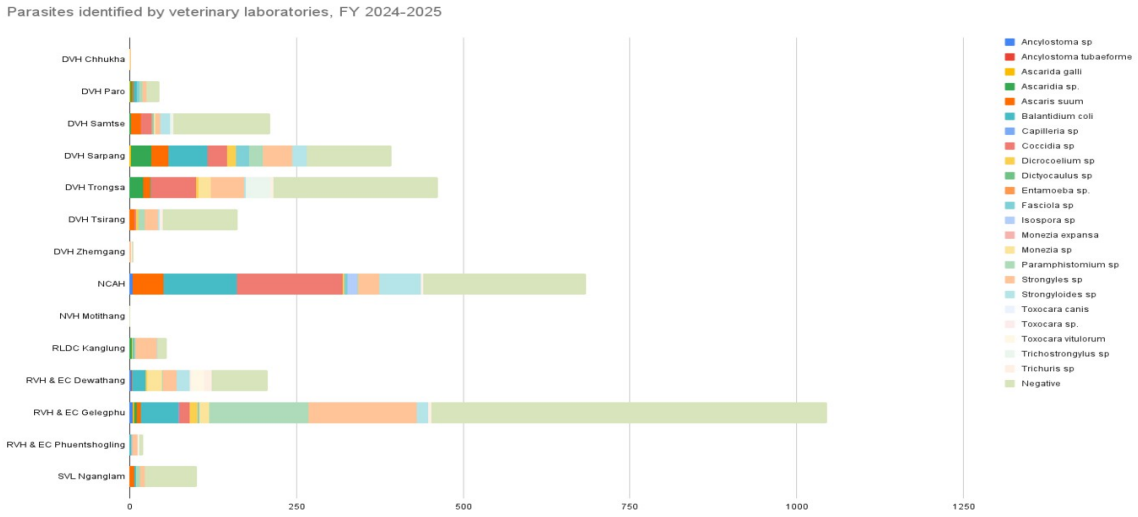


Figure 16. Different helminths identified by centers

2.4.2 Serology

The Figures below illustrate the range of serological tests conducted by 24 veterinary laboratories during the fiscal year 2024–2025. These include the Rose Bengal Test (RBT) for Brucella screening, as well as various antigen and antibody detection tests for disease surveillance. The majority the tests performed were RBT (76%), followed by antibody detection tests and antigen detection rapid tests (Figure 17).

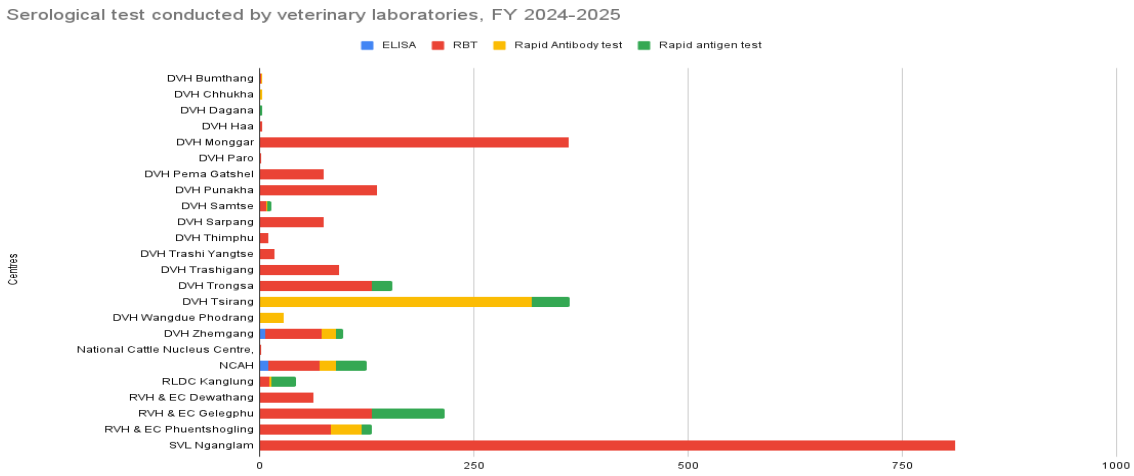


Figure 17. Serological tests performed by different centers

2.4.3 Post-Mortem Examinations

In the fiscal year 2024–2025, a total of 230 post-mortem examinations were conducted by various veterinary laboratories, as illustrated in the Figure below. The highest number of examinations was carried out by the Regional Veterinary Hospital and Epidemiology Centre (RVH&EC) in Gelephu, followed by the National Centre for Animal Health (NCAH), Dzongkhag Veterinary Hospital (DVH) Tsirang, and DVH Trongsa (Figure 18).
By species, majority of post-mortem cases were from avian species (53%), followed by swine (19%) and caprine (13%).

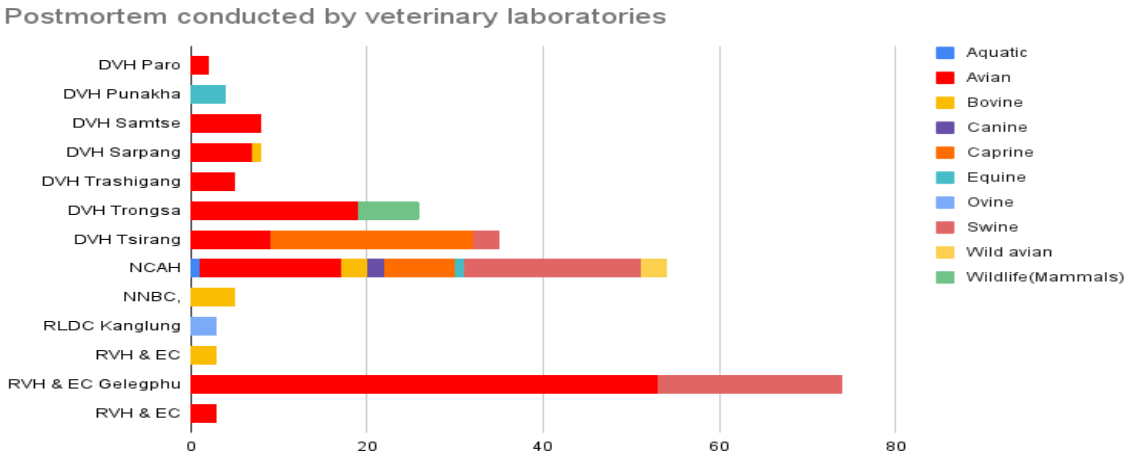


Figure 18. Postmortem examinations conducted by different centers

2.5 Laboratory Quality Assurance and New Methods

Participation in internal and external quality assurance systems is a useful tool for the production of reliable laboratory results of consistently good quality. The laboratory service unit participated in proficiency testing for Bacteriology and Molecular biology in the FY 2024-2025.

2.5.1 External Quality Assurance System (EQAS) with EQASIA for Bacteriology

The Bacteriology Section participated in the proficiency testing (PT) program organized by EQASIA for the 9th and 10th rounds of bacterial detection and antimicrobial susceptibility testing (AST). Samples were received in October 2024 September and May 2025. The test panel comprised 5-10 unidentified isolates, which needed to be identified as either *Enterococcus spp*, *E. coli*, *Campylobacter*, or *Staphylococcus aureus*. Laboratories were tasked with employing their standard methodologies for the identification and AST of these bacterial strains. Results were submitted to DTU Food via a secure, password-protected web tool, which will generate an evaluation report upon the deadline (Table 7 and Figure 19).

Table 7. Participation in EQASIA

Date of participation	*Panels and round*	*Evaluation report*
October-November 2023	9 round *Campylobacter spp* *Enterococcus spp* Antibiotic susceptibility testing	Available
May-June 2024	10 round *Escherichia coli* *Staphylococcus aureus* Antibiotic susceptibility testing	Available

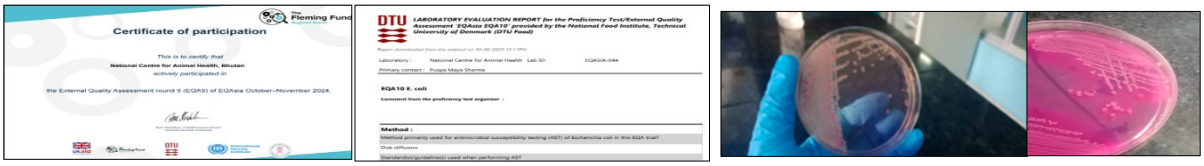


Figure 19. Certification and Results of EQASIA

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

The Bacteriology Laboratory took part in the 8th round of NEQAS in November 2024 and 9th round in May 2025. Three unidentified lyophilized samples were provided; bacterial identification and antimicrobial susceptibility testing (AST) were conducted using the available antibiotic discs. The report was submitted online via RCDC NEQAS. The results and scores are detailed in Figure 20 below.

National Centre For Animal Health	BAC248-010	Staphylococcus *saprophyticus*	Staphylococcus *saprophyticus*	1.00	Not Applicable	Not Applicable	1	24/72
	BAC248-011	Aeromonas *Hydrophilia*	Aeromonas *Hydrophilia*	1.00	Not Applicable	Not Applicable	1	21/36
	BAC248-012	Salmonella *enteritidis*	Salmonella *enteritidis*	1.00	enteritidis: Group D (9, g, m)	enteritidis: Group D (9, g, m)	1	34/27
Total Score				**3/3**			**3/3**	**79/135**

National Centre For Animal Health	BAC259-010	Salmonella *species*	Salmonella *species*	1.00	Not Applicable	Not Applicable	1	17/27
	BAC259-011	Escherchia *coli*	Escherchia *coli*	1.00	Not Applicable	Not Applicable	1	29/39
	BAC259-012	Staphylococcus *aureus*	Staphylococcus *aureus*	1.00	Not Applicable	Not Applicable	1	21/72
Total Score				**3/3**			**3/3**	**67/138**

Figure 20. Results of NEQAS with RCDC

2.5.3 Asia Pacific Terrestrial Regional Proficiency Testing Program for Molecular Biology

As part of continuous quality assurance and external validation of molecular diagnostic capabilities, the National Veterinary Laboratory participated in the 2024 Proficiency Testing (PT) program organized by the Australian Centre for Disease Preparedness (ACDP), AAHL, Geelong. The panels assessed laboratory performance in the molecular detection of key transboundary animal diseases using Real-Time PCR (Figure 21).

The **Avian panel**, conducted during May–June 2024, evaluated laboratory proficiency in detecting:

- **Avian paramyxovirus type 1 (APMV-1)** [M gene]
- **Avian Influenza Virus (AIV)** [Matrix gene]
- **AIV H5 subtype**

Results for all three targets were reported as *acceptable*. However, internal data review indicated minor variability, including an outlier in the within-laboratory Z-scores and Youden plots for sample pairs 5 & 6, and a borderline between-laboratory Z-score for sample pair 9 & 10. The **Swine panel**, conducted in July 2024, included targets:

- **African Swine Fever Virus (ASF)**
- **Classical Swine Fever Virus (CSF)**
- **Porcine Reproductive and Respiratory Syndrome Virus (PRRS)** – both EU (PRRS-E) and Southeast Asian (PRRS-S) strains

Results were *acceptable* for ASF, PRRS-E, and CSF targets. One *unacceptable* result was noted for PRRS-S due to a false negative report for sample 17 and statistical outliers observed in the Youden plot and Z-score analysis for sample pair 4 & 5.

Despite minor discrepancies, participation provided valuable insights into assay performance, aiding refinement of internal processes. Regular PT participation remains a cornerstone of quality assurance and capacity building in molecular diagnostics. Code for Bhutan was AT19.

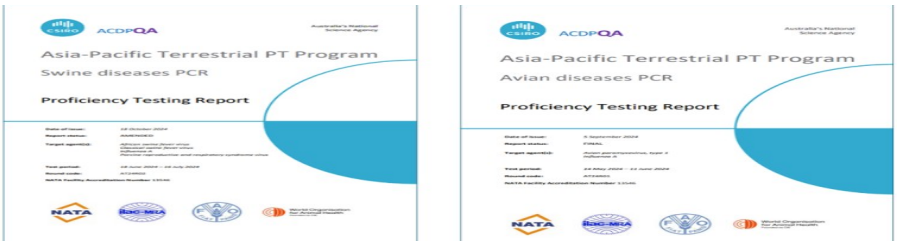


Figure 21. Proficiency testing report for Swine and avian diseases PCR

2.6 New Tests Introduced, Validated, and Standardized

To strengthen diagnostic capacity and support disease surveillance efforts, the laboratory undertook validation, standardization, and implementation of a range of new diagnostic tests during the reporting year. These included serological, molecular, and rapid point-of-care assays.

2.6.1 New Tests Introduced

The following tests were newly introduced to expand diagnostic capabilities, particularly in the Livestock Surveillance Unit (LSU):

- Extended-Spectrum Beta-Lactamase (ESBL) Detection:
  Using MacConkey Agar supplemented with Cefotaxime (4%) to detect ESBL-producing bacteria.
- Infectious Bursal Disease Virus (IBDV) RT-PCR:
  Molecular detection of IBDV in poultry. (Make: GenScript)
- Feline Panleukopenia Virus Rapid Test:
  Antigen detection kit for screening of feline parvovirus. (Make: VECHEK)

2.6.2 Validation and Standardization of Rapid Tests

A series of commercially available rapid immunochromatographic kits were validated and standardized for in-house diagnostic use (Table 8):

Table 8.Immunochromatographic kits validated

Test	*Purpose*	*Make*
ALC test kit	Antigen detection	Abbexa
Avian Influenza Virus (AIV)	Antigen detection	Bio-note
Infectious Bursal Disease Virus (IBDV)	Antigen detection	Bio-note
Ehrlichia canis	Antibody detection	Bio-note
Canine Distemper Virus (CDV)	Antigen detection	Bio-note
Canine Parvovirus (CPV)	Antigen detection	Bio-note
Newcastle Disease Virus (NDV)	Antigen detection	Bio-note
Rabies virus	Antigen detection	Bio-note
Aflatoxin detection	Toxin detection	ELabscience
Classical Swine Fever (CSF)	Antigen detection	ELabscience

Note: NDV, AIV, and IBDV rapid test kits (1 kit each, 10 tests per kit) were issued to Regional Livestock Development Centre (RLDC), Kanglung; and Regional Veterinary Hospitals & Extension Centres (RVH & ECs) at Phuentsholing and Gelephu for field use.

2.6.3 Validation and Standardization of ELISA Tests

Two ELISA kits; Brucella abortus and Bovine tuberculosis were validated (Table 9).

Table 9. ELISA test kits validated

Test	*Purpose*	*Brand*
Brucella Abortus	Antibody detection	Bio note
Bovine Tuberculosis	Antibody detection	ELab science

2.6.4 *Validation and Standardization of RT-PCR Assays*

Two molecular kits Porcine Reproductive and Respiratory Syndrome (PRRS)_EU and Avian Influenza Virus – N1 subtype were validated (Table 10).

Table 10. RT-PCR kits validated

Test	*Purpose*	*Brand*
Porcine Reproductive and Respiratory Syndrome (PRRS)_EU	RNA detection	GenScript
Avian Influenza Virus – N1 subtype	RNA detection	GenScript

2.7 Fleming Fund Activities

2.7.1 Capacity-building outcomes

Training on Mastitis Detection and Laboratory Techniques (Sampling, Testing, Packaging, Transportation, and Bacteria Identification).
Mastitis is a major health concern in dairy animals, causing significant economic losses and often leading to the use of antibiotics. Improper diagnosis and antibiotic use contribute to antimicrobial resistance (AMR), impacting animal health, food safety, and public health.
In line with the AMR Surveillance Plan under Fleming Fund Phase 2, two regional hands-on trainings were conducted in December 2024 to build technical capacity in mastitis surveillance among field staff and laboratory technicians.

i. Training 1:

- Venue: Professional Development Center, Tsirang
- Dates: December 14–16, 2024
- Participants: Lab technicians and livestock in-charges from Wangdue, Tsirang, Paro, Chhukha, Samtse, Dagana, RVEC Phuentsholing & Gelephu

ii. Training 2:

- Venue: Druk Doethjung Resort, Trashigang
- Dates: December 20–22, 2024
- Participants: Lab technicians and livestock in-charges from Trashigang, Mongar, Pemagatshel, Nanglam, Chaskar, Orong, Deothang, Samkhar, Yangner, RVEC Dewathang and RLEC Kanglung (Figure 22).

iii. Objectives

1. Develop proficiency in mastitis detection using the California Mastitis Test (CMT)
2. Strengthening skills in sterile sample collection, packaging, and transport
3. Enhance laboratory capabilities in bacterial culture and pathogen identification
4. Promote use of Epicollect 5 for real-time data collection
5. Familiarize field staff with the AMR surveillance plan and site-specific requirements

Figure 22. Participants of Mastitis training in Tsirang (left) and Trashigang (right)

Figure 23. Demonstration of CMT on bulk milk and individual animal

iv. Outcomes

- Participants acquired hands-on experience in CMT screening
- Enhanced knowledge in milk sampling, handling, and biosecurity
- Strengthened laboratory skills in culturing and identification of pathogens
- Participants identified and finalized their respective sampling locations for surveillance
- Increased familiarity with digital data entry tools and AMR surveillance workflow

v. Participant Feedback

- Confidence gained in CMT and sterile milk collection
- Increased awareness on AMR risks associated with mastitis treatment
- Enthusiasm for implementation of the surveillance plan
- Participants showed readiness to identify cases and contribute to regional AMR surveillance

vi. Conclusion

These regional trainings successfully built the technical competency of field and laboratory staff for effective mastitis detection and AMR surveillance. The integration of theoretical and practical approaches ensured that participants were equipped with the skills necessary to support national surveillance activities. These events served as foundational preparation for coordinated mastitis surveillance and data-driven antimicrobial stewardship across Bhutan's dairy sector.

2.7.2 Bhutan Microbiology Workshop Summary Report

A. Training on Microbiology

Facilitators: Lynn Rogers (New Zealand) and Puspa Sharma (Bhutan)

Location: National Centre for Animal Health (NCAH), Thimphu

Dates: 3–7 of February 2025

Participants: 19 staff from central, regional, and district labs (NCAH, Gelephu, Phuentsholing, Kanglung, NFTL, SVL Dewathang, and NVH) (Figure 25).

i. Background & Needs Assessment

The workshop was part of the Fleming Fund-supported AMR surveillance activities, with the goal of strengthening microbiology capabilities across animal health labs. Based on preliminary discussions and a needs assessment involving NCAH and partners, priority training areas included sampling procedures, pathogen identification, AMR testing, data recording, and isolate storage. Mastitis surveillance was used as the central theme for the hands-on training.

ii. Workshop Purpose

To provide practical training in microbiology—focusing on identification and antimicrobial susceptibility testing (AST) of mastitis pathogens. It also aimed to improve lab quality control, data management, and inter-lab coordination.

iii. Training Activities Summary

Over five days, participants were trained through presentations, group discussions, lab work, and troubleshooting exercises. Using mock milk and wound samples, they followed a full workflow from culturing to pathogen identification and AST. Emphasis was placed on using the national mastitis flow chart, understanding media and incubation conditions, recording results, and applying CLSI guidelines for AST interpretation. Special topics such as ESBL detection and urine microscopy were introduced. A demonstration Access database for storing surveillance data was reviewed for possible use at NCAH (Figure 24 and 25).

Figure 24. Participants in laboratory training

Figure 23. Hands on practice on bacterial identification and AST

iv. Key Outcomes

- Participants gained hands-on experience in culturing, identifying mastitis pathogens, and performing AST.
- Lab staff resolved technical issues such as incubation methods, catalase test setup, and media quality control.
- A standard worksheet was developed to streamline data entry and harmonize results across labs.
- Basic exposure to ESBL testing and urine microscopy was provided.
- Participants improved their understanding of quality control procedures and troubleshooting.

B. Biosafety Cabinet, Risk Assessment and SOP Development

Date: January 7–11, 2025
Venue: Lhazaay Suites, Gelephu

Organized by: National Center for Animal Health (NCAH)
Funded by: Fleming Fund Country Grant Phase II
Facilitators: Puspa M Sharma (NCAH), Kinley Gyem (RCDC)
Participants: 13 laboratory professionals from animal health, public health, and food laboratories across Bhutan

1. Introduction

This five-day national training-workshop was designed to strengthen the understanding and practical competencies of laboratory professionals in the safe use and maintenance of Biosafety Cabinets (BSCs), implementation of biosafety risk assessments, and development of Standard Operating Procedures (SOPs). It addressed critical gaps in the day-to-day use of BSCs and biosafety practices observed across diagnostic and surveillance labs under the Ministry of Agriculture and Livestock and Ministry of Health.

The training integrated theoretical concepts with practical exercises, providing participants with tools to assess laboratory risks, respond to biological spills, and develop essential biosafety documentation. The sessions were facilitated by technical experts from NCAH and RCDC and built on real-world scenarios and experiences from Bhutanese laboratories.

2. Objectives

The workshop aimed to:

- Introducing the concept and purpose of BSCs in lab safety and containment
- Enhance participant skills in BSC usage, maintenance, decontamination, and troubleshooting
- Conduct hands-on risk assessment exercises tailored to Bhutan's priority zoonoses
- Provide practical experience in biological spill response inside and outside BSCs
- Guide participants in the development of SOPs for consistent BSC operation and documentation

Figure 24: Group work on risk assessment and SOP development for BSC

Figure 25: Hands-on-practice on spill management

Outcomes and Key Takeaways

- Enhanced Technical Capacity: Participants gained clear understanding of BSC functions, proper usage, daily maintenance, and decontamination protocols.
- Practical Risk Assessment Skills: Through structured exercises, participants practiced identifying and mitigating risks associated with high-risk pathogens.
- SOP Development: Draft SOPs on BSC maintenance and spill management were created, contributing to standardized practices across Bhutanese labs.
- Spill Response Preparedness: All participants practiced safe and effective response to biological spills, improving lab safety readiness.
- Collaborative Learning: The workshop fostered collaboration between MoH and MoAL lab staff, encouraging harmonized biosafety practices across sectors.

Conclusion and Recommendations

The training successfully enhanced participants' knowledge and skills in handling Biological Safety Cabinets (BSCs). It was observed that many laboratory personnel use BSCs daily without a clear understanding of their mechanisms, functions, routine cleaning and maintenance, basic troubleshooting, risk grouping, and risk assessments.

Although this training workshop included a limited number of participants, it highlighted the need for all laboratory personnel working with BSCs to receive at least one comprehensive training session on these aspects. This is crucial for ensuring staff safety and the long-term maintenance of BSCs. This workshop marked a critical step in strengthening Bhutan's laboratory biosafety culture and preparedness.

C. Workshop on development of AMR Surveillance Plan

The National Center for Animal Health (NCAH), under the Department of Livestock, Ministry of Agriculture and Livestock, successfully conducted a five-day workshop on the development of an AMR surveillance plan for mastitis in dairy cattle. The workshop was held from 18th to 22 of November 2024 at Punakha Boutique Hotel, Punakha, as part of the Fleming Fund Country Grant Phase II initiative.

The workshop brought together participants from various relevant agencies including the Animal Health Division (DoL), National Dairy Development Center (Yusipang), Regional Livestock Development Center (Kanglung), Regional Veterinary Hospital and Epidemiology Center (Phuntsholing), Dzongkhag Veterinary Hospital (Paro), Fleming Fellows, and technical experts from AMROH, the Regional Grant Coordinator.

Mastitis, being a major concern in the dairy sector, was recognized as a priority area due to its economic impact and the associated risk of antimicrobial resistance (AMR) from indiscriminate antibiotic use. The workshop focused on developing a comprehensive surveillance plan to identify key mastitis-causing pathogens and their antimicrobial resistance patterns.

During the workshop, participants collaboratively:

- Developed a draft AMR surveillance framework for mastitis.
- Identified priority pathogens including *Streptococcus agalactiae*, *Streptococcus dysgalactiae*, *Streptococcus uberis*, *Staphylococcus aureus*, *Staphylococcus spp.*, and *Escherichia coli*.
- Standardized sampling strategies, diagnostic protocols, and antimicrobial susceptibility testing (AST) methods.

The outcomes of the workshop laid the foundation for a coordinated national surveillance effort, aiming to improve mastitis management, ensure rational antibiotic use, and mitigate the threat of AMR in Bhutan's dairy sector.

Figure 26. Participants involved in developing mastitis surveillance plan

D. Workshop Report: Working with AMR Surveillance Data from Animals, Food, and Environment

Date: March 31 – April 4, 2025
Venue: River Valley Hotel, Paro

Organized by: National Center for Animal Health (NCAH) in collaboration with the Bhutan Food and Drug Authority (BFDA)
Supported by: Fleming Fund Country Grant Phase II
Technical Expertise: AMROH-SA Regional Grant

The National Center for Animal Health (NCAH), in collaboration with the Bhutan Food and Drug Authority (BFDA), successfully conducted a five-day workshop titled "Working with AMR Surveillance Data from Animals, Food, and Environment" from March 31 to April 4, 2025 at River Valley Hotel, Paro. The workshop was organized under the Fleming Fund Country Grant Phase II, with technical support from the AMROH-SA Regional Grant. The sessions were led by international experts from: Massey University, New Zealand, Utrecht University, Netherlands, Brigham and Women's Hospital, USA

These experts brought global insights and ensured the use of best practices and methodologies in AMR data analysis.

Figure 27: Participants of AMR data analysis workshop

Participants and Stakeholders
The training brought together professionals from key agencies involved in AMR surveillance, including the Department of Livestock (DoL), BFDA, and the Royal Centre for Disease Control (RCDC). A diverse group of participants from veterinary, public health, and food safety backgrounds attended the workshop.

Objectives

The primary objectives of the workshop were:

- To build national capacity in antimicrobial resistance (AMR) data analysis.

- To provide hands-on training in using the R AMR package for data processing and visualization.
- To enhance the quality and interpretation of AMR surveillance data for informed decision-making.
- To align Bhutan's AMR data management practices with international standards.

Workshop Highlights

The sessions combined theoretical knowledge with intensive practical exercises. Key highlights included:

- Introduction to AMR data management and principles of surveillance.
- Data quality control and standardization approaches for AMR datasets.
- Practical sessions on the R AMR package, including:
    - Data cleaning and transformation
    - Visualization and resistance trend analysis
    - Interpretation of susceptibility profiles and multidrug resistance patterns
- Application of statistical tools for evidence-based policy support.

Figure 28. Data analysis demonstration

Outcomes

- Participants developed practical skills in processing and analyzing AMR data from animals, food, and environmental sources.
- A better understanding of national surveillance datasets and their use in One Health AMR monitoring was achieved.
- The workshop enhanced collaboration among the veterinary, public health, and food safety sectors.
- Standardized tools and workflows for AMR data handling were introduced and adopted.

Conclusion

The workshop was a significant step forward in strengthening Bhutan's AMR surveillance capacity. By equipping professionals with analytical tools and knowledge, the initiative supports the development of a robust, evidence-based AMR surveillance system. Continued

collaboration across sectors and with international partners will be essential to sustain these efforts.

E. AMR data analysis and dissemination

Summary of Mastitis Surveillance Activities (January–June 2025)

In response to persistent mastitis cases, limited laboratory submissions, and increasing field reports of third-generation cephalosporin use, Bhutan implemented a nationwide mastitis surveillance program from January to June 2025. The primary objectives were to identify mastitis-causing pathogens, assess their antimicrobial resistance patterns, and inform national treatment and AMR control strategies.

The program was implemented across three surveillance laboratories:

- National Centre for Animal Health (NCAH)
- Regional Livestock Development Centre, Kanglung
- Regional Veterinary Hospital and Epidemiology Centre, Phuentsholing

Sampling Strategy

A two-tier approach was used:

- Tier 1: Bulk milk samples collected from milk collection points were tested using the California Mastitis Test (CMT). Farms with CMT scores of 2 or 3 were selected for individual-level investigation.
- Tier 2: Individual cows from selected herds were tested using CMT. Cows with positive CMT scores (T/1/2/3) had milk samples collected for laboratory testing, including bacterial culture and antimicrobial susceptibility testing.

Farms with clinical signs of mastitis were included regardless of CMT scores to ensure comprehensive coverage.

Sampling Coverage

The surveillance was carried out in 10 districts (Table 11), resulting in:

- 1,082 bulk milk samples tested
- 552 individual cows screened

Table 11. Milk samples screened dzongkhag wise

District	*Bulk Milk Samples*	*Individual Cows Screened*
Samtse	81	60
Dagana	118	50
Chukha	37	27
Tsirang	123	46
Punakha	59	30
Trashigang	129	71
Mongar	138	54

Wangdue	112	79
S/Jongkhar	217	73
Paro	38	32
Total	*1082*	*552*

Laboratory Findings till May 2025

Out of 310 milk samples tested from individual CMT-positive cows:

- 84.5% yielded bacterial growth
- 15.5% showed no growth, possibly due to: Prior antibiotic use, *E. coli* mastitis with transient shedding, or False-positive CMT results

Pathogen Distribution (Figure 32):

- *Staphylococcus aureus* – 50.5%
- Coagulase-negative staphylococci (CoNS) – 34%
- *Streptococcus* spp. – 13%
- *E. coli, Corynebacterium* spp. – 2.4%

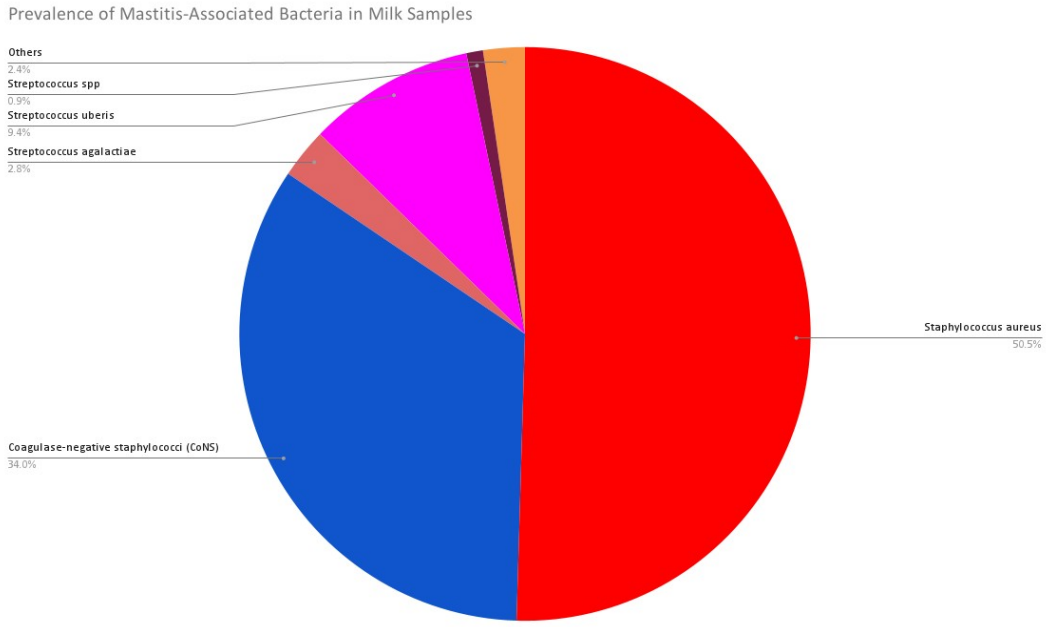


Figure 29: Pie chart showing the bacterial pathogen distribution from mastitis milk

Antibiotic Susceptibility (Figure 33):

- Both *Staphylococcus aureus* and *Streptococcus* spp. showed high sensitivity to all seven antibiotics tested: Penicillin G, Tetracycline, Trimethoprim-Sulfamethoxazole, Erythromycin, Amoxicillin-Clavulanate, Ciprofloxacin, Cefoxitin

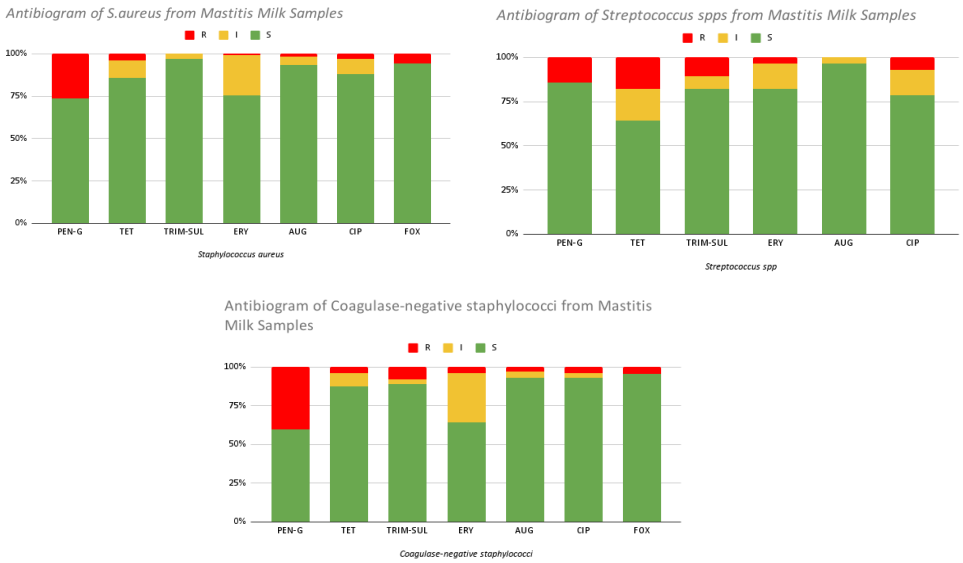


Figure 30: Percentage of RIS against mastitis pathogens and antibiotics.

Conclusion

The sample testing is still ongoing, and a detailed report will be generated upon completion of laboratory analysis and data interpretation. However, the data generated thus far has already proven instrumental in guiding Para veterinarians on mastitis prevention and appropriate treatment. These findings support evidence-based mastitis management and will inform updates to the national veterinary drug formulary and treatment guidelines.

Additionally, based on the findings from this surveillance, a dairy practitioner engagement program was planned and implemented. The outcomes of this initiative were documented in a technical report, which has been submitted to the Department for necessary action and implementation.

F. AMR Surveillance and Dairy Practitioner Engagement Program on Mastitis

In 2025, the National Centre for Animal Health (NCAH), under the Department of Livestock, conducted a national AMR surveillance program on mastitis in dairy cattle, supported by the Fleming Fund Country Grant Phase II. This initiative aimed to strengthen evidence-based mastitis control by generating data on key pathogens and their antimicrobial resistance (AMR) profiles, and to build capacity among field-level animal health practitioners.

Mastitis Surveillance (January – June 2025)

Surveillance was conducted through three designated laboratories—NCAH (Serbithang), RLDC (Kanglung), and RVH&E Centre (Phuentsholing). A two-tier approach was used:

- Initial screening of 614 bulk milk samples using the California Mastitis Test (CMT), with 42% testing positive, indicating high herd-level mastitis prevalence (Figure 35 & 36).
- Follow-up testing on individual CMT-positive cows yielded 310 samples, with 84.5% showing bacterial growth.

Figure 31: Mastitis screening from bulk milk and proportion of 614 bulk milk samples that were CMT positive from

Figure 32: Sterile milk collection from individual cattle for microbiological analysis

The dominant pathogen identified was *Staphylococcus aureus* (50.5%), followed by coagulase-negative *Staphylococcus* spp. and *Streptococcus* spp. Antibiotic susceptibility testing showed high sensitivity to first-line antibiotics (e.g., penicillin, tetracycline, amoxicillin), indicating that high-end antibiotics such as cefoperazone (currently widely used) are unnecessary. Methicillin-resistant *S. aureus* (MRSA) strains were preserved for further genomic analysis.

G. Dairy Practitioner Engagement Workshop (27–28 May 2025, Wangdue)

A "train-the-trainer" workshop was conducted for 34 Para veterinarians from 14 Dzongkhags, government farms, and the National Dairy Development Centre (NDDC) (Figure 36 & 37). The training focused on:

- Diagnosis of mastitis using CMT
- Understanding pathogens and AMR
- Proper hygiene and treatment protocols
- Development of farmer training modules on udder hygiene, mastitis detection, and milking practices

Pre- and post-training assessments showed significant improvements in knowledge and diagnostic confidence among participants. A Field Management Guideline was developed, refined with field feedback, and distributed as a decision-making tool for Para veterinarians.

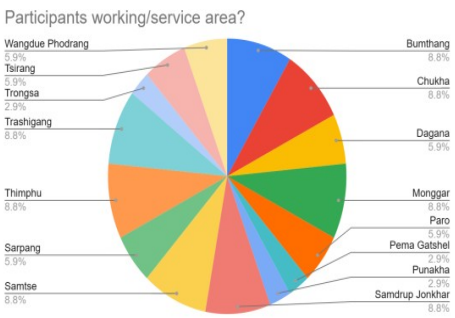



Figure 33: Dairy practitioner workshop

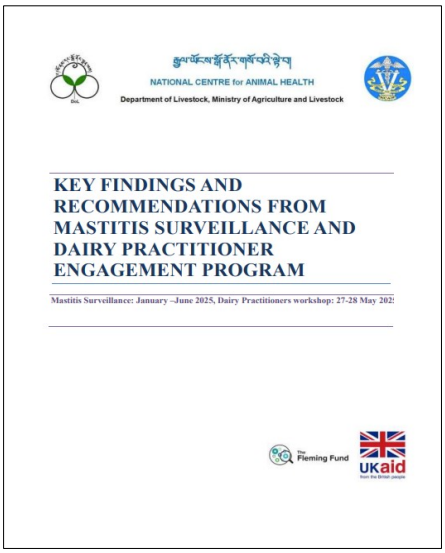



Figure 34: Theoretical presentation on mastitis followed by hands-on training in performing the California Mastitis Test (CMT) on milk samples

Key Recommendations and Way Forward

- Discontinue procurement and use of critical antimicrobials like cefaperazone and gentamicin for mastitis cases.
- Promote Selective Dry Cow Therapy (SDCT) as a control measure for chronic infections.
- Improve the availability of CMT kits, sterile sampling materials, and first-line antibiotics.
- Enhance hygiene training and farm-level engagement, especially involving women farmers.
- Support introduction of a milk quality-based payment system to incentivize mastitis control.
- Empower NDDC to lead clean milk production and mastitis prevention programs.

Note: The full technical report, including laboratory findings, survey results, recommendations, and the field guide for mastitis management and key skills for farmers is provided as a separate technical report.



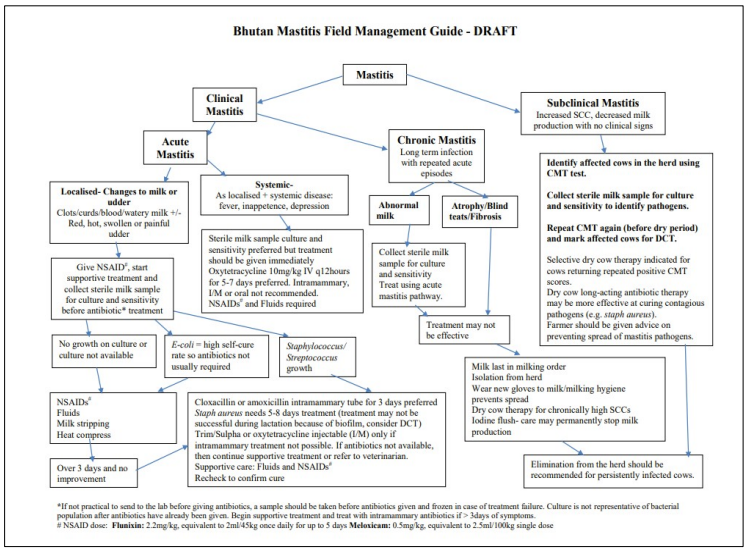


Figure 35: Technical findings and mastitis field management guide developed through the workshop and surveillance

H. Infrastructure and Equipment Procured

Under the Fleming Fund Country Grant Phase II, key laboratory infrastructure and equipment were supported to enhance the diagnostic capacity for mastitis surveillance and antimicrobial resistance (AMR) testing at the National Centre for Animal Health (NCAH) and partner laboratories. These investments have strengthened microbiological testing capacity and improved the quality and consistency of laboratory operations.

The following equipment and consumables were procured:

- Biosafety Cabinets (Class II), Qty 2
  Installed to ensure safe handling of infectious materials and protect laboratory personnel during microbiological procedures.
- Shaker Water Baths, Qty 2
  Used for uniform temperature-controlled incubation and mixing, essential for certain culture and reagent preparation procedures.
- Laboratory Incubators, Qty 2
  Procured to maintain optimal conditions for bacterial growth and culture, critical for pathogen identification.
- 2–8°C Laboratory Refrigerator (Qty 1)
  Replaced an earlier non-functional unit; used for proper storage of culture media, reagents, and antibiotics.
- Microbiological Consumables
  A range of essential consumables including culture media, Petri dishes, antibiotic discs, reagents, sterile collection materials, and other laboratory supplies necessary for bacterial isolation and antimicrobial susceptibility testing.

i. Maintenance and Upgradation of the Reverse Osmosis (RO) Plant

As part of infrastructure strengthening, key components of the laboratory's RO plant were repaired, upgraded, and replaced. The RO system is critical for supplying purified water, which is essential for microbiological testing and media preparation. Its maintenance has ensured

continuous, high-quality water supply—an essential requirement for reliable laboratory performance.
Prepared by Ms. Puspa M Sharma, Tenzin la.
Submitted to: Project Management Unit, Fleming Fund Country Grant – Bhutan
Executing Firm: The Family Home Décor, Firm ID: 17597568
Work Title: Repair and Maintenance of Reverse Osmosis (RO) Plant
Date of report preparation: 27 June 2025

1. Background

The Reverse Osmosis (RO) Plant at the National Center for Animal Health (NCAH), Serbithang, is critical for supplying purified water for laboratory functions. Over time, several components of the plant had degraded due to age and wear, compromising the system's efficiency and safety. Through funding support from the Fleming Fund project, repair and maintenance activities were carried out to restore full functionality of the RO system.

2. Scope of Work

The maintenance activity included replacement of worn-out and non-functional components, installation of essential new components, and replenishment of filtration media to ensure the plant's optimal and safe operation.

3. Details of Work Executed by the Family Home Décor

The details of work carried out are as below (Table 12 and Figure 39):

Table 12. Work details

Sl. No	Particular	Unit	Quantity	Remarks
1	RO Control Panel	Nos	1	Replaced with a new control panel. The existing panel was non-functional and beyond repair.
2	UV Lamp 30W	Nos	2	One lamp installed and one provided as spare. Lifespan of each: 1 year.
3	Activated Carbon (Coal-based)	Kg	200	Replaced carbon from the second pressure vessel. Previously used for over 6 years. Requires annual replacement.
4	Silica Sand	Kg	400	Replaced old sand from the first pressure vessel. Requires annual replacement.
5	URN Dosing Pump	Nos	2	Newly installed. One for membrane cleaning and one for RO system.

				Previously not installed; essential for chemical dosing.
6	Anti-Scalant Chemical	Kg	20	Used to prevent/reduce scale deposit formation. Administered through dosing pump.
7	Membrane Cleaning Chemical	Kg	20	Used to remove fouling/scaling on membrane, restoring performance.
8	Pressure Gauge (21kg BC/PM)	Nos	2	Replaced faulty gauges. Accurate pressure monitoring restored.
9	CRI Make Monoblock Pump (1.5 HP)	Nos	1	Replaced damaged pump to restore water flow and pressure.
10	Rotameter (6000 LPH, Acrylic)	Nos	1	Replaced damaged rotameter for flow rate monitoring.
11	Chemical Dosing Tank	Nos	2	Installed tanks to store anti-scalant and membrane cleaning chemicals.
12	HDPE Pipe	Roll	1	Replaced old GI pipe from RO plant to lab with HDPE pipe.
13	MCB Box	Nos	1	Installed a box to secure the new MCB unit.
14	MCB (63A, 4 Pole)	Nos	1	Replaced to handle voltage fluctuations and stabilize power supply.

4. Financial Summary

- ✓ Deposited Amount Received: Nu. 300,000.00
- ✓ Amount Utilized: Nu. 280,650.00
- ✓ Balance/Unspent Amount: Nu. 19,350.00

The utilized amount covers the cost of materials, parts, and services as detailed in the Table 11 above. The Unspent amount was refunded to Project.

5. Remarks and Recommendations

- ✓ The RO plant has been fully restored and is now operational.
- ✓ Preventive maintenance, including annual replacement of activated carbon and silica sand, and servicing of UV lamps and dosing pumps, is recommended.

- ✓ Installation of the dosing system has significantly enhanced the RO plant's efficiency and membrane lifespan.

Figure 36: Picture showing the repair and maintenance of RO plant at NCAH

These enhancements have played a vital role in ensuring biosafety, improving diagnostic efficiency, and supporting high-quality, evidence-based mastitis surveillance in Bhutan.

2.8 Disease Investigations

2.8.1 Summary investigation *Report: Water Poisoning and Hemorrhagic Septicemia in Yaks – Damthang, Haa*

Dr. Basant Sharma [1], Mr. Thinley [2,] Mr. Kinzang Namgay [2], Mr. Tenzinla [1] Mr. Kuenga [2]

[1]National Center for Animal Health, Department of Livestock, [2]Haa Dzongkhag Livestock Sector

i. Background

As of November 26, 2024, since the first case of Yak mortality in Mr. Tobgay's herd on November 10, 2024, cases of sudden deaths and illness in yaks were reported from highland areas of Damthang, Haa. The clinical signs and preliminary investigation suggested two possible causes: Water Poisoning and Hemorrhagic Septicemia (HS). A team comprising officials from NCAH, Serbithang, Gewog in-charge of Bji, and Laboratory Technician from District Veterinary Hospital, Tshilungkha was deployed for rapid field assessment. Haa has 57 yak-rearing households with 3,197 yaks (IALC 2023, NSB 2024).

ii. Clinical, Postmortem and Laboratory findings,

Clinical Signs: Five sick yaks were examined in Mr. Tobgay's herd, showing dullness, nasal discharge, respiratory distress, and lymph node swelling. One yak was severely ill; others were recovering. Respiratory and digestive signs (e.g., blood-tinged dung) were common. Aggression prior to death was noted in suspected water poisoning cases.

Postmortem Findings: One suitable carcass showed liver degeneration (yellow, friable) (Figure 40), congested lungs and spleen (Figure 42), hemorrhagic intestines, and an engorged gallbladder—indicating Chuduk (water poisoning). A ruptured gallbladder (Figure 41) was noted in another carcass.

Laboratory Results: Low levels of *Pasteurella multocida* were found in nasal smears, supporting Haemorrhagic Septicemia (HS) in some cases. No specific tests could confirm cyanobacterial toxins, but field and postmortem signs strongly suggest cyanobacterial poisoning.

iii. Morbidity and Mortality

A total of 698 yaks were affected during the outbreak, with a morbidity rate of 8.17%. Out of these, 35 yaks died, resulting in a mortality rate of 5.01% and a high case fatality rate of 61.40%. Most deaths occurred suddenly, with little to no visible clinical signs prior to death.

iv. Risk Factors

Key risk factors identified include prolonged drought followed by sudden access to cold water, seasonal stress linked to changing weather patterns, lack of timely Hemorrhagic Septicemia (HS) vaccination in certain herds, and overcrowding at communal water sources and grazing areas, increasing exposure risks.

v. Interventions Taken

The response involved emergency treatment of sick animals using antibiotics and anti-inflammatory drugs. Water intake was regulated using controlled methods to prevent further poisoning. Awareness was raised among herders on hydration practices and HS prevention. Ring vaccination against HS was promptly carried out in surrounding yak herds, and carcasses were properly disposed of to prevent disease transmission.

vi. Recommendations

Annual vaccination against HS before the onset of the monsoon season is strongly recommended. Yak herders should be educated on safe watering practices during high-risk periods. Strengthening surveillance and early disease reporting systems is critical. Basic veterinary kits should be maintained at highland camps, and collaboration with gewog authorities and local communities should be enhanced for monitoring and rapid response.

vii. Conclusion

The outbreak in Damthang was caused by a combination of water poisoning (Chuduk) and Hemorrhagic Septicemia, both of which are preventable. Timely interventions, improved surveillance, community education, and proactive veterinary measures are essential to protect yak populations in high-risk areas. The full investigation report is available at www.ncah.gov.bt.

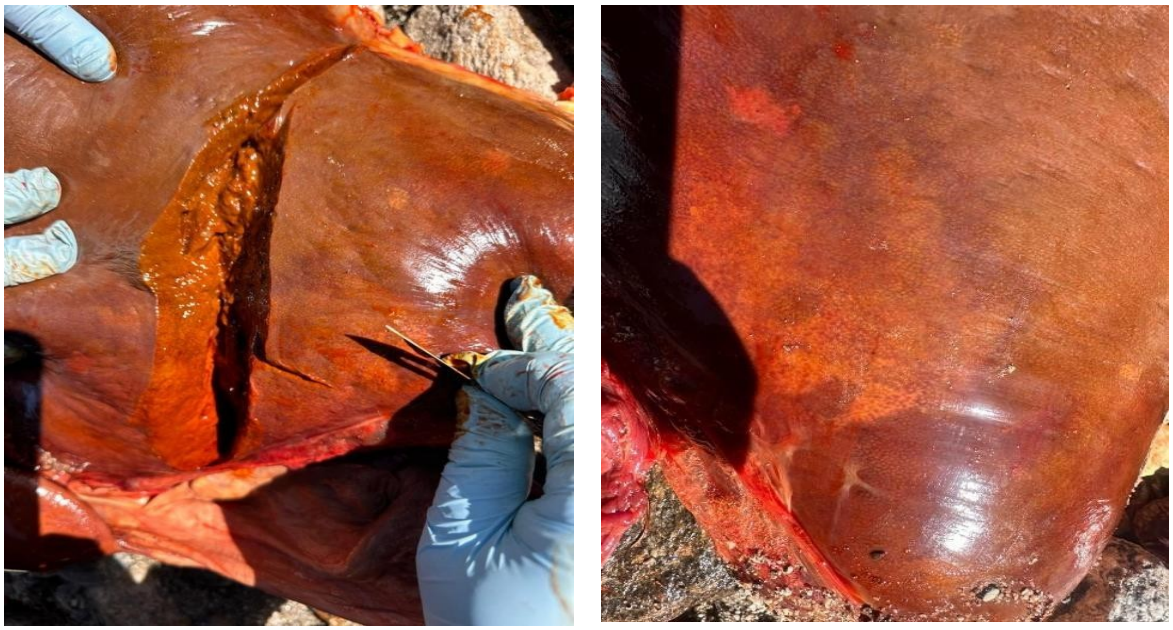


Figure 37: Liver with severe jaundice appearance and friable in nature with petechial hemorrhages

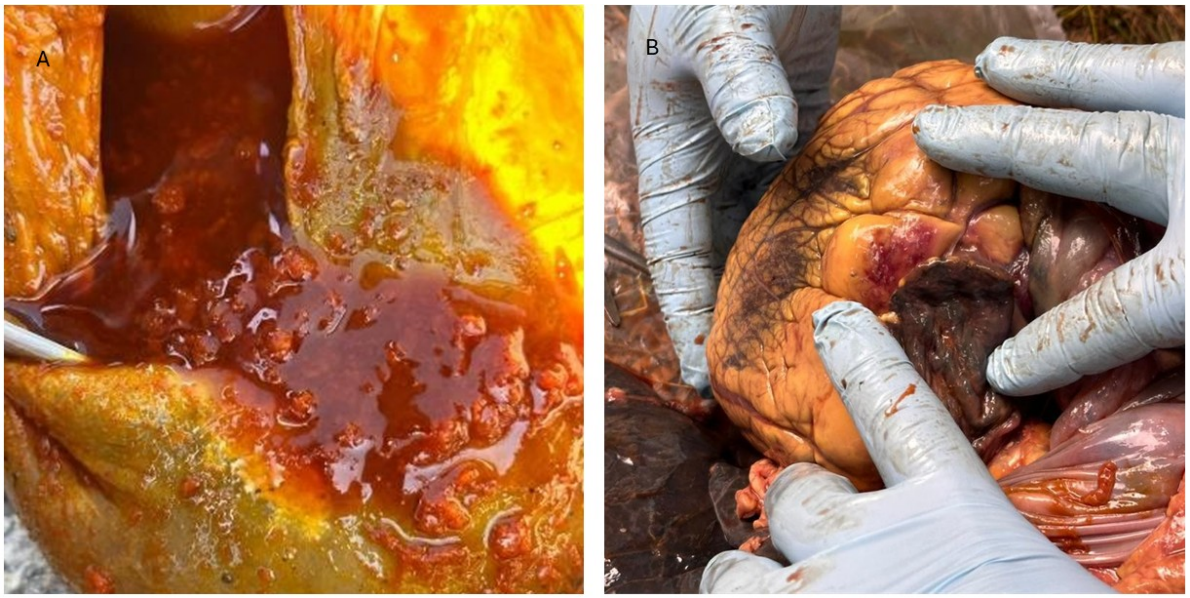


Figure 38. Gall bladder engorged with thick bile mixed with tissues

Figure 39. Spleen with congestion

2.8.2 Report on Postmortem examination of Fish

Dr. N K Thapa, Tenzinla and Tshewang Dema

i. Introduction:

A male rainbow trout of about 2.5Kg, 44cm length was presented for examination from Samtenling to identify the cause of the disease. As per history, the fish was sluggish and was caught and submitted after sacrificing for diagnosis.

ii. External Examinations:

Gills- No significant changes were observed except slightly pale in colour.
Skin: Skin lesion of about 4cm diameter filled with fluid on the ventral region (Figure 40 A) resembling furunculosis lesion. and the entire skin covered with thick mucus (Figure 40 B).

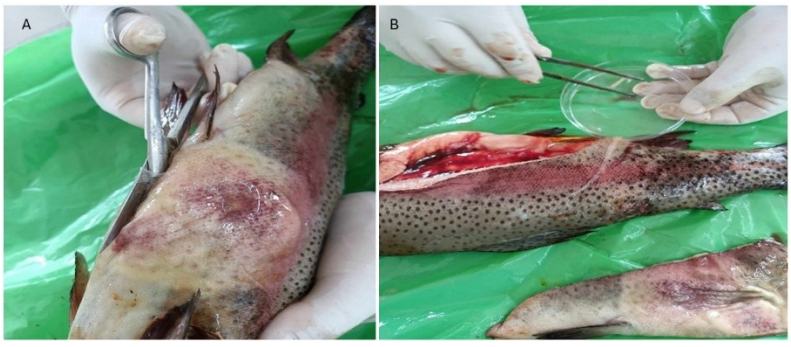


Figure 40.Furunculosis like lesion A and thick mucus on skin

No significant changes were observed on the fins.

Internal organs

Liver- Slightly yellowish in color. Rest organs did not show any significant changes.

iii. Diagnosis:

Severe bacterial skin infection by *Aeromonas sorbia*. Both bacteria and fungi were isolated from the skin lesions (Bacteria-*Aeromonas sorbia* ***and*** *Hafnia alvei, Fungi- Rhizopus* and *Microsporum*. Both bacteria are opportunist pathogens and may even cause mortality.

Aeromonas hydrophilia was isolated from the gills which is also an opportunist pathogen and causes septicemia in fish including trout and causing even mortality.

iv. Management:

Rainbow trout (Oncorhynchus mykiss) is a salmonid fish found in both marine and freshwater habitats worldwide. It is an important game fish and is among the most widely cultivated fish species in the world.

Disease organisms are frequently present in water or in fish, and when fish are stressed or exposed to sub-optimal environmental or husbandry conditions, disease outbreaks occur. Crowding, low dissolved oxygen content, high particulate levels in water, and stress associated with handling are examples of conditions that can result in disease outbreaks. Hence, management requires a clean water flow system and avoiding overcrowding.

The presence of the above organisms indicates the poor water quality of the pond, contamination could be from human or animals. Hence, the proper cleaning of the pond should be carried out. The affected fish could be segregated and treated.

2.8.3 Liver Fluke Eggs in Mastitis Cattle

Ms. Tshewang Dema and Ms. Puspa M Sharma

As part of an integrated disease surveillance approach, the Parasitology Section conducted targeted screening for liver fluke (Fasciola spp.) eggs in fecal samples collected from cattle that tested positive for mastitis under the Bacteriology Section's surveillance program. This activity aimed to explore the potential co-occurrence of parasitic and bacterial infections in dairy cattle.

The screening revealed the presence of Fasciola eggs in a proportion of the mastitic samples, indicating a possible overlap between fasciolosis and mastitis in affected animals. These findings highlight the importance of cross-sectional diagnostics in understanding the broader health status of dairy herds and inform better-targeted interventions for improving animal health and productivity.

i. Objective

The purpose of the screening was to detect liver fluke (*Fasciola* spp.) eggs in fecal samples collected from mastitis-positive cattle. Fasciolosis is a significant parasitic disease that affects cattle health and productivity, with implications for both animal welfare and dairy performance.

ii. Methodology

A total of 182 fecal samples were collected from five locations: NDDC Yusipang, Tsirang, Punakha, Wangdue, and Paro. The samples were examined microscopically for the presence of liver fluke eggs and categorized as positive or negative accordingly (Figure 41).

Figure 41. Screening for Liver fluke

iii. Results

Out of 182 samples tested, 15 samples (8.2%) were positive for liver fluke eggs, with cases detected only in Punakha and Wangdue (Table 13). No positive samples were found in NDDC Yusipang, Tsirang, or Paro. The positive results were promptly communicated to the respective district livestock officers, and treatment was recommended for the affected animals.

These findings suggest a localized presence of fasciolosis in specific areas and highlight the importance of integrated parasitological surveillance, especially in herds showing signs of other infections such as mastitis.

Table 13.Fasciola screening

Sample collection sites	*Samples collected*	*Positive*	*Negative*
NDDC Yusipang	34	0	34
Tsirang	47	0	47
Punakha	30	9	21
Wangdue	49	6	43
Paro	22	0	22
Total	182	15	167

iv. Conclusion

While the overall prevalence of fasciolosis was relatively low in the tested population, the detection of positive cases in Punakha and Wangdue warrants further investigation and

monitoring. Follow-up surveillance in these areas is recommended to assess the risk of spread and to implement control measures.

v. Recommendations

- Immediate deworming and treatment initiated in positive herds.
- Regular screening and deworming programs should be incorporated into herd health protocols.
- Awareness and training for farmers on liver fluke prevention and pasture management strategies.

2.8.4 Report on Investigation of poultry mortality at National Poultry Development Center

Dr. NK Thapa, Mr. Purna Bahadur Rai and Ms. Sangay Dema

Summary
The report on the investigation of poultry mortality at the National Poultry Development Center (NPDC) outlines the investigation of an unusual number of poultry deaths. It provides a detailed background on NPDC, which was established to maintain elite poultry breeds and supply Day-Old Chicks (DoC) to farmers. The investigation was triggered by a mortality outbreak at a private farm in Trongsa, suspected to be Avian Leukosis Complex (ALC).
Key findings include:

- The overall mortality rate was low (0.1%), with 5 dead birds out of 4616, but signs of reduced feed intake, lethargy, and diarrhea were observed.
- Post-mortem examinations showed bronzed livers (Figure 43 A), enlarged kidneys (Figure 42 B) and heart edema. However, testing for Avian Leukosis Virus (ALV-P27) was negative (Figure 43 A & B).
- Laboratory analyses identified the presence of E. coli (non-significant findings) in one sample but ruled out ALC as a cause of death.
- The mortality and morbidity patterns were within acceptable ranges (5-7.5%) in some sheds, and no significant pathogen was linked to the deaths.

The investigation concluded that multiple factors, including infectious diseases, toxicosis, and nutritional deficiencies, could have contributed to the deaths. No direct link between ALC and the NPDC was found. Recommendations included continued isolation and treatment, temperature regulation, and regular vaccination and feed testing. The investigation was carried out by a team from NCAH Serbithang and RVH & EC Gelephu on 26/9/2024.

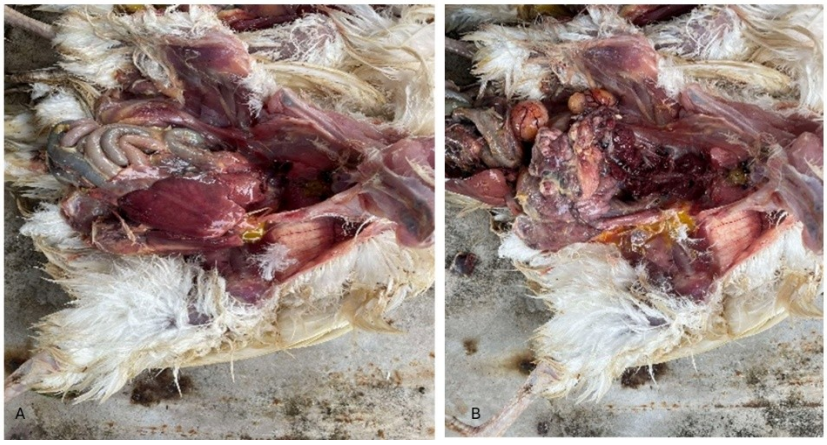


Figure 42. Bronzed liver A and enlarged kidneys B

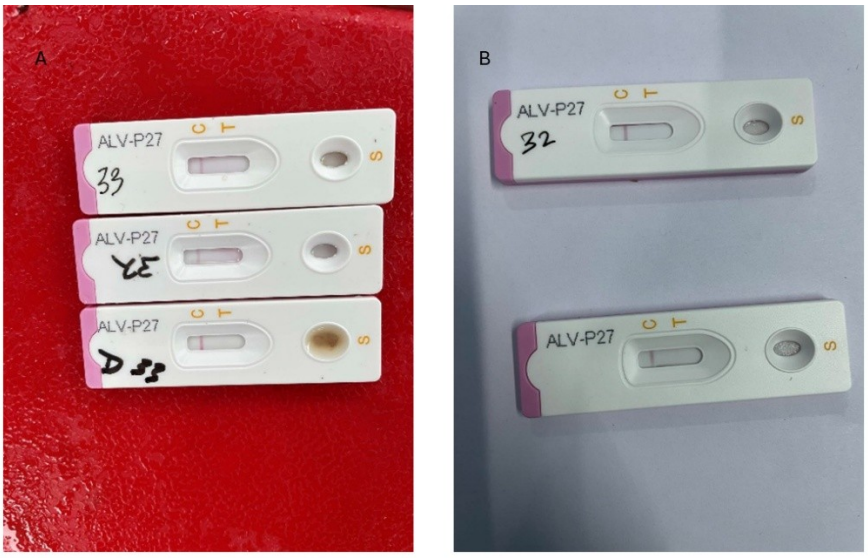


Figure 43. Rapid antigen detection test for Avian Leukosis Virus -P27 protein conducted in sick birds, shed 32 and 33 were negative A and carcass submitted at NCAH B

2.8.5 A Case Report on Equine gastric ulcer syndrome (EGUC)

Dr. N K Thapa and Tenzin la

i. Introduction:

A male foal of about 3 days old was submitted by National veterinary hospital, Motithang on 13/1/2024. As per the history, the animal had died at about 10 PM on 12/1/2024.

ii. External Examinations

Externally no significant changes like swelling and fractures were observed on the carcass, rigor mortis had set in the hind quarter (Figure 44 A) and no accumulation of abnormal fluid were observed in the body cavities (Figure 44 B).

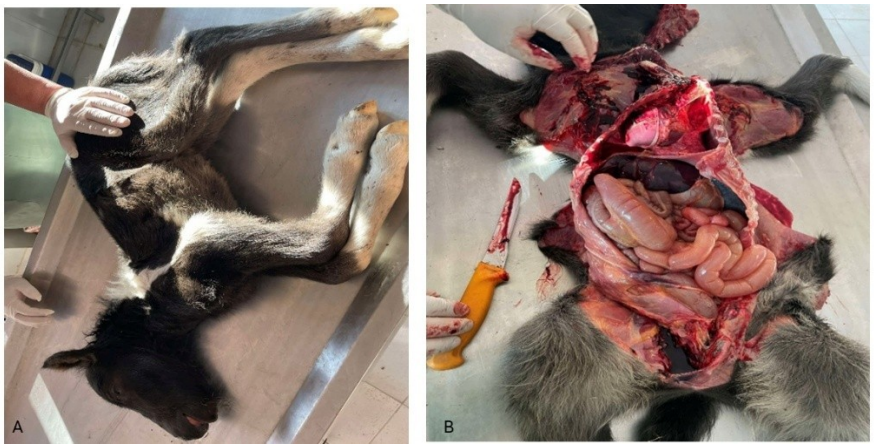


Figure 44. External appearance A and Body cavities B

iii. Internal Examinations

Lungs: Ecchymosis were observed on the surface of both the lobes of the lungs (Figure 45 A).
Stomach: The stomach was empty with a few streaks of undigested grass materials. Internal walls were hemorrhagic, eroded and inflamed (Figure 45 B).
Small intestines: Empty with some mucous contents in the lumen

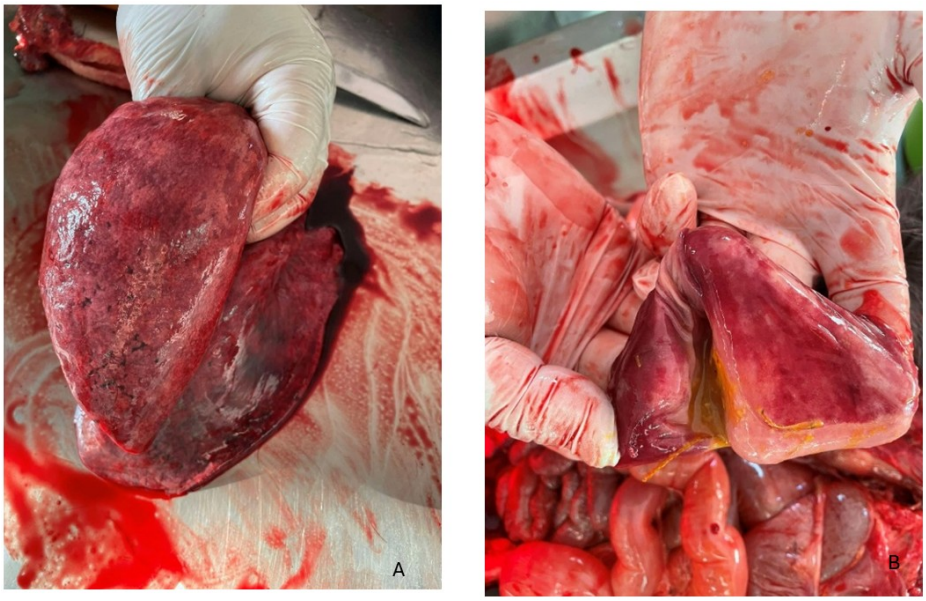


Figure 45. Ecchymoses of lungs A and inflammation of internal wall of stomach B

Kidneys: The cortical areas were bit hemorrhagic.
Liver- The color was bit dark and congestion was noted
No visible gross lesions were observed in other organs.
iv. Laboratory Findings
a. Samples collected: Heart Blood swab, Lungs swab for culture and isolation of pathogenic bacteria. Liver, Lungs, heart were collected for histopathological examinations.
b. Bacterial culture:
Heart Blood swab: *Leuconostoc mesenteroides ssp cremoris* was isolated.
Lungs swab: *Kocuria varians* was isolated

Both the isolates were not significant for the disease.

c. Histopathological findings:

Heart: Mild degrees of focal necrosis of Myocardial cells were observed (Figure 46 A).

Lungs: Infiltration of mononuclear cells and neutrophils in the alveoli were noted in moderate degree. (Figure 46 B).

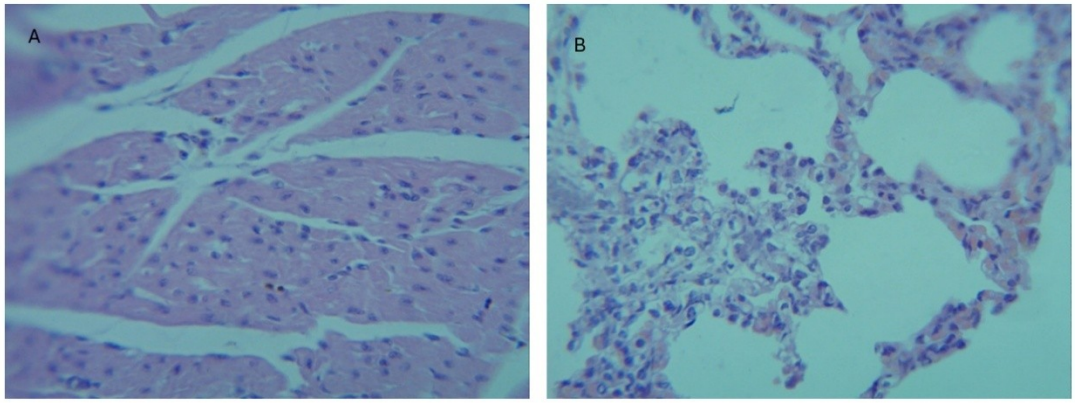


Figure 46 Myocardial necrosis A and infiltration of MNC in the alveoli B

Liver: Congestion of blood vessels and hemorrhages in the sinusoids, periportal degeneration of hepatocytes, degranulation of cytoplasm of hepatocytes were observed.

v. Diagnosis:

The bacteria isolated are not significant for the cause of the disease. Further, the histopathological examination also did not reveal any pathognomic findings. Hence, based on the gross lesions, the disease could be equine gastric ulcer syndrome (EGUS). Mild form of pneumonia is also observed as per the gross lesions and the histopathological findings.

vi. Management:

Equine gastric ulcer syndrome (EGUC) is considered as a common problem in foals. Gastric physiology differs between foals and adult horses, and the risk of EGUS also depends on age and other factors and stress is thought to be an important contributor to gastric ulcer development in the foals. Unfortunately, some foals with EGUS do not demonstrate any clinical signs and hence are often difficult to diagnose. Omeprazole is generally considered the first-line treatment for EGUS in foals. Non-steroidal anti-inflammatory drugs (NSAIDs) also can be provided as supportive therapy.

2.9 Off-Hour Service

The Laboratory Service Unit (LSU) offers off-hour diagnostic services for emergency samples and samples related to notifiable diseases. The laboratory maintains records of staff working during holidays, weekends, and off-hours, which are verified by the laboratory head for authenticity. The Table below outlines the number of days staff members were involved in off-hour duty across various sections (Table 14).

Table 14. Off hour emergency services provided

Section	*Duration*	*Purpose*	*Staff on Duty*
Molecular	12 days	Processing and testing emergency ASF samples	Dawa Tshering,

Section	*Duration*	*Purpose*	*Staff on Duty*
		from Sarpang, Zhemgang, Chukha, Samtse, Dagana, Punakha, and Wangdue	Tenzinla, Kelzang Lhamo
Molecular	4 hours	Processing and testing emergency NDV samples from Zhemgang	Dawa Tshering, Tenzinla, Kelzang Lhamo
Histopathology	2 hours	Examination of H&E-stained slides and report generation in LIMS	Dr. N. K. Thapa, Tenzinla
Bacteriology	7 days	Culturing, identification, antimicrobial susceptibility testing (AST), archiving, and lyophilization	Tenzinla, Karma Choki

3. Dog Population Management Unit

3.1 Dog Population Management and rabies control program

Dog Population Management (DPM) activities center around supporting the long-term sustainability of successful achievement of 100% sterilisation of free roaming dog during Nationwide Accelerated Dog Population Management and Rabies Control Programme (NADPM & RCP), addition to the planning and implementation of its second phase (NADPM & RCP 2.0) in the Gelephu Mindfulness City. The key highlights of the activities include:

3.1.1 Mass Dog Vaccination and sterilization program supported by RGOB

To ensure that animals in the rabies high-risk zones are immune to rabies, annually mass dog vaccination is carried out in these areas. During this financial year, a total of **5084 dog** and **1353 cats** were vaccinated across 13 Dzongkhags. Samtse recorded the highest number of vaccinated dogs (2,114), followed by Chukha-Phuentsholing (637) and Trashigang (548). For cats, the highest number of vaccinations was reported in Tashigang (315), followed by Samtse (257) and Chukha-Phuentsholing (201) (Figure 47 A).

The center supported Dzongkhags that reported the emergence of aggressive and feral dogs. During this financial year, a total of 752 dogs and 225 cats were sterilized across eight Dzongkhags. The highest number of dog sterilizations was recorded in Paro (205), followed by Samtse (177), Haa (105), and Phuentsholing (117). In terms of cats, Phuentsholing led with 95 sterilizations, followed by Paro (76) and Haa (31). Samtse**,** Thimphu**,** Punakha, and Trashigang did not report any cat sterilizations (Figure 47 B). This data suggests targeted sterilization efforts for both dogs and cats in some Dzongkhags, while in others, activities may be focused solely on dog populations.

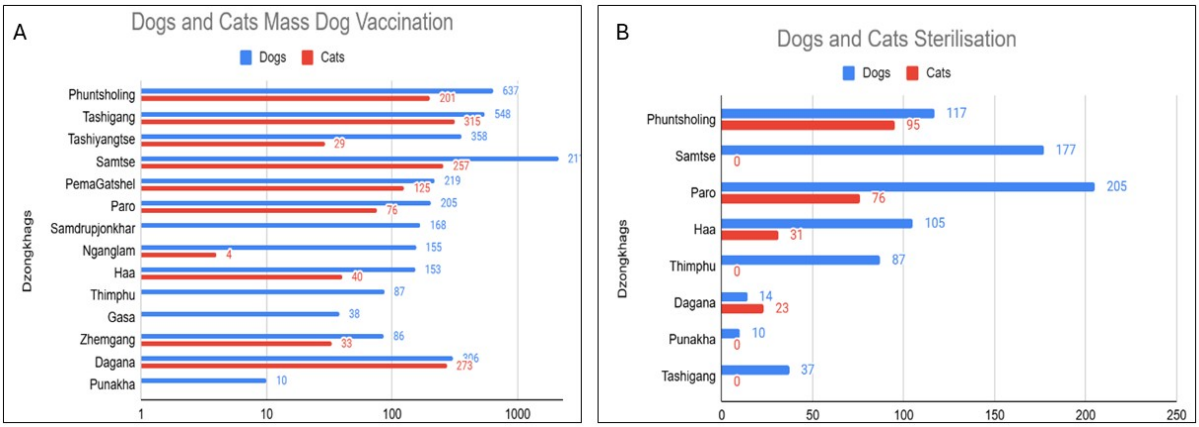


Figure 47. Dogs & Cats mass vaccination A, Dog & Cats sterilization B

3.2 National Accelerated Dog Population Management and Rabies Control Program 2.0 in Gelephu Mindfulness City.

Following the successful completion of NADPM & RCP 2.0 (2021–2023), the second phase launched in 2024 with aims to eliminate rabies and sustainably manage free-roaming dog populations in Gelephu Mindfulness City (GMC). The Department of Livestock, in partnership with Desuung, implemented a series of strategic interventions including the development of targeted strategies, stakeholder consultations, pet and stray animal surveys, stray dog capture in priority areas, establishment of animal control units, cross-border vaccination campaigns, and the sterilization and vaccination of pet cats and dogs, with consideration also given to vaccinating susceptible livestock in bordering chiwogs.

3.2.1 Consultation meetings

The first took place on 6 September 2024**,** involving 46 technical staff**,** 4 DeSuups, and 12 representatives from Local Government and BIFA**.** The objective was to sensitize local stakeholders on the planned dog population and pet management activities. The second consultation, held on 29 September 2024**,** engaged 8 technical officers and 4 DeSuups with institutional stakeholders including the Royal Bhutan Army (RBA)**,** Royal Bhutan Police (RBP)**,** BAFDA**,** and Thromde**.** This session focused on institutional-level sensitization and coordination to garner support for the program (Figure 48).

Figure 48. Consultation meeting with stakeholders

3.2.2 Free roaming dog, Pet animal and susceptible species Population

Survey and census of Free roaming dog, Pet animal and susceptible species Population was conducted for 5 days. The objective was to collect the population for adoption of the strategies such as for sheltering of free roaming dog, to conduct targeted vaccination and sterilization program.

The survey and census recorded a total of 10185 cattle, 6178 goat, 3660 cats, 1835 owned dogs, 476 sheep, 95 horses, 17 Buffalo nd 903 free roaming dog of which only 83 dogs were unnotched (Figure 49).

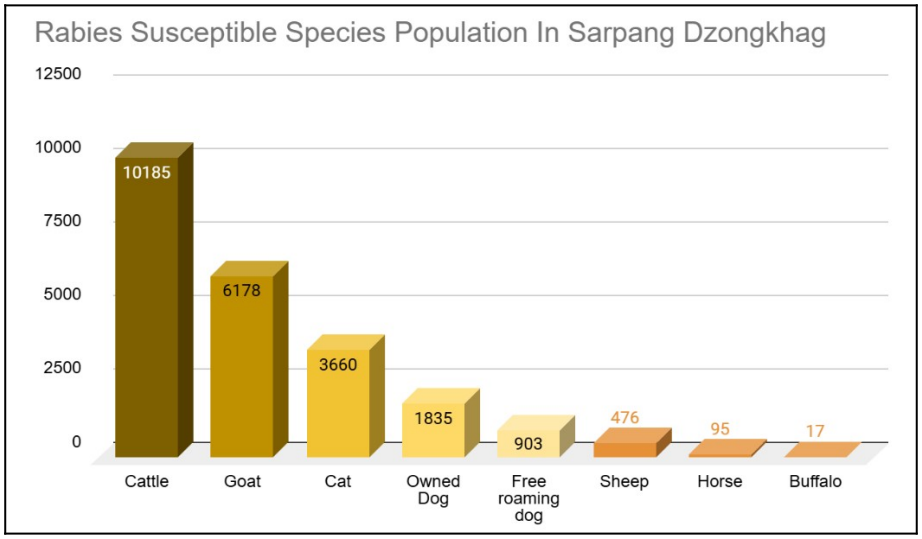


Figure 49. Rabies susceptible population in Sarpang dzongkhag

3.2.3 Pet cat & dog sterilization and anti-rabies vaccination

i. Sterilization

The primary focus of the program was cat sterilization, with pet dog sterilizations conducted opportunistically conducting a campaign (Figure 50). The September 2024 survey recorded 3660 total cats, of which 3,430 unsterilised cats and 575 unsterilised pet dogs across 12 gewogs and Gelephu Thromde. In total 2,476 cats were sterilized, achieving an overall coverage of 72%. High sterilization numbers were recorded in Jigmecholing, Chuzergang, and Gakidling gewogs. Additionally, 395 dogs were sterilized, achieving an overall coverage of 69% (Figure 51 & 52).

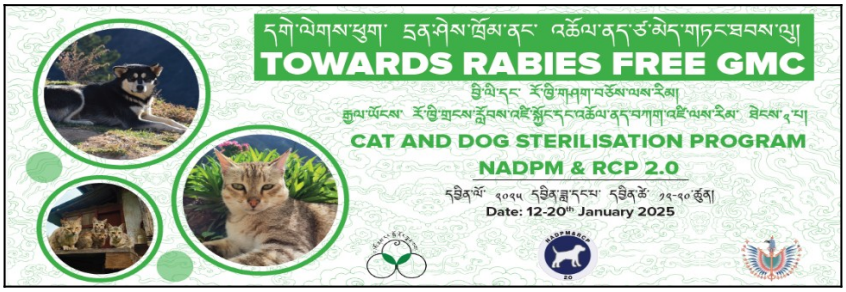


Figure 50. Sterilization campaign banner

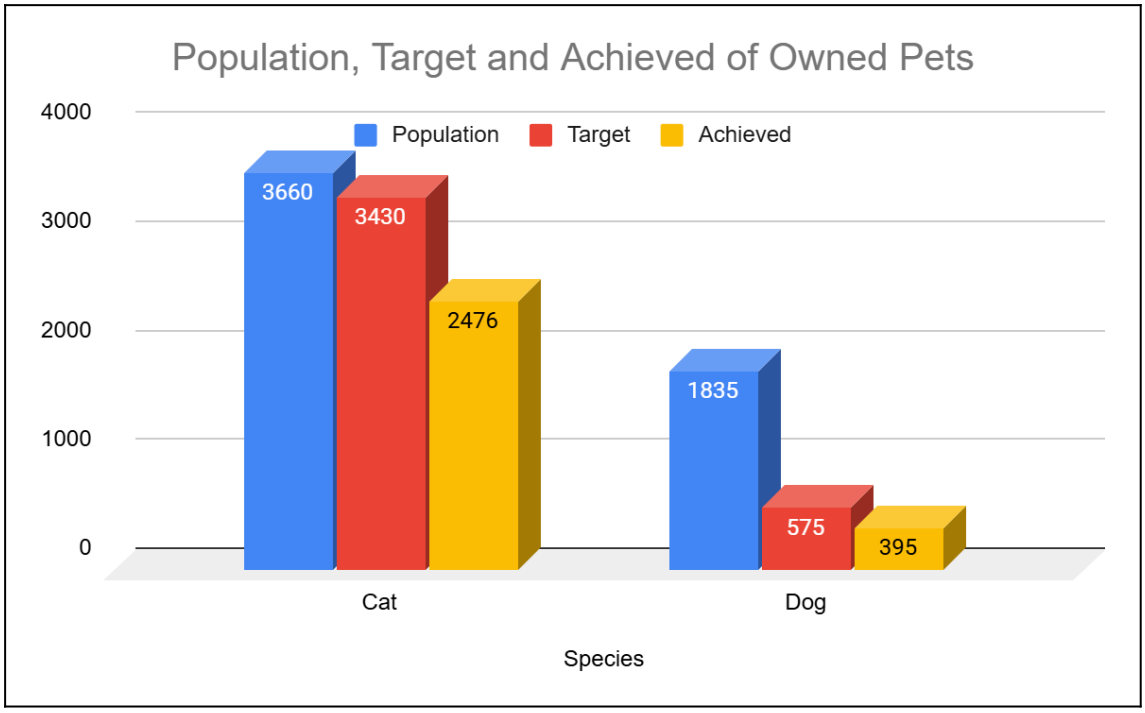


Figure 51. Number of cats and dog sterilized in GMC

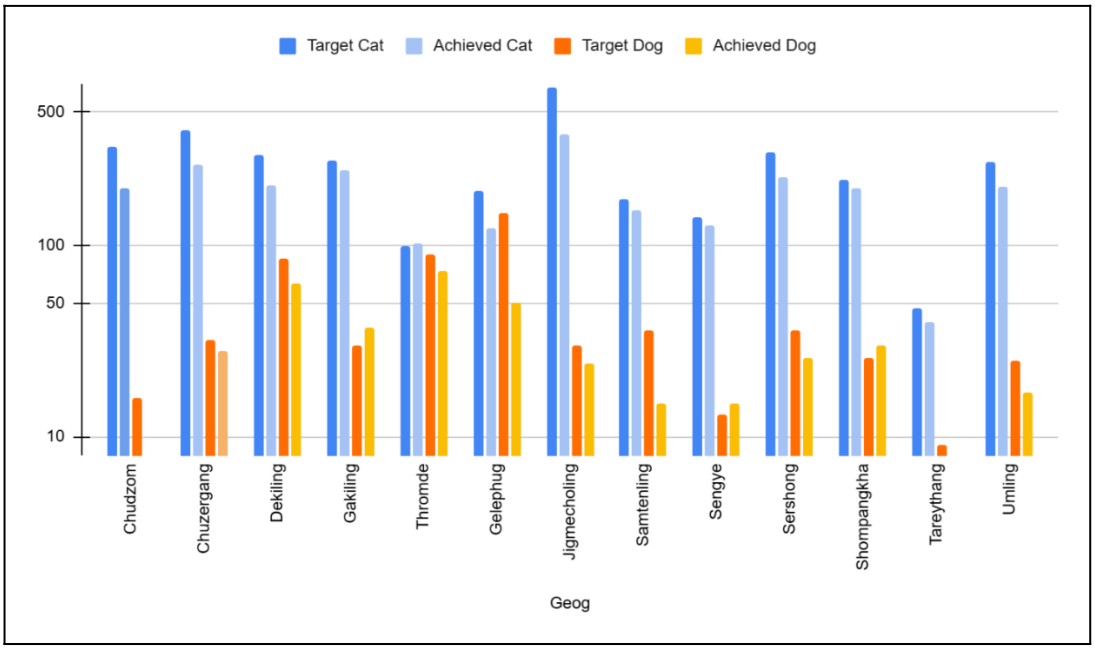


Figure 52. Geog wise sterilization within GMC

ii. Anti-rabies vaccination

As part of the sterilization program, anti-rabies vaccinations were administered to all cats and dogs brought to the clinics. A total of 2,700 cats were vaccinated**,** reaching 74% coverage, while 763 dogs received vaccinations, achieving 42% coverage of the dog population (Figure 53).

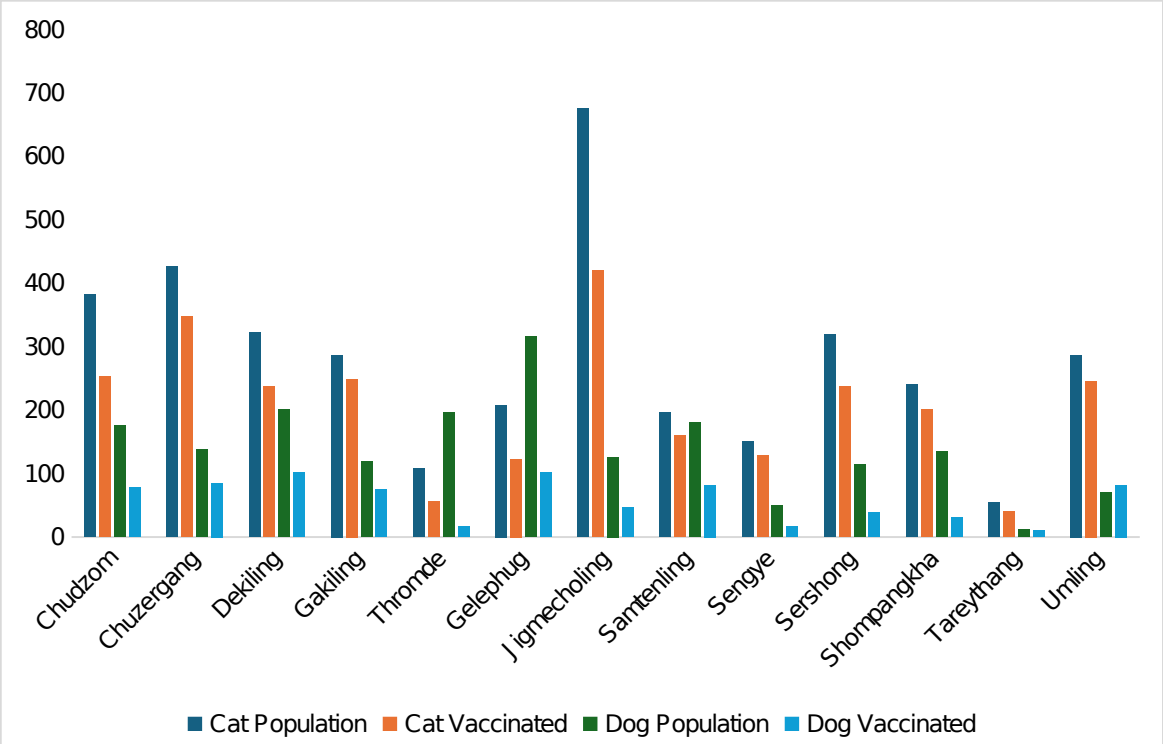


Figure 53. Antirabies vaccination coverage in GMC

3.2.4 Anti-rabies vaccination across the border

Between October 2024 and January 2025, a series of cross-border collaboration and rabies control activities were conducted in coordination with Indian counterparts in Hatisar, Saralpara, Dadgari, and Malivita. On 30 October 2024, a cross-border meeting was held in Hatisar to initiate cooperation, involving 6 technical staff, 4 Desuups, and 13 BIFA members. This was followed by bilateral coordination meetings on 13–14 November 2024 in Saralpara and Malivita, each attended by 6 technical staff and 4 Desuups (Figure 54).

Figure 54. Activities carried out across the bordering districts of India in collaboration with BIFA

Rabies vaccination campaigns were carried out across multiple locations. On 17 November 2024, a team of 11 technical staff, 8 Desuups, and 13 BIFA members vaccinated 216 dogs and 3 cats in Hatisar and Dadgari. On 20 November 2024, the same team vaccinated 184 dogs in Saralpara. The final vaccination round was conducted on 14 January 2025 in Malivita, where 8 technical staff, 8 Desuups, and 26 local volunteers vaccinated 160 dogs and 14 cats.

In total, these cross-border activities resulted in the vaccination of 560 dogs and 17 cats, demonstrating effective collaboration between Bhutanese authorities, Desuups, BIFA, and local Indian communities.

3.2.5 Susceptible species anti-rabies vaccination coverage

To create a buffer(immunity) zone, the program vaccinated 2,515 animals across 25 chiwogs within a 1-km radius of the Indian border. Species included cattle (1,566), goats (725), sheep (164), and horses/mules/donkeys (5). Excluding 229 ineligible animals, the program achieved 92% coverage (Figure 55 & 56).

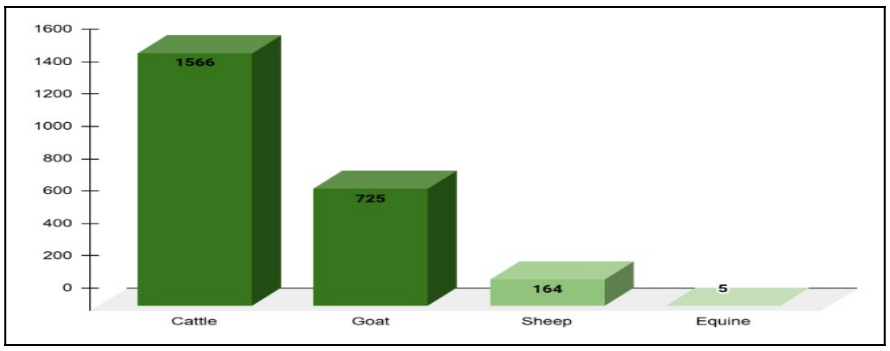


Figure 55. Vaccination of other susceptible species with 1 km radius

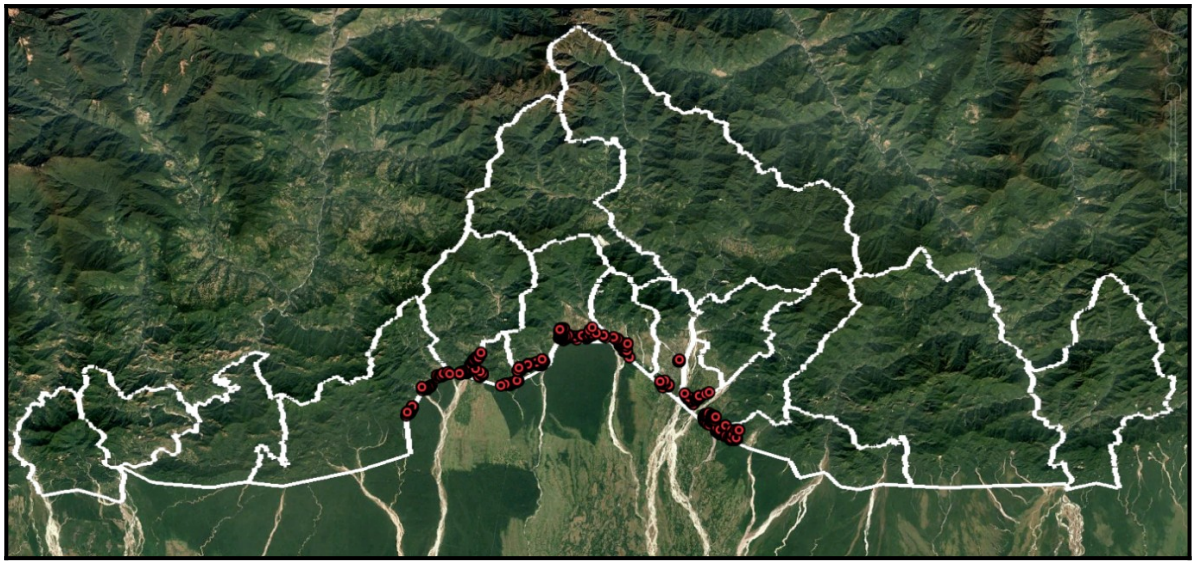


Figure 56. Geo-locates of households of susceptible livestock species vaccinated against rabies

3.2.6 Final catching of FRD in GMC

A total of 518 free-roaming and owner-surrendered dogs are currently housed at the Gemtekha shelter. Of the estimated 562 free-roaming dogs, 416 were captured and sheltered.

Additionally, 147 pet dogs were voluntarily surrendered by their owners. During the entire operation, 27 dogs died. Furthermore, 18 unnotched dogs—likely migrants from across the border—were captured and managed according to established protocols (Figure 57 & 58).

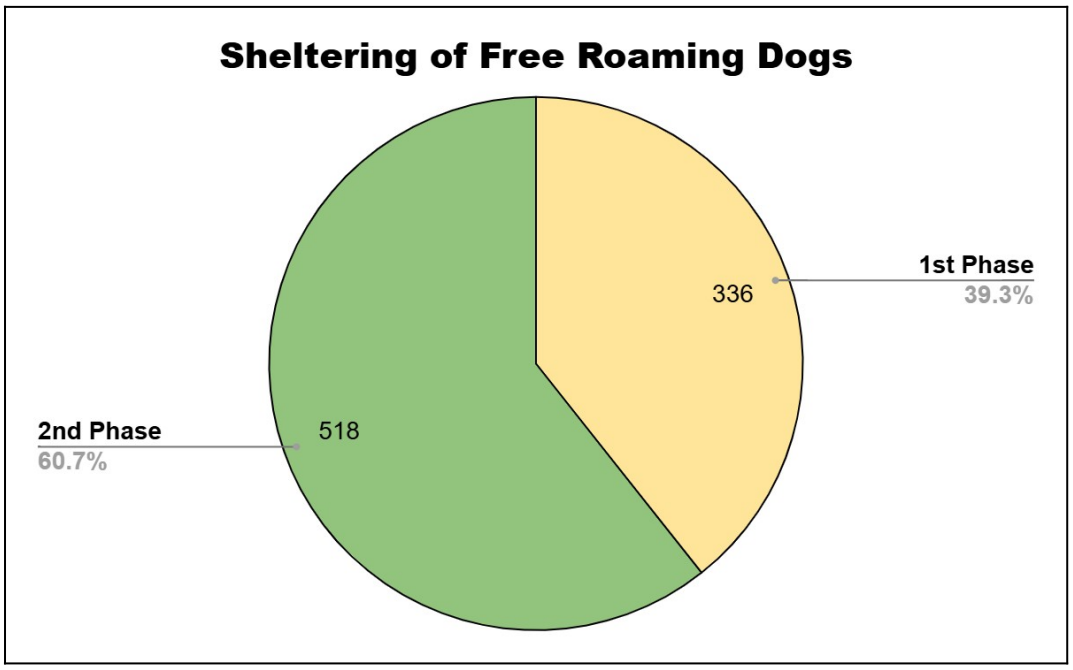


Figure 57. Phase wise sheltering of Free Roaming Dogs

Figure 58. Phase wise sheltering of Free Roaming Dogs

3.3 Responsible Pet Ownership: Registration and Microchipping

A total of 916 pets were registered in the VIS and issued pet registration cards. Among them, 91 dogs were registered and microchipped simultaneously, while 825 cats were registered only. Moreover, Pet owners were briefed on responsible pet ownership and the risks associated with rabies, particularly in high-risk areas (Figure 59).

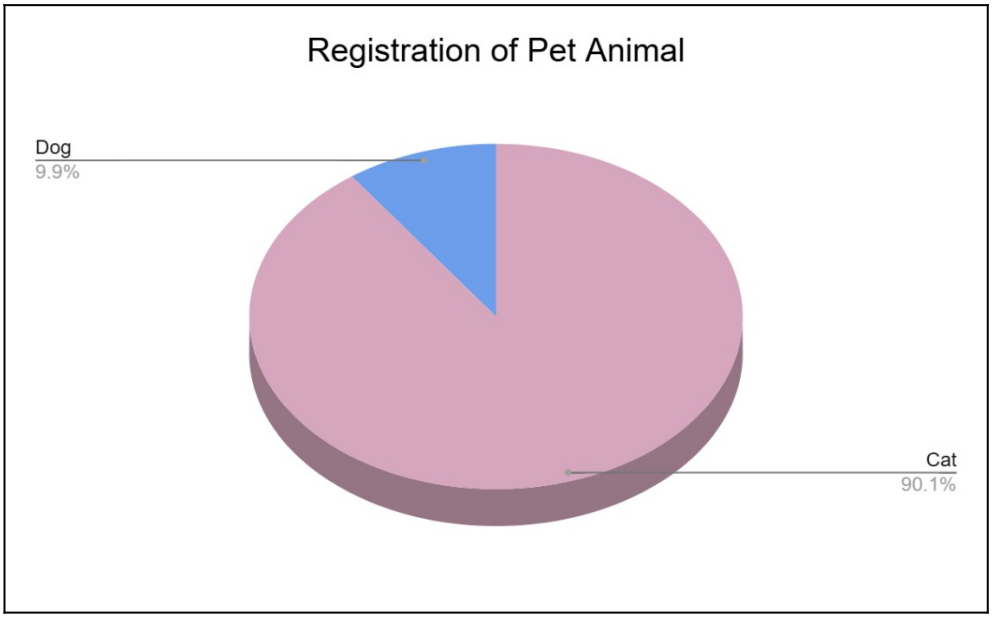


Figure 59. Microchipping and registration

3.4 Human Resource Deployment (NADPM&RCP 2.0)

A total of 1,430 personnel were involved in the NADPM & RCP 2.0 activities. This included 294 livestock technical staff, 687 Desuups, and 358 local government representatives. Additionally, 91 police officials stationed at integrated check posts were trained to scan/ identify microchipped dogs and were made aware of the implications of unnotched dogs, as well as the risks associated with rabies and illegal dog imports (Figure 60).

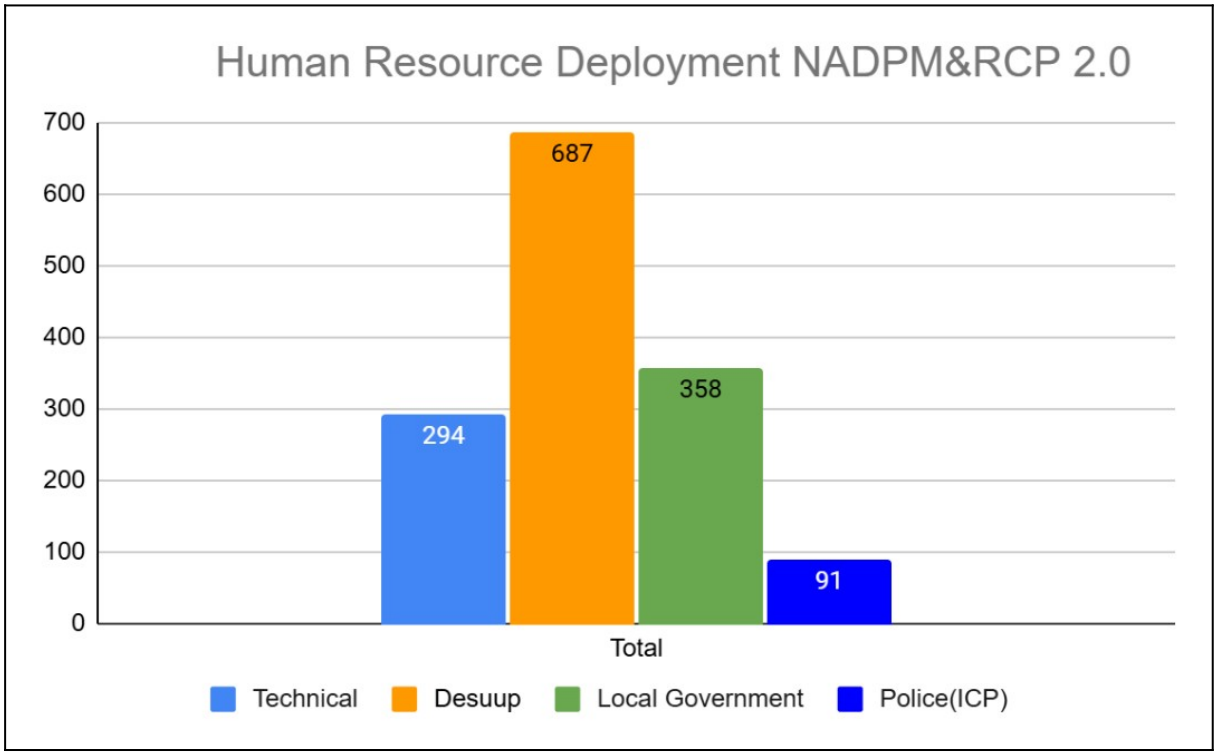


Figure 60. Human resource deployment

4. Drugs, Vaccine, and Equipment Unit (DVEU)

4.1 Procurement and Supply Overview

4.1.1 Procurement

During the year medicines worth about 33M, vaccine 9.2 M and consumables worth 8.8M were procured. Besides the regular animal vaccines, Lumpy skin disease vaccines were imported worth about 14M.

Link: ESSENTIAL VETERINARY Supplies System

The tendering process started from last week of July through online e-GP system where about 20 bidders participated. Out of 169 medicine items, 10 vaccines and 97 consumables tendered; 144 medicine items, 9 vaccines and 92 consumable items were selected and awarded. Further, out of 169 medicine items, 29 items were identified, which could be procured using MOH tender.

From the unselected medicines, nine of the items identified as critical were floated a limited tender method, where the quote for only for Calcium, Magnesium, Phosphorus and Dextrose Inj. or Calcium borogluconate and PCV2 vaccine were received. Based on the budget availability, only Calcium borogluconate was procured.

4.1.2 Distribution

During the year, in total medicine worth Nu.27 M was distributed to the dzongkhags and Nu. 4.9 M to central agencies. In terms of financial value, the highest was of antimicrobials 15% (5.3M) followed by antiseptics 13.3% (4.4M), Insecticides 11.9% (4.0M), antiprotozoals 10.3% (3.4M), anthelminthics 9% (3.0M) & hormones 6.9% (2.3M) (Figure 61).

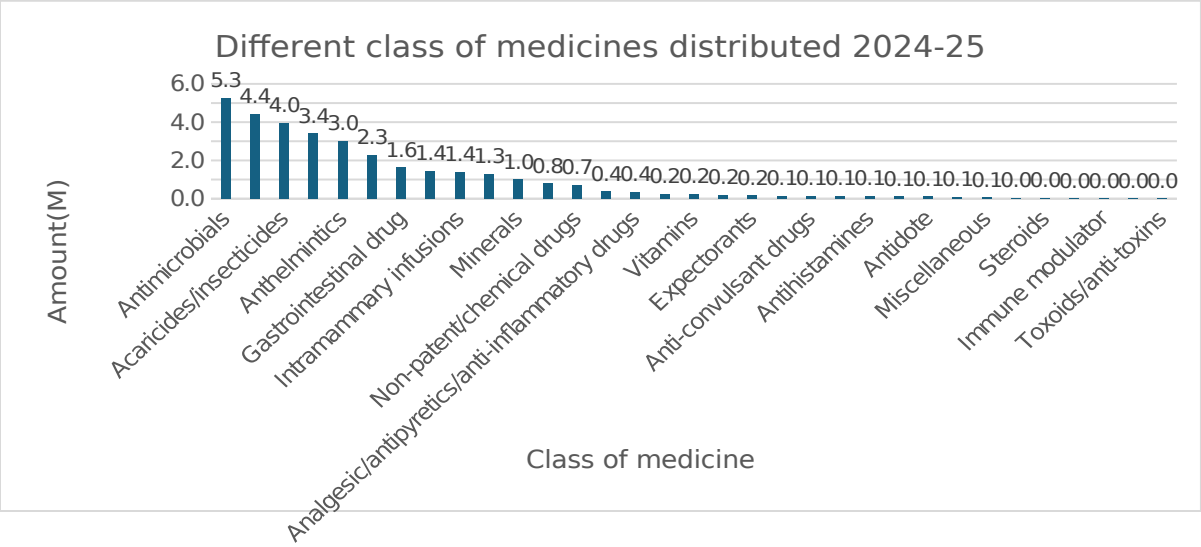


Figure 61. Class wise medicines distributed

Likewise, non-medicine consumables worth 5.7 M were distributed to the dzongkhags and 2.7M to the central agencies.

No emergency procurements were carried out as the stock were adequate and no alarming outbreaks of diseases were reported.

4.2 Comparison of Indent vs. Supply

Out of the indented value of about 37.2M worth medicines, only 33M worth were procured. This was based on the past procurements and also to distribute budget evenly for medicines, vaccines and consumables (above web link).

Medicines were mobilized either from the livestock central store if the stock were available and other source used was mobilized from other centers or programs like NADPM. The recent outbreaks of ASF required more tranquilizer drugs like Ketamine & Xylazine.

4.3 Dzongkhag-wise Supply Trend

Of the total budget ceiling proposed of Nu. 32.8 M for the dzongkhags, medicines worth 23.5 M were distributed. This could be due to non-quote of some of the medicines and some due to quality fail and the variation in minimum pack size. Medicines were distributed in 2 lots and were within the budget ceiling of each dzongkhag. However, Punakha & Trashigang dzongkhags had collected above their ceiling. This could be due to outbreaks of diseases or other disease control programs (Figure 62).

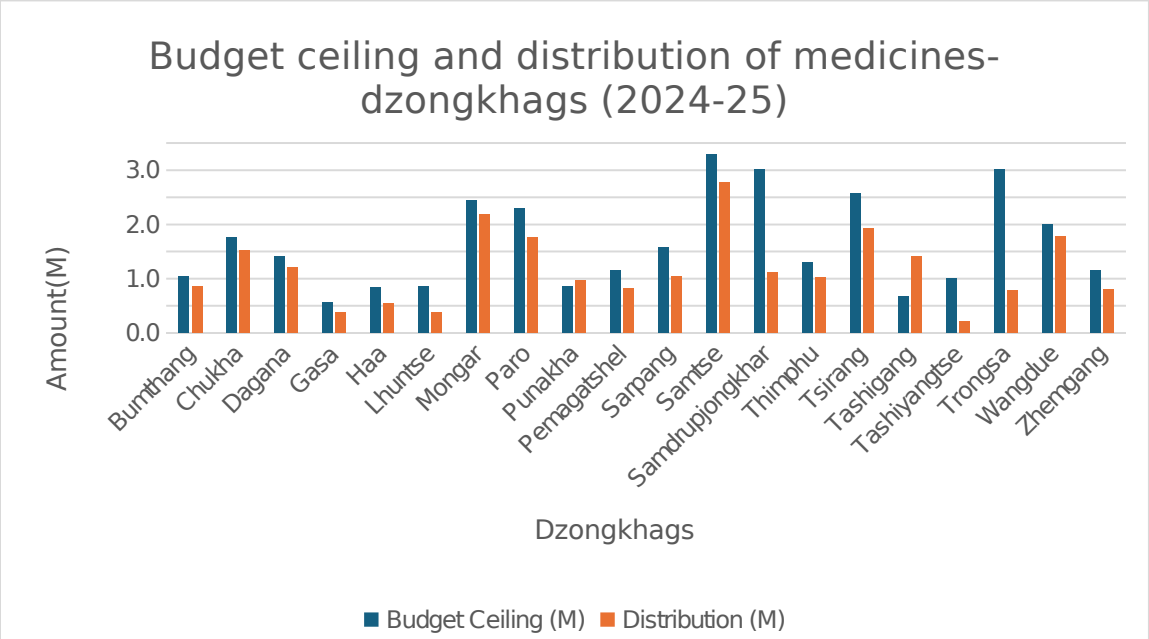


Figure 62. Budget ceiling against the medicine distributed to dzongkhags

4.4 Central agency wise supply trend

Similarly, of the total Medicines were distributed to central agencies with in their budget ceiling and some especially outside agencies (BLDCL) and programs (NADPM, refresher training), medicines were distributed despite their budget allocations and ceilings (Figure 63).

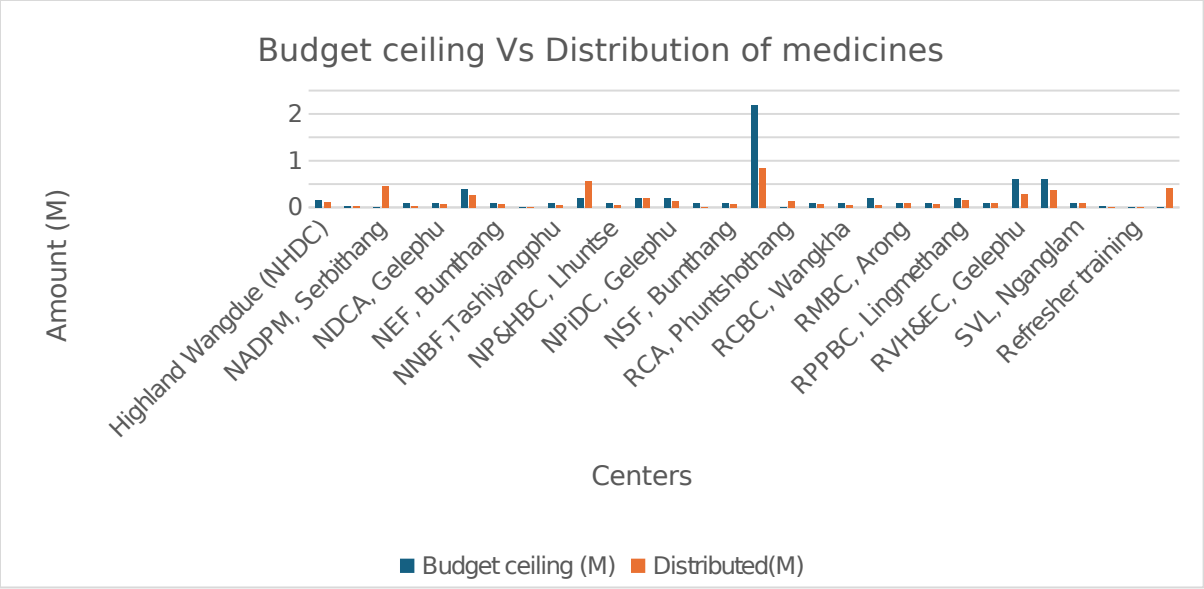


Figure 63. Budget ceiling against medicines distributed to central agencies

4.5 Updates to Essential Veterinary Drug Program (EVDP)

DVEU being the secretariat for technical committee, EVDP and NVMC meeting were conducted. During the 14th NVMC meeting held at Gelephu on February 2025, based on the mandates and the responsibilities beyond the essential veterinary drugs, it was decided to rename the Essential Veterinary Drug Program (EVDP) as Essential Veterinary Supplies System (EVSS) hereafter. The MOM is uploaded on website for reference (above web link).

4.5.1 New additions/ deletions

During the year, the Essential Veterinary Medicine list (EVML) was also revised by the NVMC sub-committee with addition of certain medicines was endorsed by the NVMC: Refer above link.

No medicines were deleted, however, use of some of the antimicrobials are to be restricted as follows:

1. Cefotaxime inj.
2. Gentamicin inj.
3. Metronidazole
4. Cefoperazone Intramammary infusions

4.5.2 Stakeholder consultations

a. Workshop on Review and update (Essential Veterinary Supplies System, SoPs, drug formulary, costing and annual budgeting for medicines) EVDP coordination workshop & National Veterinary Medicine Committee Meeeting

A five-day workshop on the review and update of the Essential Veterinary Drug Program (EVDP) strategy, Standard Operating Procedures (SOPs), veterinary drug formulary, and annual budgeting for veterinary medicines, including antimicrobials, was held from 10–14 February 2025 in Gelephu. The workshop aimed to revise existing guidelines and SOPs to align with current developments, update the veterinary drug formulary in line with the recently revised antibiotic and standard treatment guidelines, and develop a proper costing method for projecting annual medicine budgets. The workshop also served as a platform to discuss issues and improvements in the veterinary supply system. Additionally, the 14th National Veterinary Medicine Committee meeting was convened on the final day to endorse key technical decisions.

Figure 64. Participants of EVDP & NVMC meeting

Participants included from Animal Health Division, DoL, National Center for Animal Health, National Veterinary Hospital, Regional Livestock Development center, Kanglung, Regional Veterinary Hospital & Epidemiology Center Gelephu/ Dewathang/ Phuntsholing, all the Dzongkhag Veterinary Hospitals, representatives of key National farms (NDDC Yusipang, NPIDC Gelphu, NPDC Sarpang), National Research & Development Center for Animal Nutrition. The participants from other organizations include Bhutan Food & Drug Authority, Ministry of health; Nature conservation Division, Department of Forests & Park Services and College of Natural Resources, Lobeysa (Figure 64).

The NVMC also endorsed the revised certain documents developed by the NVMC sub-committee:

1. TOR for Essential Veterinary Supplies System (EVSS)
2. SOP for Essential Veterinary Supplies System (EVSS)
3. Veterinary Drug Formulary 2025
4. Antibiotic Guidelines, Traffic light system and veterinary antibiotic use cards for animals in Bhutan 2025
5. Standard Treatment Guidelines 2025

6. Costing for veterinary medicines were also initiated for future annual budgeting:

The costing method was used on pilot basis using the data available for Monger dzongkhag as complete data was not available for other centers. The revised mechanism for medicine budgeting from the respective centers, including Dzongkhags, farms, and regional centers, will be based on the actual cost estimate for medicines used per medication. The budgeting shall be carried out considering the total annual number of clinical cases and the average unit cost

of medication incurred (species-wise). Additionally, a 3% contingency cost is being considered to account for potential losses during administration and emergency use.

The above work out was totally based on the VIS data of Monger DVH and for proper workout, all the centers should strictly make regular entry. Final cost will be completed when complete data is available from all the animal health facilities.

The above documents (sl. 1 to 4) are available on the website for reference (above web link).

4.5.3 ANIMUSE hands on Practice workshop, Paro 3 to 5 of June 2025

A three-day hands-on training workshop on ANIMUSE (Animal Antimicrobial Use System) was held from 3 to 5 June 2025 at Metta Resort, Paro, organized by the National Centre for Animal Health (NCAH) with funding support from the Fleming Fund Country Grant Phase II. The workshop aimed to build the capacity of regional and district focal persons on accurately calculating and reporting antimicrobial import and use data for submission to WOAH's ANIMUSE, a global web-based AMU database with analytical dashboards. As NCAH centrally procures and distributes veterinary medicines, including antimicrobials, accurate data entry is essential for effective analysis and international reporting.

Figure 65. Participants of ANIMUSE training

The workshop was represented from Department of Livestock; National Veterinary Hospital, National Center for Animal Health; Regional Veterinary Hospital Phuntsholing, Gelephu, Dzongkhag Veterinary Hospitals, Thimphu/ Chhukha/ Mongar/ Haa/ Gasa/ Tashiyangtse/ Trongsa/ Bumthang. Representation from other agencies includes from medical product division, Bhutan Food & Drug Authority, MoH (Figure 65).

4.5.4 Annual Antimicrobial consumption trend

Bhutan reports the annual consumption data to ANIMUSE WOAH database annually since 2014. As per the importation record of 2014-2023, the consumption was as low as 4.67mg/kg

in 2020 to as high as 8.11mg/kg of biomass adjusted by report coverage compared to other countries (Figure 66). The rate of consumption in 2020 is lower than that of New Zealand of 7.4mg/kg and 2023 to that of New Caledonia of 11.3 mg/kg, Myanmar of 31.1 mg/kg and Sri Lanka of 52.4mg/kg among the reported Asian countries and comparable to Albania 8.1mg/kg among the European countries; and lower than Congo 10.4mg/kg among African Countries and lower than Bolivia of 15.6mg/kg among American countries.

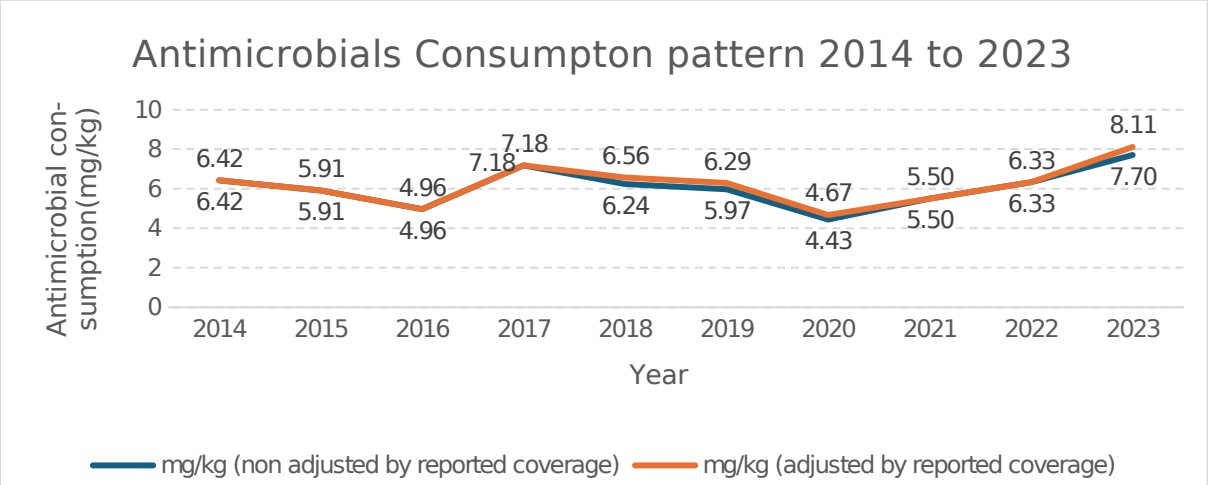


Figure 66. Antimicrobial consumption trend in Bhutan (2024-2023)

As per the analysis of ANIMUSE, the overall consumption trend shows slight fluctuations with drop in 2020, mainly due to post COVID economic austerity measures with reduction in budget allocations for procurement of medicines and later steady rise due to reviving animal health activities.

Almost steady antimicrobial consumption pattern throughout the years in the country could be attributed to the regular awareness of AMR coupled with stringent regulatory practices for antimicrobial sale and use guided by the Medicine Act of the Kingdom of Bhutan 2003 and the Medicine Rules and Regulations of Bhutan 2019.

4.6 Vendor performance analysis

4.6.1 Medicine Supplies

The total procurement across nine vendors amounted to Nu. 33,325,473.56 for 578,324 units ordered, out of which 552,861 units worth Nu. 32,440,715.61 were received. The overall quantity fulfillment rate stood at 95.6%, and financial fulfillment at 97.3%. Most vendors achieved full (100%) fulfillment, except KMT PMS (96.6% quantity, 97.9% financial), Lamgong PMS (98.7% quantity), and Paruna PMS, which had the lowest fulfillment (88.8% quantity, 94.7% financial) (Table 15).

Table 15. Vendor performance

S.N.	*Vendors*	*Total Qty. ordered*	*Total amount ordered (Nu.)*	*Total Qty. received*	*Total received (Nu.)*	*Qty. fulfilment Rate (%)*	*Financial fulfilment (%)*
1	Capital PMS	20825	884635.8	20825	884635.8	100.0	100.0
2	Karma PMS	78867	2838322	78867	2838322	100.0	100.0

3	KMT PMS	75447	2193456	72846	2148151	96.6	97.9
4	Lamgong PMS	6136	1405301.21	6056	1405158.01	98.7	100.0
5	Ngangpa PMS	1700	6630	1700	6630	100.0	100.0
6	Paruna PMS	202549	15940843.05	179769	15101663.3	88.8	94.7
7	Tsampaka PMS	10167	2149265	10167	2149265	100.0	100.0
8	Vetline PMS	87591	7575855	87589	7575725	100.0	100.0
9	Wamling PMS	95042	331165.5	95042	331165.5	100.0	100.0
	TOTAL	*578324*	*33325473.56*	*552861*	*32440715.61*	*95.6*	*97.3*

Eight of the medicines were rejected due to quality issues (Nitrofurazone,Urea and Metronidazole bolus; Benzathine Penicillin Inj. 24 lakhs IU per vial; Rumenotoric/stomachic herbal powder; Yeast extract, Ferrous sulphate, Copper sulphate, Vit B,Lactic acid base bolus; Salmon Gonadotropin Releasing Hormone analogue and Domperidone (Ovaprim); Spawn Pro hormone; Synthetic Gonadotropin Releasing Hormone (SGnRH) Analogue (WOVA FH); Synthetic Salmon gonadotropin releasing hormone and Domperidone (Ovatide).

Two of the medicines (Strepto-penicillin I/mammary infusion & Frusemide inj. 50mg per ml) could not be supplied by the vendors due to varied reasons (above web link).

4.6.2 Consumables Supplies

Suppliers could not supply 2 items (Bandages, Specification Cotton, 5 cm 12x1, 28 TPI & Dispensing materials, Specification Polyethylene bag with top locking facility, Size 5 cmX7 cm) and including the variation of pack size, the total unsupplied items worth Nu. 183060.00 was not received at livestock central store (Table 16).

Table 16. Consumables supply

SN.	*Vendors*	*Item*	*Presentation*	*Qty*	*Rate (Nu.)*	*Amount (Nu.)*	*Remarks*
A	Paruna PMS	Bandages, Specification Cotton 15 cm 12x1, 28 TPI	Nos.	1500	49.40	74100.00	Balance
B	DSA Enterprise	Bandages, Specification Cotton, 5 cm 12x1, 28 TPI	Nos.	2467	30.00	74010.00	Balance cannot supply
C	Tshering enterprise	Dispensing materials, Specification Polyethylene bag with top locking facility, Size 15cm X 20cm.	Kg	50	179.00	8950.00	Balance
		Dispensing materials,	Kg	500.000	52.00	26000.00	Cannot supply

	Specification Polyethylene bag with top locking facility, Size 5 cmX7 cm	
	Total	**183060.00**

4.7 Cost-saving or efficiency improvements

4.7.1 Rational Procurement

Medicine indented from the animal health facilities was estimated about Nu. 37,159,888.46 and by scrutinizing indents and prioritizing procurement of high-need and high-impact medicines, procurement was made for about Nu. 32,983,529.77, and the cost saving of approximately Nu. 4.18 million was achieved, despite procuring a slightly higher quantity than indented.

4.7.2 Synchronization of Procurement with Ministry of Health

As experienced in the past, it was difficult to get low volume drugs. Hence, the MOH tender was used to procure, and the supply order was placed side by side to MoH. However, out of 32 drugs ordered, only about 26 drugs worth about Nu. 2.32 M worth were procured as below (Table 17):

Table 17. Procurement of medicines using MOH tender

Sl no	*Generic name*	*Composition/Strength*	*Presentation*	*QTY*	*Rate*	*Amount*
1	Cefotaxime Inj.	1 gram per vial	1 gram vial	3651	21	76671.00
2	Ceftriaxone Inj.	1 gm Ceftriaxone	1 gm vial	953	17.5	16677.50
3	Ranitidine inj.	25 mg per ml	2 ml ampoule	1838	4.2	7719.60
4	Sodium Bicarbonate Inj.	7.5% w/v solution,	25 ml ampoule	1232	17.5	21560.00
5	Diazepam inj.	5mg/ml	2 ml amp.	16040	19.75	316790.00
6	Adrenaline inj.	1mg/ml,	1 ml X 10 amp/pkt	2375	118	280250.00
7	Ciprofloxacin ear or eye drops,	Ciprofloxacin 0.3%,	5 ml vial	1700	3.9	6630.00
8	Sodium Bicarbonate powder	450 gm net	450 gm packet	897	70	62790.00
9	Magnesium Sulphate powder	400 gm net	400 gm packet	1160	35	40600.00
10	Zinc Oxide powder	450 gm net	450 gm packet	387	213	82431.00
11	Salicylic acid powder	450 gm net	450 gm packet	337	240	80880.00

12	Oxytocin inj.	5 IU in 1 ml	1 ml ampoule	5656	9.5	53732.00
13	Ketamine inj.	50 mg per ml,	10ml vial	3318	140	464520.00
14	Lignocaine HCL inj.	Lignocaine 2% preservative free	50ml vial	3351	51	170901.00
15	Acetazolamide tab	250mg per tab	10 tabs strip	2980	3.5	10430.00
16	Atropine Sulphate Inj.	0.6 mg/ml	1ml amp.	10310	7	72170.00
17	Omeprazole inj.	Omeprazole sodium 42. 6 mg per vial equivalent to 40 mg omeprazole	40 mg ampoule	730	17.9	13067.00
18	Chloramphenicol eye ointment applicaps	250 milligrams in each gram	100 capsules per jar	92800	0.38	35264.00
19	Benzoic acid powder	I.P. 450gm net	450gm pkt.	350	144.75	50662.50
20	Petroleum Jelly (WSF)	I.P 1 Kg net	1 kg jar	600	194	116400.00
21	Charcoal Activated powder	450 gm net	450 gm pkt.	562	206	115772.00
22	Amino acid	10 % solution, L-isolucine 0.5 gm, leucine 0.74 g, lysine acetate 0.931 g, kysine 0.66 g, Methionine 0.44 g, Phenylalanine 0.51 g, Threonine 0.44 g, Tryptophan 0.2 g, Valine 0.62 g, Arginine 1.2 g, Histidine 0.3 g, alanine 1.4 g, Glycine 1.1 g, Proline 1.12 g, Serine 0.65 g, Tyrosine 0.02=4 g, Taurine 0.1 g.	200 ml bottle	711	269.31	191479.41
23	Phenobarbitone sodium	30mg tab	10 tab strip	2420	1.79	4331.80
24	Dexamethasone inj.	4mg per ml,	2 ml vial	3260	5.85	19071.00
25	Prednisolone tab,	5mg tab,	10 tab strip	12680	0.41	5198.80
26	Propofol,	10 mg per ml,	10ml vial	100	38.51	3851.00
	TOTAL					**2319849.61**

4.7.3 Stock Mobilization

During the year, medicine is worth Nu. 675967.25 were mobilized from one center to another. Mostly the Xylazne and Ketamine were mobilized to meet emergency needs for ASF control (Table 18).

Table 18. Items mobilized

From	*To*	*Item*	*Presentation*	*Rate*	*Qty.*	*Amount (Nu.)*	*Remarks*
NADPM	Punakha	Xylazine HCL inj.	30 ml vial	188.5	254	47879	ASF control
		Ketamine inj.	10 ml vial	140	533	74620	
		surgical mask	piece	1.17	100	117	
NADPM	Wangdue	Xylazine HCL inj.	30 ml vial	188.5	190	35815	ASF control
		Ketamine inj.	10 ml vial	140	280	39200	
		Rectified spirit		60	20	1200	
NADPM	NVH	Diazepam inj.	10 ml vial	98.75	45	4443.75	
		Diazepam inj.	2 ml amp	19.75	250	4937.5	
		Cefotaxime Inj.	1 gm vial	21	3200	67200	
		Adrenaline inj.	10 amp/pkt	118	400	47200	
		Xylazine HCL inj.	30 ml vial	188.5	15	2827.5	
		Syringe	Nylon	1.48	10000	14800	
NADPM	Paro	Ketamine inj.	10 ml vial	140	50	7000	
		Diazepam inj.	2 ml amp	19.75	100	1975	
		Lignocaine HCL inj.	30 ml vial	51	30	1530	
NADPM	Bumthang	Lignocaine HCL inj.	30 ml vial	51	50	2550	
NADPM	RVH Pling	Biohazard bag	pack	8.89	100	889	
		Diazepam inj.	2 ml amp	19.75	100	1975	
		Diazepam inj.	10 ml vial	98.75	100	9875	
		Ketamine inj.	10 ml vial	140	352	49280	
NADPM	Dagana	Diazepam inj.	2 ml amp	19.75	50	987.5	
		Xylazine HCL inj.	30 ml vial	188.5	250	47125	ASF control
		Ketamine inj.	10 ml vial	140	496	69440	
		Surgical gloves	pairs	11.5	250	2875	

		Surgical gloves	pairs	11.5	250	2875	
		Surgical gloves	pairs	11.5	500	5750	
NADPM	Tsirang	Xylazine HCL inj.	30 ml vial	188.5	100	18850	ASF control
		Ketamine inj.	10 ml vial	140	600	84000	
DVH Haa	NDDC Yusipang	Busrelin acetae	10ml	364	30	10920	
NVH Motithang	NCAH	Ringers Lactate	450ml	32	10	320	
	Paro DVH	Ringers Lactate	450ml	32	15	480	
	NNPBC Yusipang	Methylcobalamine	10ml vial	50	10	500	
DVH Monger	DVH Punakha	Ketamine	10 ml vial	140	100	14000	
	NVH Motithang	Ketamine	10 ml vial	140	10	1400	
NVH Motithang	NNPBC Yusipang	Piperazine 40%	450ml	188.5	6	1131	
TOTAL						*675967*	

4.8 Innovations in storage and distribution

4.8.1 Annual stock reconciliation at Livestock Central Store

From 31st July to 2nd August 2024, the Drugs, Vaccines, and Equipment Unit (DVEU), NCAH, in collaboration with the Livestock Central Store (LCS) in Phuntsholing, conducted a comprehensive stock reconciliation of medicines, non-medicines, and equipment. The exercise aimed to verify inventory accuracy, identify discrepancies, and improve inventory management practices. Physical counts were compared with database records, and interviews with store in-charges helped determine potential causes of mismatches. Discrepancies were categorized into four types: physical deficits (unrecorded distribution), data entry errors (excess physical stock), inventory management issues (mismatches between physical and recorded stock), and supplier-related issues (defective, expired, or short shelf-life items).

i. Discrepancies in medicine stock

In medicine stock management, the most common discrepancies observed were physical deficits (45%), followed by data entry errors (34%), inefficient inventory management (17%), and supplier-related issues (4%). A root cause analysis, using Pareto Analysis indicates that addressing the physical deficit (45%) and data entry error (34%) could resolve approximately 80% of the discrepancies, focusing efforts on these areas would yield the most significant improvement. There is a net deficit of Nu. 51,618, which needs to be updated.

The most common discrepancies observed were physical deficit of 45%, followed by data entry error 34%, inefficient inventory management 17% and supplier discrepancies of 4% (Figure 67).

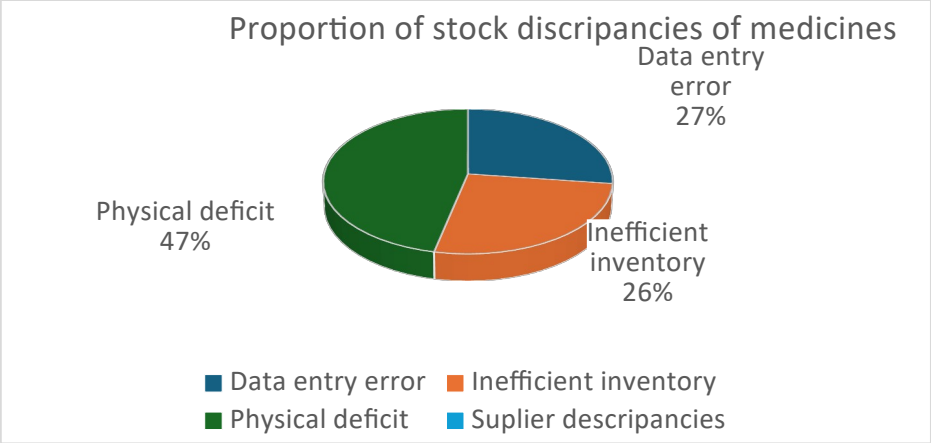


Figure 67. Proportion of discrepancies in stock management of medicines

To identify the root cause and to recommend corrective action, pareto analysis was conducted on the data of discrepancies.

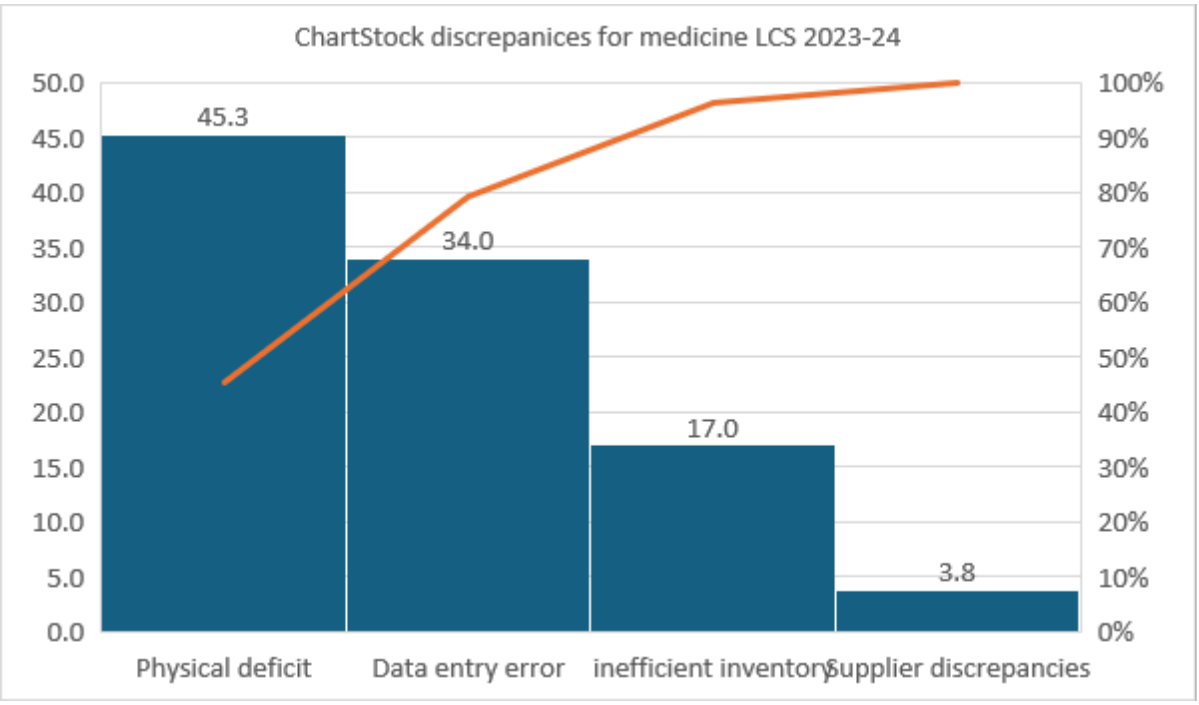


Figure 68. Pareto analysis graph for various causes of discrepancies for medicines

It was found that (24)/53≈80% of the incidents from 2 out of 10=20 % of the causes of discrepancies were due to physical deficit or could be *distributions unrecorded*. Therefore, if the practice of proper recording after distribution is followed regularly, it will help in overcoming 80% of the stock discrepancies (Figure 68).

As per the valuation, physical counting versus the database, there is an overall deficit in medicines worth Nu.68920 and surplus of Nu. 17302.55 leading to an overall deficit of Nu. 51618, Table .1. In the *supplier related discrepancies*, Benzathine penicillin 24 Lakhs IU 1429 vials amounting (Nu.30/vial) to Nu.42870 was supposed be replaced by the supplier as it was nearing expiry is not replaced yet. Similarly, vitamin C injection 3ml vial (Nu.359/vial) amounting to Nu. 12565 also supplied nearing expiry was not replaced. A reminder letter

needs to be sent again. In the data entry error, hormone, CIDR-B intravaginal progesterone releasing inserts 50 nos. (Nu.5740/inserts) amounting to Nu.287000/ was entered in database however, later the item was rejected by the verification team. The same was deleted from the database.

ii. Discrepancies on Consumables & equipment stock

In the consumables & equipment stock, the most common discrepancies observed were physical deficits (47%), followed by data entry errors (27%) and inefficient inventory management (26%), with no supplier discrepancies reported. Root cause analysis using Pareto analysis indicated that addressing physical deficits (47%) should be prioritized, followed by improving data entry accuracy (27%) and inventory management (26%), as no supplier discrepancies were observed (Figure 69). In the overall physical counting and the data record of consumables and equipment, there is a deficit of items of about Nu. 617680.32 and surplus items of about Nu. 296029 with net physical deficit of Nu. 321650.92 which needs to be updated.

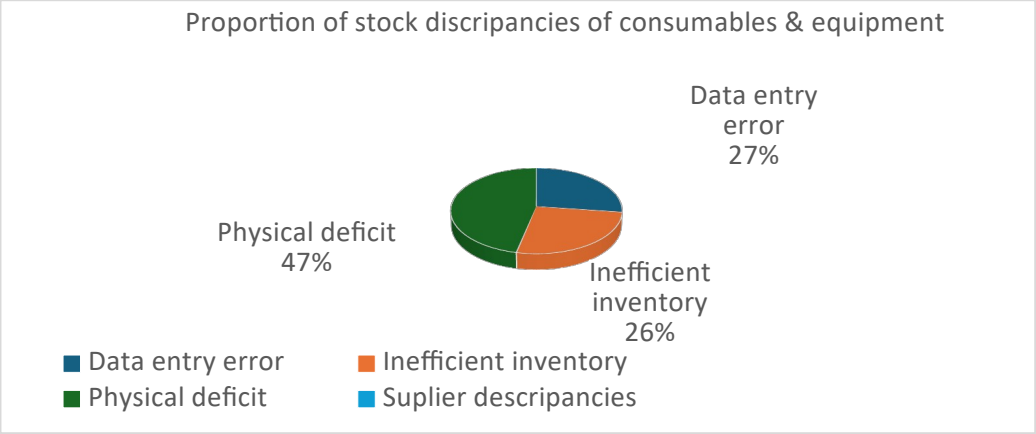


Figure 69. Proportion of discrepancies in stock management of consumables & equipment

To identify the root cause and to recommend corrective action, pareto analysis was also conducted on the data of discrepancies for consumables and equipment (Figure 70).

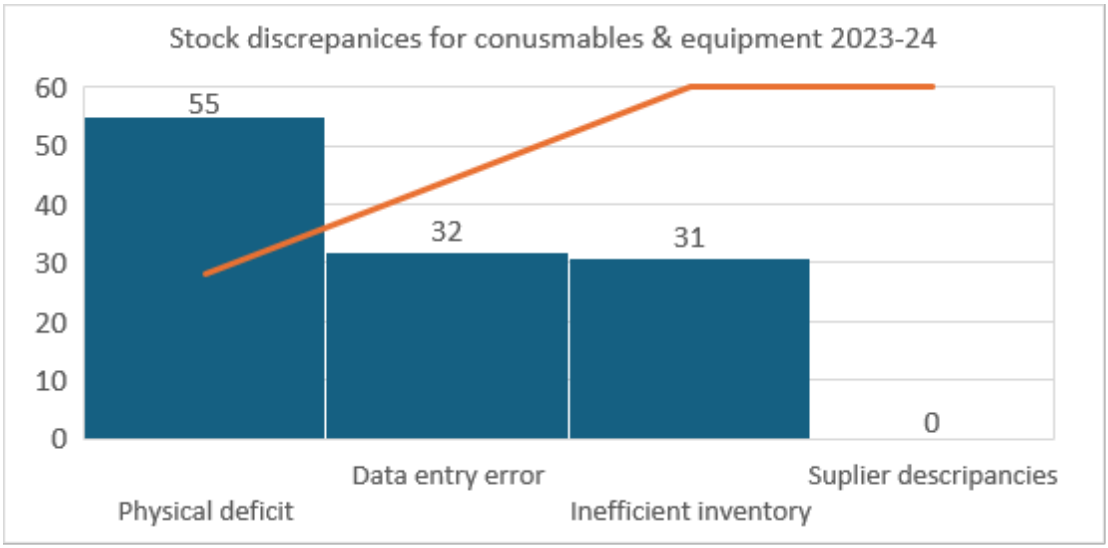


Figure 70. Pareto analysis graph for various causes of discrepancies for consumables & equipment

It was found that (55)/118≈80% of the incidences from 2 out of 10=20 % of the causes of discrepancies were also due to *physical deficit* or it could be *unrecorded distributions*. Therefore, if the practice of proper recording after distribution is followed regularly, it will help in overcoming 80% of the stock discrepancies.

In the overall physical counting and the data record of consumables and equipment, there is a deficit of items of about Nu. 617680.32 and surplus items of about Nu. 296029 with net physical deficit of Nu. 321650.92.

5. Biological Production Unit (BPU)

5.1 Total Vaccines Procured and Supplied:

During the Financial year 2024-2025, BPU procured and 10 different type of Livestock & Poultry vaccines worth Nu. 26 million (Table 19). The budget was used to procure doses of 10 (Ten) livestock and poultry vaccines viz; Foot and Mouth Disease (FMD), Haemorrhagic Septicaemia-Black Quarter (HS-BQ), Rabies, Classical Swine Fever(CSF) Fowl Pox, Infectious Bursal Disease (IBD), Marek's Disease, Newcastle Disease (B1), Newcastle Disease (R2B), and Lumpy Skin Disease(LSD).

Table 19. Total doses of vaccines procured

Vaccines	Rate/Vial	Total Vial	Total Dose	Total Amt (M)
Anti-Rabies	159	1000	10000	0.159
Foot & Mouth Disease	773	3000	150000	2.319
HS&BQ combined	179	4000	100000	0.716
Fowl Pox	150	1800	900000	0.27
Infectious Bursal Disease	85	17500	3500000	1.4875
Marek's Disease	1000	300	300000	0.15
Newcastle Disease (B1)	75	5000	1000000	0.375
Newcastle Disease (R2B)	85	12000	1200000	1.02
Classical Swine Fever	790	4000	40000	3.16
Lumpy Skin Disease (25 doses)	63.87	5618	280900	16.8
Lumpy Skin Disease (50 doses)	55.89	2809		
Grand total budget (Nu.)				**26.4**

5.2 Type of vaccines

In order to provide effective and efficient service delivery in procurement, distribution, and application in the field, BPU has to properly plan the procurement based on past records with a 5 to 10% provision on these Figures. It is mandatory to keep a buffer stock of all vaccines for

emergency use during outbreaks and other ad hoc requirements from the field. The vaccines, including pet animal were procured through 3 (Three) Bhutanese suppliers and one international company, Turkey (Table 20).

Table 20. Vaccines, manufacturers and supplier

Sl. No	*Vaccine*	*Manufacturer*	*Supplier*
1	Anti-rabies Vaccine (10 dose)	Brilliant Bio-Pharma.Pvt. Ltd	Paruna PMS
2	FMD Vaccine (50 dose)	Brilliant Bio-Pharma.Pvt. Ltd	Paruna PMS
3	HS-BQ Combined (25 dose)	Brilliant Bio-Pharma.Pvt. Ltd	Paruna PMS
4	CSF (10 dose)	Indian Immunologicals	Karma PMS
5	Fowl Pox (500 dose)	Venkateshwara Hatcheries Pvt Ltd	Karma PMS
6	IBD (200 dose)	Venkateshwara Hatcheries Pvt Ltd	Karma PMS
7	Marek's (1000 dose)	Venkateshwara Hatcheries Pvt. Ltd	Karma PMS
8	NCD B1 (200 dose)	Hesters Biosciences. Ltd	Tsampaka PMS
9	NCD R2B (100 dose)	Venkateshwara Hatcheries Pvt Ltd	Karma PMS
10	Lumpy Skin Disease Vaccine	VETAL Turkey	International Company (Direct Procurement)

5.3 Comparison of Indent vs Supply of vaccine 2024-2025

5.3.1 Procurement versus Distribution during FY 2024- 2025

A total of 74,80,900 doses of livestock and poultry vaccines were procured, out of which 60,77,390 doses were distributed during 2024-25 with the distribution rate of 81% of the vaccine procured during the year. About 19% of the procured vaccine remained in the BPU vaccine bank as of the record compiled from July '2024 to June 2025. Accordingly, the stock balance of vaccines verified and presented in Table 21.

Table 21. Vaccines indent, procured and distributed (doses)

SN	*Vaccine*	*Indented (doses)*	*Procured (doses)*	*Distributed (doses)*
1	FMD	1,92,662	1,50,000	1,63,650
2	HSBQ	1,12,334	1,00,000	67,375

3	ARV	38,265	10,000	1,00,490
4	PPR	0	0	600
5	CSF	36,950	40,000	36,730
6	IBD	42,23,884	35,00,000	20,60,820
7	NCD B1	19,20,300	10,00,000	13,10,500
8	NCD R2B	12,76,800	12,00,000	8,59,500
9	Fowl Pox	13,73,737	9,00,000	6,03,500
10	Marek's	11,87,500	300,000	6,27,500
11	LSD	2,23,327	2,80,900	2,46,725
	Total	**1,0585,759**	**7480900**	**60,77,390**

Vaccines	Indented (Dose)	Distributed (Dose)
FMD	1,92,662	1,63,650
HSBQ	1,12,334	67,375
ARV	38,265	100490
CSF	36,950	36,730
IBD	42,23,884	20,60,820
NCD B1	19,20,300	13,10,500
NCD R2B	12,76,800	8,59,500
Fowl Pox	13,73,737	6,03,500
Marek's	11,87,500	6,27,500
LSD	2,23,327	2,46,725

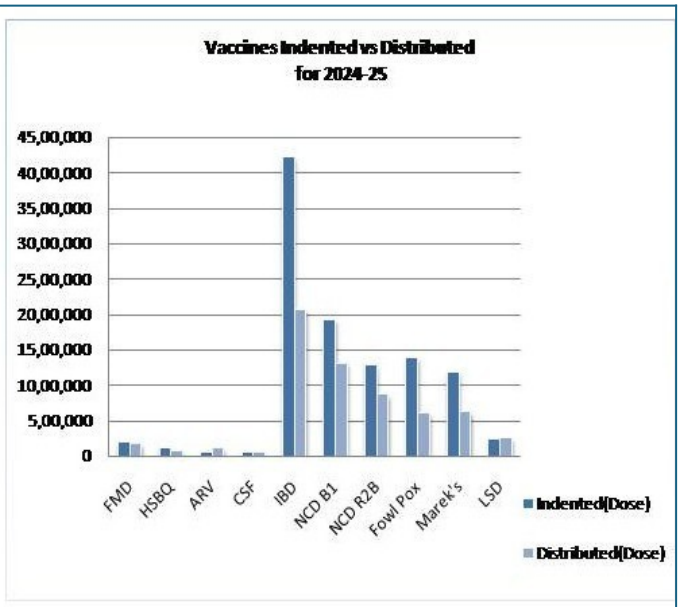


Figure 71. Vaccines indent and distributed

For the major Livestock vaccines viz; FMD and HS-BQ, total of 1,63,650 doses of FMD vaccines were issued from the total procured of 1,50,000 doses. Thus, utilizing little over the quantity procured in the same year. However, actual indent for livestock vaccines for FMD and HS-BQ was very high whereas the consumption in the field was low. The total indent for FMD and HS&BQ vaccines were 1,92,662 doses and 1,12,334 doses respectively, whereas the field utilization were 1,63,650 and 67,375 doses respectively.

Although the indent for poultry vaccines were very high, the unit did a validation with the individual Dzongkhags and worked out the final quantity based on the existing population. However, in the same year, lifting of poultry vaccines from the respective Dzongkhags and Central farms also was comparatively low, except for Mareks's vaccine which amounted as

6,27,500 to that of indented 11,87,500 doses. This could have been accounted due to the closing-down of Farms in the Dzongkhags (Figure 71).

5.3.2 Vaccine stock balance

A total of 11 types of veterinary vaccines were in stock, with varying quantities and expiry dates. The highest doses were for Infectious Bursal Disease (1,746,800 doses), followed by Fowl Pox (1,404,000 doses) and Newcastle Disease B1 strain (655,000 doses). Foot and Mouth Disease vaccine had 141,400 doses expiring in September 2026. Other notable vaccines included HS–BQ Combined (55,475 doses), Rabies (10,000 and 10,560 doses expiring in September 2027 and 2026), Classical Swine Fever (20,100 doses), and Lumpy Skin Disease with two batches totaling 35,625 doses expiring in May and July 2026. The stock also included Marek's Disease (5,000 doses), PPR (5,700 doses), and Newcastle Disease R2B strain (610,300 doses), all expiring between 2025 and 2026 (Table 22).

Table 22. Stock of vaccines

Name of vaccines	*Vials*	*Total (Doses)*	*Expiry Date*
Rabies	1000/1056	10000/10560	Sep-27/Sep-26
Foot & Mouth Disease		141400	Sep-26
HS–BQ Combined	2219	55475	Aug-26
Fowl Pox	1404	1404000	June-25
Infectious Bursal Disease	8734	1746800	Oct-25
Marek's Disease	1000000	5000	March-26
Newcastle Disease (B1)	3275	655000	May-26
Newcastle Disease (R2B)	6103	610300	Sept-25
Classical Swine Fever	2010	20100	April-26
Lumpy Skin Disease	320/725	16000/19625	May-26/Jul-26
Peste des Petits Ruminants (PPR)	57	5700	Aug-26

5.3.3 Identified gaps and resolutions:

Although there was mass distribution of vaccines twice annually, delivery could not be done as scheduled, so there were excess of quantity of vaccines remaining at BPU. There is no budget ceiling set for vaccines, unlike for medicine and non medicine items, so the center placed higher demand resulting in unrealistic demand. Uncertainty and closure of farm led to under-utilization of procured vaccines leading to vaccine expiry and wastages.

5.4 Dzongkhag-wise supply trend of FMD & HS-BQ vaccine

The Dzongkhag-wise budget allocation for major livestock vaccines, namely FMD and HS-BQ, was analyzed to derive key insights. Based on data compiled from July 2024 to June 2025, Samtse Dzongkhag reported the highest utilization at approximately Nu. 2.9 M, followed by Sarpang with Nu. 2.7 M during the fiscal year 2024–2025. Regarding HS-BQ vaccine

expenditure, Bumthang recorded the highest at Nu. 0.046 M, followed by Wangduephodrang at Nu. 0.042 M (Figure 72).

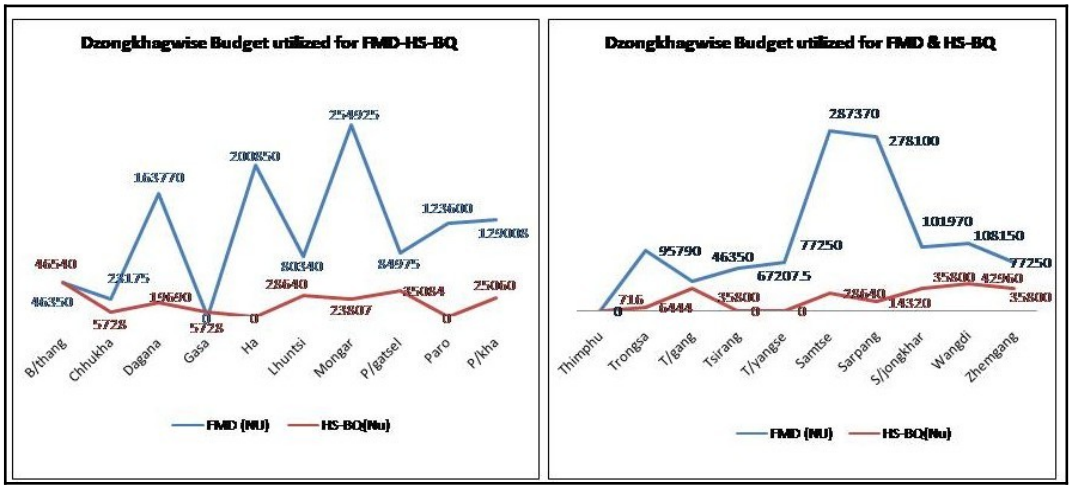


Figure 72. Dzongkhag wise supply trend of FMD and HS-BQ vaccine

5.5 Cold chain monitoring at Dzongkhags and other Central Agencies

All the vaccines and biological consignments are transported and delivered by suppliers at BPU and stored in a cold storage room maintained at 2 to 8°C (Figure 73). The daily temperature of the cold storage is managed using data loggers, and the data uploaded in the device is downloaded periodically to maintain proper records for reference. While the vaccine consignment are transported, the temperature of the vaccines is maintained at the range of 2 to 8°C by using data logger till it reaches the cold room.

Figure 73. Cold room and data logger

The temperature of the vaccines in cold storage at BPU is monitored by using data loggers. The data logger record findings for the month of December 2024 and April-2025 as reference evidence for cold storage management is shown in Figure 74.

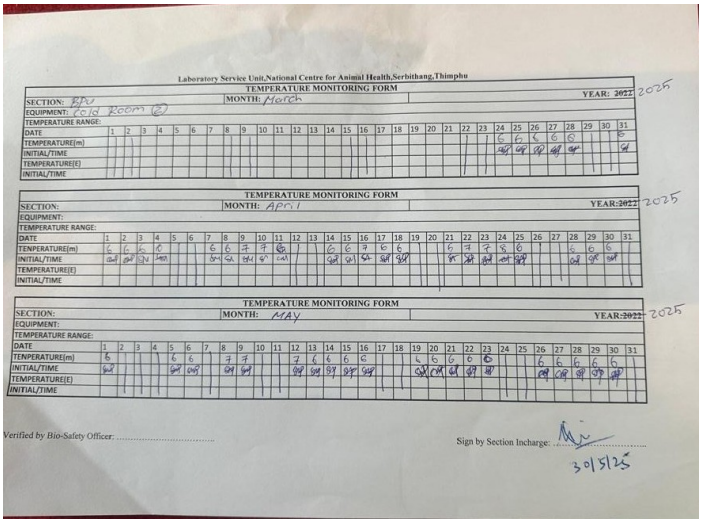


Figure 74. Temperature monitoring form

Monitoring of cold chain & vaccine storage facility at the field had been an important activity of the unit. However, the activity could not be conducted in the past current year due to the shortage of staffs in the unit. The same activity will be revived soon in next financial year.

5.6 Way Forward

5.6.1 Recommendations for procurement & improvement:

To ensure timely availability of vaccines to the Dzongkhags, it is important that the standard procurement timeline of 60 to 90 days is strictly adhered by the manufacturing company and suppliers. Following this timeframe will help expedite subsequent essential processes to be completed before the vaccines can be distributed and administered at the field level.

5.6.2 Planning for future outbreaks and demand forecasting:

Given the constant risk of emerging livestock disease incursions, the Biological Production Unit (BPU) under NCAH must remain prepared to implement preventive measures for both newly emerging outbreaks and the prophylactic management of recurrent diseases within the country. To ensure timely response during such events, BPU should allocate an additional 5 to 10 percent of vaccines over and above the actual annual indent. Furthermore, securing supplementary budgetary support is essential to effectively manage and respond to any unforeseen disease outbreaks in livestock.

5.6.3 Vaccine wastage and expiry management:

The annual vaccine indent submitted by field centers and Dzongkhags should be aligned with the existing livestock population to ensure realistic and appropriate forecasting of vaccine requirements. During the annual distribution, each field center and Dzongkhag shall be held accountable for lifting the entire quantity of vaccines as per their respective indents.

5.6.4 Collaboration with vaccine producers/suppliers

To ensure timely and smooth delivery of vaccine, the procuring agency, BPU, NCAH must maintain continuous coordination with manufacturers and suppliers, primarily based in India. Given that Bhutan's vaccine demand is relatively low compared to standard Indian manufacturing volumes, consistent engagement is essential to manage supply expectations and issues that might arise.

5.6.5 Vaccine pack size for Fowl Pox & Mareks Disease Vaccine

For fowl pox vaccines, a pack size of 500 doses is preferred over the standard 1000-dose vials, as most backyard poultry farms in Bhutan are small-scale and operated by individual farmers. To minimize vaccine wastage—an issue previously observed due to oversized vials—suppliers and manufacturers should be duly informed of this packaging preference.