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STATUS OF NOTIFIABLE ANIMAL DISEASES IN BHUTAN



1996-2015



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Royal Government of Bhutan
Ministry of Agriculture & Forests
Department of Livestock
National Centre for Animal Health
Serbithang: Thimphu
www.ncah.gov.bt

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



PABX: +975-2-351083/351093; Fax: +975-2-351095; Email: ncah2013@gmail.com; Post box: 155

FOREWORD

The booklet on Status of Notifiable Animal Diseases 2015 in Bhutan compiled by the Disease Prevention and Control Unit (DPCU) of the National Centre for Animal Health is a continuation of the annual publication of the status of notifiable diseases reported in Bhutan during the period. This edition gives an overview of all notifiable animal diseases reported in the country during 2015 including the spatio-temporal pattern of outbreaks from 1996 to 2015. This report is combination of several years outbreak data and the outbreak data recorded in the *TADInfo* online database system maintained at National Centre for Animal Health.

The main purpose of this booklet is to provide an update on the livestock disease situation in the country for information of all stakeholders including field livestock staff, veterinarians, livestock farmers and policy makers. The information contained in this booklet could also be used for preparedness and response plans by the concerned government agencies responsible for disease prevention and control.

I would like to urge the *TADInfo* focal persons of all Dzongkhags to ensure that all outbreaks of notifiable livestock diseases are entered compulsorily in the database to ensure such reports reflect the true situation in the ground. I would like to thank all the Program Directors of RLDCs, the *TADInfo* focal persons, and all field veterinarians for their active disease reporting and investigation.

I hope this edition of the disease status in the country will be useful and informative.


 Dr. Kinzang Dukpa
 Program Director



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1. Introduction

Notifiable disease means a disease listed by the Veterinary Administration in the country, and that, as soon as detected or suspected, must be reported to any of the animal health service Centres by the fastest means of communication to contain the disease.

Outbreaks of notifiable diseases have been reported every year from different parts of the country. A brief descriptive analysis is being attempted in this report to present the status of reported notifiable diseases reported in Bhutan during 2015 (Figure 1). The data used for this analysis were retrieved from the Veterinary Information System database (VIS) for the period from 1996 to 2010 and Transboundary Animal Disease Information System (TADinfo database) for the period 2011–2015 and were validated accordingly. Therefore, the data presented in this report can be used as baseline information in future.

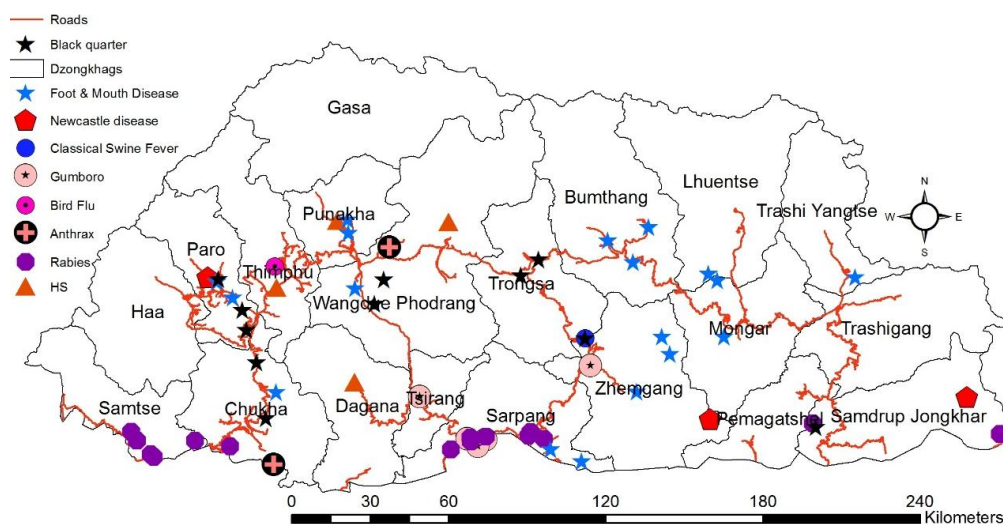


Figure 1: Distribution of reported outbreaks of notifiable animal diseases in Bhutan during 2015

During 2015, foot and mouth disease in cattle was major disease outbreak occurred in the country which spread to Bumthang, Zhemgang, Lhuentse and Mongar Dzongkhags.

2. Multiple species disease

2.1 Foot and mouth disease

Foot-and-mouth disease (FMD) is a highly infectious viral disease of cloven-hoofed species characterized by fever and vesicles in the mouth and on the muzzle, teats, and feet. In a susceptible population, morbidity approaches 100% but the disease is rarely fatal except in young and very old animals. There are 7 immunologically distinct serotypes: A, O, C, Asia 1, and SAT1, SAT2, and SAT3 (Southern African Territories). Within each serotype, there are a large number of strains that exhibit a spectrum of antigenic characteristics; therefore, more than one vaccine strain for each serotype, particularly O and A, is required to cover the antigenic diversity.

FMD is endemic and is reported from almost all parts of the country. In the past there were more outbreaks reported from Dzongkhags bordering India, but during 2014 year, outbreaks have been reported mostly in the interior parts of the country. Serotype O is the principal FMDV serotype involved in Bhutan, consistent with the disease epidemiology in the neighboring countries in the region. Serotype O was confirmed in all the outbreaks through Sandwich ELISA performed at NCAH

During 2015, 18 outbreaks have been reported in 10 Dzongkhags, affecting 731 cattle and 14 sheep when compared to 16 reported outbreaks in 2014 (Figures 2, 3 and annexure 1, 2). Most of the outbreaks have occurred in places near the highways in interior parts of Bhutan and near international borders. Although the source of infection was largely unknown, some outbreaks may have been associated with import of livestock products and through cross border grazing of animals.

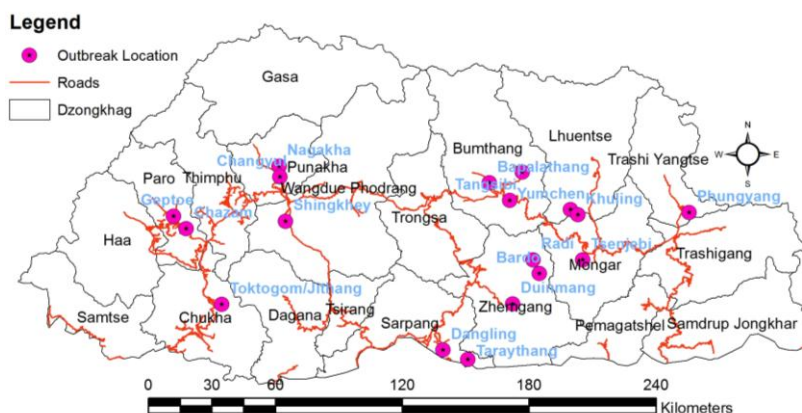


Figure 2: Distribution of FMD outbreaks in animals between January & December 2015

A Progressive Control Pathway (PCP) approach for control of FMD is being implemented in the country with an ultimate objective to enable Bhutan reach stage 3 of the PCP by the year 2020 under the GF-TADs concept.

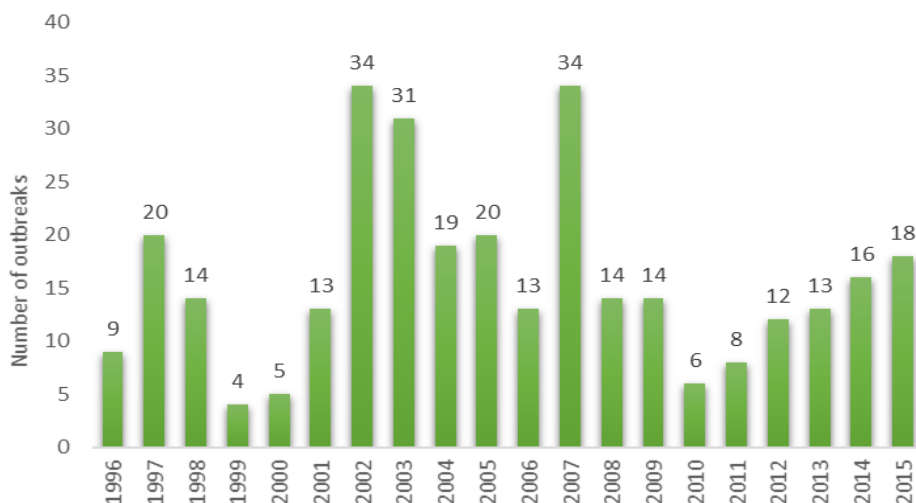


Figure 3: Annual distribution of reported FMD outbreaks in Bhutan (1996 to 2015)

2.2 Rabies

Rabies is a fatal zoonotic disease transmitted mainly by the bite of rabid animals, predominantly domestic dogs. Rabies was present in most parts of Bhutan until the early 1990s but has been controlled mainly through mass vaccination and restrictive elimination of dogs. Currently the disease is endemic in the southern Dzongkhags of Bhutan along the border with India.

During 2015, 17 outbreaks of rabies were reported in Chukha, Samtse, Sarpang & Samdrup Jongkhar Dzongkhags affecting 23 cattle, 10 dogs, 4 goats and one pig when compared to 21 outbreaks in 2014 (Figures 4, 5 and annexure 3, 4). Highest outbreaks were reported in Sarpang followed by Samtse, Samdrup Jongkhar and Chukha Dzongkhag. The cases in domestic animals (livestock) resulted from spill over infection from rabid dog.

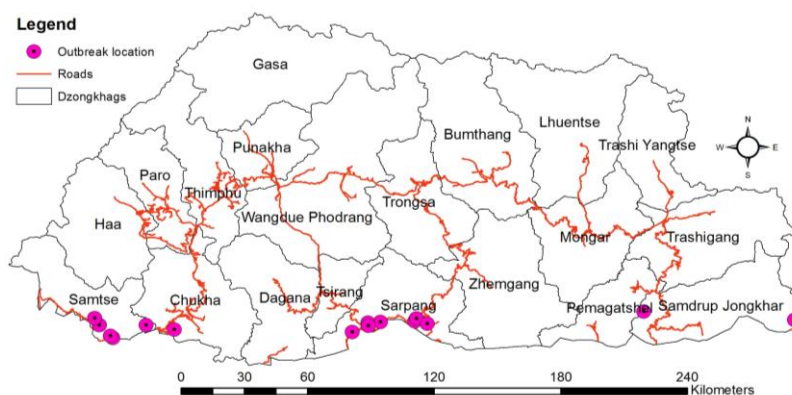


Figure 4: Distribution of reported rabies outbreaks in animals between January & December 2015

In humans, 16 deaths due to rabies (mostly children) has been reported between 2006 and 2013 with only one death in 2013. No human rabies cases were reported during 2014 and 2015.

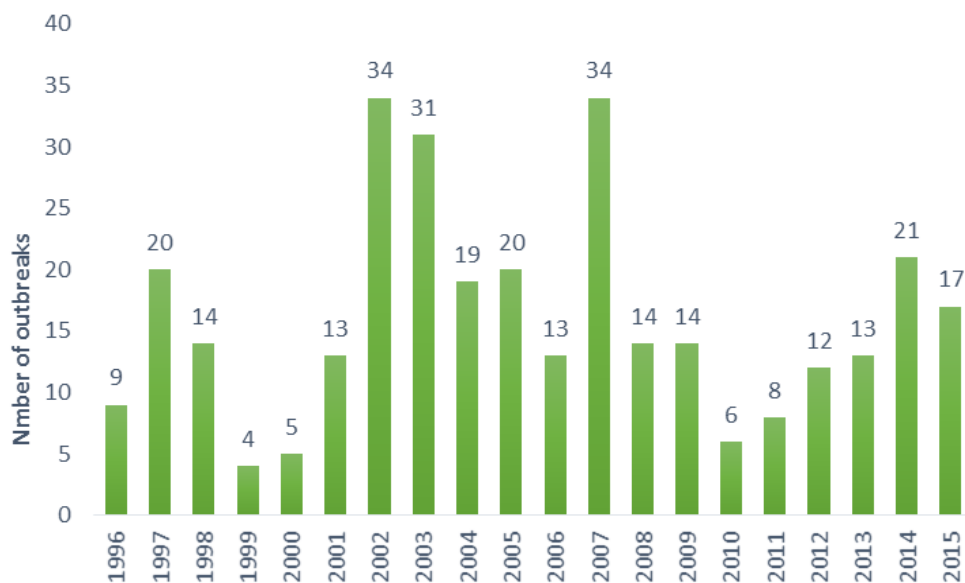


Figure 5: Annual distribution of Rabies outbreak in animals in Bhutan (1996 to 2015)

2.3 Anthrax

Anthrax is a serious zoonotic disease caused by the spore forming bacterium *Bacillus anthracis*. Anthrax commonly presents as an acute septicemia with a high fatality rate in herbivore animals. The most common signs are sudden death, discharge of un-clotted tarry blood from natural orifices, rapid bloating and absence of rigor mortis.

In Bhutan, anthrax cases are sporadically reported in domestic animal, primarily in cattle. Occasionally, cutaneous anthrax cases have been reported in humans following contact with infected animals. The anthrax isolates in Bhutan were found to be part of the multilocus variable-number tandem repeat analysis B1 lineage (genotype 83) and canonical single-nucleotide polymorphism subgroup B.Br.001/002 (Figure 6). The B lineage is less widespread and primarily associated with South Africa, but it has been reported in parts of the United States, Europe, and Asia, including the Caucasus region. In contrast, the strains from nearby Bangladesh and India belong to the more widely dispersed A lineage.

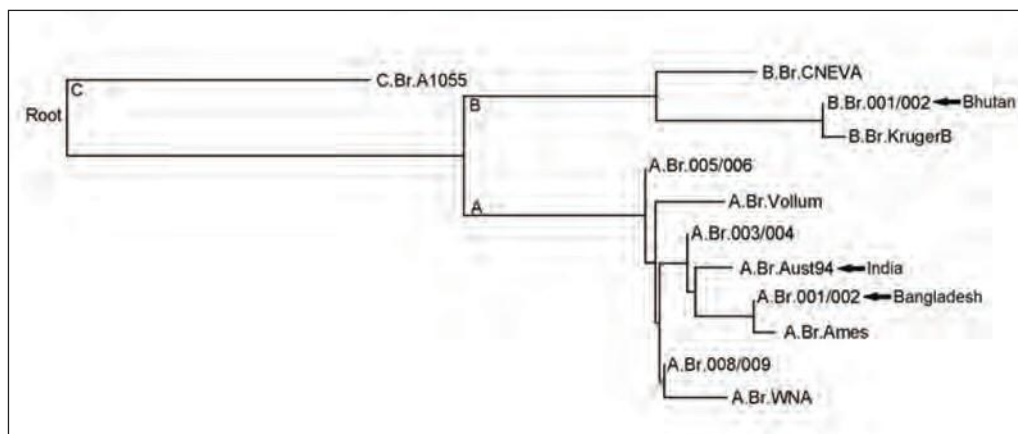


Figure 6. Phylogeny of major *Bacillus anthracis* groups as determined by using canonical single nucleotide polymorphisms. Arrows indicate the lineages/groups of genotyped *B. anthracis* isolates from India, Bangladesh, and Bhutan (Source: Thapa et al., 2014).

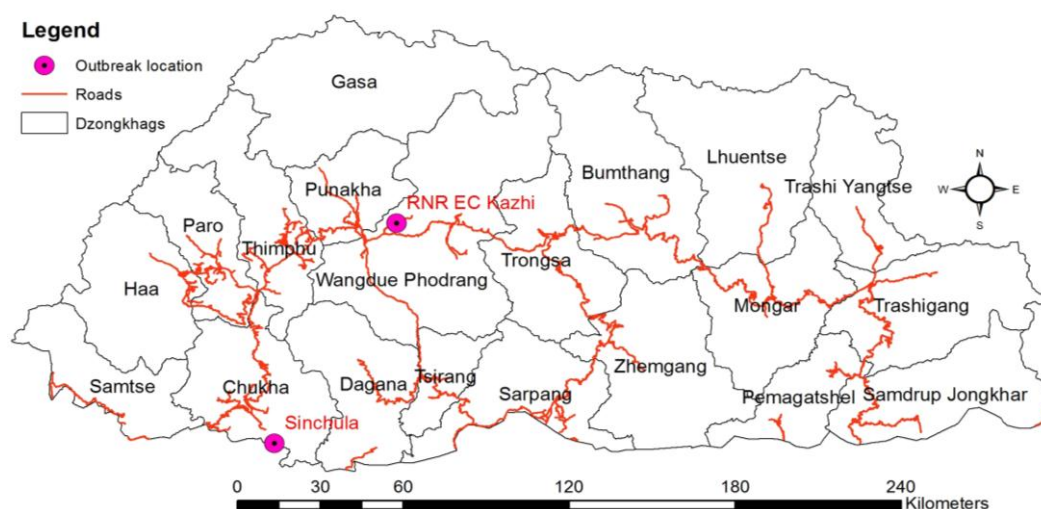


Figure 7: Distribution of reported anthrax outbreaks in animals between January & December 2015

During 2015, two outbreaks were reported from Wangdue & Chukha Dzongkhags compared to one outbreak reported in 2014 (Figure 6, 7, 8 and Annexure 5). Anthrax cases were reported in cattle and swine. No human cases were reported during 2015.



Figure 8: Annual distribution of Anthrax outbreak in animals in Bhutan (1998 to 2015)

3.1 Black Quarter



Figure 10: Annual distribution of Black Quarter outbreak in animals in Bhutan (1998 to 2015)

3.2 Hemorrhagic Septicemia

Hemorrhagic septicemia (HS) is an acute, highly fatal disease of cattle caused by particular serotypes of *Pasteurella multocida*. HS is seen infrequently in swine and even less commonly in sheep and goats. Although HS may be seen at any time of year, is commonly occurring during the rainy season. The disease causes severe economic losses through morbidity and mortality and can be prevented by vaccination

HS is sporadically reported in cattle every year. A total of 22 outbreaks have been reported between 1998 and 2014 with a report of 215 cases and 130 deaths of cattle (Figure 11 & annexure 8). HS is diagnosed based on clinical signs as well as by laboratory test.

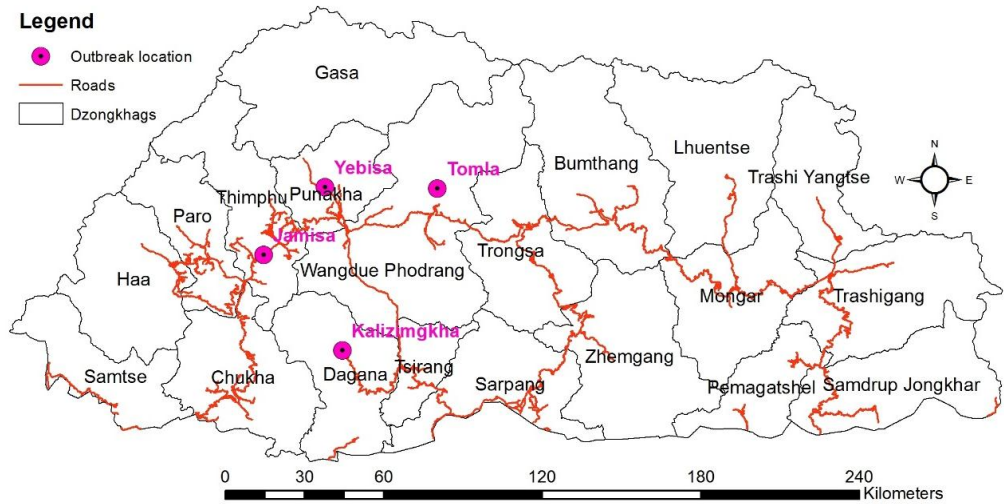


Figure 11: Distribution of reported HS outbreaks between January & December 2015

During 2015, four outbreaks of HS were reported from Thimphu, Punakha, Wangdue & Dagana Dzongkhags compared to only one outbreak in 2014. A total of 10 cases were reported with 100% mortality.

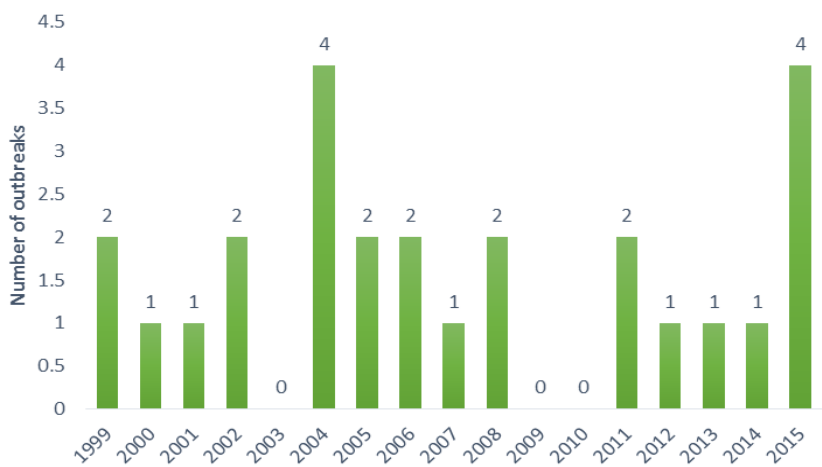


Figure 12: Annual distribution of Haemorrhagic Septicemia outbreaks in Bhutan (1999 to 2015)

4. Diseases in poultry

4.1. Newcastle disease

Newcastle (NCD) is an acute viral disease of domestic poultry and many other bird species caused by Newcastle disease virus, synonymous with avian paramyxovirus-1.

NCD incidence in poultry is reported sporadically in Bhutan and cause morbidity and mortality of poultry birds, but most cases remain unreported due to small and scattered nature of flocks in the villages. Although vaccination against NCD in government poultry farms is mandatory, village poultry vaccination is limited due to the small and scattered nature of flocks.

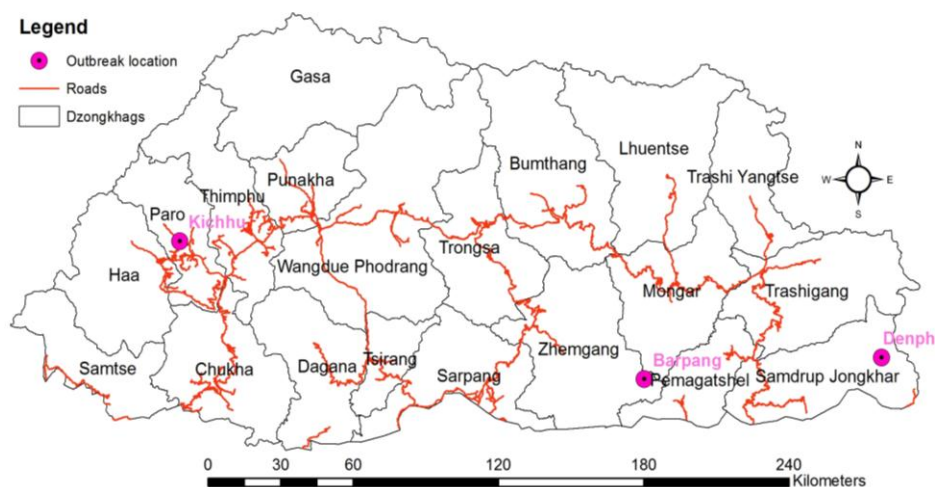


Figure 13: Distribution of reported NCD outbreaks in poultry between January & December 2015

During 2015, three outbreaks of NCD were reported from Paro, Zhemgang & Samdrup Jongkhar Dzongkhags compared to five outbreaks in 2014 (Figures 13, 14 and annexure 9 , 10). A total of 95 cases in poultry were reported of which 55 have died.



Figure 14: Annual distribution of reported NCD outbreaks in Bhutan (1998 to 2015)

4.2. Infectious Bursal Disease

Infectious Bursal Disease (IBD), or Gumboro Disease is a highly contagious disease of poultry caused by infectious Bursal disease virus affecting chicks. The target organ of the virus is the Bursa of fabricious, an important organ in the chickens for developing immune system. The disease is of economic importance to poultry industry.

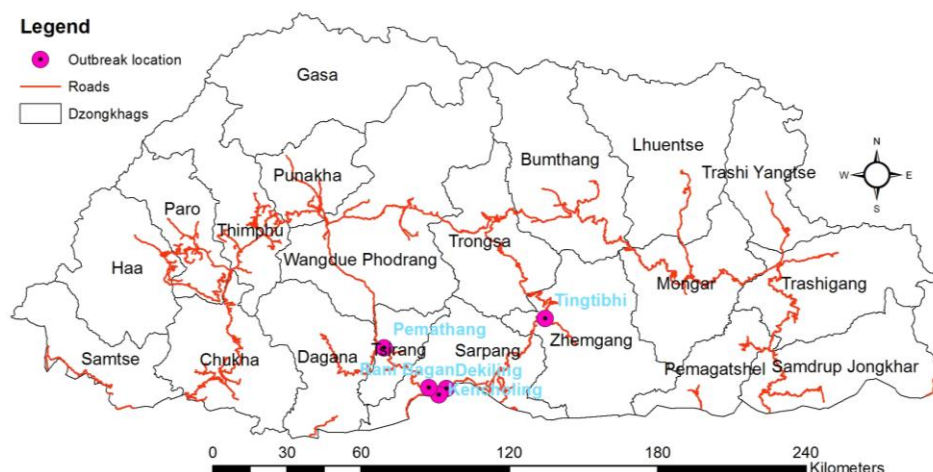


Figure 15: Distribution of reported IBD outbreaks between January & December 2015

During 2015, five outbreaks of Gumboro disease were reported from Tsirang, Sarpang & Zhemgang Dzongkhags compared to 23 outbreaks in 2014. (Figure 14, 15 and annexure 14 , 15). Of the 1965 cases, 486 birds have died of IBD.

4.3 Highly Pathogenic Avian Influenza

Bhutan reported its first HPAI H5N1 outbreak on 23 February 2010 to the Office International Des Epizooties (OIE). The disease was first detected on 18th February 2010 at Rinchening village, Chukha district in free-ranging poultry that was subsequently confirmed by the High Security Animal Disease Laboratory (HSADL) Bhopal, India and the National Institute of Animal Health (NIAH), Bangkok, Thailand. Subsequently, at least seven separate outbreaks of HPAI H5N1 were confirmed in 21 locations of six districts in 2011, 2012 and 2013. All these outbreaks in Bhutan were rapidly contained following the implementation of the National Influenza Pandemic Preparedness Plan (NIPPP) and standard operating procedures (SOPs) for response to HPAI outbreak.

The phylogenetic analysis of the first Bhutan isolates belonged to 'Qinghai like lineage' virus clade 2.2 (sub clade 2.2.3) and shared common progenitor virus with Bangladesh virus. Based on the evidence of phylogeny and molecular markers, it was concluded that the outbreaks in Bhutan and Bangladesh in 2010 were due to independent introductions of the virus probably through migratory birds. The outbreaks during 2012 in Chukha, Thimphu and Mongar involved clade 2.3.2.1 which is antigenically similar to the 2011 chicken virus clade of India.

During 2015, one outbreak of HPAI was recorded in April in Mothithang, Chang Geog under Thimphu Dzongkhag (Figure 16, annexure 15 & 16). A total of four cases in poultry were reported. The outbreak was confirmed using RT-PCR test at the National Centre for Animal Health, Serbithang, Bhutan and subsequently confirmed at the High Security Animal Disease Laboratory Bhopal, India.

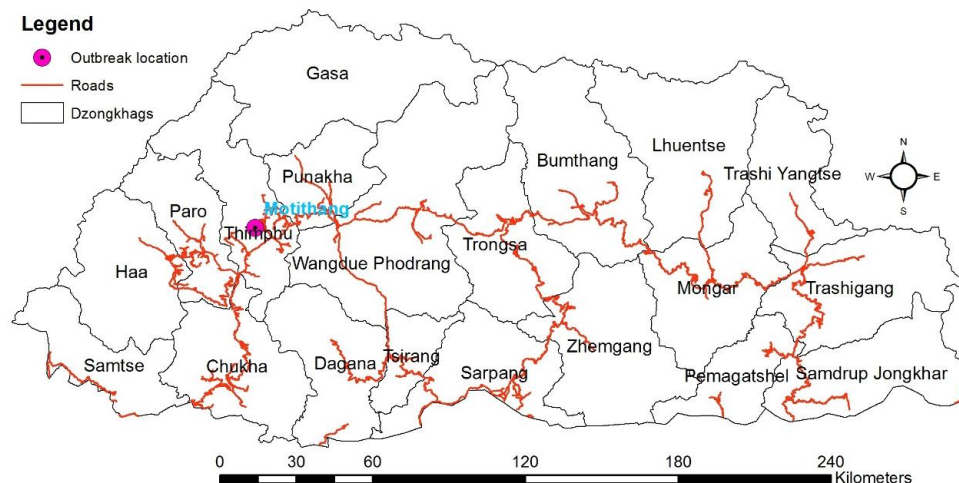


Figure 16: Distribution of reported Highly Pathogenic Avian Influenza outbreaks between January & December 2015

5 Disease of pig

5.1 Classical Swine fever

Classical swine fever (CSF) is a contagious febrile disease of pigs caused by CSF virus of the genus *Pestivirus*, family *Flaviviridae*. The main source of infection is the pig-either live animals (movement of infected pigs) or through illegally imported pig meat and meat products that find their way into the porcine food chain through the feeding of waste food (e.g., Swill feeding).

Only sporadic cases of CSF are reported in village pigs in Bhutan. Although CSF vaccine is available, vaccination has been very limited due to practical field difficulties in the village pigs. However, pigs in the government farms are regularly vaccinated and the piglet distribution to the farmers are done after vaccination at the farms. A recent study has demonstrated sero-prevalence of CSFV about 62% and 52% in the government and backyard farms (due to vaccination), respectively, but no direct evidence of CSFV infections was found, either by clinical signs or virus isolation.

During 2015, one outbreak of classical swine fever was reported from Zhemgang Dzongkhag. The disease was diagnosed by clinical symptoms. There was no swine fever outbreak in 2014 (Figure 17 and Annexure 17 & 18).

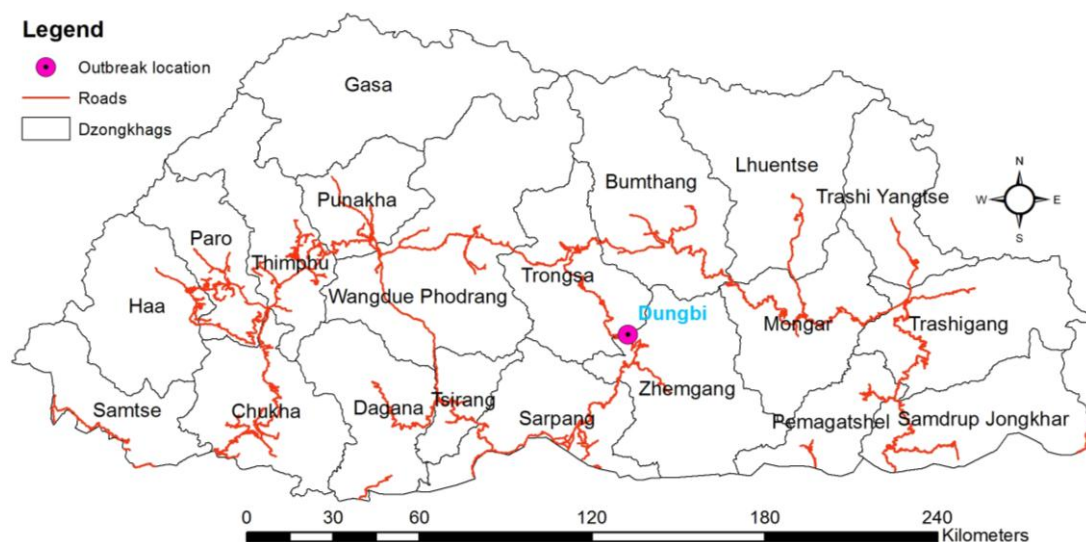


Figure 17: Distribution of reported swine fever outbreaks between January & December 2015

Acknowledgements

The NCAH would like to acknowledge all the TADinfo focal units of RLDCs, SVLs and DVHs for their prompt reporting and update of the disease outbreaks in their locality in the TADInfo database system. The center would also like to urge all animal health staff and veterinarians to compulsorily undertake flash reporting of all notifiable diseases and enter the outbreak data into the TADinfo database so that the annual health report produced by NCAH reflects the disease situation in the country more accurately.

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Status of Notifiable Animal Diseases in Bhutan 2013, NCAH, Serbithang

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8. Annexure

Annexure 1: Details of FMD outbreaks during 2012, 2013 & 2014 (Source: TADInfo database, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
27-Jul-12	Titring	Tading	Samtse	Bovine	146	2
17-Aug-12	Thothang	Lauri	S/Jongkhar	Bovine	30	1
29-Aug-12	Richanglo	Gomdar	S/Jongkhar	Bovine	47	1
2-Sep-12	Khelphu	Merak	Trashigang	Bovine	111	12
3-Sep-12	Pusa	Sakteng	Trashigang	Bovine	30	0
4-Sep-12	Gonong	Lauri	S/Jongkhar	Bovine	30	1
7-Sep-12	Borangmang	Sakteng	Trashigang	Bovine	43	0
16-Oct-12	Giri Gaon	Sipsu	Samtse	Bovine	72	1
16-Oct-12	Penjorling A	Sipsu	Samtse	Buffalo	4	
16-Oct-12	Penjorling A	Sipsu	Samtse	Bovine	19	
16-Oct-12	Peljorling B	Sipsu	Samtse	Bovine	119	1
17-Oct-12	Jogimara	Sipsu	Samtse	Bovine	9	
17-Oct-12	Hangay	Sipsu	Samtse	Buffalo	5	
17-Oct-12	Hangay	Sipsu	Samtse	Bovine	55	
17-Oct-12	Hangay	Sipsu	Samtse	Caprine	2	
18-Oct-12	Khelphu	Merak	Trashigang	Bovine	387	3
15-Nov-12	Mujuwa	N/Chhoeling	Samtse	Buffalo	5	
15-Nov-12	Mujuwa	N/Chhoeling	Samtse	Bovine	23	
28-Nov-12	Torsatar	Phuntsholing	Chukha	Bovine	7	0
28-Nov-12	Torsatar	Phuntsholing	Chukha	Swine	2	
28-Nov-12	Dagphel	Nangkori	Zhemgang	Bovine	3	1
27-Dec-12	Jangsa	Ugentse	Samtse	Bovine	12	
7-Jan-13	Jagarthan	Lamgong	Paro	Bovine	6	0
13-Feb-13	Khasadrapchu	Mewang	Thimphu	Bovine	2	0
29-May-13	Bunakha	Chapcha	Chukha	Bovine	10	
6-Jun-13	Phuentsholing	Phuntsholing	Chukha	Bovine	4	
30-Sep-13	Phuentsholing	Phuntsholing	Chukha	Bovine	16	
10-Oct-13	Shebji	Sombeykha	Haa	Bovine & Swine	179	6
18-Nov-13	Dangloe	Lamgong	Paro	Bovine & Swine	6	0
11-Dec-13	Phakpashi	Drepung	Mongar	Bovine	3	0
11-Dec-13	Phakpashi	Drepung	Mongar	Bovine	2	
18-Dec-13	S/jongkhar	Dewathang	S/Jongkhar	Bovine	13	7
24-Dec-13	Yarpheling	Sengye	Sarpang	Bovine	12	

29-Dec-13	Chaebakha	Nyisho	Wangdue	Bovine	10	
30-Dec-13	Narphung	Jangchhubling	S/Jongkhar	Bovine	2	0
30-Dec-13	Labarbotay	Chargharey	Samtse	Bovine	5	0
8-Jan-14	Gebjakha	Lungnyi	Paro	Bovine	3	1
23-Jan-14	Pang Gomo	Lingmukha	Punakha	Bovine	29	
28-Jan-14	Tongchen	Yangtse	T/ Yangtse	Bovine	28	
3-Feb-14	Geptoe	Wangchang	Paro	Bovine	1	0
10-Feb-14	Paga Gempa	Chapcha	Chukha	Bovine	1	
23-Feb-14	Gelekha	Nyisho	Wangdue	Bovine	20	
25-Feb-14	Jakar Kha	Chhokhor	Bumthang	Bovine	41	
31-Mar-14	Chuzom	Dogar	Paro	Bovine	29	0
4-Apr-14	Juka	Doteng	Paro	Swine	6	0
7-Apr-14	Dekha	Shaba	Paro	Bovine	1	0
30-Apr-14	Zor,Chhema,Dungs	Yalang	T/ Yangtse	Bovine	27	2
16-Jun-14	Hilley	Samrang	S/Jongkhar	Bovine	8	
14-Jul-14	Domphu	Dewathang	S/Jongkhar	Bovine	7	
2-Sep-14	Drugyel school	Tsento	Paro	Bovine	3	0
14-Oct-14	Gobja	Dangchu	Wangdue	Bovine	14	
23-Oct-14	Gebjakha	Lungnyi	Paro	Bovine	14	0

Annexure 2: Details of Foot and Mouth outbreak in domestic animals in Bhutan during 2015 (Source: TADInfo Database system,)

5-Feb-15	Nagakha	Chhubu	Punakha	Bovine	32	0
4-Mar-15	Changyul	Guma	Punakha	Bovine	13	0
15-May-15	Taraythang	Taraythang	Sarpang	Bovine	6	0
12-Jun-15	Dangling	Umling	Sarpang	Bovine/Ovine	29	0
27-Jul-15	Ugyen choling	Tang	Bumthang	Bovine	94	3
12-Aug-15	Radi	Shingkhar	Zhemgang	Bovine	65	1
10-Sep-15	Tangsibi	Ura	Bumthang	Bovine	200	0
13-Sep-15	Bardo	Bardo	Zhemgang	Bovine	40	0
5-Oct-15	Toktogom	Bongo	Chukha	Bovine	4	0
6-Nov-15	Bapalathang	Chhokhor	Bumthang	Bovine	40	0
6-Nov-15	Yumchen	Jarey	Lhuentse	Bovine	28	1
14-Nov-15	Khuling	Tsamang	Mongar	Bovine	47	0
19-Nov-15	Duinmang	Nangkor	Zhemgang	Bovine	3	0
24-Nov-15	Tsenjebi	Saleng	Mongar	Bovine	73	0
24-Nov-15	Phungyang	Yalang	T/ Yangtse	Bovine	4	0
27-Dec-15	Shingkhey	Gasetshowom	Wangdue	Bovine	62	0
28-Dec-15	Geptoe	Wangchang	Paro	Bovine	17	0
28-Dec-15	Chazam	Shaba	Paro	Bovine	6	0

Annexure 3: Details of reported rabies outbreaks in domestic animals in Bhutan during 2011, 2012, 2013 & 2014 (Source: TADInfo Database system)

Date	Village	Geog	Dzongkhag	Species	Death
27-Jul-12	Tsangchhu	Phuntsthothang	S/Jongkhar	Bovine	1
10-Aug-12	Yub_Khezo	Jamkhar	T/ Yangtse	Bovine	1
13-Aug-12	Golanti	Langchhenphu	S/Jongkhar	Bovine	1
13-Aug-12	Golanti	Langchhenphu	S/Jongkhar	Canine	1
25-Aug-12	wangtsa	Katsho	Haa	Canine	1
4-Sep-12	RBA Colony	Dewathang	S/Jongkhar	Canine	1
4-Sep-12	Laring	Hiley	Sarpang	Feline	1
12-Sep-12	Golanti	Langchhenphu	S/Jongkhar	Bovine	5
9-Oct-12	Phuentsholing	Phuntsholing	Chukha	Canine	1
10-Oct-12	Phuentsholing	Phuntsholing	Chukha	Canine	1
10-Oct-12	RBA Colony	Dewathang	S/Jongkhar	Canine	1
12-Oct-12	Chumkuna	Phuntsholing	Chukha	Canine	1
25-Oct-12	Gelephu	Gelephu	Sarpang	Canine	1
28-Oct-12	Kuwapani	Hiley	Sarpang	Caprine	1
13-Nov-12	Gelephu	Gelephu	Sarpang	Bovine	1
17-Nov-12	Chenari	Dewathang	S/Jongkhar	Canine	1
17-Nov-12	Chenari	Dewathang	S/Jongkhar	Bovine	1
17-Nov-12	Chenari	Dewathang	S/Jongkhar	Feline	1
6-Dec-12	Pelrithang	Gelephu	Sarpang	Feline	1
20-Dec-12	Pelrithang	Gelephu	Sarpang	Canine	1
22-Dec-12	Gelephu	Gelephu	Sarpang	Bovine	1
5-Jan-13	Phuentsholing	Phuntsholing	Chukha	Canine	1
7-Jan-13	Gelephu	Gelephu	Sarpang	Canine	1
12-Jan-13	Phuentsholing	Phuntsholing	Chukha	Canine	1
18-Jan-13	Sarkitar	Samtse	Samtse	Canine	1
22-Feb-13	BCCL Colony	Samphelling	Chukha	Bovine	1
24-Feb-13	Phuentsholing	Phuntsholing	Chukha	Canine	1
26-Feb-13	BCCL Colony	Samphelling	Chukha	Bovine	1
12-Mar-13	DVH Samtse	Samtse	Samtse	Bovine	1
28-Mar-13	Phuentsholing	Phuntsholing	Chukha	Canine	1
28-Mar-13	Phuentsholing	Phuntsholing	Chukha	Canine	3
2-Apr-13	Deptshang	Serthig	S/Jongkhar	Bovine	5
4-Apr-13	« Samtse »	Samtse	Samtse	Canine	1
22-May-13	Malaybasay	Samphelling	Chukha	Canine	1
12-Jun-13	Lower Toribari	Phuntsholing	Chukha	Bovine	1

24-Jul-13	Phuentsholing	Phuntsholing	Chukha	Canine	1
6-Oct-13	Pana 'A'	Samphelling	Chukha	Bovine	1
14-Nov-13	RBA Colony	Dewathang	S/Jongkhar	Canine	1
25-Nov-13	Bukey	Samtse	Samtse	Bovine	1
13-Dec-13	Samdrupling	Dewathang	S/Jongkhar	Bovine	1
1-Mar-14	Dolungang	Dekiling	Sarpang	Bovine	2
4-Mar-14	DVH Samtse	Samtse	Samtse	Bovine	1
20-Mar-14	Yeuling	Chhuzagang	Sarpang	Canine	1
25-Mar-14	Chaskar	Chhuzagang	Sarpang	Bovine	1
31-Mar-14	Kaphung	Sherzhong	Sarpang	Bovine	2
17-Apr-14	Kalimati	Sipsu	Samtse	Bovine	1
22-Apr-14	Phuentsholing	Phuntsholing	Chukha	Canine	1
1-May-14	Gelephu	Gelephu	Sarpang	Canine	5
5-May-14	Gaden	Umling	Sarpang	Canine	2
13-May-14	Sarpangtar	Shompangkha	Sarpang	Canine	1
20-May-14	Pelrithang	Gelephu	Sarpang	Canine/bovine	2
21-May-14	Rai Gaon	Ugentse	Samtse	Bovine	1
10-Jun-14	Pelrithang	Gelephu	Sarpang	Bovine	1
10-Jun-14	Pemaling	Sherzhong	Sarpang	Bovine	1
24-Jun-14	Phuentsholing	Phuntsholing	Chukha	Canine	1
8-Jul-14	Pakhaygaun	Shompangkha	Sarpang	Canine	1
16-Jul-14	DVH Samtse	Samtse	Samtse	Canine	1
5-Aug-14	Sukreti	Samtse	Samtse	Bovine	1
7-Aug-14	Gaden	Umling	Sarpang	Bovine	1
29-Aug-14	Dzomlingthang	Gelephu	Sarpang	Canine	1
5-Sep-14	DVH Samtse	Samtse	Samtse	Canine	2
8-Sep-14	Dekiling	Dekiling	Sarpang	Bovine	1
12-Sep-14	Serzhong	Sherzhong	Sarpang	Bovine	1
21-Sep-14	Bhimtar	Chengmari	Samtse	Canine	1
17-Oct-14	Pelrithang	Gelephu	Sarpang	Caprine	1
9-Dec-14	Dzomlingthang	Gelephu	Sarpang	Bovine	1
29-Dec-14	Phuentsholing	Phuntsholing	Chukha	Canine	2

Annexure 4: Details of reported rabies outbreaks in domestic animals in Bhutan during 2015
(Source: TADInfo Database system)

Date	Village	Geog	Dzongkhag	Species	Cases
8-Jan-15	Pelrithang	Gelephu	Sarpang	Bovine	1
16-Jan-15	Pelrithang	Gelephu	Sarpang	Bovine	1
23-Jan-15	Pelrithang	Gelephu	Sarpang	Bovine	1
23-Jan-15	Pelrithang	Gelephu	Sarpang	Bovine	1
5-Feb-15	Lahatar	Pagli	Samtse	Bovine	1
11-Feb-15	Pelrithang	Gelephu	Sarpang	Bovine	1
11-Feb-15	Balatung	Sengye	Sarpang	Canine	1
14-Feb-15	Bukey	Samtse	Samtse	Bovine	1
14-Feb-15	Bukey	Samtse	Samtse	Caprine	1
14-Feb-15	Bukey	Samtse	Samtse	Canine	2
14-Feb-15	Bukey	Samtse	Samtse	Bovine	1
2-Mar-15	Lewkhop	Dekiling	Sarpang	Bovine	1
14-Mar-15	Uttarey/Sangla	Pagli	Samtse	Bovine	1
27-Mar-15	Dzomlingthang	Gelephu	Sarpang	Bovine	1
24-Apr-15	Pelrithang	Gelephu	Sarpang	Bovine	1
6-May-15	Pelrithang	Gelephu	Sarpang	Caprine	1
11-May-15	Chhar	Shompangkha	Sarpang	Bovine	2
16-May-15	Pelrithang	Gelephu	Sarpang	Bovine	1
14-Jun-15	Phuentsholing	Phuntsholing	Chukha	Bovine	3
29-Jun-15	Malaybasay	Samphelling	Chukha	Caprine	2
11-Aug-15	Saureni	Samtse	Samtse	Bovine	2
17-Sep-15	Norbuling	Sherzhong	Sarpang	Canine	3
24-Nov-15	Tala Busty	Langchhenphu	S/Jongkhar	Bovine	1
18-Dec-15	Dugsa	Jangchhubling	S/Jongkhar	Canine/Bovine	4 & 2
31-Dec-15	Khare Pakhey	Shompangkha	Sarpang	Swine	1

Annexure 5: Details of reported anthrax outbreaks in domestic animals in Bhutan (2012, 2013 & 2014)
(Source: VIS and TADInfo system NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
17-Jan-12	Mikche	Nubi	Trongsa	Bovine	1	1
18-Feb-12	Yonphula	Kanglung	Trashigang	Bovine	3	3
26-Feb-12	Lower Ghathia	Chargharey	Samtse	Bovine	3	3
26-Feb-12	Rongthung	Kanglung	Trashigang	Bovine	1	1
28-Feb-12	kongkha	Phuntsholing	Chukha	Bovine	1	1
9-Mar-12	Kadam	Kanglung	Trashigang	Bovine	1	1
21-Mar-12	Tselungkha	Uesu	Haa	Bovine	1	1
22-Mar-12	Bali	Katsho	Haa	Bovine	1	1
17-Apr-12	Willing	Nubi	Trongsa	Bovine	1	1
22-Apr-12	Chhuchhup	Nubi	Trongsa	Bovine	1	1
15-Jul-12	Willing	Nubi	Trongsa	Bovine	1	1
15-Sep-12	Kalizimgkha	Tseza	Dagana	Bovine	3	3
7-Jul-14	Gonglhakha Zero	Gayling	Chukha	Bovine	1	1

Annexure 6: Details of reported anthrax outbreaks in domestic animals in Bhutan for 2015
(Source: VIS and TADInfo system NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
1-Jan-15	RNR EC Kazhi	Kazhi	Wangdue	Bovine	5	5
26-Oct-15	Sinchula	Darla	Chukha	Swine	1	1

Annexure 7: Details of reported BQ outbreaks animals in Bhutan between 2012, 2013 & 2014
(Source: TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
8-Feb-12	Chongzhik	Shengana	Punakha	Bovine	3	2
12-Feb-12	Semji	Nubi	Trongsa	Bovine	1	1
2-Mar-12	Mirichemo	Bongo	Chukha	Bovine	4	4
7-Mar-12	Gonpa Woo	Dechhenling	Pemagatshel	Bovine	5	5
9-Mar-12	kongkha	Phuntsholing	Chukha	Bovine	1	1
17-Mar-12	Rizor	Udzorong	Trashigang	Bovine	1	1
17-Mar-12	Rizor	Udzorong	Trashigang	Bovine	1	1
10-Apr-12	Cheeyul	Getana	Chukha	Bovine	1	1

16-Apr-12	Cheeyul	Getana	Chukha	Bovine	1	1
16-Apr-12	Cheeyul	Getana	Chukha	Bovine	1	1
16-Apr-12	Jikhu	Getana	Chukha	Bovine	3	3
26-Apr-12	Tshachhup	Toewang	Punakha	Bovine	3	3
4-May-12	Choilicop	Samtse	Samtse	Bovine	2	1
4-Jul-12	Gangkha	Nahi	Wangdue	Bovine	4	4
12-Sep-12	NNBF	Khaling	Trashigang	Bovine	1	1
21-Sep-12	Willing	Nubi	Trongsa	Bovine	1	
13-Oct-12	Bjasa	Goenkhame	Gasa	Bovine	3	3
20-Oct-12	NNBF	Khaling	Trashigang	Bovine	1	0
18-Nov-12	NNBF	Khaling	Trashigang	Bovine	1	1
23-Nov-12	Goling	Nangkor	Zhemgang	Bovine	4	4
8-Jan-13	Namling	Saleng	Mongar	Bovine	1	0
8-Jan-13	Gangjug	Saleng	Mongar	Bovine	5	0
10-Jan-13	Namling	Saleng	Mongar	Bovine	1	0
25-Jan-13	Jarogang	Athang	Wangdue	Bovine	9	8
2-Feb-13	Dzomesa	Dzome	Punakha	Bovine	2	2
6-Feb-13	Gangtramo	Talo	Punakha	Bovine	3	3
6-Feb-13	Labtsakha	Talo	Punakha	Bovine	1	1
7-Feb-13	Silipang	Guma	Punakha	Bovine	1	
26-Feb-13	PWD Colon	Bapisa	Punakha	Bovine	1	1
28-Feb-13	Tshachhup	Toewang	Punakha	Bovine	12	12
4-Mar-13	Kadam	Mongar	Mongar	Bovine	1	0
9-Mar-13	Chadokha	Lokchina	Chukha	Bovine	14	14
10-Mar-13	Willing	Nubi	Trongsa	Bovine	1	
29-Mar-13	Bartsheri	Shumar	Pemagatshel	Bovine	1	1
3-Apr-13	Ramatoto	Chang	Thimphu	Bovine	1	1
16-Apr-13	Shangling	Nangkor	Zhemgang	Bovine	21	21
21-May-13	Tshangkha	Tangsibji	Trongsa	Bovine	1	1
19-Jun-13	Pamlamfrang	Samkhar	Trashigang	Bovine	1	
28-Jun-13	Alubari	Bjachho	Chukha	Bovine	1	1
2-Jul-13	Alubari	Bjachho	Chukha	Bovine	1	1
11-Jul-13	Pakhaygaun	Shompangkha	Sarpang	Bovine	4	4
26-Jul-13	Chazam	Samkhar	Trashigang	Bovine	1	
1-Aug-13	Norgang	Chhokhor	Bumthang	Bovine	1	
26-Aug-13	Phungputhoe	Yangtse	T/ Yangtse	Bovine	1	
1-Sep-13	DechenPelri	Tang	Bumthang	Bovine	1	1
3-Sep-13	Sisithangka	Sama	Haa	Bovine	1	1
6-Sep-13	BS farm	Chhokhor	Bumthang	Bovine	1	1
25-Sep-13	Riserboo	Mendrelgang	Tsirang	Bovine	7	7
28-Nov-13	Thangu	Thedtsho	Wangdue	Bovine	1	1

8-Dec-13	Om Teykha	Rubesa	Wangdue	Bovine	1	1
10-Dec-13	Thangu	Theedtsho	Wangdue	Bovine	1	1
19-Dec-13	Tshangkha	Tangsibji	Trongsa	Bovine	1	1
5-Jan-14	BarsaKab	Goenkham	Gasa	Bovine	3	1
9-Jan-14	Baikunza	Bongo	Chukha	Bovine	8	8
17-Jan-14	Kadam	Mongar	Mongar	Bovine	2	1
30-Jan-14	Juprey	Bhur	Sarpang	Bovine	1	1
23-Feb-14	Gothong	Udzorong	Trashigang	Bovine	10	10
7-Mar-14	Bunakha	Chapcha	Chukha	Bovine	2	1
13-Mar-14	Yonphula	Kanglung	Trashigang	Bovine	1	1
14-Mar-14	Dungkharling	Bhur	Sarpang	Bovine	3	3
17-Mar-14	Samkhara	Jigmichhoeling	Sarpang	Bovine	4	4
5-May-14	Lungkha	Dzome	Punakha	Bovine	2	1
17-Jun-14	Omchhu	Gayling	Chukha	Bovine	3	3
19-Jun-14	ManiChol	Goenkhatoe	Gasa	Bovine	1	0
5-Jul-14	Bachhu	Getana	Chukha	Bovine	3	3
24-Aug-14	NNBF	Khaling	Trashigang	Bovine	1	1
24-Sep-14	Goensakha	Dogar	Paro	Bovine	2	0
11-Nov-14	Drupchugang	Tsholingkhar	Tsirang	Bovine	1	1

Annexure 8: Details of reported BQ outbreaks animals in Bhutan for 2015 (Source: TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
10-Feb-15	Padichhu	Bongo	Chukha	Bovine	3	3
10-Feb-15	Tangsibji	Tangsibji	Trongsa	Bovine	1	1
10-Feb-15	Philuma	Jangchhubling	S/Jongkhar	Bovine	11	11
6-Mar-15	Kangugom	Rubesa	Wangdue	Bovine	3	3
9-Mar-15	Jangsa	Dopshari	Paro	Bovine	1	1
30-Mar-15	Dungbi	Trong	Zhemgang	Bovine	11	11
19-Jun-15	Loushong	Nubi	Trongsa	Bovine	2	2
24-Sep-15	Bunakha	Chapcha	Chukha	Bovine	8	7
13-Oct-15	Jadigang	Dogar	Paro	Bovine	1	1
20-Oct-15	Peljorling	Rubesa	Wangdue	Bovine	3	3
26-Oct-15	Tamcho	Dogar	Paro	Bovine	2	0

Annexure 9: Details of HS outbreak in cattle in Bhutan during 2012,213 & 2014) (Source: VIS and TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
22-Jun-12	Peljorling	Rubesa	Wangdue	Bovine	6	6
9-Oct-12	Norgang	Chhokhor	Bumthang	Bovine	1	1
19-Nov-12	Nangsephe	Chhokhor	Bumthang	Bovine	2	2
10-Nov-13	Mongar	Mongar	Mongar	Bovine	1	0
19-Jan-14	Jedokha lumbukha	Lokchina	Chukha	Bovine	4	4

Annexure 10: Details of HS outbreak in cattle in Bhutan for 2015 (Source: VIS and TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
24-Mar-15	Jamisa	Mewang	Thimphu	Bovine	2	2
29-Mar-15	Tomla	Dangchu	Wangdue	Bovine	1	1
2-Apr-15	Yebisa	Chhubu	Punakha	Bovine	4	4
22-Jul-15	Kalizingkha	Tseza	Dagana	Bovine	1	1

Annexure 11: Details of NCD outbreak in cattle in Bhutan (2012, 2013 & 2014) (Source: VIS and TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
13-Sep-12	Lower Salami	Kikorthang	Tsirang	Avian	1000	5
18-Dec-12	Serjung	Martshala	S/Jongkhar	Avian	10	9
29-Jan-13	Chuwabari	Dekiling	Sarpang	Avian	10	7
26-Feb-13	RNR EC Mongar	Mongar	Mongar	Avian	3	0
23-May-13	Phuentsholing	Phuntsholing	Chukha	Avian	260	8
28-May-13	Toktokha	Bongo	Chukha	Avian	97	97
17-Jul-13	Lower Toribari	Phuntsholing	Chukha	Avian	30	5
11-Sep-13	Lower Toribari	Phuntsholing	Chukha	Avian	300	6
14-Sep-13	Wangdi Gasel	Phuntsholing	Chukha	Avian	170	8
23-Sep-13	Gurung Drangra	Darla	Chukha	Avian	10	6
4-Dec-13	Khamdra	Dogar	Paro	Avian	20	0
28-Dec-13	Dangragoon	Lhamoizingkha	Dagana	Avian	194	194
29-Dec-13	Yangbari	Gongdue	Mongar	Avian	82	77
14-Feb-14	Gangzur	Gangzur	Lhuentse	Avian	41	41
19-Feb-14	Hilley	Samrang	S/Jongkhar	Avian	73	38
8-Mar-14	Ree Jue	Umling	Sarpang	Avian	30	20
9-Mar-14	Tashiphug	Sherzhong	Sarpang	Avian	50	30
10-May-14	Kadam	Mongar	Mongar	Avian	7	7

Annexure 12: Details of Newcastle disease outbreak in cattle in Bhutan for 2015 (Source: VIS and TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
18-Jan-15	Barpang	Bjoka	Zhemgang	Avian	50	21
7-Feb-15	Denphu	Serthig	S/Jongkhar	Avian	32	29
16-Feb-15	Barpang	Bjoka	Zhemgang	Avian	10	5
21-Aug-15	Kichhu	Lamgong	Paro	Avian	3	0

Annexure 13: Details of Gumboro disease outbreak in cattle in Bhutan for 2014 (Source: VIS and TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
6-Apr-14	Rani Bagan	Hiley	Sarpang	Avian	1120	1120
6-Apr-14	Patabari	Shompangkha	Sarpang	Avian	2450	1106
8-Apr-14	Juprey	Bhur	Sarpang	Avian	4150	865
19-May-14	Gawaithang	Dekiling	Sarpang	Avian	657	657
30-May-14	Lower Lobsibotay	Goserling	Tsirang	Avian	4571	2230
31-May-14	LowerTsholingkha	Tsholingkhar	Tsirang	Avian	1000	252
5-Jun-14	Sarpangtar	Shompangkha	Sarpang	Avian	350	350
11-Jun-14	Petakarpo	Thedtsho	Wangdue	Avian	901	734
16-Jun-14	Chhoekhorling	Dekiling	Sarpang	Avian	47	13
8-Jul-14	Juprey	Bhur	Sarpang	Avian	48	17
8-Jul-14	Chhuzomsa	Beteni	Tsirang	Avian	881	297
11-Jul-14	Jaruwa	Bhur	Sarpang	Avian	6	3
19-Jul-14	Chhoekhorling	Dekiling	Sarpang	Avian	29	11
21-Jul-14	Khorsanay	Dunglegang	Tsirang	Avian	600	103
23-Jul-14	Norbugang	Shompangkha	Sarpang	Avian	60	37
25-Jul-14	Charkilo	Genye	Thimphu	Avian	44	36
1-Aug-14	Patabari	Shompangkha	Sarpang	Avian	55	29
1-Aug-14	Dekiling	Dekiling	Sarpang	Avian	62	27
6-Aug-14	Chilikhar	Toepisa	Punakha	Avian	385	385
7-Aug-14	Chhoekhorling	Dekiling	Sarpang	Avian	12	5
11-Aug-14	Juprey	Bhur	Sarpang	Avian	35	17
22-Aug-14	Lower Bokray	Kikorthang	Tsirang	Avian	495	215
27-Aug-14	Rani Bagan	Hiley	Sarpang	Avian	700	500

Annexure 14: Details of Gumboro disease outbreak in cattle in Bhutan for 2015 (Source: VIS and TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
15-Mar-15	Pemathang	Goserling	Tsirang	Avian	500	28
21-Apr-15	Dekiling	Dekiling	Sarpang	Avian	16	16
14-May-15	Kencholing	Shompangkha	Sarpang	Avian	5	4
2-Jul-15	Rani Bagan	Hiley	Sarpang	Avian	44	38
13-Dec-15	Tingtibhi	Trong	Zhemgang	Avian	1400	400

Annexure 15: Details of Highly Pathogenic Avian Influenza disease outbreak in poultry in Bhutan for 2012 & 2013 (Source: VIS and TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases
13-Jan-12	Motithang	Chang	Thimphu	Avian	49
4-Jan-12	Tshemakha	Bjachho	Chukha	Avian	87
6-Jan-12	Mepesa	Bjachho	Chukha	Avian	16
8-Jan-12	Mepaiarig	Bjachho	Chukha	Avian	3
28-Jan-12	Kamji school area	Gayling	Chukha	Avian	4
30-Jan-12	Bunakha	Chapcha	Chukha	Avian	38
19-Feb-12	Gedu	Bongo	Chukha	Avian	10
14-Feb-12	Wangdi Gasel	Phuntsholing	Chukha	Avian	12
27-Mar-12	Yangbari	Gongdue	Mongar	Avian	70
14-Oct-12	Wangdi Gasel	Phuntsholing	Chukha	Avian	24
27-Dec-12	Kalikhola	Lhamoizingkha	Dagana	Avian	18
3-Mar-12	Burkhay	Samphelling	Chukha	Avian	1
10-Feb-12	Alay	Phuntsholing	Chukha	Avian	5
15-Feb-12	Thakuri Gaon	Ugentse	Samtse	Avian	12
14-Oct-12	Wangdi Gasel	Phuntsholing	Chukha	Avian	24
27-Dec-12	Kalikhola	Lhamoizingkha	Dagana	Avian	18
15-Jan-13	Gelephu	Gelephu	Sarpang	Avian	50
18-Jan-13	Pelrithang	Gelephu	Sarpang	Avian	8
25-Jan-13	Shawapang	Chhuzagang	Sarpang	Avian	6

Annexure 16 : Details of Highly Pathogenic Avian Influenza disease outbreak in poultry in Bhutan for 2015 (Source: VIS and TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases
3-Apr-15	Motithang	Chang	Thimphu	Avian	16

Annexure 17: Details of Classical Swine fever disease outbreak in cattle in Bhutan for 2013 (Source: VIS and TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
1-Apr-13	Bapalathang	Chhokhor	Bumthang	Swine	1	1
13-Aug-13	Damchu	Chapcha	Chukha	Swine	2	1
21-Nov-13	Phumu	Doteng	Paro	Swine	9	1

Annexure 18: Details of Swine fever disease outbreak in cattle in Bhutan for 2015 (Source: VIS and TADInfo Database system, NCAH).

Date	Village	Geog	Dzongkhag	Species	Cases	Deaths
23-Oct-15	Dungbi	Trong	Zhemgang	Swine	1	0

Annexure 19: Laboratory diagnostic capacity at LSU, NCAH, Serbithang (2016)

Disease	Bhutan*	OIE**
Anthrax	Agt id	-
Foot and mouth disease	ELISA, PCR	ELISA, VN, CF
Leptospirosis	Agt id, MAT	MAT
Paratuberculosis (JD)	ELISA	ELISA, DHT
Rabies	IC, FAT	ELISA, VN
Trichinellosis	Agt id	Agt id, ELISA
Trypanosomiasis	Agt id	-
AI (A, H5N1, H7N9)	PCR, HAI, IC	VI, AGID, HAI
Avian Mycoplasmosis	ELISA	SAT, HAI
IBD (Gumboro disease)	ELISA	ELISA, AGID
ND	PCR	VI, HAI
Bovine anaplasmosis	Agt id	CAT, CF
Bovine babesiosis	Agt id	CF, ELISA, IFA
Bovine brucellosis	RBT, SAT, ELISA	BBAT, CF, ELISA, FPA
Bovine cysticercosis	Agt id	Agt id
Bovine tuberculosis	IDT	IDT, IFN γ
Bovine viral diarrhoea	ELISA	Agt id
CBPP	ELISA	ELISA, CF
HS	Agt id	Agt id
IBR	ELISA	Agt id, ELISA, PCR, VN
Theileriosis	Agt id	Agt id, IFA
Trypanosomiasis	Agt id	IFA
EI	IC, ELISA	AGID, ELISA
Equine piroplasmosis	Agt id	ELISA, IFA, CF
PPR	IC, ELISA	VN, ELISA
CSF	ELISA	ELISA, FAVN, NPLA
PRRS	PCR	ELISA, IFA, IPMA
Toxoplasmosis	ELISA	Agt id

*Practical value

**Prescribed/alternative