Operational Manual
Kyasanur Forest Disease

Directorate of Health and Family Welfare Services
Ananda Rao Circle, Bengaluru - 560 009

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Kyasanur Forest Disease

Directorate of Health and Family Welfare Services
Government of Karnataka

2020

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Message

Kyasanur Forest Disease which is also known as 'Monkey Fever' around Malnad areas of Karnataka, was first discovered in 1955–56, in Kyasanur Forest of Shivamogga district. The disease was confined to Malnad forests and was seasonal. This viral disease has slowly percolated into other neighboring and contiguous States since 2012 onwards and now emerged as a major Public Health Problem, due to the increase in both mortality and morbidity over the last few years.

It is 65 years ago that the Virus was first Isolated by the Scientists of the erstwhile 'Virus Research Centre', Pune in coordination with the Officers of the Department of Health, Government of Karnataka. The studies conducted over this period on the epidemiology of the disease needs to be updated, and the probable change in Virulence may be causing more damage to the Community, despite availability of vaccine against the disease. The Medical and Para-medical staffs dealing with the disease have also been changing over these six decades who may need an updated knowledge about the disease. Therefore, there is a need to provide very comprehensive information on KFD and Standard Operational Guidelines for the Health Staff, in order to go ahead with preventive and control aspects of this unique disease.

The Department of Health and Family Welfare has brought out this Comprehensive Operational Manual on Kyasanur Forest Disease—with latest updates, which will go a long way in providing the necessary scope for preventing any further transmission of the disease among the community, as also for taking up further research studies to permanently eliminate KFD in the near future.

Karnataka has been in the forefront of eliminating many Communicable diseases during the past, and on the verge of eliminating many other diseases like Polio, Small Pox, Malaria and Filaria. I wish that this Operational Manual shall help our expert Medical Professionals to achieve success in phasing out Kyasanur Forest Disease, with a concerted effort.

B. SREERAMULU
Minister for Health and Family Welfare
Govt. of Karnataka

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Message

KARNATAKA is always contributing to the cause of Public Health and playing a major role in prevention and control of Communicable diseases.

Kyasanur Forest Disease, is one among many Arthropod borne Diseases, which spreads from a virus and transmitted through the bites of ticks prevailing in the Forest areas. Prevention and control of the disease is still a 'State Issue' and yet to be considered as a National Program, though it has now started to spread to other neighboring States, depending on the contiguity of forest areas and movement of hosts as well as reservoirs of the virus.

The Virus was isolated during 1956–57 and since then it has been circulating in the pockets of forest confined to only certain areas for over five decades. Due to Environmental modifications and manipulations, changing climatic conditions, the disease started moving on, extending its activity to newer areas and with increasing incidence of morbidity and mortality. Though a vaccine has been available against the disease, still more studies about improving its potency and efficacy have to be conducted extensively.

As the responsibility of prevention and control of KFD still vests with the State Department of Health and Family Welfare. It was felt necessary to draw up an exhaustive Operational guidelines with a lot of scope for Research activities and useful to Public Health experts, Program Managers, implementing Officers and field staff for a holistic approach in phasing out the disease.

This Operational Manual is the result of the knowledge and experience shared by all those who were and are in the field, dealing with Kyasanur Forest Disease. I, sincerely, hope that this manual will be most useful to the Public Health personnel working in all the affected States and to the stake holders as well, in phasing out the disease with a co-ordinated effort.

Jawaid Akthar, IAS
Additional Chief Secretary
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Message

Arthropod Borne Virus Diseases which are usually known as 'Arbo virus' diseases are usually caused in Humans accidentally and in many instances, Humans are the dead-end hosts. Such diseases occurring with the involvement of Vectors as active hosts pose a challenge to the Public Health experts in its containment. Kyasanur Forest Disease is one such Arbo-virus Disease prevailing in the State of Karnataka for more than 60 years.

The prevention and control of Vector Borne Diseases (including Arthropod Borne virus diseases) involves epidemiological and entomological expertise which should go hand in hand, apart from clinical management of individual cases. Therefore, it is important that all those involved in the activities related to containment of the disease, should invariably have all the knowledge and experience in their approach.

The Government of India has not yet decided upon inclusion of this Communicable disease under the main umbrella of 'National Vector Borne Disease Control Program', due to the limited area of its activity. However, during the recent times, the disease is not only spreading into larger areas, percolating into other States but also is showing more virulence among the infected persons.

Therefore, the Government of Karnataka is committed to provide all necessary inputs to phase out this disease in the near future, for which a Standard Operating Procedural Manual has to be in place, for the benefit of all those who are involved in such activities.

This Operational Manual on Kyasanur Forest Disease, has been brought out keeping in mind all the above aspects, and I sincerely hope that this manual will be of much use to all the Public Health cadres in providing qualitative service to the Community in High-risk areas of KFD and to take a major step ahead in attaining the goal of the Government of Karnataka viz., 'Health for all—Health everywhere'.

8.6.20

Pankaj Kumar Pandey, IAS
Commissioner of Health and Family Welfare
Govt. of Karnataka

Dr. Arundhathi Chandrasekhar, I.A.S.,
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ಆನಂದರಾವ್ ವೃತ್ತ, ಬೆಂಗಳೂರು – 560 009.

Message

Kyasanur Forest Disease (KFD) is a tick-borne Viral Disease being reported in the State since 1956. Subsequently, the disease has spread to a few contiguous States of Western Ghats and posing a threat to Public Health. Thus, KFD, which was regarded as a 'State subject'earlier, is gradually turning in to a disease of National Concern.

The State is providing the necessary support for Salaries and operational cost of the establishment of Virus Diagnostic Laboratory at Shivamogga and for the field stations at Sagar, Honnavar and Belthangadi. The staffing pattern and infrastructure was provided to serve the limited area and population at risk which existed 5 decades ago, where as it is insufficient to cope with the present day situations after considering the modifications and manipulations of the Eco-system and the increase in the population at risk.

Therefore, the National Health Mission started to supplement assistance since 2018-19, by way of providing Human Resource, with grants for IEC and Training activities. Provision is also made to take up Research work as there is a vast scope in various fields like improving the efficacy of Vaccines, studies regarding change in virulence of the virus strain, Eco-friendly Tick Control measures, Organic Tick repellants and so on, for Prevention and Control of KFD. Emphasis isalso on orientation of other departmental Officers/staff through Interdepartmental Workshops to elicit their co-ordination in combating the disease.

This operational Manual on Kyasanur Forest Disease, is the Primary Edition brought out by the Department of Health & Family Welfare, *though there were some Handouts, Writeups, and other educational materials for the use of high risk population*, which has covered every minute aspects of the Disease with implementation guidelines, and I am sure that this will help our Medical and Para-medical fraternity to pave the way for eliminating the disease in the coming years.

Mrs. Arundathi Chandrashekhar, IAS
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Message

Kyasanur Forest Disease is a tick-borne and Zoonotic disease confined to few districts of Karnataka since 1957. Presently, 10 districts have reported KFDV activity. Since 2015, he KFD cases were also reported from other states like Maharashtra, Goa, Kerala and Tamil Nadu. Over the years it is becoming a major public health concern. During 2019, the state has witnessed a major outbreak of KFD with 434 cases and 15 deaths. This triggered many activities in the state related to KFD including this manual preparation.

During 1990, Formalin-inactivated vaccination strategy was adopted by the state with technical inputs of NIV Pune. Till now, it remains the key strategy for prevention of KFD. Karnataka is also receiving indent from other states for vaccine doses and the state is fulfilling the same.

The Health Department plays a key role in KFD prevention and control. However, it requires Inter-departmental Co-ordination involving Animal Husbandry, Forest, RDPR and others stake holders. Role and responsibility of each stake holder is explained in the manual. Involvement of public in prevention of disease is through Personal Protection is explained in detail.

The manual covers all the Operational guidelines required at field-level including patient treatment. Hope this comprehensive document fulfill the needs of field-level Medical and Para-Medical staff to combat the disease.

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Preface

Kyasanur Forest Disease (KFD, locally better known as Monkey fever) is a Zoonotic disease which is being reported from Karnataka and other few contiguous States of Western Ghats in Southern India. The disease prevention and control guidelines are framed by the Directorate of Health and Family Welfare Services in coordination with the Deputy Director, Virus Diagnostic Laboratory-Shivamogga, and also by some of the most experienced professionals who have done yeoman service in the field of KFD. These guidelines are framed for the convenience of the Program Officers and Staff involved in the implementation of prevention and control activities, as well as to the Physicians, Pediatricians, Medical Officers/Clinicians for treatment and management of KFD cases at District/Taluk/ PHC levels.

In recent years, considering the disease epidemiology and its spread to newer areas, the Directorate of Health and Family Welfare Services, felt the need of a user friendly Operational Manual that can guide all those involved in implementing various activities of containing the Disease, in a more scientific and systematic way, since hitherto the information on the disease epidemiology and other related aspects were provided as a piece-meal.

This manual aims to bring all the facts and findings about KFD in an exhaustive manner and also for its use as an operational guideline at the field level. Efforts have been made to fill the gaps in providing proper guidance, and to be in line with IDSP and IHIP reporting. Reporting formats are redesigned and standardized to enable proper Monitoring and Evaluation. Role and responsibility of stakeholder at each level is explained in detail. As recommended by the State-level Technical Advisory Committee, the upper age limit for vaccination has been revised and incorporated in the manual. Technical issues related to Management of Hotspot are made clear. Guidelines are framed in such a way that it can be achieved without disturbing flora and fauna of Western Ghats.

This manual provides Operational and Technical guidance to help implementation at field level and can also be used as an authenticated reference material for further Research and Training purposes. The State, being in the frontline of KFD, I hope that this Operational Manual will also help other States to co-ordinate in combating KFD successfully.

Dr. Prakash Kumar B.G.
Joint Director (CMD) and
I/c Project Director (IDSP)

Acknowledgements

The manual was finalized under the leadership of Dr. Prakash Kumar B.G., Joint Director (CMD) who had a fore thought of preparing an Operational Manual on KFD and has initiated work to bring up this manual. He had personally reviewed all the chapters and gave suggestions throughout the process of manual preparation.

This manual was written and developed by Ms Sunanda M., Entomologist, State Surveillance Unit. She has co-ordinated with the specialists in field to get the inputs for manual. She has specially conducted an Operational Research Study to fill the gaps in Tick Surveillance and hotspot management.

Sri Sudarshan Kadambi Seshadri, Training-Consultant, NVBDCP, DH&FWS is acknowledged for his contribution in the field of KFD during 1980's. He has laid the basic framework for the manual. Timely advises and critical comments have helped in developing and finalizing the manual.

Dr Kiran SK, Deputy Director, Virus Diagnostic Laboratory, Shivamogga is acknowledged for his vast field experience in KFD which had resulted in improving Surveillance chapter. He has also framed 'roles and responsibility of various stakeholders' and 'role of other departments during hotspot management'. He is also acknowledged for providing KFD surveillance data for the manual.

Dr Satishchandra, Surveillance Medical Officer, WHO, Mangalore Division is highly acknowledged for his valuable inputs especially to the Human Surveillance, SOP for reporting, designing various reporting formats, vaccination chapters. He has reviewed all the chapters and suggested valuable inputs.

Dr Ravikumar K., Sr. Regional Director, Regional Office for HFW, Govt. of India is acknowledged for raising the critical issues and providing valuable inputs to the manual especially in Outbreak Investigation, Surveillance Monitoring Indicators, Role and responsibility of Officers at each level i.e., PHC, Taluk and District.

Dr Padma M.R., Deputy Director, State Surveillance Unit, DH&FWS is acknowledged for providing input for Generation of EPID number under IHIP and also for reviewing all the chapters and providing critical annotations specially Surveillance.

Ms Bhavana R., Entomologist, NVBDCP, DH&FWS is acknowledged for her reviewing and giving valuable suggestion especially for Surveillance and tick chapters. Also, assisted to conduct Operational Research study.

Dr Pallavi D.M., Medical Microbiologist, VDL Shivamogga is acknowledged for providing inputs to Laboratory Diagnosis and Vaccination chapter; and Ms Sandhya, Microbiologist, VDL, Shivamogga is acknowledged for her inputs to Laboratory Diagnosis and Vaccination chapter and also for providing the chronological details of the events related to KFD diagnosis, vaccine preparation, VDL development. Ms. Bhuvaneshwari, Consultant-Entomologist, VDL Shivamogga is acknowledged for providing valuable inputs specially to the 'Tick' and 'Tick surveillance' chapter and re-drawing the pictures required for manual. Sri Anand, Sr. Lab. Technologist is acknowledged for providing KFD surveillance data.

Dr Darshan, Research Associate, VDL Shivamogga is acknowledged for proving field activity photos, re-drawing the pictures required and providing valuable suggestions.

Sri Raghunandan, Data Manager, Demography, DH&FWS is acknowledged for designing cover page for the manual. Sri Mithun Rao, Wild-life Phtographer, Shivamogga is acknowledged for providing wildlife-related photos for the manual.

Dr. Kavita Saravu, Prof and Head, Department of Infectious Diseases, Kasturba Medical College, Manipal is acknowledged for contributing inputs to Clinical manifestation and Treatment.

Dr Anand K.J., Prof and Head, Department of Parasitology and Dr.Dhanalaxmi H, Asst. Professor, Department of Parasitology, Veterinary College, Hebbal, Bengaluru for their valuable inputs especially on ticks and tick control.

Dr Mohammad Shariff, Research Officer, NVBDCP; Dr Prashanth Bhat, DVBDCO, Udupi; Dr Mudassar Chanda, Scientist, ICAR-NIVEDI, Bengaluru; Dr Nagabhushan, Veterinary Consultant-IDSP; Dr Prasanna, NIV-Field Station, Bengaluru are acknowledged for reviewing the manual and providing valuable suggestions and inputs.

Dr Bhyregowda, Director, IAH&VB, Hebbal, Bengaluru is acknowledged for supporting the department in combating KFD by providing required vaccine doses.

The Directorate of Health and FW Services acknowledges all the Scientists and Researchers in the field of Kyasanur Forest Disease. Many of the study results and materials have been included in this Manual for the benefit of the Program Officers and Technical staff who are dealing with Prevention and control of KFD.

The Department of Health and FW Services acknowledges NIV Pune for the contributions in the field of KFD. They have been a great support since 1950' till date in terms of diagnosis and outbreak investigations. NCDC New Delhi is highly acknowledged for their continued technical support especially during outbreaks.

The State-level Technical Advisory Committee for KFD is acknowledged for valuable technical inputs to the manual. The staff from IDSP, SSU, JD (CMD) and JD (NVBDCP) are acknowledged for assisting in preparing manual.

I gratefully acknowledge Sri Jawaid Akthar, The Additional Chief Secretary, Department of Health and Family Welfare, Govt. of Karnataka for addressing the gaps in KFD surveillance and research.

I sincerely acknowledge Sri Pankaj Kumar Pandey, Commissioner, Department of Health and Family Welfare, Govt. of Karnataka for his continued support to strengthen the KFD surveillance.

I have great pleasure to acknowledge and appreciate all the grass-root level workers from ASHA to Medical officer, who are the backbone of health system. It is hoped that they will make best use of manual to curtail KFD in the state.

Dr. Prakash Kumar B.G.
Project Director (IDSP)

Acronyms

AEFI	Adverse Events Following Immunization
ARDS	Acute Respiratory Distress Syndrome
ASHA	Accredited Social Health Activist
CCHF	Crimean Congo Hemorrhagic Fever
CFR	Case Fatality Rate
CHC	Community Health Center
DD-VDL	Deputy Director, Virus Diagnostic Laboratory
DHO	District Health and Family Welfare Officer
DSO	District Surveillance Officer
DVBDCO	District Vector Borne Disease Control Officer
ELISA	Enzyme-linked Immunosorbant Assay
ILR	Ice-Lined Refrigerator
IDSP	Integrated Disease Surveillance Program
IHIP	Integrated Health Information Platform
MO	Medical Officer
NVBDCP	National Vector Borne Disease Control Program
PHC	Primary Health Center
RSSE	Russian Spring–Summer Encephalitis
RT-PCR	Reverse Transcription Polymerase Chain Reaction
SSU	State Surveillance Unit
THO	Taluk Health Officer
VDL, Shivamogga	Virus Diagnostic Laboratory, Shivamogga

Chapter - 1
Kyasanur Forest Disease

1.1 History and Introduction

Kyasanur Forest Disease (KFD) is a tick-borne viral hemorrhagic fever transmitted by the bite of 'Ticks' infected with KFD Virus. The disease was first reported during 1956 in 'Kyasanur Forest' of Shivamogga district, Karnataka, India. Hence, the disease was named Kyasanur Forest Disease. Currently, KFD is being reported from the States along the Western Ghats range, namely: Karnataka, Kerala, Tamil Nadu, Goa and Maharashtra.

The first report of occurrence of fever in people having a history of forest exposure in Kyasanur area, dates back to 1956. A large number of monkey deaths were also noticed during the same period, prior to fever incidence.

Though reports are available about monkey deaths in the reported area of Kyasanur during1918, they are not ascertainable. It would be hard to believe that such a susceptible animal, monkey would have remained unaffected if the virus was active in the natural cycle. Therefore, in all probability, the virus would have entered the monkeys through ticks somewhere in 1954 or 1955 (*1*).

Noticing the sudden spurt of fever, the erstwhile Government of Mysore ordered an emergency and declared a typhoid epidemic. As a part of containment measure, free distribution of antibiotics was initiated and patient care was intensified. However, the outbreak was not contained by anti-typhoid measures (*1*).

During the initial days of investigation, monkey fever (local terminology for KFD) was mistaken for Yellow Fever which is transmitted by the vector mosquito *Aedes aegypti*. But, the investigations revealed that there was neither population of *Ae. aegypti*, nor distinct canopy and ground biting mosquito fauna. Further, no Yellow fever virus was isolated from mosquito pools. Hence the occurrence of Yellow fever was ruled out (*1*).

Meanwhile, all field staffs working in Kyasanur forest area were vaccinated with 17-D strain of Yellow Fever vaccine. As a routine procedure, pre- and post-vaccination blood samples were collected from these field personnel and tested for virus. Preliminary results revealed the presence of Group B viral antibodies in some of the blood samples. But most significant was: a strain of virus was isolated from blood samples collected from four insect collectors. Also, isolation of similar virus from blood samples and tissue samples of sick and dead monkeys.

The virus isolated was identified as a virus belonging to Russian Spring Summer Encephalitis (RSSE) group. Since RSSE is a tick borne virus, all mosquito studies were given up, and studies on ticks were taken up. All these events lead to ruling out of occurrence of Yellow fever.

The studies were conducted on migratory birds to find their role in bringing ticks and virus from Soviet Union. A total of 8474 birds belonging to 184 species were collected and examined in Shivamogga district, out of which 1082 birds of 81 species were found to be infested with ticks. The genus *Haemaphysalis* accounted for 99.5% of all the ticks collected and the remaining belonged to genera *Dermacentor*, *Amblyomma*, *Boophilus* and *Hyalomma*. *H. spinigera* was the commonest species, followed by *H. wellingtoni* and *H. turturis*. The results of study indicated that there was no evidence of birds bringing ticks which was not indigenous to India (*1*).

Then, massive numbers of ticks were collected for further confirmation. The KFD virus was isolated from nymphs of *H. spinigera* and *H.turturis*. Subsequently, several other species of ticks were also found positive for KFD virus.

The erstwhile Virus Research Centre, Poona in collaboration with the Rockefeller Foundation Organization, along with the State Public Health experts initiated the collection of tick samples from bovines, rodents and humans, in and around the forest areas of Soraba and Sagara taluks of Shivamogga district. The constant laboratory studies on various tick samples collected from the said area resulted in the isolation of the virus in March 1957. **The virus isolated was coded as P9605**.

Kyasanur village, PHC Ulavi (previously in PHC Hosabale),
Soraba taluk, Shivamogga district

Global scenario

KFD Virus is reported from India only. The virus is found structurally similar to the Russian Spring Summer Encephalitis (RSSE) Virus. The other viruses which are closely related to KFD are Omsk Hemorrhagic Fever Virus in Siberia, Alkhurma Virus in Saudi Arabia and Nanjianyin Virus in China.

Country scenario

Tamil Nadu: During 2012–13, KFD Virus was detected in autopsy of dead monkeys in Nilgiri district of Tamil Nadu. Vaccination was done. No human case was recorded during that period. Later in 2016, 1 human positive case was reported.

Kerala: During 2013–14, six human cases were reported from Wayanad and Malappuram districts of Kerala. But in 2014–15, a major outbreak was reported with 102 human positives and 11 deaths.

Goa: In 2015–16, KFD outbreak was reported from North Goa district of Goa state with 36 human positives and 1 death.

Maharashtra: In 2016, KFD outbreak was reported from Sindhudurg district of Maharashtra with 129 cases and 8 deaths.

Human cases reported from other states in India

State / Year	2015	2016	2017	2018	2019
Kerala	102	9	0	0	8
Tamil Nadu	0	1	1	10	4
Maharashtra	0	129	202	109	82
Goa	36	284	85	59	19

In Karnataka

From 1957–1971, the disease was confined to Shivamogga district alone. During 1972, cases were reported from neighboring district: Uttara Kannada (Gadgeri village, Sirsi taluk). During 1980, cases were reported from Chikkamagaluru (Koppa); in 1982, Dakshina Kannada (including present Udupi district) has reported cases. In 2012, the disease was reported from Southern part of Karnataka in Bandipur forest area of Chamarajanagara district. In 2016, an outbreak occurred in Khanapura taluk of Belagavi district. In 2017, Gadag district has reported tick pool positive. In 2019, Mysuru district (Heggada Devena Kote) has reported 2 human positive cases; and in the same year, Hassan district has reported 1 human positive, 2 tick pool positives and 1 monkey positive.

KFD Virus activity reporting taluks in Karnataka

Sl. No.	District	Taluks
1	Shivamogga	Sagar, Thirthahalli, Hosanagara, Soraba, Shikaripura, Shivamogga and Bhadravathi
2	Uttara Kannada	Siddapura, Honnavar, Bhatkal, Joida, Sirsi, Ankola and Kumta
3	Chikkamagaluru	Sringeri, Narasimharaja Pura, Koppa and Mudigere
4	Udupi	Udupi, Kundapura, Karkala
5	Dakshina Kannada	Mangalore, Puttur and Belthangadi
6	Chamarajanagara	Gundlupete
7	Belagavi	Khanapura
8	Hassan	Beluru and Sakaleshapura
9	Mysuru	Heggada Devana Kote
10	Gadag	Mundargi

Geographical spread of KFD reported over the years in Karnataka

1957

1972

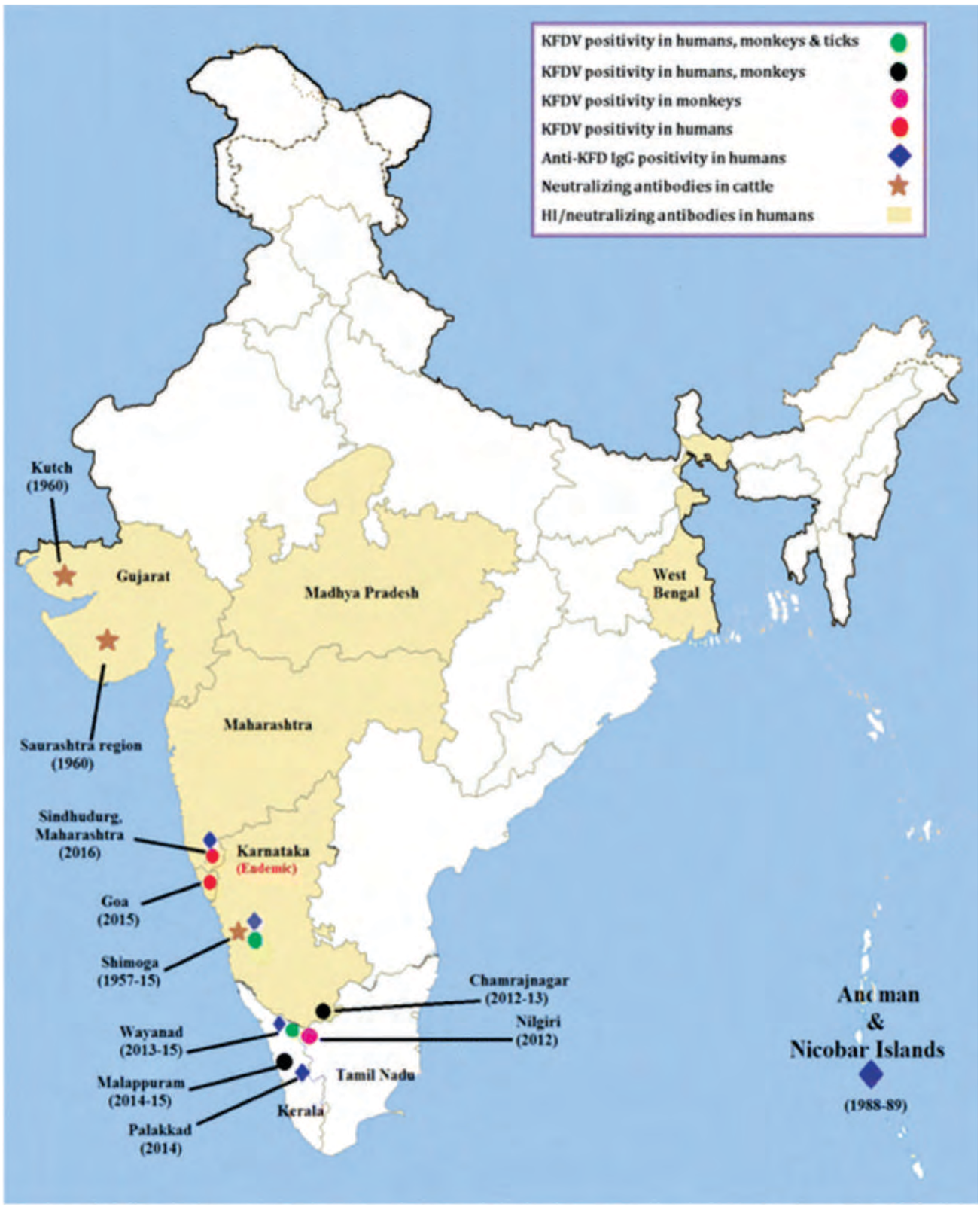
1990

2012

2018

2019

KFD Virus activity recorded in India



[Source: (3)]

Chapter - 2
Epidemiology

KFD is being reported from Western Ghats of Southern India which consists of evergreen, deciduous and semi-deciduous forest on the slopes mixed with bamboo and shrub jungle at the edges. The villages or discrete hamlets range in size from a cluster of few houses to over a hundred. Villagers frequently visit the forest for collection of fire woods/ dry leaves and get infected by tick bites. Also, the forest sustains a large population of wild monkeys which harbor these ticks. High-humidity generated from the cultivated field is suitable for maintenance of ticks throughout the year.

Forest area

Cattle grazing

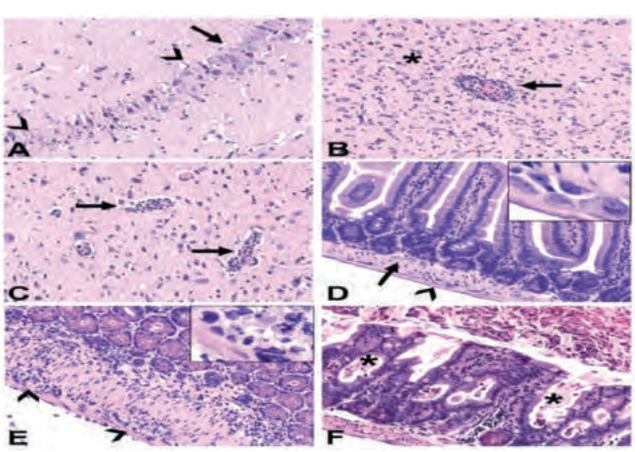
A typical natural forest of Malnad with heavy forest-floor vegetation

2.1 Epidemiological triad

2.1.1 Agent

The causative agent is KFD Virus which is capable of causing disease.

KFD Virus is an Arthropod-borne virus classified under Group B—Togaviridae family, Genus: Flavivirus, with positive sense, single-stranded RNA genome measuring ~25-m in diameter and ~11-kb in length and encodes a single polyprotein which can be cleaved into three structural (C, M and E) and seven non-structural (NS1, NS2a, NS2b, NS3, NS4a, NS4b and NS5) proteins.



(A) Brain, hippocampus, KFDV-infected mouse; (B) Brainstem, KFDV-infected mouse; (C) Brainstem, AHFV-infected mouse; (D) Small intestine, mock-inoculated mouse; (E) and (F) Small intestine, KFDV-infected mouse [Source: (*4*)].

Origin of the virus: Many theories are in vogue about the origin of KFD Virus. One of the theories is that migratory birds and many wild birds might have brought this virus into the country—has been ruled out. It is now accepted that the virus might have been in circulation in Malnad forests very early from before only, but due to the difficult terrain there was hardly any human movement in these deep forest areas. However, due to manipulation of the forest and ecological changes, the virus might have become active and the gradual increase in movement of humans along with migration of susceptible mammalian hosts due to de-forestation has caused infections which later-on was developed into epidemic proportions.

2.1.1 Host

Natural/reservoir host: A reservoir is critical for the maintenance of virus which circulates between the vector and the reservoir. They can become infected by a virus and develop a low-level viremia, sufficient for transmission to a blood-feeding arthropod, without becoming ill. In KFD, reservoirs of virus are mainly porcupines, rats, squirrels, mice and shrews (birds and bats have less significant as reservoirs). They do not suffer from the disease.

Natural/ reservoir host

Amplifying host: Primates, black-faced Hanuman langoors (*Presbytis entullus*) and red-faced bonnet monkeys (*Macaca radiata*) are the *amplifying* and *susceptible* hosts since they amplify virus load. These infected monkeys develop tremendous viremia and suffer from the disease like humans. In the recent years, it is observed that the Bonnet monkeys are found dead. Monkey death acts as a "**sentinel event**" to forecast a possible epidemic in an area.

Red-faced bonnet monkeys
(*Macaca radiata*)

Black-faced Hanuman langoor
(*Presbytis entullus*)

Maintenance host: Larger animals such as goats, sheep and cattle may become infected but play a limited role in transmission of the disease to human. These animals neither suffer nor amplify KFD Virus but have shown the presence of antibodies to the virus. However, they play a major role in maintaining and distributing the tick population.

Dead-end/ accidental host: Human accidentally comes in contact with the tick. The infected ticks transmit the virus to human and he suffers from the disease. Human is dead-end in natural cycle of the virus. There is no human-to-human transmission.

2.1.1 Environment

It is an external factor that allows disease transmission.

Climatic factors: Temperature, humidity, rainfall, affects 'reservoir animal population', 'vector distribution' and also affects 'pathogenecity of virus'.

Ecological factors: Human population growth, displacement, socio-economic status, changes in pattern of residence and land use, deforestation, expanded agriculture practices and projects like Sharavathi Hydro-Electric, Beltangadi project, etc. in the forest area, favors disease transmission.

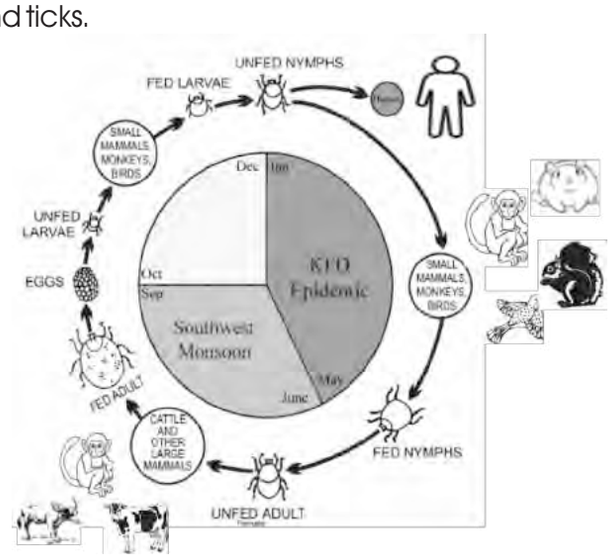
2.1.2 Vector

The hard ticks *H. spinigera* and *H. turturis* are the main vectors in transmitting the disease. Nymphal stage is the most active stage for transmission of KFD Virus to human. Transmission of virus is through tran-stadial transmission [trans-ovarian transmission has been reported under laboratory conditions in *H. spinigera* species (5)].

Ticks species belonging to genera *Haemophysalis, Ixodes, Dermacentor, Rhiphicephalus, Amblyomma, Ornithodoros* are identified as vectors of KFD. *H. spinigera* is the chief vector of KFD.

2.2 Transmission dynamics

Transmission season: Usually the disease transmission begins from late November and continues till the end of June every year. It peaks between December and March months of the year. The transmission is interrupted by the onset of monsoon. The lean period is from July to October. However, the sighting of monkey deaths is an early sign of transmission of the disease. The transmission cycle involves mainly monkeys and ticks.



Natural cycle of KFD

The disease is transmitted by the bite of infective tick, especially Nymph stage. The tick once infected, remain infective throughout its life.

Usually, adult ticks feed on cattle and other large mammals. Inside the forest they feed on monkeys and other mammalian forest hosts. However, they rarely feed on human and can be easily identified by the humans when they are attached on the skin of the human. The adult ticks can be removed or plucked out. But the nymphs which feed on any animal/ rodent/ humans due to their small size and as they are not sensed by the skin when they attach on to the host, cause the infective bite and transmit the disease to monkeys and human.

The wild monkeys *Macaca radiata* and *Semnopithecus entellus*, contracting the disease develop fever, get dehydrated and move towards the water sources either in the forest or near the human settlements where they succumb to the disease. After the death, the body temperature comes down; the ticks which are present on the skin of such monkeys move on to the nearest forest floor generating '**Hotspot**'. Thus, the infected ticks which were deep inside the forest move towards the outskirts of the forest near human settlements along with the infected monkey. Then they settle down on the forest floor and bite humans when they move into the forest, by attaching onto their skin, as they brush the forest floor when they move. Human is only a tangential host and a 'dead end'.

Usually a tick takes a few hours to get accustomed to the surrounding temperature (of the skin) and then bites the host for blood meal. This advantage is used in advising the humans moving into the forest to come back within 2 hours and dip all the clothes in hot water and pluck out the nymphs sticking on to their skin, before they could bite. It is always advisable to apply tick repellent before visiting the forest.

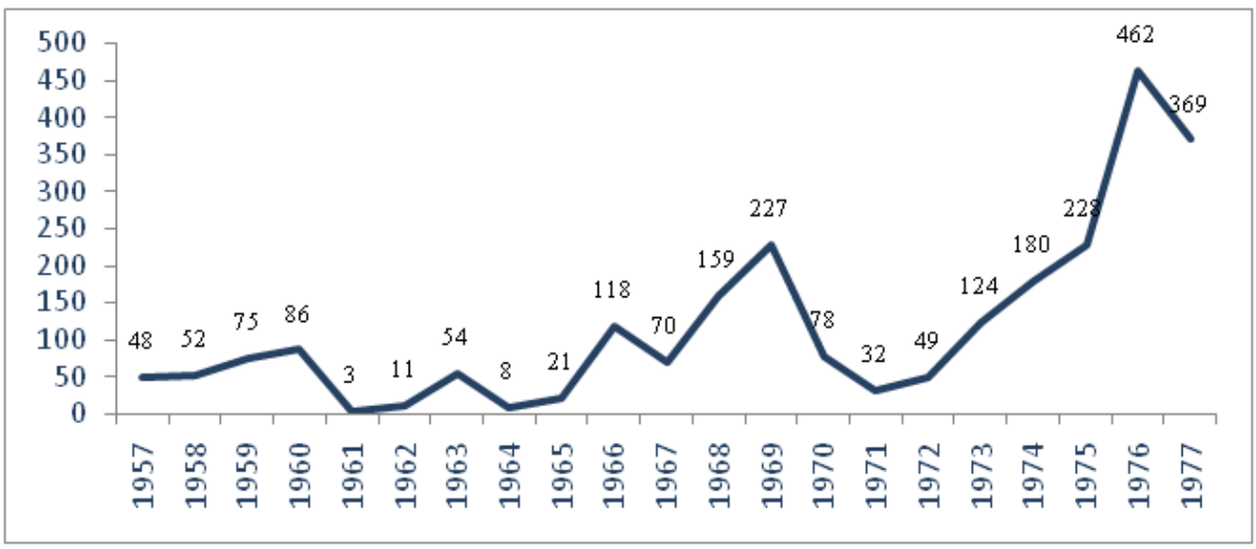
Available epidemiological data does not suggest any human-to-human transmission. However, human cases have been reported in the past while working on this virus in the laboratory.

2.3 KFD status in Karnataka

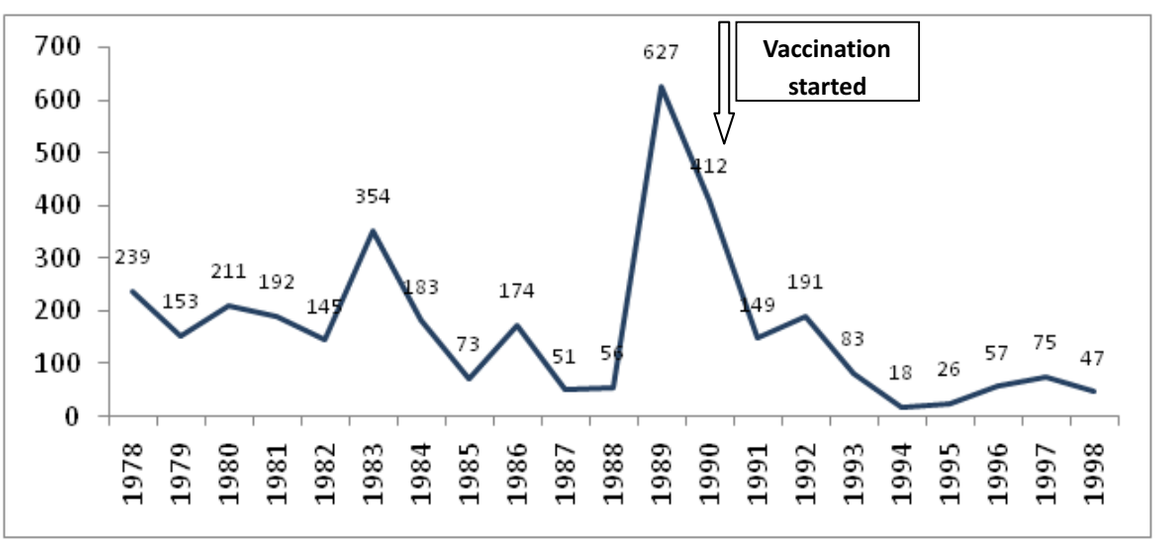
Year	No. of serum samples tested	No. of human positives	No. of human deaths	No. monkey autopsy	Monkey positive
1956	47	INA	INA	INA	INA
1957	466	48	4	17	6
1958	281	52	1	20	6
1959	448	75	3	114	45
1960	200	86	9	60	24
1961	44	3	0	22	5
1962	104	11	2	43	20
1963	213	54	2	71	35
1964	91	8	0	47	22
1965	101	21	0	38	15
1966	303	118	2	76	36
1967	209	70	4	31	11
1968	314	159	9	50	32
1969	503	227	12	26	15
1970	435	78	2	16	8
1971	424	32	5	30	4
1972	219	49	4	20	6
1973	330	124	2	21	4
1974	693	180	2	20	6
1975	898	228	4	18	5
1976	1128	462	11	0	0
1977	1520	369	7	5	0
1978	662	239	7	4	0
1979	524	153	10	4	1
1980	711	211	13	7	0

Year	No. of serum samples tested	No. of human positives	No. of human deaths	No. monkey autopsy	Monkey positive
1981	571	192	11	5	0
1982	563	145	14	0	0
1983	1555	354	110	10	0
1984	877	183	171	4	0
1985	378	73	10	3	1
1986	576	174	7	4	0
1987	228	51	10	2	1
1988	316	56	6	6	1
1989	1636	627	14	25	0
1990	1309	412	22	12	0
1991	967	149	9	12	1
1992	1188	191	5	10	0
1993	699	83	3	10	0
1994	110	18	0	5	0
1995	174	26	2	2	0
1996	140	57	3	1	0
1997	277	75	4	4	0
1998	298	47	1	0	0
1999	159	10	0	1	0
2000	142	30	3	2	0
2001	383	59	2	7	0
2002	546	98	6	11	1
2003	953	306	11	11	1
2004	568	153	5	10	2
2005	661	63	3	7	1
2006	354	99	2	16	3
2007	76	14	0	5	0
2008	112	36	0	7	0
2009	179	64	1	16	1
2010	5	0	0	9	0
2011	41	19	1	8	5
2012	359	97	1	22	5
2013	82	17	1	17	4
2014	400	166	1	8	3
2015	126	41	1	8	4
2016	115	25	0	3	2
2017	250	45	3	12	1
2018	536	37	0	18	3
2019	6723	434	15	305	41
2020 (till 31st March)	4967	165	2	107	3

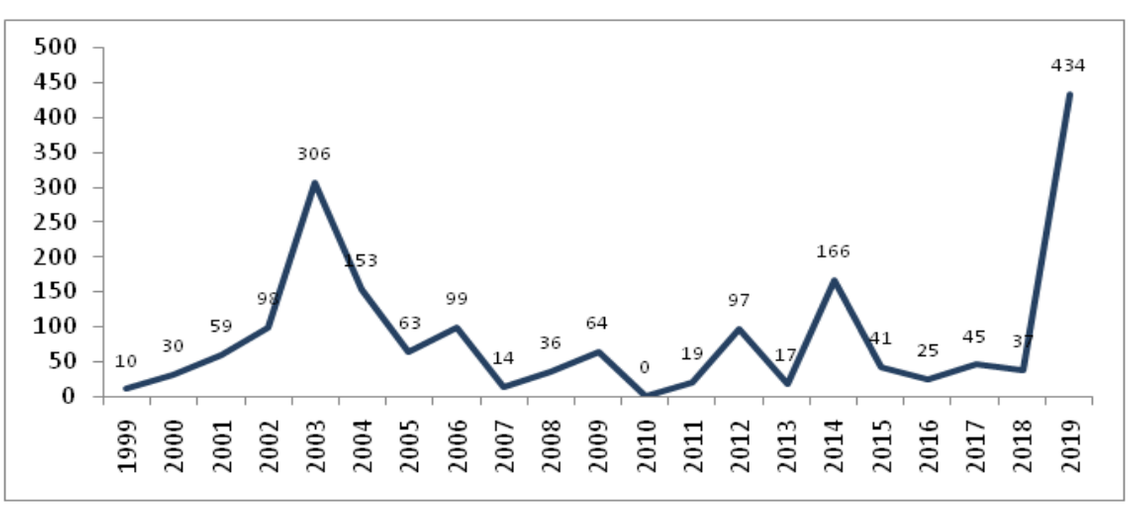
Trend of confirmed KFD cases in the State from 1957 to1977



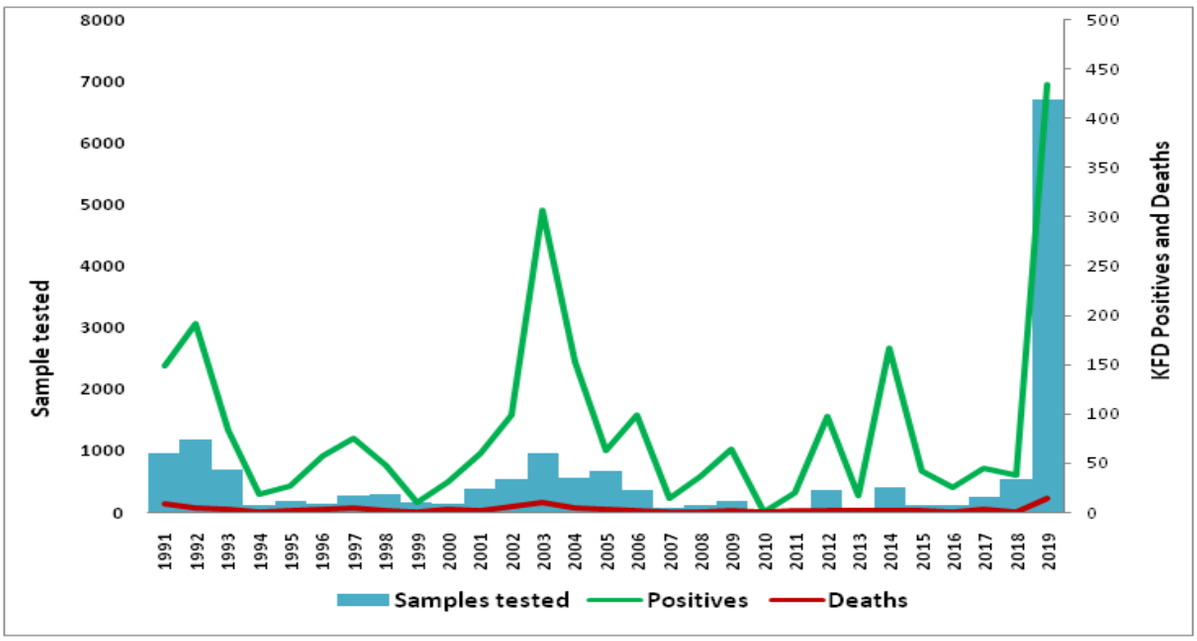
Trend of confirmed KFD cases in the State from 1978 to 1998



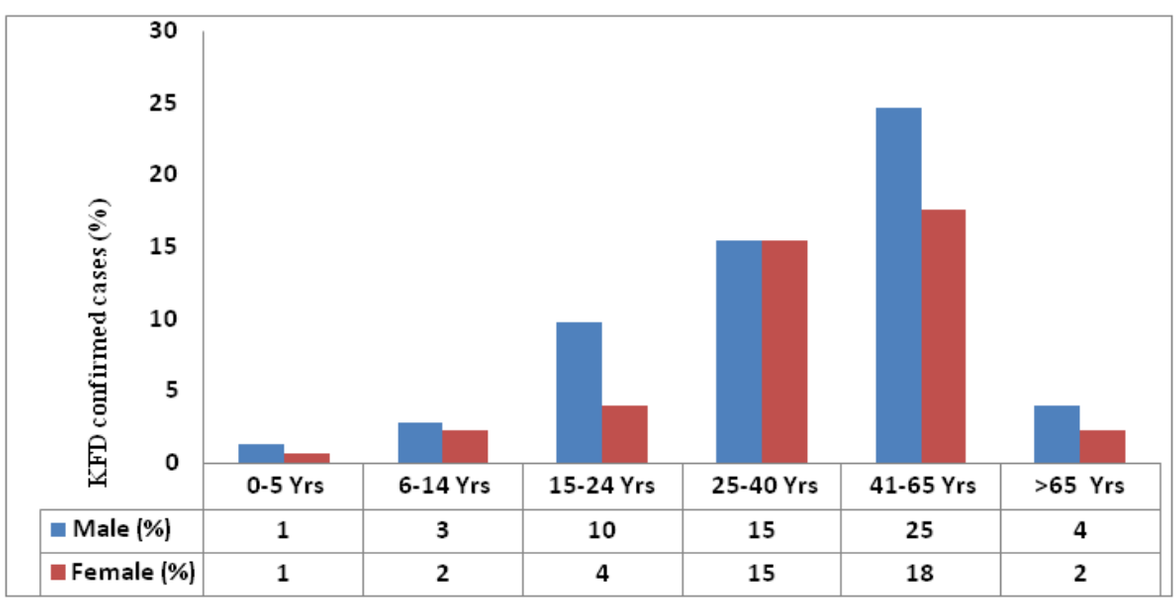
Trend of confirmed KFD cases in the State from 1999 to 2019



KFD samples tested, positives and deaths reported in Karnataka from 1991 to 2019

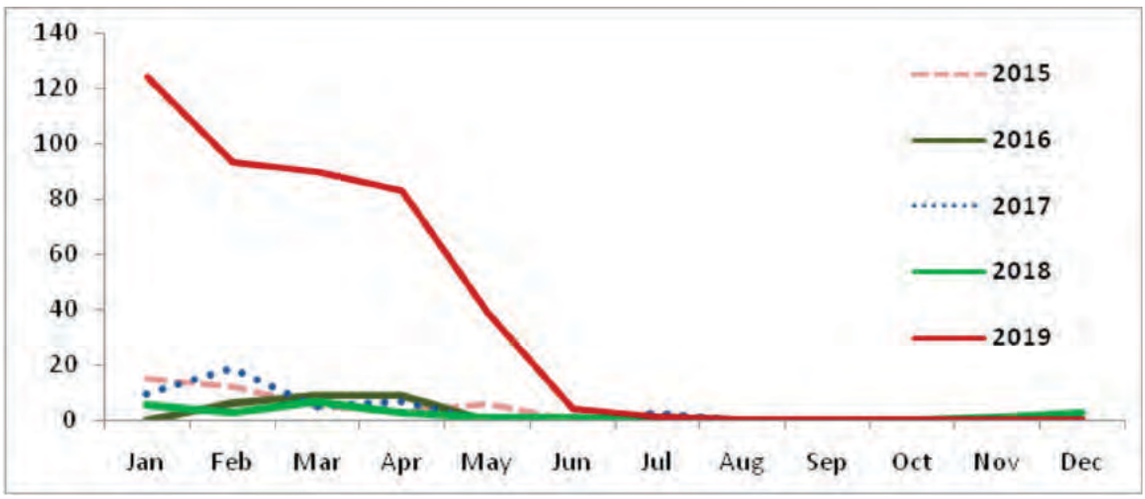


Age and gender-wise distribution of confirmed KFD cases in Karnataka From the year 2009 to 2019 (*n* = 869)

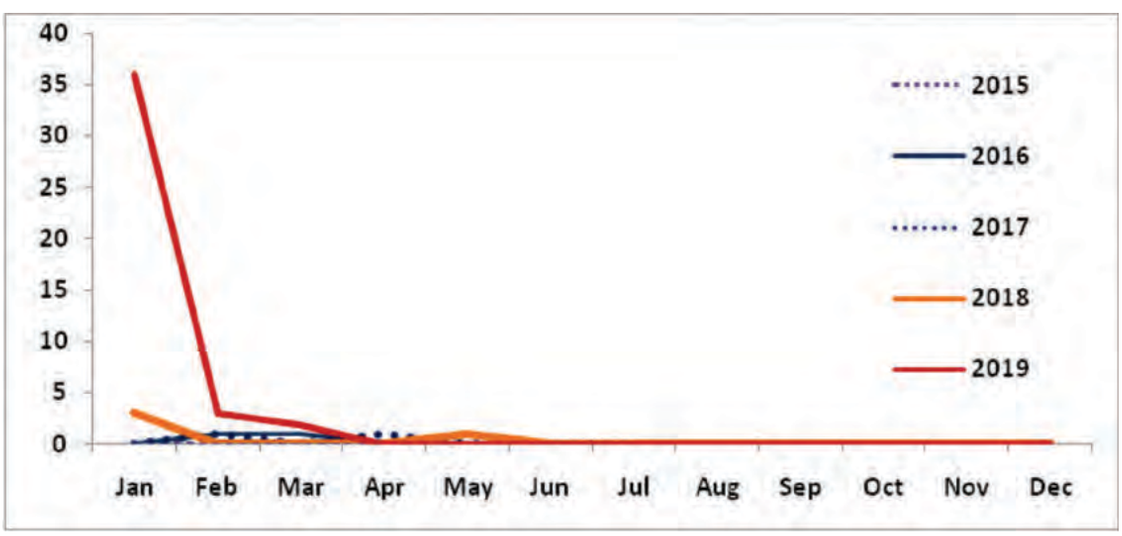


	0-5 Yrs	6-14 Yrs	15-24 Yrs	25-40 Yrs	41-65 Yrs	>65 Yrs
Male (%)	1	3	10	15	25	4
Female (%)	1	2	4	15	18	2

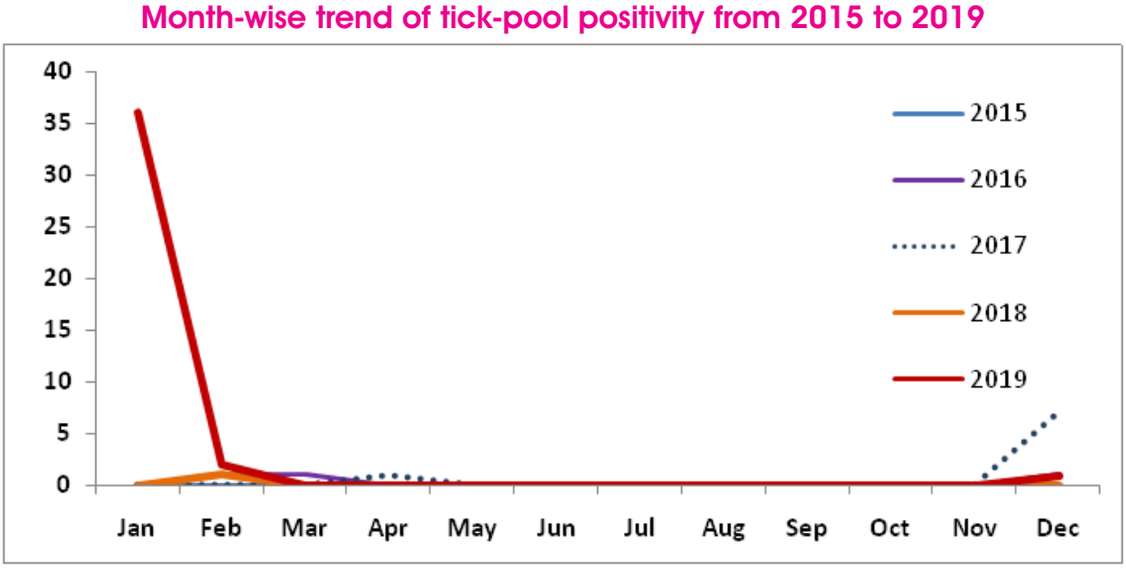
Month-wise trend of KFD human positives from 2015 to 2019



Month-wise trend of individual monkey positive from 2015 to 2019



Month-wise trend of tick-pool positivity from 2015 to 2019



Chapter – 3
Vectors of KFD

3.1 Introduction

Ticks are obligate blood sucking arthropods found in almost every region of the world. They belong to the Family Ixodidae of the Order Acarina of Subclass Acari and Class Arachnida. They are very important vectors of human and animal diseases. They surpass all other arthropods in the variety of pathogenic organisms transmitted to human and animals, which includes viruses, rickettsia, protozoa and bacteria. Many of these diseases are Zoonotic in nature causing infection to the human population who are closely associated with cattle and forest. Ticks rank second only to mosquitoes as vectors of human diseases.

Immature stages of these ticks often feed on rodents, lagomorphs, birds and so on, which are resources of some of these disease causing pathogens. The pathogens may be transmitted to human and domestic animals when the immature stages of these ticks feed on them.

There are a number of arbo-viruses which are known to be transmitted by Ixodid and Argasid ticks. Most of the times the reservoir hosts will be domestic animals or animals in the sylvatic cycle. All over the world, over 80 such viruses have been recorded with tick involvement. However, in India, the isolation of viruses from ticks and their hosts has been restricted only to a few areas.

Important tick-borne disease reported in India

Disease	Principle Vector	Causal organism	Reservoir
Kyasanur Forest Disease (KFD)	*H. spinigera*	Arbovirus group B	Monkey/ birds/ rodents
Crimean Congo Hemorrhagic Fever (CCHF)	*Hyalomma species*	Nairovirus	Cattle, camel
Indian tick typhus	*Rhipicephalus sanguineus*	*Rickettsia conorii*	Dogs
Relapsing fever	Soft ticks species	*Borrelia duttoni*	Rats

3.2 The tick studies: historical background

Ticks, which have been around in much the same form for ~200-million years, are among the oldest and most successful groups of arthropods. They were described as pests by the ancient Greeks and ever since have been treated in literature mostly with revulsion. These primitive, obligate, blood-sucking parasites prey on every class of vertebrate in all parts of the world. Ticks were the first arthropods to be clearly established as vectors of infectious disease, owing to the discovery in 1893 by Smith and Kilbourne of the role of *Boophilus annulatus* as the vector of *Babesia bigemina*, the protozoan responsible for Texas fever in cattle. In 1903, ticks were first proved as vectors of human disease, when JE Dutton, working in the Congo, discovered the principal cause of endemic relapsing fever (named *B. duttonii* in his honor) and its *Argasid* (soft-tick) vector, *Ornithodoros moubata* (6).

The history of Indian ticks dates back to the time of Linnaeus who described *Acarus elephantinus* in 1758 and *Acarus indus* in 1767 from India. Both these species were invalid according

to Neumann (1911) who published a monograph on ticks, Ixodidae; wherein he described a few tick species belonging to seven genera: *Haemaphysalis, Ixodes, Amblyomma, Aponomma, Dermacentor, Hyalomma* and *Rhipicephalus* from India. Subsequently, a number of new species belonging to the above genera were described and published between 1911 and 1938 (6).

The discovery of Kyasanur Forest Disease (KFD) from ticks in March 1957 marked a next milestone in the history of Indian tick studies and had stimulated extensive studies on different aspects of studies on Indian ticks, which included taxonomy, distribution, biology and ecology, disease relationships and control. Subsequently, the tick fauna of the KFD which presented a perplexing array of nomenclature and identifications problems, involving larvae, nymphs and adults of 14 *Haemaphysalis* species, were solved by the classic work by Trapido *et al*. (1964) who prepared a key for the identification of these ticks. Detailed studies on the ecology of ticks in India are mostly confined to the ticks of KFD area. The extensive field studies on *H. spinigera*, the main vector of KFD by R.G. Bhat (1968) will remain classic in the field of ecology of Indian ticks (*6*).

In KFD area, a total of 41 species of ticks have been recorded (*7–10*). They belong to genus *Haemophysalis* species (20), *Ixodes* (3), *Dermacentor* (1), *Amblyomma* (3), *Rhipicephalus* (3), *Boophilus* (1), *Hyalomma* (2), *Aponomma* (3), *Nosomma* (1), *Ornithodoros*(2) and *Argas* (2).

The KFD Virus has been isolated from 16 species (*7*): 10 species of genus *Haemophysalis*; 2 species of genus *Ixodes*; 1 species each from genus *Dermacentor*, *Amblyomma*, *Rhipicephalus* and *Ornithodoros*. In KFD area, 95% of the isolations are from *Haemaphysalis*. *H. spinigera* is the most predominant species and has also yielded the maximum number of isolates. This species is considered to be the chief vector of the disease. There was an average of 2.5 ticks per infected person.

List of tick species recorded in KFD endemic area: Karnataka

Sl. No.	Tick species		Sl. No.	Tick species
1	*Argas robertsi*		22	*Haemaphysalis canestrinii*
2	*Argas vespertilionis*		23	*Haemaphysalis cornigera shimoga*
3	*Amblyomma integrum*		24	*Haemaphysalis cuspidata*
4	*Amblyomma javanense*		25	*Haemaphysalis donitzi*
5	*Amblyomma testudinarium*		26	*Haemaphysalis indica*
6	*Aponomma gervaisi*		27	*Haemaphysalis intermedia*
7	*Aponomma leave*		28	*Haemaphysalis papuana kinneari*
8	*Aponomma lucasi*		29	*Haemaphysalis kyasanurensis*
9	*Boophilus microplus*		30	*Haemaphysalis leachi*
10	*Dermacentor auratus*		31	*Haemaphysalis megalaimae*
11	*Ixodes vespertilionis*		32	*Haemaphysalis minuta*
12	*Ixodes petauristae*		33	*Haemaphysalis spinigera*
13	*Ixodes ceylonensis*		34	*Haemaphysalis turturis*
14	*Nosomma monstrosum*		35	*Haemaphysalis wellingtoni*
15	*Ornithodoros chiropterphilia*		36	*Haemaphysalis hystricis*
16	*Ornithodoros piriformis*		37	*Haemaphysalis obese*
17	*Rhipicephalus haemaphysaloides*		38	*Haemaphysalis leachii*
18	*Rhipicephalus ramachandrai*		39	*Haemaphysalis centropi*
19	*Rhipicephalus sanguineus*		40	*Hyalomma anatolicum anatolicum*
20	*Haemaphysalis aculeata*		41	*Hyalomma marginatum issaci*
21	*Haemaphysalis bispinosa*			

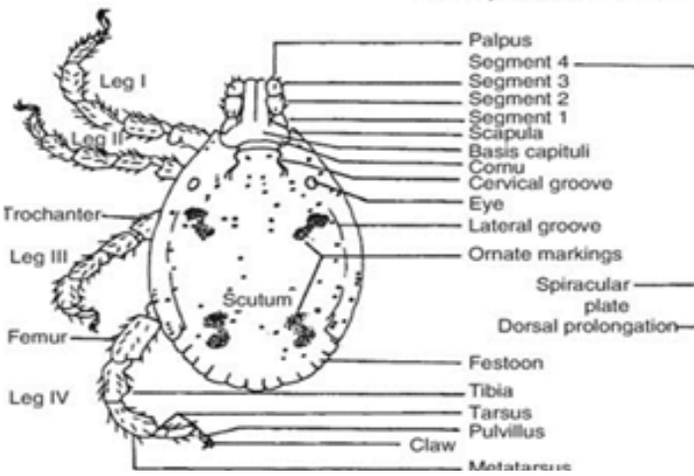
Vectors of KFD Virus

Sl. No.	Vector species
1	*Haemaphysalis spinigera*
2	*Haemophasilis turturis*
3	*Haemaphysalis kinneari*
4	*Haemaphysalis kyasanurensis*
5	*Haemaphysalis minuta*
6	*Haemaphysalis wellingtoni*
7	*Haemaphysalis cuspidata*
8	*Haemaphysalis bispinosa*
9	*Haemaphysalis intermedia*
10	*Haemaphysalis shimoga*
11	*Ixodes petauristae*
12	*Ixodes ceylonensis*
13	*Dermacentor auratus*
14	*Amblyomma species*
15	*Rhipicephalus haemophysaloides*
16	*Ornithodoros chiropterphite*

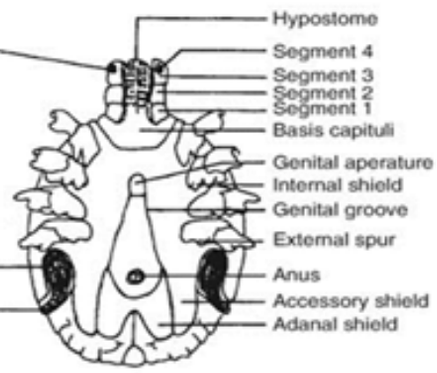
3.3 Morphology

The body of a tick is divisible into an anterior region, gnathosoma (capitulum), and a posterior region called the idiosoma or the main body part. In the *Ixodidae*, a sclerotized shield called the scutum covers the entire dorsal surface. However, in the female larvae and nymph, it covers only the anterior region. Scutum is absent in *Argasidae*. There are a number of grooves on the scutum and these are named after their location on the scutum, namely cervical, lateral, marginal grooves. The scutal surface also may bear a number of small pits called punctations, which vary in size and number. The posterior end of the idiosoma is divided into a number of rectangular areas called festoons. Eyes when present are situated on the lateral margins of the scutum, anteriorly in males or at the greatest width of scutum in the female. Important structures placed on the ventral side of the ticks are: (a) ventral plates; (b) genital aperture placed anteriorly covered by a delicate sclerotized flap called the genital operculum; (c) anus on the posterior side; and (d) spiracle. The mouthparts consist of a tongue-like projection called the hypostome over which lie dorsally a pair of chelicerae, which are used for piercing. Chelicerae consist of long movable shafts and cutting digits attached dorsoanteriorly. Hypostomes possess a number of rows of backwardly directed curved teeth, which vary in shape, size and number. A sensory organ called Haller's organ is situated dorsally on the tarsus of leg number 1. This organ is unique and is believed to be olfactory in nature.

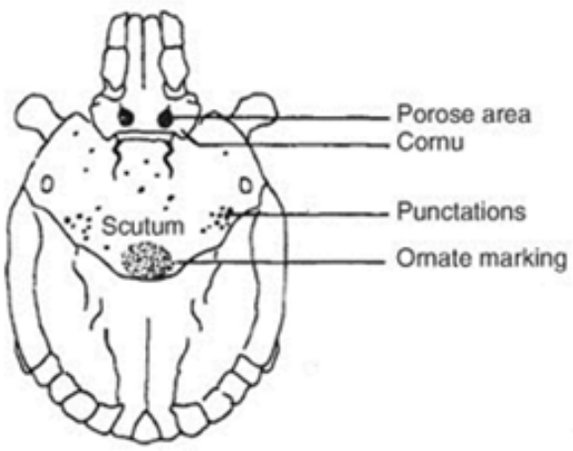
Male and female Ixodidae (hard tick) with key



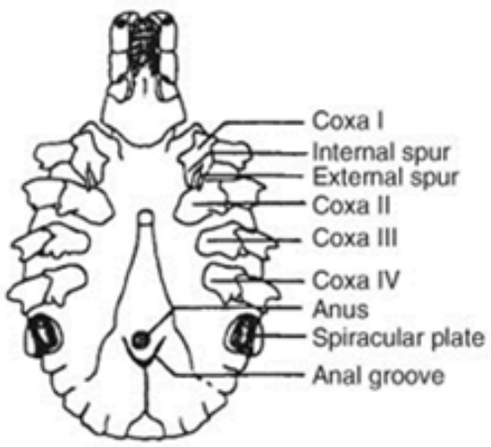
Dorsum of male



Venter of male



Dorsum of female



Venter of female

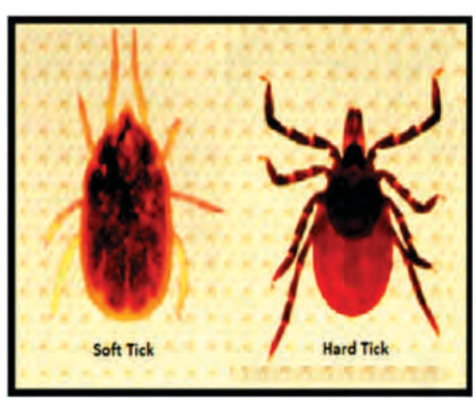
Dorsal view

Ventral view

3.4 Classification

There are two major families: the hard ticks (*Ixodidae*), comprising about 650 species, and the soft ticks (*Argasidae*), comprising about 150 species. Both are different in terms of morphology, feeding pattern and life cycle. The differences between hard tick and soft tick are as follows:

	Ixodidae (hard ticks)	**Argasidae (Soft ticks)**
Gnathosoma	Terminally located, visible from dorsal aspect	Subterminally located, not visible from dorsal aspect (except larvae)
Scutum	Present	Absent
Integument	Smooth or superficially folded, grows vastly during feeding	Leathery cuticle allows rapid but limited expansion
Life cycle	Three distinct life stages	Non-uniform number of nymphal stages
Feeding	One feeding per each life stage, secrete attachment cement, remove water from blood meal via the salivary glands	Multiple feedings during the nymphal and adult stages, no attachment cement, remove water from blood meal via coxal glands
Mating	Occurs mostly on the host, essential for feeding accomplishment	Occurs off the host, not important for feeding accomplishment
Oviposition	Lay 1 huge batch of eggs (up to 23,000) and then dies	Lay small batch of eggs (200-300) after each feeding
Host seeking	Ambush passing hosts.	Mostly nidicolous, attacks hosts in nest, caves, etc.

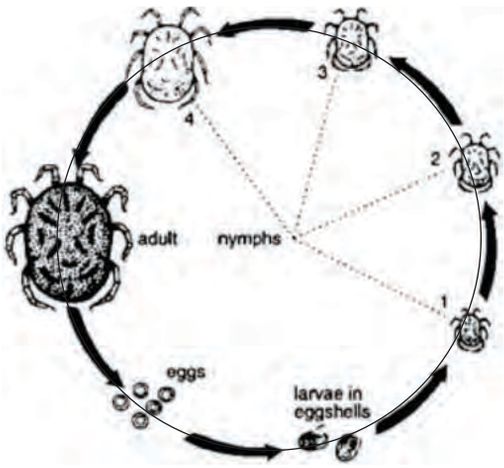


3.5 Life cycle

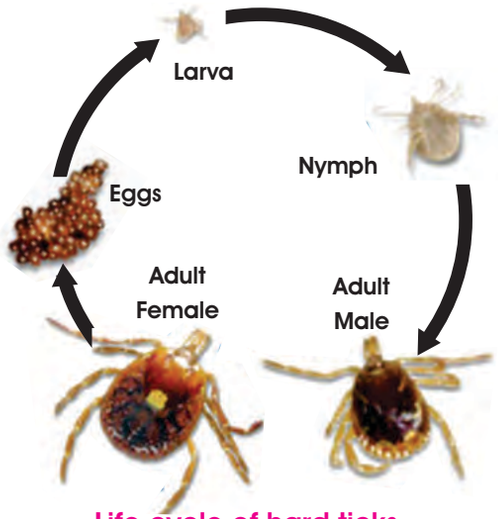
Ticks possess four developmental stages *viz*., egg, larva, nymph and adults.

Life stages of genus *Haemophysalis*: eggs (left-hand corner), larva, nymph and adult (male and female)

Soft ticks have two or more stages. Hard ticks usually feed and engorge with blood only once during each stage that contribute to their remarkable success and vector potential.



Life cycle of soft ticks



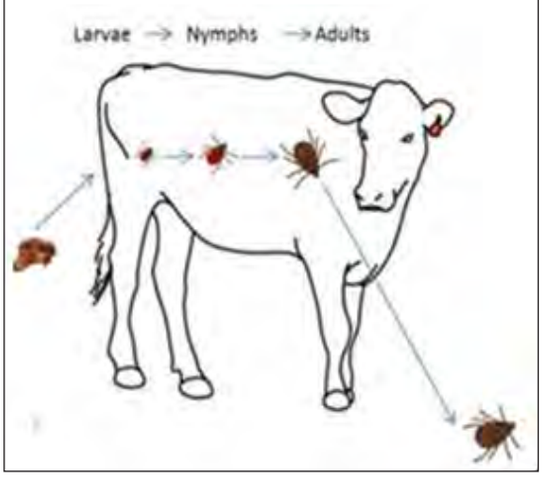
Life cycle of hard ticks

On the basis of the number of hosts required for completion of life cycle, ticks are categorized into three types, *viz*.:

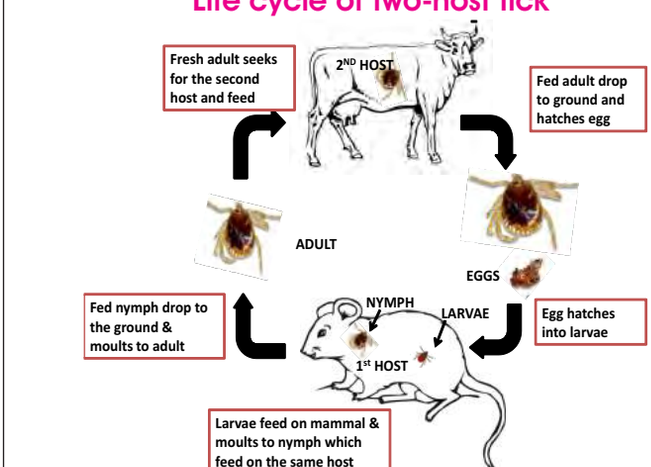
One host ticks—remain on a single host from the time of their first attachment as larvae to the time when they drop as fully-fed adults. Example: *Boophilus microplus*.

Two host ticks—the larvae attach themselves to the host, feed and moult into nymphs which feed on the same host and then drop to the ground. The adults emerging from these nymphs attach to another host and drop down for egg laying. Example: *Hya. isaaci*. In this case, the fed larvae undergo moulting in the host without detachment from the host.

Life cycle of one-host tick



Life cycle of two-host tick



Three host ticks—in which larvae, nymph and adults feed on separate hosts. The vertebrate hosts may be of the same species and or of different species, e.g. all species of *Haemaphysalis* ticks (see Section 3.5.1). Some of the tick species such as *Hya. anatolicum* behave as both two and three host ticks. Compared to hard ticks, soft ticks have a number of gonotrophic cycles and there is more than one nymphal instar in the life cycle. The duration of feeding is restricted to a few minutes. In most of the hard ticks there is a rhythm with regard to the dropping of fed stages of the ticks, which is

synchronized with the daytime when the host is actively grazing in the field. Two species *viz*., *Hya. anatolicum* and *H. bispinosa* are exceptions to this. They drop only during night when their hosts i.e. cattle, are taking rest inside the cattle shed.

3.5.1 Life cycle of *H. spinigera*

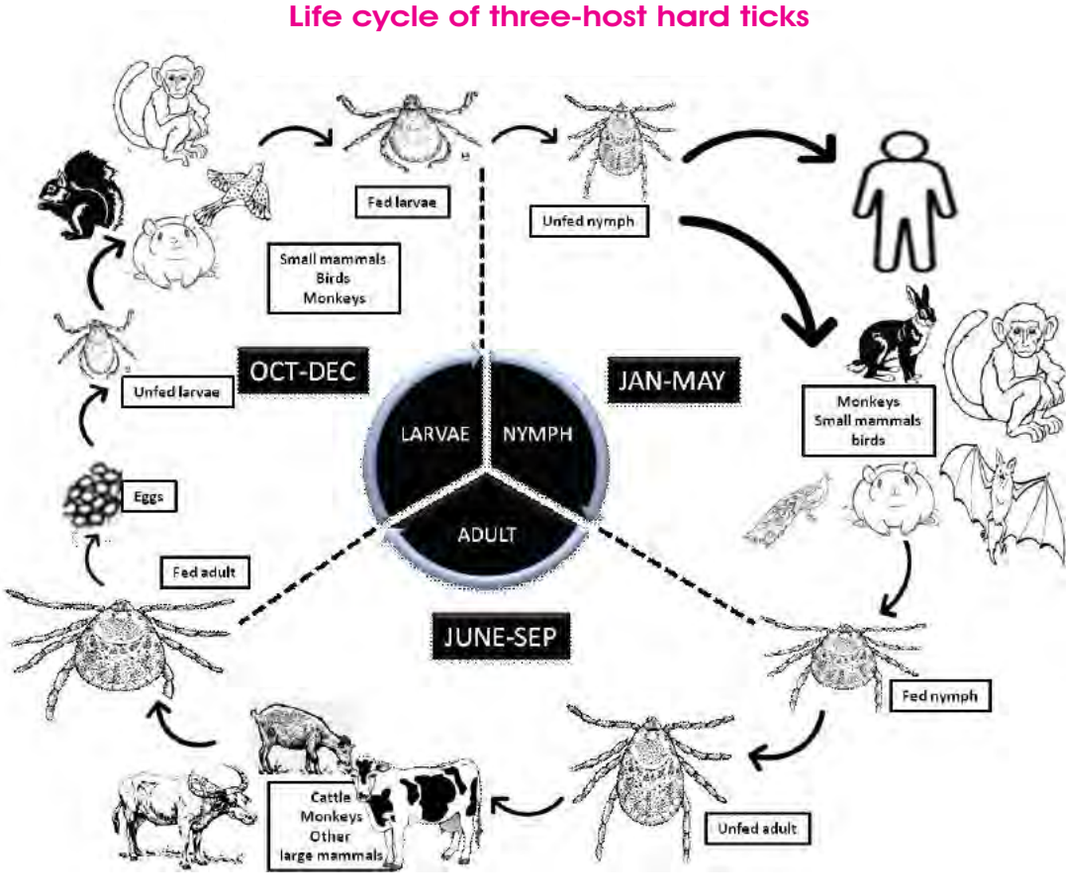
It is a predominant vector of KFD, is a *three-host tick*. The life cycle is as follows:

Eggs and larvae (October–December): During post-Monsoon, the adult tick lay their eggs in sheltered spots, under the stones, soil near the wooden surface, cracks and crevices of the walls. Eggs are small, spherical, light to dark brown in color and are laid in masses. These eggs will hatch into six-legged larvae and these larvae feed on small mammals and rest underneath the leaves and vegetation. The eggs laid down by the unmated females are not viable and fertile. Larval prevalence is from November–December. Infection of tick with KFD Virus takes place during larval stage. After moulting to nymphs, it becomes capable of transmitting the virus to other animals upon which it feeds.

Nymphs (January–May): After 10–20 days, larvae are transformed to nymphs with four pairs of legs and rests underneath the leaves and vegetation, and wait for blood meal (questing stage). These nymphs are attached to hosts and sucks blood for 1–6 days. The nymphs get infected with KFD Virus during larval stage. When they bite monkeys/ human beings, the virus gets transmitted. Engorged nymphs will fall on the ground.

Adult male and female ticks (June–September): The nymphs will rest for 15–20 days and moult to become adult. Adults rest underneath the vegetation till the rainy season and wait for large animals for blood meal (cattle). During Monsoon, the adult male and female ticks mate on cattle and other large mammals. The fed female drops off and rest in the vegetation and after 8–10 days they lay eggs (4000–5000 eggs) and die.

Life cycle of three-host hard ticks



Life cycle of *H.spinigera* under laboratory conditions

Ghalsasi and Dhanda (1974) and Bhat (1979) studied biology of *H. spinigera* under laboratory conditions. In the laboratory, the life cycle was completed in 118–160 days at ambient temperature, which ranged from 18–35C and relative humidity from 80–90% (6).

The unfed males and females from the colony readily fed on calf or rabbit and engorged within 8–13 days. The weight of a fully engorged female fed on laboratory rabbit ranged from 0.105 to 0.23 g and those fed on calf from 0.146 to 0.298 g. Oviposition usually commenced 2–5 days after detachment and continued for 17–25 days. The number of eggs laid by the females fed on rabbit ranged 388–3136 and those fed on calf from 1804 to 3536. The eggs hatched 25–30 days after laying. The larvae were not ready to feed until 5–7 days after hatching. They readily fed and engorged on chick, mice, or rabbit within 3–6 days and moulted to nymphs in 13–16 days after detachment. The pre-feeding, feeding, and the moulting periods of the nymph were almost the same as for larvae. They fed well on chick or rabbit. The females were ready to feed 25–30 days after moulting.

Stage	Phase	Duration (in days)
Engorged females	Pre-oviposition	2–5
	Oviposition	18–23
	Post-oviposition	1–39
Egg	Incubation	29–33
Larva	Quiescent	3–10
	Life span (maximum)	320
	Parasitic	2–6
	Moulting	10–15
Nymph	Quiescent	3–10
	Life span (maximum)	276
	Parasitic	2–6
	Moulting	12–15
Adults	Quiescent	5–10
	Life span (maximum)	323 (M) and 339 (F)
	Parasitic	7–16

3.6 Bionomics

The KFD affected area has a number of diverse biotopes such as forest, cultivated valley and grasslands. Each biotope is distinguished into a number of associations. These associations are interspersed to form a mosaic. The forest biotope, which only provides the necessary abiotic and biotic environment, forms the main habitat of the tick fauna. This is divisible into three types: semi-evergreen, semi-deciduous and deciduous. These three types are found in most of the localities adjacent to each other forming a mosaic. Delineation of the types is not clear cut. Along the border between the forests and the grasslands, there are usually ecotones of scrub or thickest of various kinds. The grassland is usually dotted with small patches of vegetation, which most of the time form thick impenetrable clumps. During a study undertaken in KFD area, it was observed that tick fauna varies in such different ecological situation. *H. turturis* and *H. kinneari* predominate in semi-evergreen and semi-deciduous forests.The relative prevalence of nymphs of *H. spinigera* and *H. turturis* varied in different localities depending upon the animal fauna and ecology. Tick species of KFD area, excepting *H. spinigera*, generally feed upon wild mammals and usually do not bite human. The tick *H. spinigera* feeds mainly upon cattles and therefore is preponderant in deciduous forest and plantation of teak and eucalyptus where cattle graze.

3.6.1 Seasonal prevalence and host preferences

Host preferences and seasonal prevalence are two hallmarks of the biology of ticks. In certain species such as *H. bispinosa* and *Hya. anatolicum* all the stages—larvae, nymph and adults, are prevalent throughout the year, with one or two small peaks. However, in the KFD area, different stages of *Haemaphysalis* are prevalent in different seasons e.g. larvae, nymphs and adults are more prevalent during October–December, Jan–May, June–September, respectively. Some of the ticks are very specific to certain hosts e.g. *R.sanguineus* adults feed on dogs whereas *R. haemaphysaloides* adults feed on domestic animals cattle, buffalo, sheep and goats, *H. wellingtoni* feed mostly on birds. Some ticks have a wide range of hosts, e.g. *H. bispinosa* feed on a wide variety of hosts. Some species have predilection for feeding on certain region of the body of the host, e.g. *Nosomma* adults attach on the bush region of tail of buffalos and cattle (*6*).

3.6.2 Ecological preferences and host patterns

Ticks are able to parasitize a variety of host species. However, host relationship patterns vary among ticks. The first pattern found in most Argasids, involves restricted vertebrate habitats and shelter seeking ticks, which feed throughout their life only on sedentary animals nesting in burrows, rookeries and ground level colonies. Such ticks are called nidicolous ticks (from *idis* for nest). The second pattern seen in the Ixodids, involves more generalized habitat where adult ticks feed on wandering larger hosts whereas immature stages feed on small or medium sized hosts. It is mostly the ecological specificity of ticks that determine the host preference and host specificity encountered among tick species. Ecological specificity also varies among different tick species, e.g. Hyalomma species generally prefer arid to semi-arid areas whereas *Haemaphysalis* and *Ixodes* have a preference for wet and humid areas. *H. spinigera* is prevalent more in the deciduous forest than in the ever-green forests (*6*).

Host preference of ticks in KFD endemic area

Sl. No.	Preferred host	*Haemaphysalis aculeata*	*H. bispinosa*	*H. cornigera shimoga*	*H. cuspid*	*H. intermedia*	*H. kyasanurensis*	*H. leachi*	*H. indica*	*H. papuana kinneari*	*H. spinigera*	*H. turturis*	*H. wellingtoni*	*Boophilus microplus*	*R. haemaphysaloides*	*R. haemaphysaloides*	*R. sanguineus*	*Dermacentor auratus*	*Ixodes petauristae*	*I. ceylonensis*	*A. integrum*	*A. testudinarium*	*Nosomma monstrosum*
1	Bonnet monkey	■	■		■	■	■			■	■	■	■		■	■		■	■				
2	Buffalo	■	■										■										■
3	Camel													■									
4	Cattle	■	■										■										
5	Deer											■		■		■							
6	Dog		■																				
7	Fox								■														
8	Indian bison			■						■	■			■		■						■	
9	Jackal		■			■	■	■	■														
10	Jungle cat		■			■			■		■	■								■			
11	Langoor monkey	■	■				■			■	■	■	■		■	■		■	■	■			
12	Large civet cat								■														
13	Lion								■						■								
14	Leopard		■		■	■			■	■		■						■		■			
15	Mouse deer	■			■	■	■				■		■						■				
16	Panther				■					■	■	■			■	■	■	■	■				
17	Sambar deer			■																	■	■	
18	Spotted deer	■	■		■											■		■	■				
19	Tiger		■							■						■							
20	Wild boar					■	■			■		■			■	■		■			■	■	■
21	Wild dog						■			■	■	■				■		■	■				

[Source: Ref. (*8*)]

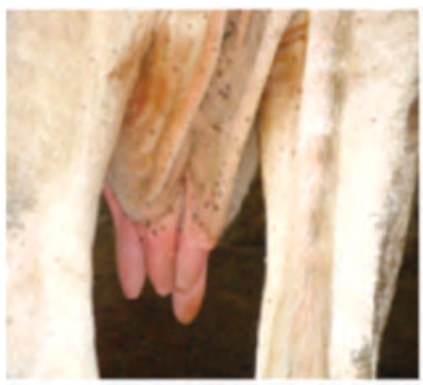
3.6.3 Lateral and vertical migration

The migration of ticks after dropping from their hosts helps for their dissemination and increases the chance of searching their preferred hosts. After completion of lateral movement up to three to six meters in search of plants, they start to climb up on the grass or bushes. Pattern of vertical distribution of Ixodid ticks on vegetation in KFD area was studied. Different species climb on the vegetation to certain height and settle there for seeking their final hosts to get themselves attached. The adults of *H. spinigera*, *H. shimoga*, *A. integrum* and *A. testudinarium* seemed to reach higher height of about 65–80cm on vegetation corresponding to the height of their preferred hosts such as gaur and sambar deer, while other ticks *viz*. *H. turtuis*, *H. kinneari* and *D. auratus* prefer hosts of lower height of nearly 40–55 cm. This criterion for host-seeking of ticks is not restricted to the adult population, but stage-wise differentiation was also noted (*11*).

(a) Nymph under the leaves

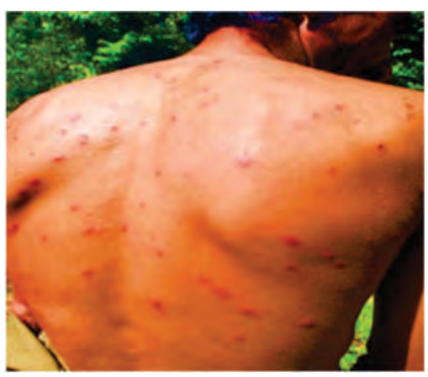
(b) Questing nymph

(c) Cattle brushes on Eupatorium gets tick infestation



(d) Tick infestation in the udder of the cow

(e) An adult tick



(f) Tick bite on human

Eupatorium: heavily infested with ticks

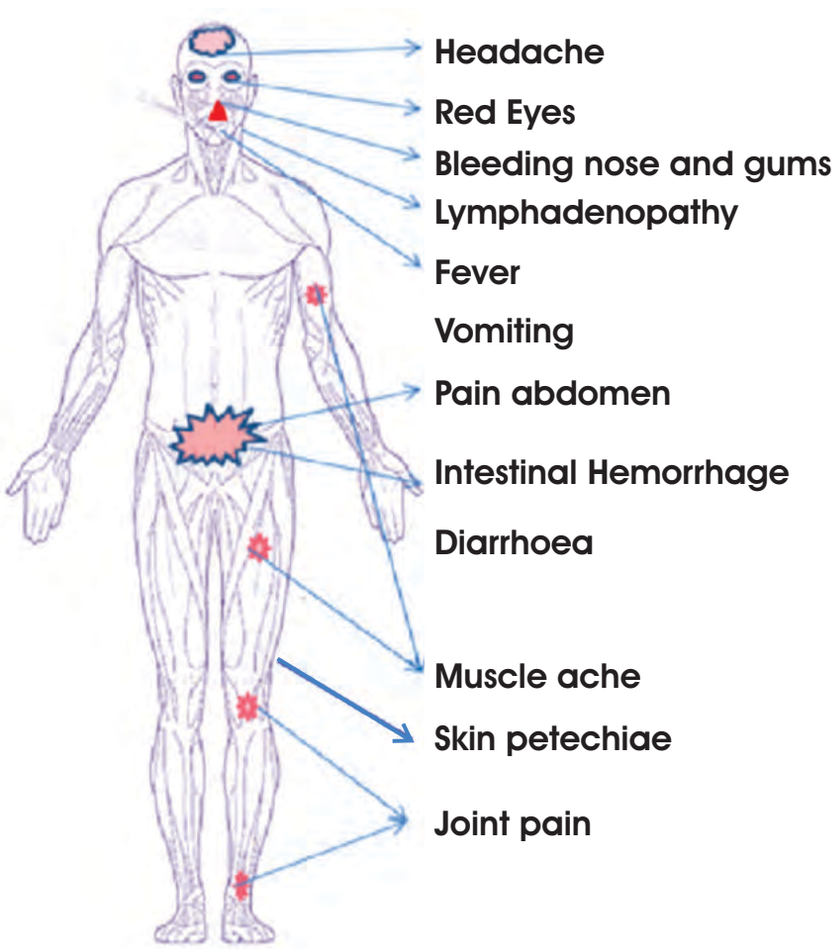
Chapter –4

Clinical manifestations, diagnosis and treatment

4.1 Clinical manifestations

Symptoms of KFD appear 3–8 days after the bite of an infective tick which is the usual incubation period. Typically, the disease appears with a sudden onset of fever which peaks by 3rd or 4th day. Redness of the eyes, pulsating severe head ache and myalgia are very common. Malaise and anorexia with prostration (fatigue with inability to get up) are often seen in patients. Gastrointestinal symptoms like vomiting and diarrhoea may occur 3–4 days after the onset of initial symptoms and patients may have low blood pressure. KFD may occur as biphasic disease in 5–10% of patients. After 1–2 weeks of symptoms, some patients recover without complication. However, the illness is biphasic for a subset of patients who experience a second wave of symptoms at the beginning of third week.

Clinical manifestations of KFD



The **acute phase of febrile illness** lasts for about two weeks. However, the fever starts decreasing from 5th or 6th day onwards and slowly the patient comes back to normalcy between 10th and 15th day.

In severe cases, bleeding from nose, gums may occur and in most severe cases gastrointestinal, pulmonary and vaginal bleeding may also occur. Cervical and axillary lymph nodes enlarge and may be palpable. Patients will have low platelet, red blood cell and white blood cell counts. Jaundice and liver function abnormality and acute renal failure may develop in the acute phase. Some patients may have altered sensorium and meningitis.

Haemorrhagic manifestations and neurological manifestations can occur in both the phases, and severe bleeding from various sites can lead to shock and death. In some patients myocarditis can occur and result in fatality. Bradycardia and hypotension may develop. Acute Respiratory Distress Syndrome (ARDS) is another severe complication.

In about 5–10% cases, there is a second phase characterized by meningo-encephalitis after an afebrile period of 7–21 days. It is manifested by return of fever, severe headache followed by neck stiffness, mental disturbances, tremors, and vision deficits. Unattended cases may rapidly progress into convulsion, coma and death. Risk factors for death seem to be older age, patients with myocarditis, ARDS, renal failure and bleeding manifestations.

The mortality rate ranges from 3–10%.

Clinical feature	Period	Signs and symptoms
Acute phase (febrile illness)/ first phase	7–14 days post incubation period	Sudden onset of high -grade fever, myalgia, head ache, prostration, vomiting, gastrointestinal symptoms and diarrhoea.
Second phase (occurs in a subset of 5–10%)	2–12 days after an afebrile period of 7–21 days	Meningeal signs, altered sensorium, seizures, bleeding manifestations, and prolonged convalescent period (may last upto 30 days)

4.2 High-risk groups/ factors

- People living in the forests of endemic area.
- KFD risk is higher in areas with forest-plantation activities with high coverage of moist evergreen forest and high-cattle density.
- People with recreational or occupational exposure wherein they directly come in contact with tick (e.g. people visiting the forest for their livelihood, coffee/ tea and other plantation workers, cashew nut/ areca nut farm workers, farmers who work in the agricultural fields, which are situated in outskirts of village and in the vicinity of forest, Forest department officials, tourists visiting forest area, wild-life photographers, etc.).
- People handling cattle and who visit forest in endemic areas are around five times higher risk of getting KFD infection compared to people who do not handle cattle and who do not visit forest (*12*).
- Seasonality is another risk factor, as increased no. of cases is reported during the dry season, i.e. from November to June with peak between December and March.
- Firewood and dry leaf collection and storage around the residence. Households storing piles of dry leaves within their compounds are having four-times risk of getting infection compared to people who do not store dry leaves (*12*).
- Use of dry leaves as bedding material for cattle.
- Persons handling dead monkey.

4.3 Diagnosis

There is no specific treatment for KFD and patients are treated symptomatically.

The history of forest exposure of the patient, reports of monkey deaths, seasonality and clinical manifestations point towards the possibility of KFD and confirmation of the same needs diagnostic procedures.

Detection of KFD virus is done using human serum, monkey viscera samples and ticks.The samples have to be collected, labeled, stored and transported as mentioned below.

4.3.1 Human serum sample: collection, storage and transportation

KFDV is ranked as one of the high-risk categories of pathogens belonging to Biosafety Level-4. Hence ensure that adequate standard operating procedures (SOPs) are in use and that staff is trained for appropriate specimen collection, storage, packaging and transport. All specimens collected for laboratory investigations should be regarded as potentially infectious. Serum sample RT-PCR/ real time RT-PCR, IgM ELISA can be performed in BSL-2 laboratory but virus isolation should be carried out in BSL-3 laboratory.

4.3.1.1 Collection of blood samples and testing criteria

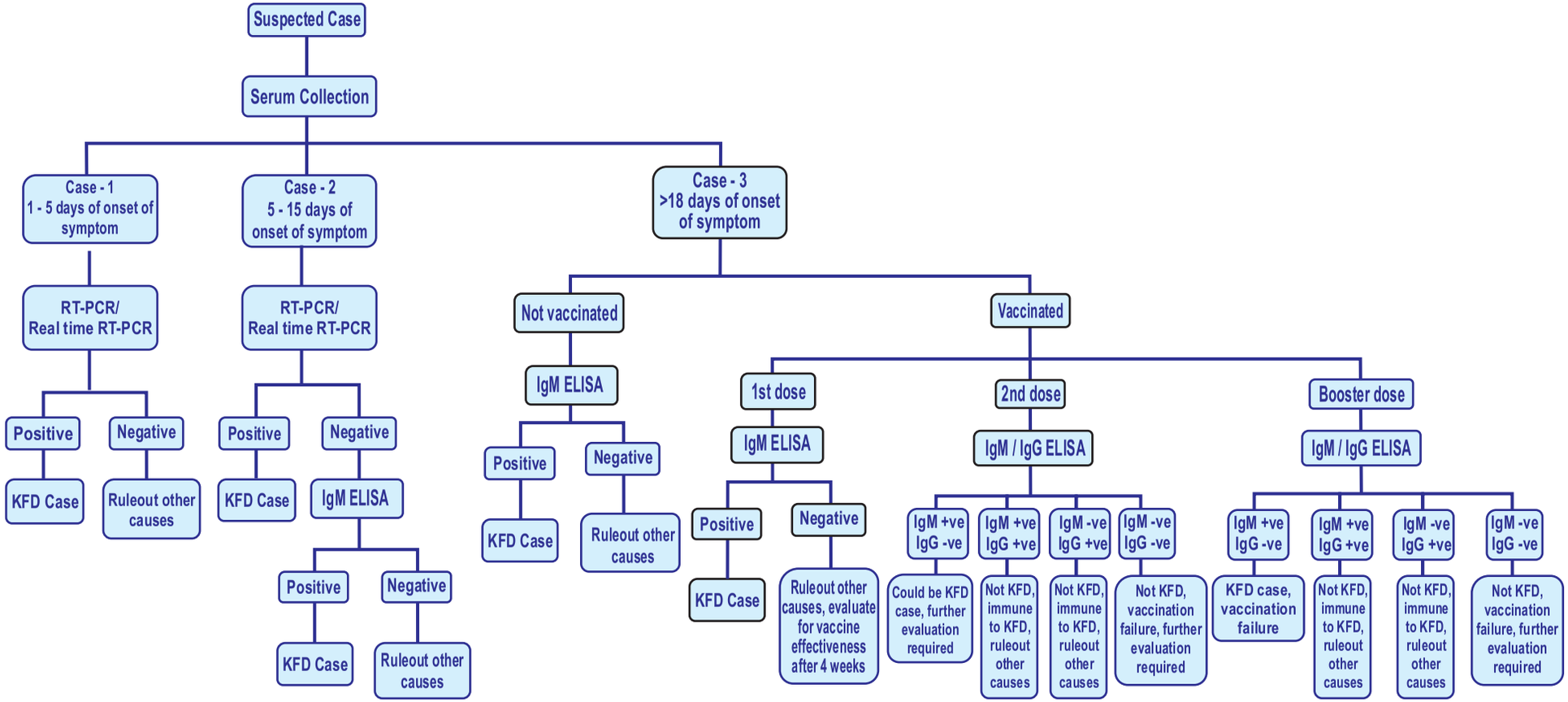
For confirmation of KFD, blood sample has to be collected from a suspected case and subject to RT-PCR, real time RT-PCR or IgM Elisa depending on: the no. of days between onset of fever and date of collection of blood sample.

- Take a sterile vacutainer tube and label with patient details—Name/ ID number of patient, sex, address, date of onset, date of blood collection.
- Draw 5-ml of venous blood with aseptic precautions.
- Remove the needle and slowly transfer the blood into a sterile vacutainer.
- Place the vial undisturbed for 30 min for blood to coagulate.
- Centrifuge the sample for 15 min at 3000 rpm.
- With a pipette carefully collect the separated serum into another sterile screw capped vial with tip of the pipette. Take care not to touch the lysed cells settled at the bottom of the tube.
- Label the vial with following details—name/ ID number of patient, sex, address, date of onset of illness, date and time of collection.
- Seal the vial tightly using parafilm/ cellophane tape to avoid leakage.
- Store the separated serum in refrigerator at 2–4°C.
- Send the sample with properly filled case investigation form cum lab-referral form (CIF-LRF) in duplicate to the laboratory within 24-h of collection.
- In event of delay in sending, store the samples at –20°C in deep freezer for maximum of 24 h.

Note:

- Transfer the blood from syringe after removing the needle to avoid hemolysis.
- Blood sample if shaken and not left undisturbed also results in hemolysis.
- If the blood is put at 4°C, the serum will become cloudy and the serum and red cells will not separate well during centrifugation.
- Hemolysed samples are not fit for ELISA tests and hence will be rejected by the lab.

Algorithm for KFD diagnosis



4.3.1.2 Storage

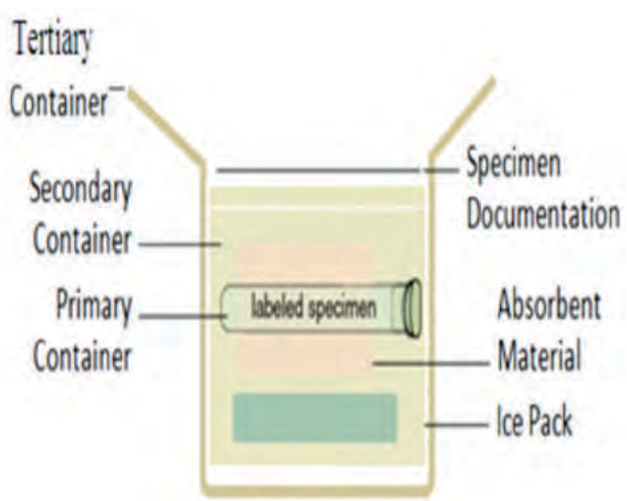
- Refrigerate at 2–4°C if it is to be processed (or sent to laboratory within 48 h)
- Keep frozen at 20°C, if it is to be processed after 48 h and within 7 days
- Keep frozen at 70°C, if it is to be processed after 7 days and preserved for extended periods.

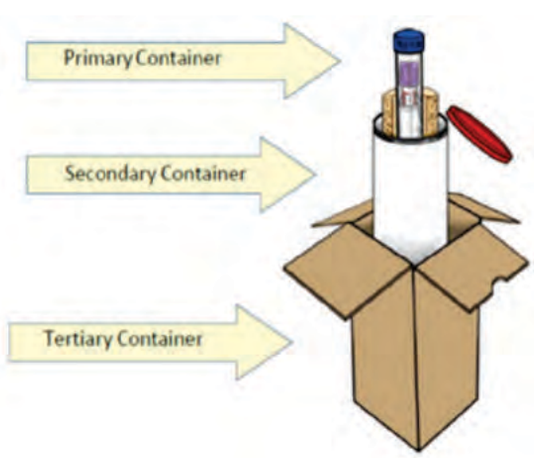
4.3.1.3 Packaging

a. The samples should be packed, labeled and documented as Clause 6.2 (as per WHO Classification)

.b. The following guidelines for standard triple-layer packing to be followed.

- Primary container: Screw-capped sterile vials should be used for dispatch. Vials should be labeledz with the sample number and test required. Keep the vials in upright position.
- Secondary container: Should be durable, watertight and leak proof to enclose and protect the primary containers. (Plastic storage boxes of good quality/zip lock bags, etc.) There should be enough absorbent material (paper napkins / old newspaper) packed around the vials to absorb all fluid in case of breakage or leakage. More than one vial can be placed in secondary container.
- Outer container: Place the secondary container inside the outer container (thermocol box/ durable cardboard box) and maintain upright position of vials. There should be enough absorbent material (paper napkins / old newspaper) packed around it to absorb any leakage/spillage. The smallest overall external dimension shall be 10 × 10 cm.
- Ice, ice pads shall be placed outside the secondary container, within outer container or if wet ice is used, it should be in a leak-proof container.
- All forms, documents should be placed inside a sealed plastic cover within the outer container and label the outer container.





4.3.1.4 Transportation

- Transport the serum to identified laboratory in a carrier (thermocol box/ ice-lined) with fully frozen ice packs maintaining cold chain (+2 to +4^{0}C) within 24 h.
- Fill up and send a separate KFD Case Investigation Form cum Lab Referral Form (CIF-LRF, Annexure-I) for each sample.
- Address labels on outer packages should display the sender and laboratory name with complete address and telephone numbers for both the sender and receiver.
- Biohazard label should be put on the cover of the box.
- Sample is transported by a person or through a designated courier.

4.3.2 Monkey viscera samples

Monkey autopsy is conducted in hotspot area following the SOP. Collect about 2–4g of brain, lungs, heart, stomach, gastro-intestinal tract (preferably duodenum), liver, kidney specimens from the dead monkey following standard biosafety precautions. Viscera should be kept in a sterilized polypropylene container without any preservatives. Each viscera specimen has to be packed in a separate container. Label the containers with details including: type of sample, date of monkey death, date of collection, name of village where monkey death has occurred. Seal the vial tightly using parafilm/ cellophane tape to avoid leakage. Follow all the above guidelines for storage, packing and transportation.

Autopsy samples have to be transported to VDL-Shivamogga or NIV-Pune for virus detection, immediately, along with 'Laboratory Request Form—Monkey Autopsy Specimen' (Annexure-II). (Note: if any district is sending sample directly to NIV Pune, obtain SVDL number from VDL Shivamogga and then send to NIV Pune.)

4.3.3 Tick pool samples

In a study area of 5-km aerial radius (minimum 10 pools) or in hotspot (2–5 pool), ticks have to be collected by adopting different collection methods. Refrigerate them. Segregate species wise and put in asterile polypropylene vials (note: don't add any preservatives). Label the vial with date and time of collection, address of area where tick is collected. Seal the vial tightly using parafilm/ cellophane tape. Then follow the above guidelines for storage, packing and transportation. Tick pools are to be sent to laboratory along with 'Lab Request form—Tick Pool (Annexure-III).

Tick pool samples have to be immediately transported to VDL-Shivamogga or NIV-Pune for virus detection. (Note: if any district is sending sample directly to NIV Pune, obtain SVDL number from VDL Shivamogga and then send to NIV Pune).

4.4 Laboratories identified

Human samples: Presently, KFD virus detection among human is done by at NIV Pune; NIV-Bengaluru Field Unit; and Viral Diagnostic Laboratory, Shivamogga.

Monkey viscera samples and tick pools: KFD virus detection among monkey viscera samples and ticks is done at NIV Pune.

Addresses:

- Viral Diagnostic Laboratory (VDL), BH Road, Opp. Scout Bhavan, Shivamogga – 577201, Karnataka State, India. Tel: 08182-222050.
- National Institute of Virology (NIV), Microbial Containment Complex, 130/1 Sus Road, Pashan, Pune 411021, India. Tel: 020-26006390.
- NIV Field Station, Bengaluru address: National Institute of Virology, Bengaluru Unit, Dept. of Microbiology, RGICD Premises, Near NIMHANS, 1st Main, Someshwar Nagar, Dharmaram College Post, Bengaluru – 560029. Tel: 080-26654084 /074.

Other conventional methods of diagnosis

(a) Serological

— Hemagglutination inhibition: Antibodies if present react with viruses and inhibit agglutination of red blood cells.

— Complement fixation: Measuring amount of complement available in serum to bind with an antigen–antibody complex.

— Neutralization test: Neutralization of viruses by specific antibodies performed on 2–3-day-old mice.

This virus is known to cause aerosol infections in field and laboratory workers. Tests were labor intensive, time consuming, lower sensitivity, therefore, KDF work in India was discontinued during the 1970s.

(b) Virus isolation:

Human serum: 0.02 ml neat serum of the suspected patient is inoculated intra-cerebrally into 4-day-old litters and observed for 21 days. The litters become sick in 5–8 days. This is known as primary isolation. The sick mouse is identified and a further passage of the brain suspension of the sick mouse [as 10% brain suspension in Rabbit serum in Phosphate saline (RSPS) or 0.75% Bovine Albumin Phosphate Saline (BAPS)] is made in a second batch of mice for further confirmation of the virus. Sickness in the second group of mice confirms KFD. This test is used for acute sera only—i.e. blood samples collected within 10 days from the date of onset of fever (serum should be separated at the laboratory).

Pools of ticks and monkey viscera sample: Pools of ticks and monkey viscera samples are ground in 0.75% BAPS, 0.03 ml of this suspension is inoculated to 3–4-weeks-old mice by IC route. Sickness in mice confirms KFD.

A group of litters

IC route inoculation of litters

Intra-peritoneal inoculation of adult mice

Processing of acute blood samples for virus detection

Acute serum sample:

1. Documentation of the details of acute specimen.
2. Centrifuge the clotted blood.
3. Separate the supernatant serum and number them (VDL Number).
4. The above serum is inoculated into one litter of mice (8 infant mice of 3-days-old with a mother) 0.02ml of serum is inoculated intracerebrally to each of 8 infant mice. Mother is left un-inoculated for feeding the infants, in a box.
5. Box is numbered (mice group number) and an observation card is opened for each.
6. Inoculated infant mice are observed for 21 days for the following symptoms.

   I. Sickness (drowsiness, feathering and spasticity of legs).

   ii. Paralysis.

7. Sick infant mice are selected and their brains are harvested for further passage and this brain is treated with BAPS and Penicillin and Streptomycin.
8. The above suspension is inoculated to one litter of 3-days-old IC (0.02 ml), one group of 4 weeks-old mice IC route (0.03ml) and one group of 10-weeks-old mice through I/P route (0.03 ml).
9. Observed for 21days for symptoms of sickness and paralysis. Litters become sick in 5–6 days while adults become sick in 8 days. Once again two brains of sick mice will be stored for further research work and NT in the lab (this is known as 1st passage—M1).
10. A 2nd dose of original serum is inoculated 0.02 ml IC route in 1 litter. The sickness confirms the presence of virus.
11. Further, the original serum is subjected for titration to know the titre of the virus.

Convalescent serum sample:

1. The 1st or 2nd convalescent serum of the patient is subjected to Neutralization Test to know the rise in the titer of neutralizing antibodies.

Neutralization test:

1. Serum sample is inactivated at 56^{0}C in a water bath for ½ an hour.
2. 0.2-ml of above serum and 0.2ml of 10^{-5} known virus are added into NT tubes and mixed well. This mixture is incubated at 37^{0}C in waterbath for an hour.
3. Inoculate the above suspension into 6 mice by IC route and observe for 14 days.
4. Depending on the survival of the mice antibody titer is determined.
5. The serum specimens and the virus infected mouse brain specimens are stored at –20^{0}C and–80^{0}C, respectively, for further studies.

4.5 Treatment

There is no specific medication for KFD. As in case of most of the viral diseases, the treatment is purely symptomatic and supportive. Supportive therapy includes the maintenance of hydration and the usual precautions for patients with bleeding disorders.

However, as patients clinical parameters change during the course of the illness, they require monitoring. **Patients whether hospitalized or not, are required to be monitored daily for vital signs and general conditions. Their complete blood picture should be repeated at least on alternate days to monitor for worsening thrombocytopenia, until it shows improving trend**.

Symptomatic treatment recommended for KFD

Sl. No.	Symptoms	Treatment	Preferred medication/ line of treatment
1	Fever, head-ache, severe myalgia, malaise	Anti-pyretic and analgesics	T. Paracetamol (0.5 –1g every 4 – 6 hourly, with maximum of 4g daily), till symptoms are abated. (The dosage can be altered as per weight of the patient and age) T. Tramadol 50 mg every 8 hourly
2	Nausea and vomiting	Anti-emetics H2 receptor blockers/ Proton pump inhibitors IV Fluids	Metoclopramide (Perinorm) 5–10 mg IV T. Domperidone 10 mg tid half an hour before meals Inj. Ondansetron 8 mg IV bd T Ranitidine 150 mg bd or T Pantoprazole 40 mg od (may be given IV) IV fluids if patient has postration / dehydration and is not able to take orally
3	Secondary infections	Antibiotics	Broad-spectrum antibiotic such as Inj Ceftriaxone 1g iv bd / other antibiotic as per the local antibiogram (if super added bacterial infection is suspected)
4	Haemorrhagic diathesis	Haemostatic agents PRBC transfusion* Platelet transfusion* Fresh frozen	a. Vitamin-K,10mg/day subcutaneously for 3 days b. T. Tranexamic acid 500mg tid If Hb< 8g/dl If thrombocytopenia <20,000 cells/mm^3 or if platelet <50,000 cells/mm^3 +bleeding If abnormal coagulopathy with bleeding
5	Altered sensorium, irritability, coarse tremors, abnormal reflexes and neck stiffness		#Mannitol 20% — 8 hourly for 3 days and followed by oral Glycerol 30ml TDS for 3 days — in case the symptoms persist (Age-wise dosage as per body wt. of the pt. is recommended)
6	Electrolyte imbalance/ hyponatraemia and acidosis	IV fluids	Sodium chloride / Soda bi-carb, depending upon the degree of dehydration, metabolic acidosis and general condition of the patient.
7.	Fluid refractory hypotension/ shock	Vasopressors	Norepinephrine – 0.2 to 1.5 μg/kg/min If required add vasopressin (up to 0.03 U/min)/ or epinephrine

*In a referral setup/ district hospital where facility is available for transfusion.

#Mannitol should not be used if there is decreased urine output or renal failure.

Note: Administration, dosage and duration of the medicines/drugs depend upon the condition of the patient. However, the Doctor/Specialist treating the patient can have the discretion to decide on the course of treatment and management.

The following should not be done:

Sl. No.	Don'ts
1	Administering NSAIDS
2	Administering steroids (Except in fluid refractory septic Shock: Inj Hydrocortisone 50 mg IV 6th hourly)
3	Administering nephrotoxic drugs (like Diclofenac, Gentamicin)
4	Administering Intramuscular injection

Referral of cases to a higher centre from PHC

Sl. No.	Indicators
1	Systolic BP<90 mm Hg
2	Heart rate >100 beats/ min or irregular pulse
3	Respiratory rate >24 breaths/min
4	Altered sensorium
5	Bleeding manifestations
6	Decreased urine output
7	Jaundice
8	Severe dehydration

Chapter - 5

Operational Guidelines for Surveillance

Surveillance is a regular, continuous and systematic vigilance activity which shows the status of a disease at a given time. In case of Kyasanur Forest Disease, which has a seasonal cycle, the surveillance should be systemized according to the known lean and epidemic periods.

The surveillance further provides for collection of data for action which is very essential for the disease control initiative. The main objectives of the surveillance is to

- Understand the basic epidemiology of disease
- Identify outbreaks
- Trigger public health control measures
- Assess the effectiveness of preventive and control measures
- Identify pockets of susceptible populations to guide vaccination strategies

Surveillance of KFD involves monkey death surveillance, human surveillance and vector surveillance.

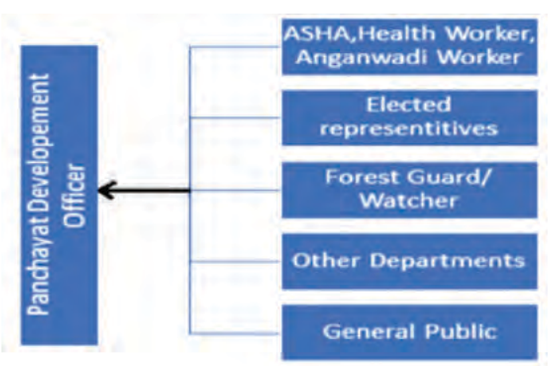
5.1 Monkey death surveillance

The wild monkeys *Macaca radiata* and *Semnopithecus entellus*, contracting the disease develop fever, get dehydrated and move towards the water sources either in the forest or near the human settlements where they succumb to the disease. After the death, the body temperature comes down; the ticks which are present on the skin of such monkeys move on to the nearest forest floor generating 'Hotspot'. Thus, the infected ticks which were deep inside the forest move towards the outskirts of the forest near human settlements along with the infected monkey. Then they settle down on the forest floor and bite humans when they move into the forest, by attaching onto their skin, as they brush the forest floor when they move. Hence, Monkey death acts as a 'sentinel event' to forecast a possible incidence in an area. It triggers human surveillance, take up prevention and control activities in the surrounding high-risk villages.

As soon as the monkey death is reported from an area, 'hotspot management team' gets triggered for action. The 'hotspot management team' involves well-trained persons/ specialists from departments like: Forest, Veterinary, Panchayath Raj (Gram Panchayath) and Health Departments.

The team shall be headed by the Panchayath Development Officer (PDO) as it requires the coordinated activity of different departments. The roles and responsibilities of various departments during 'Hotspot management' is annexed (Annexure-XX). Monkey autopsy is conducted in hotspot area following the SOP (Section 6.5).

Notification of monkey death in a real time or near-real time is a prime activity in controlling the spread of the disease. Monkey death reporting in the field must be encouraged.



Flow of information of monkey death reporting

5.2 Human surveillance

During transmission period, the monkey death reporting triggers human surveillance in an endemic area. It involves early detection of cases through active and passive surveillance following case definition of KFD.

Reporting of human KFD cases should be a component of all routine communicable disease surveillance systems in the vulnerable districts. Early detection of KFD cases, laboratory diagnosis and case management is very important. Routine surveillance and review of the surveillance to be done to detect impending outbreaks of KFD.

Steps for the strengthening of KFD surveillance system: The following steps are to be followed for strengthening the human surveillance system

- Defining a Reporting unit
- Strengthening of the Reporting unit
- Response to the Suspected KFD Case

5.2.1 Defining a Reporting Unit

An efficient and reliable reporting network and notification systems are vital for KFD surveillance. The following individuals / facilities are considered as Reporting Unit:

- Government health facilities—District and Taluk hospitals, Community Health Centers (CHC), Primary Health Centers (PHC), Dispensaries, Subcenter, Health and Wellness Center
- Medical colleges—Both Government and Private
- Private health facilities—Private Hospitals, Nursing homes, clinics, others
- Indian System of Medicine (ISM) practitioners
- Frontline health workers: Health Assistant Male and Female, ASHA, MLHP
- Any person or institution where a case of KFD case may visit for treatment
- KFD related information can also be captured by informers for feedback response.

5.2.2 Strengthening of Reporting Unit

The knowledge among the Health Professionals (doctors and paramedics) about the case definition and response to the suspected KFD case is very important for the high sensitivity and quality of a surveillance system. This will result in timely notification, investigation and response to the suspected cases. Therefore, efforts should be made to engage health staff of the reporting network in surveillance activities. Medical platforms like Indian Medical Association (IMA), AYUSH conferences and monthly meetings of government sector should be targeted to organize sensitization workshops. The Reporting Network should be sensitized through workshops periodically.

5.2.3 Response to the Suspected KFD Case

There should be a clear understanding about the case definition before proceeding into the Surveillance response. The following are the KFD Case definition for response activities (*13,14*).

Suspected case: A person of any age presenting with acute onset of fever with any of the following: Headache/ Myalgia/ Prostration/ Generalized weakness/ Nausea/ Vomiting/ Diarrhoea/ Occasionally neurological/ hemorrhagic manifestations and associated with any of the following risk factors:

- Lives in the forests of endemic area
- Visit to endemic area* during past 2 weeks
- Recent visit to unexplained monkey death area
- History of occupational engagement in forests of endemic area during past 2 weeks.

(*Endemic area: An area which has reported human positive *and/or* monkey viscera positive *and/or* tick positive in the last 5 years).

Confirmed case: A suspected case, which is laboratory-confirmed by any one of the following assays:

- Detection of KFD Virus by real time RT-PCR or RT-PCR from serum or tissues.
- Detection of KFD Virus antibodies through anti-KFD IgM ELISA from serum.
- Isolation of KFD Virus in cell culture or in a mouse model, from blood or tissues (methods used in earlier years for confirmation).

Differential diagnosis: Dengue/ DHF, Typhoid, Malaria, Rickettsial infections (especially Scrub Typhus, Tick Typhus), Chikungunya, Influenza, Leptospirosis, Viral hepatitis, other viral hemorrhagic fevers and bacterial sepsis.

The below steps are to be followed in response to a suspected case.

- Identification and notification of suspected case
- Investigation of the case
- Sample collection and shipment to Accredited Laboratory

5.2.3.1 Identification and notification of Suspected case

The Suspected case has to be identified during active and passive surveillance by the Reporting unit and frontline workers, respectively, based on the Suspected case definition mentioned above.

Active Surveillance has to be conducted periodically. But in response to the following two criteria, surveillance has to be intensified in the community for taking up further containment measures.

1. *During unusual monkey death (Hotspot):* The human surveillance shall begin when once the unusual Monkey death reporting starts—usually one month before the start of the transmission season—wherein the concerned field staff will start conducting house-to-house survey and line listing all suspected cases based on case definition. The line listed cases are referred / handed over to the concerned Medical Officer for arranging sample collection within 24 h of reporting. Simultaneously, weekly surveillance is continued in and around 2-km aerial radius of Monkey death spots till the results of the first round human samples / monkey autopsy samples are received from the laboratory.
2. *After receipt of confirmed human positive and/or monkey positive and/or tick positive for KFD Virus:* The positive areas are identified along with Hot-spots and earmarked for regular weekly surveillance, which should now be extended for an aerial radius of 5 km. The fever surveillance will be continued till the end of that transmission season.

With proper micro-planning and training of team members, house-to-house survey and line listing of all suspected cases is conducted in the community by a team of Health Assistant supported by Accredited Social Health Activist (ASHA). (Before conducting the active surveillance, the teams should be sensitized about the Suspected case definition to look for additional cases in the community.) During active surveillance, the IDSP and IHIP form (S-form) shall be used for recording and further reporting.

During the active surveillance, the KFD vaccination beneficiary list shall also be updated.

Passive Surveillance at the health facility, the suspected cases are captured by following two ways: (a) Fever cases who have not been covered during regular active surveillance attend health institution for treatment; and (b) Cases which are suspected during active surveillance shall also visit the health institution for treatment (the cases which are already enumerated during active surveillance by Health Assistant and referred to health institution).

The Medical Officer shall manage the case symptomatically. Then investigate the case and fill the CIF-LRF. Arrange for transporting sample to the identified laboratory within 24 h of collection. CIF-LRF should be sent to laboratory in duplicate (one to submit to laboratory and other to maintain at health institution).

All the suspected cases are to be documented in the KFD Human Surveillance Register maintained at the health facility (make sure that all suspected cases found during active surveillance, visits the health facility).

Further, Suspected case definition should be followed for capturing data in S- and P-form of IDSP and IHIP. On CIF-LRF, the EPID number generated by IHIP P-form should be mentioned.

At the end of the week, the Medical Officer should verify whether any **"drop out"** (the cases which are referred from active surveillance to the health institution) are listed in passive surveillance in order to get good *Patient response rate.*

5.2.3.2 Investigation of the case

The case investigation is of paramount importance to obtain accurate epidemiological and clinical information of the KFD cases. All suspected cases reported during surveillance should be investigated (to achieve 100% *Institution response rate*). The details documented in the Case Investigation Form (CIF) cum Lab Referral Form (LRF)—Human samples (CIF-LRF, Annexure-I) forms the basis of data analysis and monitoring of surveillance indicators helpful for implementing control measures. Any Suspected KFD case notified should be investigated at the earliest preferably within 48 hours. Early investigation will provide opportunities for sample collection and timely medical intervention so as to reduce the morbidity and mortality of the disease and take control measures in the community.

A KFD CIF-LRF has been designed to investigate suspected case of KFD. CIF-LRF can be used as a guide to obtain all desirable and specific information of a Suspected KFD case.

On CIF-LRF, the EPID number generated by IHIP (P-form) should be mentioned.

Description of CIF-LRF: The initial sections of the CIF-LRF, the information on case reporting, identification, hospitalization and KFD vaccination details are collected. The details about KFD vaccination include: number of KFD vaccine doses received; date of primary and booster doses; date of last dose of KFD vaccine received. The vaccination details will help in assessing the impact of vaccine or efficacy of vaccine.

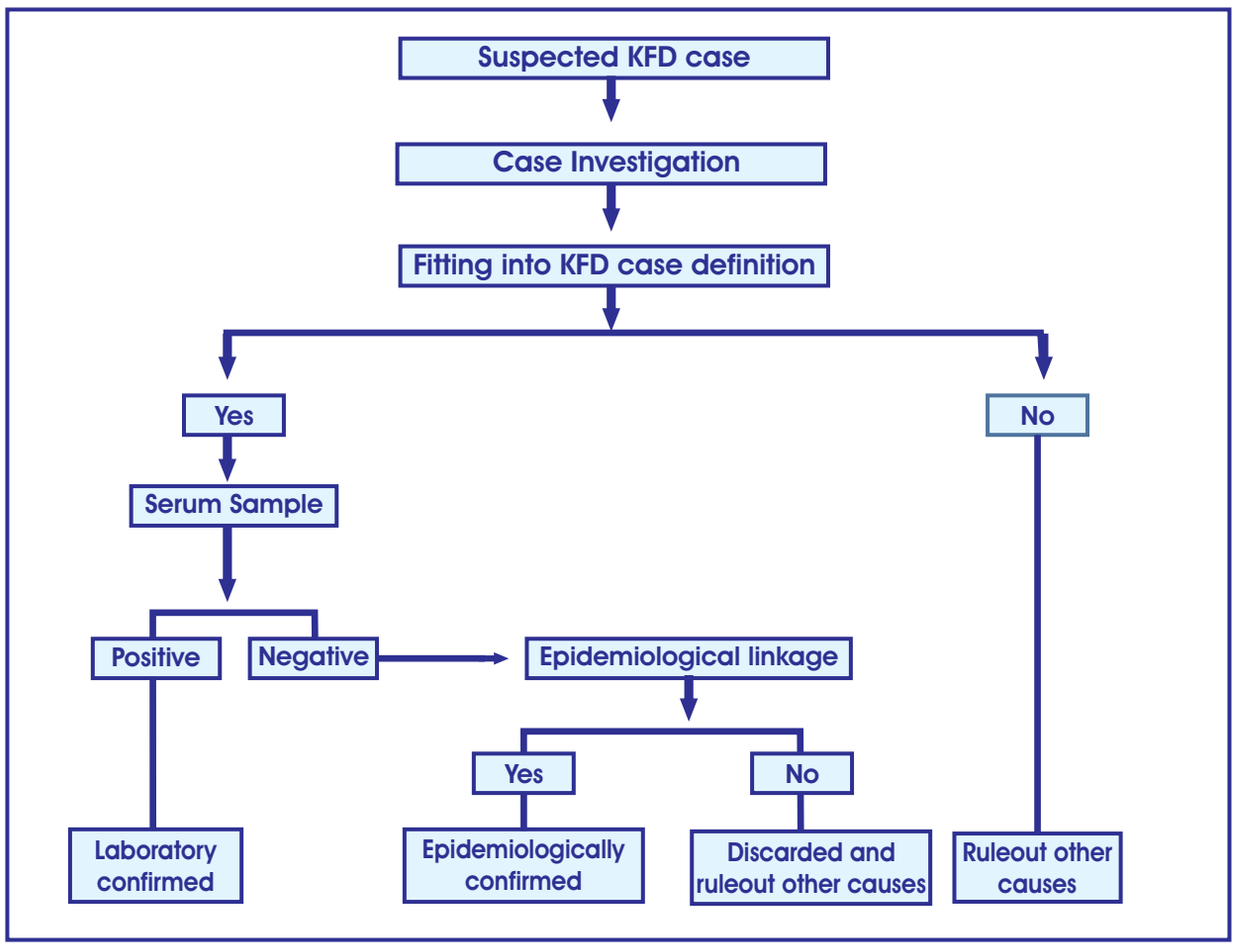
A brief description of the *clinical signs and symptoms* of the Suspected case should be documented in the space provided. *Date of onset of fever* is the most critical information that should be documented accurately in the CIF-LRF. Various performance and monitoring indicators are calculated from date of onset so it is extremely important to specify the correct date of onset of fever.

Travel history is important to identify the area from where the case has picked up the infection taking into account the incubation period of the disease.

Information on sample collection and laboratory results should be entered and updated in the CIF-LRF. (Along with the results, the laboratory should return CIF-LRF form to the concerned for documentation and epidemiological monitoring through E-mail.)

In the last section, the case should be classified as laboratory confirmed, epidemiologically/clinically linked, or rejected. The details are discussed below.

KFD Case classification is important to decide for the appropriate use of resources in case management and public health interventions. It also supports epidemiological analysis and exchange of information with policy makers, health officials and providing feedback. Every suspected case that has been investigated irrespective of sample collection should undergo case classification as per the below algorithm.



Algorithm of case classification of a suspected or probable KFD case

Laboratory confirmed: A case that meets the Suspected case definition, where samples are collected and laboratory results are positive for the disease.

Epidemiologically/ Clinically confirmed: A case that meets the Suspected case definition and is epidemiologically linked to a positive case or clinically confirmed. These cases will not be reported as KFD positive. However, all preventive and control measures will be taken.

Discarded: A case that meets the Suspected case definition but the laboratory results are negative and also there is no epidemiological linkage to the positive case. Rule out other causes.

After the final case classification, the PHC Laboratory Technician shall update the results in the KFD Surveillance Register in consultation with the Medical officer.

Assigning a unique KFD-EPID number under IHIP: Assigning a unique EPID number is one of the important ways of assuring quality of epidemiological data. The unique EPID Number is important for generating computerized line list of cases as personal identification information can be same for two or more cases. On CIF-LRF, the EPID number generated by IHIP (P-form) should be mentioned.

The unique case number is an alphanumeric code consisting of 31–35 characters. This code is allotted to each suspected or confirmed KFD patient. **EPID number is self-generated in IHIP portal.** Brief explanation of the unique case number with example is as follows:

The first 15 characters determine the place of the patient. Out of the 15 characters, the first two characters represent State, next three represent District, subsequent four represent Taluk and the remaining six represent Village to which the patient belongs. The next 6-10 characters after determining the place of the patient is the Facility ID of the health center where the patient is being treated. Following eight characters is the reporting date of the suspected patient which is given in the form dd/mm/yyyy. The last two characters are assigned to the patient depending on the document type [Suspected z(S/P), Laboratory form (L)] and the sequence is as below.

Case number: 29-548-5537-611445-162758-21062018-L-1

State: Karnataka (29)

District: Tumakuru (548)

Taluk: Tumakuru (5537)

Village: Heggare (611445)

Facility ID: Health Center (162758)

21062018 (dd/mm/yyyy) corresponds to the reporting date of the suspected case

S/P-1: Suspected case; L-1: Laboratory Confirmed case

5.2.3.3 Sample collection and transportation to laboratory

Described in Sections 4.3.1 and 4.4.

5.3 Vector surveillance

Regular / routine surveillance involves the study of vector to know the prevalence, density and distribution of vector species especially in Western Ghats area. This enables to create KFD high-risk maps for strengthening the surveillance, prevention and control. Also, impending outbreak can also be predicted in advance by virus detection in tick pools. The District / Zonal Entomological team along with KFD Field Station team shall perform the vector surveillance regularly. The Entomological Team at VDL, Shivamogga shall co-ordinate with the District/ Zonal Entomologists and take up studies in districts.

5.3.1 Selection of area

Endemic area of Western Ghats: 4 random sites and 4 sentinel (fixed) sites are to be selected for regular vector surveillance. During transmission season, the number of studies may be increased to know the virus activity especially in the areas where positivity was recorded in the previous years.

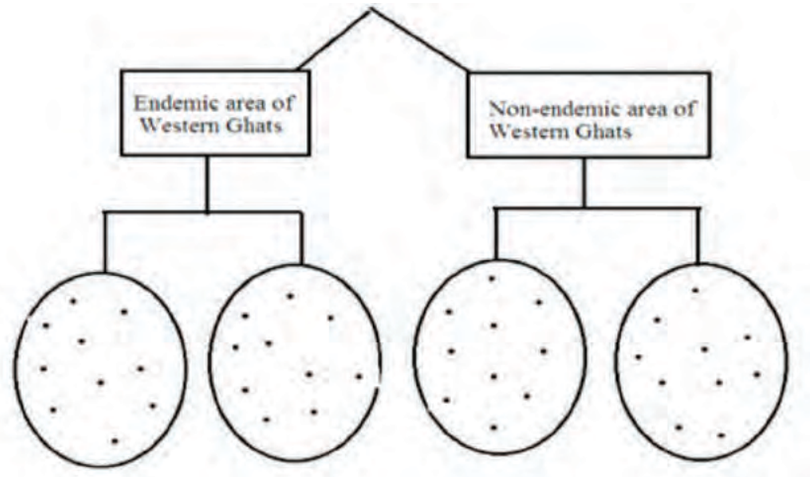
Non-endemic area of Western Ghats: 4 random and 4 sentinel (fixed) sites are to be selected for vector surveillance. During transmission season, the number of studies may be increased to know the virus activity especially in the areas where monkey deaths have occurred.

Sentinel (fixed) site: An area which has reported human and/or monkey and/or tick positive in the last 5 years.

Random site: An area which are reporting fever cases in the present year / high-tick density recorded during previous years.

[Note: From one study site (aerial radius of 5-km), minimum 10 pools should be collected. The minimum distance between *two collection sites* should be 0.5–1 km].

Tick surveillance



The tick surveillance should represent all the habitats like pathway leading from village to paddy field/ areca/ cashew plantation/ forest, edge of the forest, forest floor, peri-domestic area, animal resting area, search on human/ animal body, etc. are searched for tick collection. Personal care must be taken by wearing personal-protection equipment's like gloves, gum boots, applying tick repellents, etc.

Hotspot: Tick collection in hotspot must be carried out as per the guidelines (see Section 6.5) to monitor the KFD virus activities. Minimum 2–5 tick pools have to be collected in a hotspot.

Note: Geo-coordinate should be recorded where the studies are done.

5.3.2 Sampling techniques

Tick has active and inactive phase. The population which are questing for the host or attached for feeding on the host are considered as active phase. The nymph stage of tick is the most active stage. The collection of ticks in active phase both questing and parasitic, usually give a reliable estimate of tick prevalence in an area.

Ticks are collected by three techniques: Flagging, Flag drag and Picking. Relative density is recorded as 0–20, 21–50, 51–100 and >100 in 50-square meter area flagged for 50 times.

Flagging: Lint-cloth with a length of 1 × 0.75-m is used for the purpose (*21*). Ticks are collected through 'Flagging' over the vegetation in to-and-fro movement. The ticks that clung on the flag are needed to be picked up with the help of fine pointed forceps and collected in sterile tubes. The density is calculated as below:

Tick density: Number of ticks collected in 50-square-meter area flagged for 50 times

Flag drag: The lint cloth of length 1.5 ×1-m is dragged over 50-m of plain land for 5 min. The ticks that clung on the drag are needed to be picked up with the help of fine pointed forceps and transferred to a sterile tube.

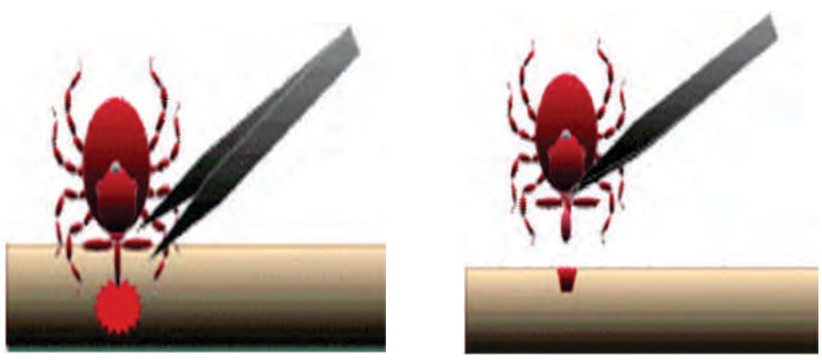
Tick density: No. of ticks collected in 50-linear-meter length dragged in 5-min

(a) (b)

Insect Collectors of VDL performing (a) flagging and (b) flag drag

(c) Ticks clung on the lint cloth

Plucking/picking' method: Forceps are used to collect ticks from domestic animals (like cattle, goat, sheep, etc.), on the body of villager, forest workers and around the hot-spots where monkey deaths have occurred. [Note: Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva, body fluids and gut contents) may contain infectious organisms. After removing the tick, thoroughly disinfect the bite site and wash hands with soap and water.] Variety of animals should be covered to know the species composition and infestation. This method is very much useful during rainy season where flagging and dragging methods are difficult and it helps in understanding the virus presence in adult tick as well. (Note: 5-min should be spent on each animal for tick collection by a person).



Removal of an embedded tick using fine-tipped tweezers

The density of tick infestation on a host is evaluated in term of tick index which represent average number of ticks per host.

$$\textit{Tick Index} = \frac{\textit{Total number of ticks collected in 5 min}}{\textit{Total number of hosts examined for ticks}}$$

$$\textit{Tick Infestation Rate} = \frac{\textit{Number of hosts found positive for tick}}{\textit{Total number of hosts examined for ticks}}$$

20–30 ticks are collected to make one pool. Refrigerate them. Identify the ticks and segregate species-wise. Label and store in sterilized polypropylene containers without adding any preservatives. Send tick pools to VDL Shivamogga for virus detection in the tick pool. (Note: District should obtain SVDL number from VDL Shivamogga before sending to NIV Pune). Annexure-III must be sent along with the tick pool sample.

In the Tick Surveillance Register (Annexure-VI), tick surveillance details of respective PHC area should be maintained at PHC. At district level, O/o the DVBDCO shall also maintain the details of tick surveillance.

5.4 Outbreak investigation

The logical steps of outbreak investigation in case of KFD are as follows

- Detection and notification of the trigger event:
  - Monkey death is the usual trigger event. The team led by PDO of Gram Panchayath, comprising of Veterinary Officer, Forest Guard, Health Assistants is to visit the area and try to ascertain the cause of death based on evidence available. Monkey autopsy is conducted in hot spot area following the SOP and monkey viscera samples are collected for analysis. Delineation of the hot spot and application of insecticide are done.
  - Cluster of fever cases reported from the same area by the field workers.
  - Reporting of a suspected case or a clutch of suspected cases by any primary health center / community health center / private practitioner /private or government hospital.
  - Detection of positives in the laboratory.
- Active search for the cases:
  - The rapid response team headed by the District Surveillance Officer/DVBDCO, Entomologist, Microbiologist, Physician /Paediatrician, Laboratory Technician, Health Assistant, Insect Collector, etc. is to visit the affected area and conduct detailed epidemiological investigation by house-to-house search. Daily surveillance is to be continued for 16 days after the last human case reported.
- Collection and compilation of personal, epidemiological, clinical and other descriptive data:
  - A line list is to be prepared indicating all the details of each suspect case as per CIF.
  - Distribution of cases as per person, time and place are to be prepared as per standard tables.
- Analysis and interpretation of data:
  - Epidemic curve is to be prepared and updated regularly.

- Preparation of a detailed report: There is a need to prepare a comprehensive report on the outbreak which should include the following.
    - Source of information of the outbreak
    - Details of day wise survey showing epidemic graph
    - Line list of cases
    - Demographic details of suspected and confirmed cases showing age and gender-wise distribution
    - Case fatality rate, if any
    - Details of entomological surveillance
    - Details of control measures undertaken
    - Analysis of all possible causes of the outbreak
    - Recommendations for preventing further outbreaks
- Response in terms of immediate control measures:
    - Hotspot Management: As per SOP
    - Intensification of vaccination
    - Advocacy for personal protection measures
    - Tick control measures: Physical control, biological control, Chemical control
    - Intensive IEC activities

The trigger levels (*15*) of cases of KFD to determine specific responses are as follows:

Trigger 1 (Suspected/ limited): Local response by the Medical Officer and the Health Worker when the outbreak is suspected.

- Suspected monkey death that has been verified by the Veterinary Officer
- Cluster of fever cases (upto5) reporting from the same area following suspected case definition.

Trigger 2: Local and district response by DSO / RRT / DD-VDL/ KFD Field Stations.

- A single case of human or tick pool or monkey viscera sample is positive for KFD Virus.

Trigger 3: Response by local, district and state level.

- Large geographic area with more than one focal point involving districts.

Reporting of outbreak: FIR /outbreak should be investigated and reported (by means of any available communication channel) immediately to State Surveillance Unit through District Surveillance Unit (Annexure –XI, FIR/ Outbreak reporting format) and enter into IDSP web portal. The investigation and continued surveillance report should be updated every Monday. Any suspected monkey death/ monkey positive/ tick pool positive should be reported in IDSP outbreak report.

5.5 Data reporting, analysis and feedback

The surveillance activities and preventive activities have to be reported periodically for analysis, interpretation and feedback.

KFD is notified as a State-specific disease under IDSP. Syndromic-form (S-form) should be filled up by the Health Assistant and Presumptive-form (P-form) should be filled up by the Medical Officer of the health institution. Further, Laboratory-confirmed (L-form) human cases shall be reported by VDL. However, under IHIP, all the reporting units need to enter surveillance data on daily basis. (Note: Suspected case definition should be followed for capturing data in S- and P-form of IDSP and IHIP).

Both IDSP and IHIP do not capture the tick and monkey death surveillance report. Hence, the reporting in prescribed formats should also be followed as provided in the annexures. During the lean period (July–October), the reporting is to be done on a monthly basis. During the transmission season (November–June), reporting has to be done on a weekly basis in the prescribed formats (Monday to Sunday surveillance week to be followed). However, the Deputy Director, VDL shall generate daily report of laboratory diagnosis during transmission period.

5.5.1 SOP for reporting

Standard Operating Procedures for surveillance and reporting are mentioned below:

1. *Active Fever Surveillance* in the community is done by Health Assistant (Male/Female) supported by ASHA. The surveillance details should be entered into IDSP and IHIP reporting form (S-form). Further, the suspected cases should be referred to PHC for case management, and blood sample collection and transportation (ensure that the suspected case visits the health facility). The suspected case details to be documented in the Case Investigation Form cum Lab Referral Form (CIF-LRF) (Annexure-I) at health facility (responsibility of the Medical Officer). Line list of suspected cases should be entered into KFD Human Surveillance Register (Annexure-IV, responsibility of the Laboratory Technologist).

2. During the active surveillance, the KFD vaccination beneficiary list (Annexure-XII) shall also be updated.

3. *Passive Fever Surveillance* in the health facility: Sample collection, treatment and management is done at health facility and documenting the patient details in the CIF-LRF (Annexure-I, responsibility of the Medical Officer). Line list of suspected cases should be entered into KFD Human Surveillance Register (Annexure-IV, responsibility of the Laboratory Technologist). Further, the surveillance details should be entered into IDSP and IHIP reporting form (P-form).

4. Blood sample collection from the suspected cases and transport to laboratory (Annexure-I should be sent along with the serum samples). Document the *result* in the KFD Human Surveillance Register (Annexure-IV, responsibility of the Laboratory Technologist).

5. *Monkey death surveillance:*
   - Reporting of unusual monkey death to the respective Panchayath Development Officer Gram Panchayath (Nodal person).
   - Transport of monkey autopsy samples to laboratory (Annexure-II, responsibility of Health Assistant of Hotspot Management team).
   - Documenting monkey death surveillance and autopsy report in a register (Annexure-V, responsibility of Laboratory Technologist).
   - Result of monkey autopsy to be shared with concerned PHC, THO, DSO and DVBDCO (responsibility of VDL Shivamogga).

6. *Tick surveillance:* The tick pools collected should be sent to laboratory for virus detection along with the Laboratory Request Form–Tick pool (Annexure-III) and documented in Tick Surveillance Register (Annexure-VI, responsibility of Health Assistant at PHC, and at district level, Entomologist, O/o the DVBDCO shall also maintain the details of tick surveillance).
   a. Hotspot: Laboratory Request Form—Tick pool (Annexure-III) to be filled by the Health Assistant of Hotspot Management team and document the same in the Tick Surveillance Register (Annexure-VI) maintained at PHC. Also, submit a report to DVBDCO for documentation.

b. Routine tick surveillance: Laboratory Request Form—Tick pool (Annexure-III) to be filled by the Entomologist and share the details with the concerned PHC for documenting the same in Tick Surveillance Register (Annexure-VI).

c. Result of tick pools to be shared with concerned PHC, THO, DSO and DVBDCO (responsibility of VDL Shivamogga).

7. All the surveillance data has to be compiled and entered in the PHC format (Annexure-VII, responsibility of the Medical Officer) and sent to Taluk and KFD field station. Meanwhile, the human surveillance data should be entered into IHIP and IDSP regularly.

8. At taluk: The data received from health facilities should be compiled into Annexures–VIII and IX; and sent to DHO, DSO, DVBDCO.

9. At district level: The DSO shall compile the surveillance data in Annexure-VIII and the DVBDCO shall compile Annexure-IX. Both Annexure-VIII and IX should be analysed and submitted to DD VDL, respective DJDs, State Nodal Officer of the district. Feedback for better performance/ improvement, etc. should be sent to the concerned.

10. DD-VDL: Shall compile Annexures-VIII and IX into Annexure-X; and send to the PD-IDSP, JD-CMD, JD-NVBDCP, DD-SSU for documentation at state level and mark a copy to the Senior Regional Director, Government of India and Surveillance Medical Officer, WHO, Sub Regional Team Leader-Bangalore. Feedback should be sent to the concerned for better performance.

11. As VDL-Shivamogga is a reporting unit under IDSP and IHIP, DD-VDL shall ensure the data feed on daily (IHIP) and weekly (IDSP) basis in L-form.

Sl. No.	Format (Annexure)	Responsibility
1	CIF-LRF (Annexure-I)	Medical Officer
2	Lab Request Form—Monkey Autopsy Specimen (Annexure-II)	Health Assistant of Hotspot Management team
3	Lab Request Form—Tick pool Specimen (Annexure-III)	Health Assistant at PHC and Entomologist, O/o the DVBDCO at district level
4	Human Surveillance Register (Annexure-IV)	Laboratory Technologist
5	Monkey Death Surveillance Register (Annexure-V)	Laboratory Technologist
6	Tick Surveillance Register (Annexure-VI)	Health Assistant at PHC and Entomologist, O/o the DVBDCO at district level
7	Surveillance Report of PHC (Annexure-VII)	Medical Officer
8	Report on KFD Surveillance (Taluk / District) (Annexure - VIII)	THO at Taluk DSO at district
9	Report on Prevention and Control of KFD (Taluk/ District) (Annexure-IX)	THO at Taluk DVBDCO at district
10	Status of KFD in Karnataka (VDL) (Annexure-X)	DD-VDL
11	FIR/ Outbreak reporting format (Annexure-XI)	MO / THO / DSO
12	Details of KFD vaccine beneficiaries (Annexure-XII)	Health Assistant

5.5.2 Data analysis and feedback

There should be a continuous process of data analysis of Surveillance data, which helps in detecting outbreaks, unexpected increase or decrease in disease occurrence, monitoring disease trends and evaluating the effectiveness of disease control measures and policies for identifying areas of improvement.

The data collected needs to be analyzed on the basis of Time, Place and Person. The analysed data should be share to the concerned for action.

Time: Number of KFD cases by week / month and year should be analyzed for village, Subcenter, PHC, Taluk, District and State.

Place: Distribution of KFD cases by village, Subcenter, PHC, Taluk, District and State by updating the spot map. It is also necessary to map tick positivity, tick density and monkey positivity and correlate with human positives.

Person: The characteristics of KFD cases like Age, Gender and Vaccination status should be analyzed for PHC, Taluk, District and State.

At district and state-level, the report needs to be analyzed and feedback should be shared for better performance / improvement, etc.

The DD-VDL should ensure the prompt feedback of the laboratory result through CIF-LRF form (Annexure-I) to the concerned which is very important to take preventive measures.

Further, the following surveillance monitoring indicators must be analysed at all levels to ensure and improve the surveillance response rate.

5.6 Surveillance monitoring indicators

Monitoring of the Surveillance system is an important tool for establishing and maintaining efficient surveillance and response system. It assesses the quality of the surveillance system over a time-period against set norms and baseline data. The information should be used locally to address and resolve problems related to control of diseases and strengthen evolving program. Implementation of a surveillance system without monitoring plan will result in no improvements in the system thus leading to increased risk of failure. The following monitoring indicators recommended for KFD surveillance:

1. **Patient response rate:** This indicator is most crucial in determining the quality and speed of a surveillance system. Timely reporting of suspected cases has many advantages: sample collection during early phase of disease increases the probability of laboratory confirmation, early detection of impending outbreaks, case management and timely public health interventions can reduce the morbidity and mortality rates. The date of onset of fever is considered as the important component and if the case reported within a 48 hours of onset of fever is considered as timely notified.

$$\textit{Patient response rate} = \frac{\textit{Total number of suspected KFD cases reported within 48 h of onset of symptoms during the week}}{\textit{Total number of suspected KFD cases reported during the week}} \; X\,100$$

Target of at least 80% timely reporting should be achieved. The reasons for delayed response should be analyzed. These could be due to lack of awareness among health care providers, lack of understanding of reporting protocols, reporting network not tuned to pick early cases or communication channels provided for reporting are not free or updated.

2. **Institution response rate:** This indicator determines the alertness of the surveillance system to respond to notification of cases. It is expected that the assigned Medical Officer at health facility level should be able to investigate all notified cases in his area within 48 hours of notification (from the date of suspected case reported). It is calculated as:

$$\textit{Institution response rate} = \frac{\textit{total no. of suspected KFD cases investigated during the week}}{\textit{Total no. of suspected KFD cases reported during the week}} \; X\ 100$$

All efforts should be made to achieve target of at least 98% for timely investigation so that immediate case management can be done.

Chapter - 6
Prevention and Control

The key activities to prevent and control KFD includes the following:

- Surveillance
- Vaccination
- Personal protection measures
- Tick control measures
- Regulatory provisions and interdepartmental co-ordination
- Information, education and communication (IEC) and Behavioral Change Communication (BCC)
- Training and capacity building

6.1 Surveillance

Refer Chapter-5.

6.2 Vaccination

Since 1990–91, KFD vaccine is being used and is an important component of KFD control. Timing of vaccination should be linked to the transmission cycle so that people can be protected. The area to be considered for vaccination is 5-km radius of infected zone (aerial distance* has to be considered not the road distance). The population at high-risk of contracting KFD Virus is determined as per the following criteria:

- If there are confirmed human cases and/or is an old known endemic area (in last 5 years), vaccination must be carried out in the area covering 5-km aerial radius.
- Even though the human cases are not reported in an area, if any monkey positive is reported in the last 5 years, vaccination should be conducted in an aerial radius of 5-km.
- Even though the human cases are not reported in an area, if any tick pool positive is reported in the last 5 years, vaccination should be conducted in an aerial radius of 5-km.
- If the vaccine is in short supply, limit the population to an area of less than 5-km from centre to periphery.

6.2.1 Mapping for vaccination

As per the guidelines, villages in the aerial radius of 5-km should be considered for vaccination. A suitable GIS application should be used to measure the aerial distance and list out the villages to be covered under vaccination.

6.2.2 Time schedule for vaccination

KFD vaccine is currently manufactured at Institute of Animal Health and Veterinary Biologicals (IAH&VB), Hebbal, Bengaluru for Department of Health & FWS, Government of Karnataka. The potency and safety of the vaccine is tested at VDL Shivamogga. The Department of Health and Family Welfare Services, Govt. of Karnataka is funding the manufacture of the vaccine. The vaccine is not available in the open market. Once the batch is passed in potency test, vaccines are supplied to VDL and in turn to districts. It requires 45 days to produce vaccine and 3 months to test the vaccine potency. Hence vaccine indent has to be placed well in advance (January–February). The districts are required to give their indent to DD-VDL, Shivamogga.

After first dose of vaccination, immunity is attained around 30 days and this will boost when the second dose is administered. Therefore vaccination is timed in such a way that the second dose shall be completed before the start of the transmission so that the subjects are immune well before the transmission season. Hence, vaccination is scheduled in June and July every year in the area which has been identified as a target area. In that area, those who have not been vaccinated will be given 1st dose so that the second dose is completed by August (the minimum period between two doses should be 30 days).

Booster dose to be given 6–9 months after the second dose and there after yearly for at least 5 years, depending on KFD activity in that area. The minimum period between two booster doses should be 9 months.

Dose	1st Dose	2nd Dose	1st Booster Dose	Annual Booster Doses
Time Schedule	June / July	Complete by August (minimum period between the two doses should be 30 days)	March–May (within 6-9 months after the second dose)	January onwards

The **vaccination card** provides the information about the beneficiary receiving the vaccination dosage, next vaccination date, etc. The village-wise beneficiary list prepared by the house to house survey team should be maintained at the PHC. The vaccination card design is given in Annexure-XV.

6.2.3 Dosage

- Target population: The upper age limit for administering vaccine is revised considering the health condition of the individual. All above 6-years of age need to be vaccinated.
- Dose
  - Adults (>15 years, no upper age limit): 1-ml
  - Children (6–14 years) : 0.5-ml
- Route: Subcutaneous. Insulin syringes are used to reduce the pain at the site of inoculation. The site of prick should not be rubbed.

6.2.4 Storage

The vaccine is normally stored at +2 to +4°C in a separate Ice-Lined Refrigerator (ILR) with power backup. Vaccine should not be frozen. The vial should be discarded if found frozen. Shelf life of vaccine is one year from the date of manufacture. There is no open vial policy for vaccination.

- Once the vaccine vial is opened, it has to be used within 6 h and time of opening the vial should be mentioned on the vial with a marker.
- Vaccine vials should be discarded as per the Guidelines of Biomedical Waste management.
- Expired unused vaccine vials have to be returned to IAH&VB, Hebbala, Bengaluru through VDL.
- Used or partially used vials should be kept for 48 h and observe for adverse events with proper labelling of vial opening date.

6.2.5 Preparations for vaccination

- Total population at risk are estimated as per the criteria.
- Number of vaccine doses required is estimated, stocked and distributed to the respective jurisdictional Health institutions.
- All the jurisdictional Hospitals, CHCs, PHCs, are informed about the villages covered for vaccination and the dates proposed for vaccination in their respective jurisdictions.
- All medical and para-medical staff to be oriented about the program and also trained about the administration of vaccine, contra-indications, etc.
- Intensive IEC activities to the community to be carried out to create awareness about the vaccination and also regarding the booster doses, so that drop-outs are prevented.
- Pre-vaccination: Interdepartmental meeting to be conducted at PHC level. This can be repeated before the start of transmission season.

6.2.6 Probable adverse events

As the vaccine is formalin inactivated, it causes slight burning sensation at the site of inoculation and last for 1–2 min (note: the inoculation site should not be rubbed).In some cases, mild giddiness may occur for 2–3 min. In rare cases, incidences of allergic reactions may be observed. In such persons, the subsequent doses should be avoided. Standard AEFI reporting protocols have to be followed for reporting.

Precautions:

- Vaccine must not be administered to persons allergic to Gentamycin, Penicillin and Egg proteins.
- Vaccine should not be administered to those who are having fever, jaundice, and to pregnant women.

6.2.7 Reporting vaccination progress

The progress of vaccination should be reported during the monthly meeting of PHC/ Taluk/ district in the Annexure-XIII at each level.

KFD Vaccination progress from 2012-13 to 2019-20

Year	Target population	1st dose	2nd dose	Booster dose	Total doses	Coverage (%)
2012–13	20531	8668	5758	6758	21184	61
2013–14	42844	11247	7731	14510	33588	52
2014–15	80435	24136	14807	26136	65079	47
2015–16	82483	9899	7252	31282	48433	47
2016–17	76262	16355	14161	37989	68505	68
2017–18	96209	27433	19983	37687	85053	60
2018–19	152129	62057	45901	57309	165267	68
2019–20	172988	71951	55306	86514	213771	82

Preparation of vaccine

Primary Chick Embryo cultures are infected with KFD virus. Inactivation of the virus is carried out by treatment of infected fluid with formalin. Safety and potency assays are carried out in Swiss Albino Mice. Toxicity is determined in Guinea pigs.

Chronology of development of formalin killed chick-embryo tissue culture KFD vaccine

- During 1983 and 1984, a major outbreak occurred with 354 confirmed cases and 110 deaths; and 183 confirmed cases with 139 deaths, respectively.
- The government of Karnataka accorded sanction to manufacture trail KFD vaccine at Shivamogga in 1983.
- Technical staff was appointed and equipment's were procured for vaccine production unit.
- The technical staffs were trained in production of Tissue Culture vaccine at the National Institute of Virology, Pune.
- The trial vaccine production was initially started at KFD Vaccine Production Unit, Shivamogga.
- Manufacturing of KFD vaccine on large scale (30,000 doses) commenced in October 1988 under supervision of expert team headed by Dr. C.N. Dandawate, National Institute of Virology, Pune and obtained drug license.
- Drug license to manufacture KFD vaccine was issued in March 1989 by the Drugs Controller, Government of Karnataka after detailed inspection of building, equipment, staff and functioning of vaccine unit by the drug controller team.
- KFD vaccine production started on large scale from 1989.
- KFD vaccine was manufactured at KFD Vaccine Production Unit, Shivamogga and quality control assays were conducted at VDL Shivamogga, till 2000.
- From 2001 onwards, KFD vaccine production was shifted to Institute of Animal Husbandry and Veterinary Biology, Hebbal, Bengaluru, for regular production and the safety tests were conducted at VDL Shivamogga.
- From 2013 onwards, all the quality control assays of KFD vaccine being conducted at VDL Shivamogga.
- KFD vaccine indent from Karnataka and other KFD affected states were received and compiled at VDL, Shivamogga, then submitted to the Directorate of Health and FWS, Bengaluru for further scrutiny and arranging supplies.
- KFD vaccine is procured from IAH&VB, Hebbal, Bengaluru and stored at VDL, Shivamogga and distributed to districts.

6.3 Personal protection measures

- People should be advised not to go to/ venture into forest where monkey deaths are reported.
- Persons, who are forced to visit the forest / plantation / farms, should cover the body with full length thick cloth and high shoes while going to forest.
- Prior to visiting forest / plantation / farms, tick repellents like DEET (*N,N*-diethyl-m-toluamide), DEPA (*N,N*-diethyl phenylacetamide), neem oil, eucalyptus oil, etc. should be applied on the exposed part of the body.
- Those venturing into the forest / plantation / farms should be advised to return within 2 h, since the tick (especially the nymphs) take much time to settle down and take a blood meal on its host.
- On returning from forest/ plantation/ farms, they should immediately wash their clothes, dip in hot water and also should have a body wash with hot water.
- A thorough body check should be conducted upon return from potentially tick-infested areas by searching entire body for ticks. A hand-held or full-length mirror should be used to view all parts of the body and any tick found on the body should be removed.
- Parents should check the body of their children for ticks.
- Children playing on collected dry leaves should be avoided.
- Frequently, thorough search should be done for ticks on the body of pet animals and cattle to remove them.
- Sitting and lying on the ground should be avoided.
- The forest department officials and officers venturing into the forest should also be advised on the same lines to prevent themselves from contracting the disease. They should be advised to get themselves vaccinated.
- Avoiding forest exposure during the transmission season is the best way for prevention of the disease.

6.4. Tick control measures

Transmission cycle of KFD virus is well documented, but its control remains challenging. Measures to minimize the human–tick interface are less likely to succeed considering the forest ecosystem and the dependence of local villagers on it. Control of ticks in the forest is far from easy. Based on the situation like outbreaks, the appropriate vector control measures should be taken up. However, the following methods are followed.

6.4.1 Physical control

- Clearing the vegetation (shrubs and dry leaves) around the human dwelling (10-m) in the forest area.
- Collecting dry leaves of forest, storing in the backyard and using for bedding purpose in cattle sheds should be discouraged.
- Combing of forest boundaries along the roadway where human and cattle movement is high.
- Restriction to cattle movement into forest to bring about a reduction in distribution of vector population.
- Frequently bathing (at least twice a week) cattle by scrubbing and applying tick-repellents and also physically searching for ticks on the body and destroying them.

6.4.2 Biological control

Research on use of nematode larvae and fungal spores to control the larval and egg stages of the ticks is going on. Few studies have shown that nematode larvae are effective on adult ticks as well.

Metarhizium anisopliae fungal exposure on ticks revealed that the egg laying capacity of ticks was reduced by 50%, weight of larvae and nymphs was reduced significantly, suggesting that the fungus reduced the tick fitness and growth and caused mortality. Also there was a 5–10-fold reduction in the number of tick population (*16,17*).

A concentration of 50 nematodes/cm^2 caused 100% mortality of ticks in less than 5 days as a spray (*18*).

6.4.3 Chemical control

The insecticide / acaricide formulations used for tick control depends on the purpose (see Annexure-XIX).

- At Hotspot: A radius of 50-ft from the monkey death area (hotspot) is considered for Acaricidal application (Malathion 5% or Malathion 25%) as per the Hotspot Management guidelines.
- During outbreaks/epidemics: A 3-meter wide pathways frequently used by villagers and near the contiguous villages, may be taken up for dusting/spraying with Neem / Eucalyptus oil (length to be determined in consultation with the forest authorities). Neem leaves + Mango leaves extract @ 10mg/ml, when sprayed on the animals, sheds, killed all the stages in less than 3–4 min (*19*).
- Sapota leaf extract was found 100% effective on adult ticks (*20*).
- Control of tick infestation on animals: Acaricides/ ectoparasiticide like Cypermethrin, Deltamethrin, etc. can be used to control tick infestation on animals by 'pour on' or 'spray on' method [*Pour-on*: liquid containing active ingredients that are applied to animals by pouring it along the backline. *Spray-on*: Liquid containing active ingredients that are sprayed on to the entire body of the animal. Mouth of the animal should be covered with muzzle (bamboo basket so that the animal do not lick and consume Acaricide)].
- Animal resting areas can be sprayed with Acaricides so that adult ticks are killed (animals are to be kept outside while spraying of shed is done).

6.5 SOP for Hotspot Management

When the infected monkey dies, ticks will detach from the carcass and crawl away. This will further spread the disease. 50-ft radius of unusual monkey death area is considered as hotspot.

Hotspot

At PHC level, Panchayat Development Officer (PDO) of Gram Panchayat will be the Nodal Person responsible for strict follow of SOP activity in the hotspot area, as it requires the coordinated activity of different departments.

The following should be members of Hotspot Management Team: Panchayat Development Officer (Nodal person) of Gram Panchayat, Medical Officer of PHC, Veterinary Officer of the area, Range Forest Officer.

For team members, it is mandatory to wear the PPE before starting the operation, as they have more chances of getting infected. Also, ensure that all the members of hotspots management teams are vaccinated well in advance. Hotspot management team should include well-trained personnel by following standard protocol. The detailed roles and responsibilities of various departments during hotspot management are provided in Annexure-XX.

Step 1: All the persons (especially those who conduct autopsy / collect ticks / perform hot spot spray) in the team should wear the PPE like gloves, gum boot, triple-layered mask, goggles, etc. before starting the procedure.

Step 2: Application of tick repellent to the exposed body part is mandatory for the team members.

Step 3: Observe the body condition of the dead monkey and check for the ticks. If ticks are present on the body, collect by plucking method in a test tube and screw the cap so that ticks don't escape. Label with the details. (Responsibility of Health team).

Step 4: Place the dead monkey body on a plastic sheet (preferably white) to conduct autopsy (if the area where the monkey has died is not convenient to conduct autopsy, bring the dead body of monkey to the near area).Collect 2–4 g each of viscera samples like brain, liver, lungs, heart, spleen, gastro-intestinal tract (preferably duodenum) and kidney in a separate polypropylene container without adding any preservative. Label them with the details. Handover the monkey autopsy sample along with filled format (Annexure-II) to Health Department to arrange for transportation to laboratory. (Responsibility of Veterinary team).

Step 5: Simultaneously, collect the ticks by flagging or dragging method in the hot spot area. The ticks are collected by dragging a lint cloth flag over the vegetation and ticks that clung on the flag should be picked up with the help of forceps and collected in tubes. Screw the cap tight so that collected ticks don't come out. Label them with the details. The tick collection activity and transportation to laboratory is to be done by the Health team. Minimum of 2–5 tick pool samples should be collected in one hotspot area. It should be transported to VDL-Shivamogga/ NIV-Pune as early as possible but within 48 h. (Responsibility of Health department).

Step 6: The carcass should be burnt completely and made sure that no organ is left unburnt. Care should be taken while burning the carcass so that the fire does not catch the forest. (Responsibilty of Forest department. If monkey death has happened in a village, activity should be done by the Gram Panchayath.)

Step 7: Spraying is the most recommended method for application of insecticide. 15-kg of Malathion (5%) or 3-kg of Malathion (25%) is mixed in 75 and 15 liters of water, respectively, and sprayed in the targeted area (50-ft radius) using stirrup pump. Other methods of insecticide application may also be considered depending on the advantage & disadvantage, and local situation (Health team shall perform the activity with the assistance of Gram Panchayath and Forest teams).

Step 8: Remove all the gloves, PPE, etc. and disposal should be done in an appropriate manner.

Step 9: Ensure all the formats are filled properly which needs to be sent to laboratory.

Step 10: Send the samples to VDL-Shivamogga / NIV-Pune.

6.5.1 Insecticide application methods in the hotspot

For an effective tick control in the hotspot, Malathion should be deposited with 1-g active ingredient in 1-sq.-meter area (*14,21*). Insecticide may be applied using the following three methods, depending on the local situation and considering the advantage and disadvantage: Spraying, Manual dusting and Mist blowers dusting (dust blower). Insecticide application should be done under the supervision of Health Assistants of Hotspot Management team.

An area of hotspot is 50-ft radius. Accordingly, the logistics are calculated, as below.

(a) Manual dusting

Manual dusting is the easiest way of application of insecticide. It doesn't require any equipment and is maintenance free. For an hotspot dusting, 15 kg of Malathion (5%) or 3-kg of Malathion (25%) is mixed well with 20-kg and 30-kg saw dust, respectively. (Note: using sand as inert material is not recommended as the quantity required is more i.e., 300 kg, and practically not possible to carry to the spot.) Uniformly dust the mixture over the hotspot. Care must be taken while dusting in high-wind velocity.

(b) Spraying

Spraying is most recommended method for insecticide application (chances for the questing nymph to come in contact with the insecticide deposited on leaves is high). Stirrup pump is preferred for spraying.

Requirement: 15-kg of Malathion (5%) or 3-kg of Malathion (25%) is mixed in 75-liter or 15-liter of water, respectively, are required and sprayed in the targeted area using stirrup pump.

(c) Dusting using mist /dust blowers)

The dusting has to be done in such a way that the bottom of the leaves comes in contact with the insecticide to target the tick vectors. When the hotspot has many herbs/shrubs/ has outreach area, dust blowers can be used. However, mist blower has many disadvantages. If the wind velocity is high, this method should be dropped.

- Mist (dust) blowers are to be filled with petrol and oil in petrol tank to start the engine. Capacity of petrol tank is 1.7 liter which can be used for 1½ hour of dusting.
- This can be used in both dusting as well as liquid spraying. Depending on the purpose the insecticide tank should be fixed.
- The maximum capacity of insecticide tank is 14 liter.
- Malathion is mixed well with saw dust in a proportion: 15 kg of Malathion (5%) is mixed 20-kg saw dust. If Malathion (25%) is used, 3-kg of it should be mixed well with 30-kg saw dust. The mixture is filled in insecticide tank.
- Machinery engine should be started keeping the 'acceleration knob' in idle condition and 'Metering knob' in medium.
- Move the hose of the machine in a circular motion from the periphery of the circle towards the center, in order to prevent the outward movement of the infected ticks. Complete the process of dusting in hotspot.
- The person in charge of dusting should compulsorily wear all the personal protection equipment.
- After completing the process of dusting, insecticide tank and fuel tank should be emptied.
- The mist blowers can also be used as 'blowers'. Dried leaves can be blown to one place and dusting can be done on piled leaves.

Trained attendant from O/o DVBDCO, Shivamogga wearing PPE and performing dusting by mist blower

Logistic requirement if Malathion 5% is used (*14, 21*)

Logistic	Dusting	Spraying	Dust blower
Malathion 5%	15 kg	15 kg	15 kg
Saw dust	20 kg	NA	20 kg
Water	NA	75-liter	NA

Logistic requirement if Malathion 25% is used (*14, 21*)

Logistic	Dusting	Spraying	Dust blower
Malathion 25%	3 kg	3 kg	3 kg
Saw dust	30 kg	NA	30 kg
Water	NA	15-liter	NA

Advantages and disadvantages of application methods*

Advantage / disadvantage	Manual dusting	Spraying	Dusting with mist blower
Mortality recorded	54%	71%	43%
Requirement of logistics	Low	Medium	High
Cost effective	Low	Medium	High
Operational easiness			
• Laborious	No	Yes	Yes
• Equipment maintenance	No	Yes	Yes
Insecticide deposit in targeted area	Good	Very good	Bad
Uniform application of insecticide	Bad	Very good	Good
Effect of environmental factors like wind flow / direction	Low	Low	High**
Transportation of logistics to the spot	Easy	Easy	Difficult
Special training required	No	No	Yes
Outreach area (shrubs and bushes)	Bad	Bad	Very good

*Source: Ref (*21*).
**When blown on the vegetation, the questing nymphs will also get blown away with dry leaves.

6.6 Regulatory provisions by the District Administration

The villagers depend on the forest for their livelihood or sometime live within the forest. People, who visit forest for collecting dry leaves or take animals to graze, are more susceptible for tick infestation and infected tick bites.

Hence, the District Administration should notify the high-risk areas (where monkey deaths are frequent / high no. of tick or human positive cases have reported) as 'Prohibited area' during KFD transmission, for a period of three months depending on the local situation.

The District Administration, Gram Panchayath, Animal Husbandry departments should make necessary arrangement for the villagers so that they don't enter in to forest.

6.7 Information, education and communication (IEC) and Behavioral Change Communication (BCC)

Intensive IEC activities through Banners, Handouts, Posters, Group health talks, Inter-personal communication should be carried out for creating awareness among general practitioners and stake holders. School IEC (by adopting strategy as in pulse polio) CD/films, advertisement in cable TV through CD/ jingles, etc. should be taken up. Social media can be utilized to create awareness with audio clips

and video films of KFD. Inter-departemental activities involving Forest and Tourism department with IEC posters and Banners can be initiated. Local folk art forms like "Jogi pada" and "Veeragase" and "Yakshagaana" also can be employed to reach out the target population. Community should be educated regarding causation of the diseases, its control measures, awareness regarding tick biology, for early reporting of cases and to inform the monkey death spots to the nearest govt. institution. BCC through Inter-Personnel Communication is imparted by the health Staff and ASHA.

Vaccination is an important component of KFD control. It causes burning sensation at the site of injection which leads to rejection for taking vaccination. Hence, it is necessary to convince the public to take vaccine.

Do's

- Report monkey deaths to Gram Panchayath/ Animal husbandry/ Forest and/ or Health Authority
- Persons, who are visiting/working in the forest, should cover body with full clothes
- Apply tick repellents to the exposed parts before going to forest
- Wash the clothes and body with hot water and soap after returning from the forest.
- Report incidence of the disease/deaths to nearest health facility.
- Educate the villagers to avoid the forests areas where monkeys have died.
- Application of Acaricides on cattle and domestic animals which helps in reducing the density of tick's population.

Don'ts

- Don't bring the leaves from KFD infected area to the village as cattle bedding material.
- Don't visit the area where recent monkey death is been reported, especially an area where cases of KFD has been reported in the past.
- Don't handle the infected monkey carcass by bare hand.

6.8 Training and capacity building

Training and capacity building is an essential component to update the knowledge / skills of health professionals with respect to KFD prevention and control. The training / workshop should be planned and conducted once a year well before the transmission season, for all the health care providers and front line workers.

- As a part of quality surveillance system, the front-line workers should have the knowledge of case definition and apply the same in the field situation in response to KFD suspected cases. This results in timely notification, investigation and prevents an impending outbreak. Therefore, efforts should be made to strengthen the reporting network in surveillance activities involving health staff. Sensitization workshops can be conducted on professional forums like: Indian Medical Association (IMA) and AYUSH. Half a day workshop can also be conducted during monthly review meetings at Taluk/ District level.
- The medical professionals (including Private Practitioners) should be made oriented about the case definitions; facility-based surveillance, case management, referral of cases, prevention and control aspects of KFD.
- The training material should contain information about the epidemiology of KFD and rationale of surveillance. All operational components of notification and reporting should be clearly explained to overcome all the factors of under reporting. Case definitions, procedure for specimen collection and reporting formats especially should be explained in detail to increase

the likelihood of timely reporting and specimen collection. The training should also focus on the case management and control measures in the community.

- Interdepartmental coordination meetings/ workshop needs to be conducted regularly to understand the roles of different department and to ensure implementation.

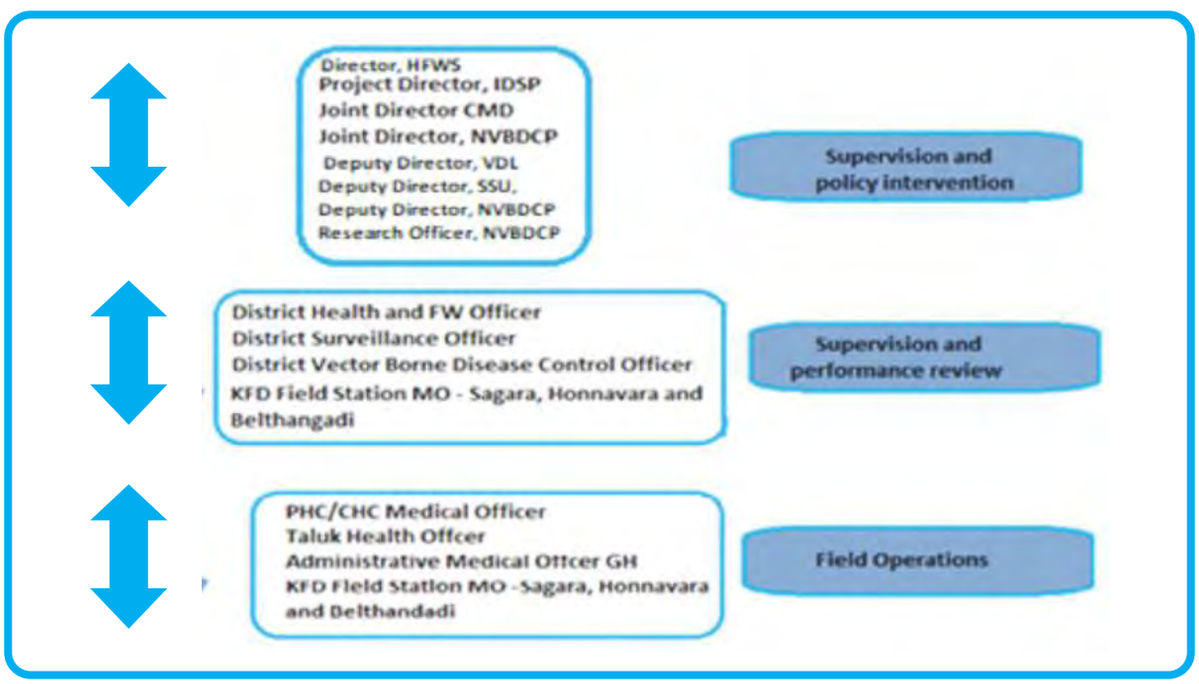
The cadre-wise training schedule has to be considered as follows:

Sl. No.	Cadre	No. of days	Level of training	Topics to be covered
1	Medical Officers / Clinicians (including private sector)	1 (Aug-Sept)	District/ Taluk	KFD Epidemiology; Human Surveillance: Case definition and case identification, sample collection, packing and transportation, reporting formats, clinical management of cases; KFD vaccination—microplan, booth planning; management of hotspots; ticks collection; personal protection measures; outbreak; Interdepartmental co -ordination; IEC; any other pertaining to KFD.
2	Health Assistants/ Laboratory technicians	1 (Aug-Sept)	District or Taluk	KFD surveillance: Case definition and case identification, sample collection, packing and transportation, reporting formats, follow up of cases; KFD vaccination—microplan, booth planning; management of hotspots; ticks collection; personal protection measures; outbreak; any other pertaining to KFD.
3	ASHA/ Anganwadi/ Panchayat Raj Institution / Forest / Identified monkey death informers	1 (Aug-Sept)	Taluk	Immediate reporting of monkey deaths; management of hotspots; fever survey, ca se identification and referral of case to the health center; KFD vaccination; prevention and control, role of stakeholders.
4	Interdepartmental workshops— Officers/ staff	Half-day	District or Taluk	Roles and responsibilities of each department; preventive and control.
5	Training to technical persons including RRT	3-days	State	State to decide upon the technical person to be trained.

Chapter - 7
Organizational Structure

7.1 State

The administrative and functional organization structure of Health Department is as shown below. At state-level, next to Director, the Project Director, IDSP (previously known as Additional Director-CMD) is the administrative and functional head of all communicable diseases including KFD. The Joint Director (CMD), Joint Director (NVBDCP) and Deputy Director (SSU) assist the Project Director (IDSP) in implementing the activities. The Deputy Director, VDL is a state-level post, stationed at Shivamogga.



7.2 Virus Diagnostic Laboratory, Shivamogga

The Virus Diagnostic Laboratory was started at Shivamogga, to facilitate virological studies and other related field studies on KFD, as it was the nearest convenient city (and the District Head Quarters) for providing all necessary transport and other logistic support facilities required for the purpose. The Laboratory started functioning from 1958 onwards with close technical collaboration of the erstwhile Virus Research Centre, Poona (presently known as National Institute of Virology, Pune), under the leadership of Dr. Khurshad M Pavri, and with the assistance of Rockefeller foundation (USA) which provided most of the equipments for conducting virological activities at the laboratory.

The Government of Karnataka (erstwhile Government of Mysore) took over and continued the establishment of Virus Diagnostic Laboratory from 1961 onwards on a temporary basis and subsequently made it a permanent establishment to cater to the needs of the KFD affected areas with an objective of Prevention and Control of the Disease. The laboratory was also conducting research towards evolving an effective Vaccine against KFD with the Technical guidance of the National Institute of Virology. Research Scientists like Dr. Telford Work, Dr. C.N. Dandawate, Dr. Banerjee, Dr. H.R. Bhatt, Dr. Dhanda, Dr. D.T. Mourya, have all contributed enormously in the epidemiology, entomology, prevention and control of the disease.

At present, the VDL is mainly engaged in virological studies and diagnosis of KFD by real time RTPCR and IgM ELISA, supporting the Quality assay tests for Tissue Culture Vaccine, and ELISA-based diagnosis of Dengue and Chikungunya virus. Mice colony is regularly maintained with Swiss Albino Mice and is being upgraded as per CPC&SPA norms (Committee for the Purpose of Control and Supervision of Experiments on Animals).

A few important milestones in the investigation of KFD:

- March 12, 1957: Telegram from the Director of public health in Mysore, requesting Dr. D.P. Narasimha Murthy, Medical Officer of Health, Sagar to investigate death of fever cases.
- March 13, 1957: Visited Sagar to investigate human cases and monkey death.
- March 15, 1957: MOH Sagar sent a sick monkey from Shigga village in a live state to Public Health Institute (PHI), Bangalore for follow up of the disease with a request to investigate and advise its relation to human acute specimens sent along with it. The monkey was subjected to autopsy after death. Mice inoculated with the above specimens as well as after passage became sick. Histopathological examination of brain by Dr. C.G.S. Iyer suggested the possibility of viral encephalitis.
- March 21, 1957: Dr. Krishna Murthy Rao, Bacteriologist, PHI Bangalore arrived to carryout exhaustive bacteriological examination of suspected human cases for culture, Widal and Weil-felix tests.
- March 23, 1957: The Virus Research Centre, Poona was informed that the monkeys had been observed to be dying in the forests of Shivamogga District.
- March 26, 1957: Arrival of an expert team consisting of Dr. T.H. Work and Dr. H. Trapido from VRC Poona at Shivamogga and discussion with DHO Shivamogga.
- March 27, 1957: Arrival of the above export team at Sagar and proceeded to the area of Monkey deaths. A moribund (later dead) monkey was brought from Barige (Kyasanur Forest) village to Ulavi hospital. After autopsy, viscera samples and blood of this monkey was sent to Poona on the same day. The first strains of virus named as KFD was later isolated from them.
- April 14, 1957: IMA Shivamogga branch clinical meeting held at Sagar. The nature of febrile illness affecting Human and Monkeys in the forest area of Shivamogga was declared to be due to a virus isolated from monkey specimen and sick persons. Dr. T.H Work made the above announcement to the professionals.
- August 29–31, 1957: A high-level conference held in Vidhana Soudha, Bengaluru, presided by the Secretary, Ministry of Health, Government of India, also attended by a state representative, Army Minister for Health and Ministry of Finance and Planning considered methods for combating the spread of KFD.
- March 1, 1959 (establishment of VDL): Starting of VDL, Shivamogga with close technical collaboration of VRC Poona for processing the materials of human, monkey, ticks to facilitate quick inoculation of materials without delay. The Rock Feller Foundation of USA provided most of the equipment's to VDL Shivamogga for taking up virological work. After reviewing the work done by this institution in 1961, the Government of Karnataka decided to continue VDL Shivamogga on permanent basis so that not only KFD but the institute could be developed to undertake research and investigation of such problems. Since then KFD Virus isolation was done by mice inoculation at VDL.

The staff sanctioned for the Virus Diagnostic Laboratory, Shivamogga (GO: PLM 751 PET 65, Bangalore, dtd: 12 May 1966)

Sl.No.	Name of post	Number sanctioned
1	Deputy Director	1
2	Research Scientist (non-medical)	1 (re-designated as per GO Akuka149HSM2019, Bengaluru, dtd. 08.05.2020
3	Asst. Entomologist	1 (shifted as per GO: Akuka 30 HSM 2019, Bengaluru dtd: 06.03.2019)
4	Scientific Assistant	2
5	Sr. Lab technologist	2
6	First Division Assistant	1
7	Second Division Assistant	1
8	Typist	1
9	Driver	1
10	Animal Assistant	7
11	Group D	3

The KFD Vaccine Production Unit is attached to the VDL with the following staff (GO No.: HFW 20 CGE 83, dtd: 10 April 1984)

Sl.No	Name of post	Number sanctioned
1	Deputy Surgeon	1
2	Microbiologist (Non-medical)	1
3	Junior Chemist	1
4	Senior Lab Technologist	5
5	Junior Lab Technologist	8
6	Lab Attend ant / Animal Attendant / Sanitary Worker / Water Carrier	15

The Deputy Director, Virus Diagnostic Laboratory, Shivamogga has three ancillary units known as 'Field Stations' and the field stations of Sagar and Honnavar is headed by a Medical Officer, while the Field Station of Belthangadi is attached to the Taluk Hospital.

The Staff position of the KFD Field stations is as follows:

1. **KFD Field Station, Sagara, Shivamogga** (established in the year-1959):

Sl.No.	Name of post	Number sanctioned
1	Medical Officer	1
2	Fist Division Assistant	1
3	Sr. Health Assistant (Male)	1
4	Typist	1
5	Driver	1
6	Group D	2

KFD Field Station, Sagar shall monitor and coordinate all field activities in the jurisdiction of Shivamogga, Chikkamagaluru, U\dupi and Hassan districts.

2. **KFD Field Station, Honnavara, Uttara Kannada** (established in the year-1976):

KFD Field Station, Honnavara shall monitor and coordinate all field activities in the jurisdiction of Uttara Kannada and Belagavi district.

Sl.No.	Name of post	Number sanctioned
1	Medical Officer	1
2	First Division Assistant	1
3	Sr. Health Assist (Male)	1
4	Typist	1
5	Driver	1
6	Group D	2
7	Insect Collector	2

3. **KFD Field Station, Beltangadi, Dakshina Kannada** (established in the year-1983):

KFD Field Station is actually attached to the Taluk Hospital, Belthangandy and is supporting the field activities of Dakshina Kannada, Mysuru and Chamarajanagara districts.

Sl. No.	Name of post	Number sanctioned
1	Sr. Health Assistant	1
2	Group D	2

From 2019–20 onwards, under National Health Mission (NHM-State Innovation) is supporting KFD surveillance by providing the following: Entomologist–Consultant (1), Insect Collectors (2), Data Entry Operator (1) and Multi-Purpose Workers (1 post each for 3 KFD Field Stations).

7.3 Roles and responsibilities of Health Department Officials at different levels

Ownership of the surveillance activity should be with the District Health officials: District Health and Family Welfare Officer (DHO), District Surveillance Officer (DSO), District VBDC Officer (DVBDCO), KFD-Field Station Medical Officer, Medical Officer of PHC.

Role and responsibility of the DD-VDL, Shivamogga

- This is a state-level position for KFD situated at Shivamogga.
- Coordinate with the DHOs of the affected districts for the smooth implementation of KFD Prevention and Control measures.
- Data management of all the affected districts and regular analysis and feedback sharing with the DHOs.
- Ensure correct data base of the samples from the field and immediate prompt feedback of the results to the district.
- Report L-form of IDSP and IHIP.
- Periodically review KFD surveillance activities and progress in the districts.
- Liaise with other stakeholders in KFD control activities.
- Overall in charge of the laboratory component of the KFD.
- Vaccine indent to IAH&VB, Hebbal, Bengaluru.
- Ensure regular supply of KFD vaccine to the districts and review the vaccination progress.
- Maintain district-wise/ institution-wise logistic details like: tick repellent, insecticide requirement, vaccine, etc.
- Any other responsibility assigned by the JD-CMD related to KFD in the interest of public.

Role and responsibility of the District Health and FW Officer

- The DHO should constitute, convene and chair the District Rapid Response Team (RRT) meetings.
- Review the disease scenario on 'top priority' during transmission period.
- Appraise the Deputy Commissioner and Chief Executive Officer (CEO) during the District Task Force (DTF) meetings.
- Liaise with other stakeholders in KFD control activities.
- Any other responsibility assigned by the PD-IDSP and JD-CMD related to KFD in the interest of public.

Role and responsibility of the District Surveillance Officer

- Overall in charge of the successful implementation of the KFD Surveillance activities in the district in coordination with the Medical Officer, KFD Field Station.
- Conduct trainings/ workshops at district level in co-ordination with the Field Station Medical Officer.
- Prepare the estimation of vaccine and place indent to DD-VDL.
- Review vaccination progress in a monthly meeting.
- Data management, analysis and feedback sharing.
    - o Maintain the database of all suspected and confirmed KFD cases.
    - o Supervision of data entry into IDSP and IHIP portal.
    - o Alert the Early warning signals of Outbreak by regular data analysis.
- Achieving Inter departmental co-operation for overall KFD management in the district.
- Overall in-charge of RRT team.
- Co-ordinate to conduct of death audit through Death Audit Committee.
- Any other responsibility assigned by the DHO related to KFD in the interest of public.

Role and responsibility of the District Vector Borne Disease Control Officer

- Plan for tick surveillance activities facilitated by District Entomologist.
- Share the feedback of tick surveillance activity to the DSO, KFD-Field Station Officer.
- Overall in-charge of the vector (tick) control measures (including management of hotspots).
- To arrange / provide insecticide required for Hotspot management.
- Maintain the stock of logistics including tick repellent, personal protective equipment, Malathion powder, etc. and submit the stock report to DD-VDL.
- Implementation of IEC in the district in co-ordination with DSO.
- Lead member of RRT.
- Any other responsibility assigned by the DHO related to KFD in the interest of public.

Role and responsibility of the Medical Officer, KFD Field Station

The field stations are engaged in the following activities:

- Capacity building of the reporting network.
- Providing technical support to the districts.
- Overall in charge of the successful implementation of the KFD Surveillance activities in their jurisdiction in coordination with the DSO and DVBDCO.
    - o Fever surveillance and collection of blood samples in co-ordination with the district
    - o Tick surveillance
    - o Monkey death surveillance in coordination with the concerned district
- Follow-up of all positive patients and taking containment measures.
- Collection, compilation and reporting of KFD activity related data.
- Ensure correct data management in their jurisdiction in coordination with the DSU.
- Maintain district-wise stock details like: tick repellent, insecticide, vaccine, etc.
- Monitoring of KFD Vaccination programme.
- Training of PHC field staff and other departmental staff (Forest, Veterinary, Education, Gram Panchayath and Women and Child Welfare) in KFD prevention activities.

Role and responsibility of THOs / MOs

- Case Investigation: All Suspected cases are to be investigated by the Medical Officer by filling the CIF-LRF.
- Medical officer should assign the EPID number to the case to avoid duplication.
- Ensure prompt Case management and Public Health Intervention measures in the community.
- Assign Laboratory Technician for sample collection and transportation to the accredited Lab.
- Assign Health Assistant for the Surveillance activities (Human, Monkey death and Tick Surveillance) in the field.
- Ensure Information, Education and Communication activities and conduct Grama Sabhas in the field to create awareness in the public.
- Regular sensitization of the reporting network.
- Review the surveillance activities regularly.
- Review vaccination progress in a monthly meeting.
- Ensure availability of vaccine and other logistics for preventive measures.
- Monitoring of Surveillance data entry into IDSP and IHIP portal.
- Provide feedback about the reported cases to the reporting network and patient.
- Taluk Health Officer to coordinate all the activities at the Taluk level.
- Conduct regular Taluk Task Force meeting.
- Ensure the functioning of Rapid Response Team at the Taluk level.
- To maintain institution-wise stock details like: tick repellent, insecticide, vaccine, etc.

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Govt. of Karnataka

Kyasanur Forest Disease
Case Investigation Cum Lab Referral Form (CIF-LRF)

(To be used during blood sample collection from suspected cases and to be returned with results by the testing lab)

EPID / Field Station No.
SVDL No.

1. Reporting / Investigation Information:

Date Case Reported: ____ /____ / _____ Reported by: _____ Title: _____

Date Case Investigated:____ /____ / _____ Investigated by: _____ Title: KFD M O / DSO / Medical Officer / Nodal Officer / Other

2. Case Identification: Patient's Name: _____ other given names: _____

Sex: M / F Date of birth (DOB): _____ /_____ / _____ *Age of patient: years_____ months_____ Father's Name:_____

*Patient's Occupation: Farmer / Cattle Grazer / Wood cutters / Arecanut picking labour / Forest staff / others specify_____

Address with land mark: _____ SC / ST / Others _____

*Village/ hamlet_____ *Subcentre: _____ *PHC: _____

*Block : _____ *District: _____ Pin code: _____Setting: Urban / Rural

State: _____ Tel. _____ Alternate tel. _____

Patient exposed to Endemic Area of KFD*?: Y / N If yes, specify: Area around Confirmed Human KFD case / Monkey Death / Tick positive in the last 5 years

Name of probable exposed forest location_____

3. Hospitalization: Yes / No Name of Hospital:_____ IP number _____

Date of Admission:____ /____ / _____ Date of Discharge/ LAMA/ Death:____ /____ / _____

4. *Vaccination Status: Has the case ever received one or more KFD vaccine doses in his or her lifetime? Yes / No / Unknown.

If Yes Date of: 1st dose _____; 2nd dose_____; Booster dose_____

Source of vaccination status: KFD Immunization Card / Any Record or Register / Recall / Both recall and register / Other, Specify (if Others)_____

Date of last dose of KFD Vaccine: ____/____/_____ Total KFD vaccine doses recieved: 0 / 1 / 2 / 3 / 4 / more

Date of last dose of KFD vaccine (before Fever onset): _____/ _____/_____ (to be filled in line list)

Date of last dose of KFD vaccine (before blood collection): _____/ _____/_____ (to be filled in linelist)

6. Clinical History: *History of Fever : Yes / No If yes, Low grade/ High Grade ***Date of Fever Onset:_____/_____/_____**

Chills: Yes / No / Unknown Myalgia / Bodyache: Yes / No / Unkr Headache: Yes / No / Unknown Nausea / Vomiting: Yes / No,

Soreness in mouth: Yes / No Skin rash: Yes / No Facial swelling / edema: Yes / No *Abdominal Pain: Yes / No

Photophobia: Yes / No Seizure: Yes / No / Unknown Change in mental status: Yes / No / Unknown Diarrhea : Yes / No

Conjunctivitis: Yes / No Jaundice / Yellow eyes: Yes / No Urine: Normal / High coloured Urine output: Normal / decreased

Neck Stiffness: Yes / No / Unknown Bleeding manifestations : Yes / No If Yes, Petechie / Blood vomit / Coughing blood / Nose bleeds / Bloody diarhoea / others specify ___

Complications : Yes / No If yes: Meningitis / Encephalitis / ARI / Pneumonia / / others (Please specify) Clinician KFD : Yes / No

Past History of fever with any of the history mentioned above: Yes / No If Yes when? _____

Comorbid conditions if any Diabetes mellitus / Hypertension / Liver disease / Cancer / Others specify _____

8. Travel History*: Travel to hot spot / forest area prior to onset of Fever (indicate dates and place of travel with arrows on date line)

-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0

District of residence: _____

Requires cross notification? Yes / No

If yes, date of cross notification: ____/_____/_____ **Block/ Urban area of residence: _____**

9. Sample Collection:

	Duration of illness	Date Collected	Date Sent	Name of Lab	Condition	Date of Result	Laboratory Result
Serum*	_____days	___/___/___	___/___/___		Good / Poor	___/___/___	PCR Positive / Ig M Positive / Negative

If no specimen is collected, reason for not collecting specimen: Death / Not willing / Lost to follow-up / Logistic issue / Late notification / Other

If other, specify: _____

Signature of sample collecting agency_____ Seal and signature of testing lab for results

10. Feedback:

Reporting Person / Institution: Mobile:_____ Email Id:_____ Date Given: ____/ ___/ _____

Patient / Caretaker: Mobile:_____ Email Id:_____ Date Given: ____/ ___/ _____

11. Final Classification: Laboratory confirmed / Epi-linked /Clinically confirmed/ Discarded and ruleout other cases / Rule out other cases

***Key mandatory variables**

Use extra sheet of paper to write additional information, if any.

Name, designation and signature of the sending official: _____

Govt. of Karnataka

Kyasanur Forest Disease
Laboratory Request Form (Monkey Autopsy Samples)

No. KFD/MONKEY/ /

To
The Deputy Director
Virus Diagnostic Laboratory
SHIVAMOGGA-577201

Sir/Madam,

I am sending the Monkey Autopsy specimens with the following details for detection of KFD virus through Sri ……..……..…… with a request to kindly intimate the results

Sl. No.	District	Taluk	PHC	Village	KFD Field No.	SVDL No.	Date of monkey death	Date of Autopsy	Monkey Species	Age	Sex	Organs/ Tissue	Village and land mark of monkey death	Source of monkey death reporting	Lab Result	Disposal of dead monkey (Yes/No)	Tick collection done (Yes/No)	Hotspot dusting / spray done (Yes/No)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

SVDL No.: Shivamogga Viral Diagnostic Laboratory Number
Note: if any district is sending sample directly to NIV Pune, obtain SVDL number from VDL Shivamogga and then send to NIV Pune

Signature

Govt. of Karnataka

Kyasanur Forest Disease
Laboratory Request Form (Tick Pool Samples)

No. KFD/TICKS/ /

To
The Deputy Director
Virus Diagnostic Laboratory
SHIVAMOGGA-577201

Sir/Madam,

I am sending pools of Ticks specimens Larva/ Nymphs / Adults with the following details for detection of KFD virus through Sri ....with a request to kindly intimate the lab results.

Sl. No.	District	Taluk	PHC	Village	Longitude-Latitude	Field No.	SVDL No.	Date of Collection	Time of collection	Hot spot collection (Yes/No)	Type of locality where tick pools are collected						Tick species	Larva (a)		Nymph (b)		Adult (c)		Total (a+b+c)		Result
											Peridomestic	Plantation	Forest	Cattle	Human body	Others		No. of pools	No. of pools Positive	No. of pools	No. of pools Positive	No. of pools	No. of pools Positive	No. of pools	No. of pools Positive	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27

SVDL No.: Shivamogga Viral Diagnostic Laboratory Number
Note: if any district is sending sample directly to NIV Pune, obtain SVDL number from VDL Shivamogga and then send to NIV Pune

Signature

Govt. of Karnataka

Kyasanur Forest Disease Human Surveillance Register

(to be maintained at PHC)

Sl No.	District	Taluk	PHC	Village	KFD Field No.	SVDL No.	IHIP Unique ID	Reported by	Name of the patient	Complete address including telephone number	Age	Sex	Date of onset of symptoms	Date of Blood Sample collection	Acute or Convalescent sample	Date of Blood Samples sent to Lab	Name of the lab where samples tested	Lab Result		Hospitalized (Yes / No)	Referral to which hospital	Outcome (recovered / sick / died)	Received KFD Vaccine (Yes /No / Unknown)			Monkey death reported in the area (Y/N)	Tick collection done (Y/N)	Remarks
																		Real time RT-PCR	IgM - ELISA				1st dose	2nd dose	Booster dose (no. of yrs)			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

Govt. of Karnataka

Kyasanur Forest Disease
Monkey Death Surveillance Register

(to be maintained at PHC)

Sl. No.	Dist	Taluk	PHC	Village	KFD Field No.	SVDL No.	Date of monkey death	Date of Autopsy done	Monkey Species	Age	Sex	Organ / Tissue	Village and land mark of monkey death	Lab where samples sent	Date of sample sent	Date of result	Result	Disposal of dead monkey (Yes/No)	Tick collection done (Yes/No)	Dusting done (Yes/No)	Monkey death reported by	Remark
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Govt. of Karnataka

Kyasanur Forest Disease
Tick Surveillance Register

(to be maintained at PHC and O/o DVBDCO)

Sl. No.	District	Taluk	PHC	Village	Longitude - Latitude	Field No.	SVDL No.	Date and time of Collection	Longitude - Latitude	Hot spot collection (Yes/No)	Type of locality where tick pools are collected							Tick species	Larva (a)		Nymph (b)		Adult (c)		Total (a+b+c)		Lab where samples sent	Date of sample sent	Date of result	Result
											Pathway	Human body	Cattles/ other pet animals	Plantation	Paddy	Forest	Others		Pools collected	Pools positive	Pools collected	Pools positive	Pools collected	Pools positive	Pools collected	Pools positive				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Govt. of Karnataka

Kyasanur Forest Disease Surveillance Report - PHC

(to be reported by the Health Institution Weekly during the transmission period and monthly during lean period)

Reporting week ……

Name if the health Institution (PHC/CHC/GH): **Taluk:**

i(a) PHC / CHC/GH report (Passive surveillance)			i(b) Field Surveillance Report (Active surveillance)		
Particulars	**For the week**	**Cumulative**	**Particulars**	**For the week**	**Cumulative**
Total OPD			Number of villages in the PHC		
Total IPD			No. of villages positive for KFDV		
Total Fever Cases			No of villages in 5-km radius of KFD +ve		
Suspected cases detected at OPD			Population of the PHC		
Suspected cases reported from field to health institution (<48 h)			Population at risk		
Suspected cases reported from field to health institution (> 48 h)			Susp. KFD cases detected in the field		
Total blood samples collected and sent			**Total Monkey deaths reported**		
Confirmed KFD Cases			Total Monkey autopsies done		
Total number of cases investigated during the week			Individual monkey positive		
Referred to higher centres			**Total Tick pools collected**		
Patients in hospital under treatment			**Total Tick pools positive**		
Discharged					
Suspected Deaths					

ii. Control measures

Particulars	For the week	Cumulative	Particulars	For the week	Cumulative
Vaccination status			**IEC activities**		
1st Dose			No. of Gram Panchayath advocacy		
2nd Dose			No. of Miking done		
Booster Dose			No. of IEC in Schools & Colleges		
Vector control activities			No. of Handbills distributed		
No. of tick repellent distributed			No. of posters used for IEC		
No. of hotspots dusted/ sprayed with insecticide			Group discussions		
Others			Others (specify)		

Note: Monday to Sunday surveillance reporting to be followed.

Signature of the Medical Officer

Govt. of Karnataka

Kyasanur Forest Disease
Surveillance Report - Taluk / District

(to be reported weekly during the transmission period and monthly during lean period)

Name of the Taluk/ District: _____

Reporting week _____

Sl. No.	Name of the PHC/ Taluk	Total no. of villages	No. of villages positive for KFDV	No. of villages in 5-km radius of KFDV +ve	Total Population of the PHC	Population at risk	KFD Suspected cases		Blood samples collected		Human Positive cases		Human Deaths				Referral cases		Admitted cases		Discharged	
													Suspected deaths		Confirmed deaths							
							During the week (active surveillance +OPD+ IPD)	Cumulative	During the week	Cumulative	During the week	Cumulative	During the week	Cumulative	During the week	Cumulative	During the week	Cumulative	During the week	Cumulative	During the week	Cumulative
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Total																						

Note: Monday to Sunday reporting to be followed.

Signature of DSO / THO

Govt. of Karnataka

Kyasanur Forest Disease
Report on Prevention and Control - Taluk / District

(to be reported weekly during the transmission period and monthly during lean period)

Name of the Taluk/ District: _____

Reporting week _____

Sl. No.	Name of the PHC/ Taluk	No. of villages	No. of villages positive for KFDV	No. of villages in 5-km radius of KFDV +ve	Total Population of the PHC	Population at risk	No. of Monkey Deaths		Monkey Autospies done		Individual Monkey Positive		No. of Pools of Tick collected		No. of Tick pools Positive by RTPCR		Health Education Activities (Cumalative)						Vector control measures (Cumalative)			Remarks
							During the week	Cumulative	During the week	Cumulative	During the week	Cumulative	During the week	Cumulative	During the week	Cumulative	No. of Gram Panchayath advocacy	No. of Miking done	No. of IEC in Schools & Colleges	No. of Handbills distributed	No. of posters used for IEC	Group discussions	No. of tick repellent distributed	No. of hot spots dusted/ sprayed	Others	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Total																										

Note: Monday to Sunday reporting to be followed.

Signature of DVBDCO / THO

Govt. of Karnataka

Kyasanur Forest Disease Status in Karnataka

Date of Reporting: _____

Sl No.	Districts and Taluks	Total no. of villages	Villages +ve for KFDV	No. of villages in 5-km radius of KFDV +ve	Total Population	Population at risk	Suspected cases	Blood sample collected		Blood samples positive		Total no. of human cases hospitalised as on the day	Total human deaths (till date)		Total monkey deaths reported (till date)	Total monkey autopsied conducted (till date)	Total Individual monkey positive (till date)	Total Tick pools collected (till date)	Total Tick pools positive (till date)	Health Education Activities (Cumulative)						Vector control measures taken (Cumulative)			Remarks
								On the day	Cumulative	On the day	Cumulative		Suspected	Confirmed						No. of Gram Panchayath advocacy	No. of Miking done	No. of IEC in Schools & Colleges	No. of Handbills distributed	No. of posters used	Group discussions	No. of tick repellent distributed	No. of hotspots dusted/ sprayed with insecticide	Others	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	**District**																												
	Taluk																												
	Taluk																												
	Taluk																												
	Taluk																												
	Taluk																												
	Taluk																												
	Taluk																												
	Total																												
	GRAND TOTAL																												

Note:To be reported daily during transmission period.

Signature of Deputy Director, VDL

Govt. of Karnataka

Kyasanur Forest Disease
FIR / Outbreak report

FIR	OBK	Week No	Disease/ Illness	District	Taluk	PHC/ CHC	Village	Source of information	Date of start of outbreak	Date of start of investigation of outbreak by RRT	Date of reporting to SSU	Total poulation of the affected area	No. of suspected and confirmed cases	Deaths
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Clinical samples	Other samples	Epidemiological factors responsible	Actions taken	Current Status	Comments	Name & No. of samples sent to ref Lab	Name & No. of samples sent to DSU/other laboratories (NIV/VDL)	Lab results	Age & sex wise distribution of cases	Entomological indices	Final OBK report
16	17	18	19	20	21	22	23	24	25	26	27

Govt. of Karnataka

Kyasanur Forest Disease
Details of Vaccine Beneficiaries

District:_____ Taluk:_____ PHC:_____ Subcentre_____ Village:_____

Name of ANM/ ASHA/AWW/Link worker / Mobilizer:_____ Team No._____ Date of vaccination:_____

Sl. No.	House No. (Survey No.)	Name of the Beneficiary	Name of father / Husband	Mobile no.	Gender	Age	KFD Vaccination status							Sl. No.	House No. (Survey No.)	Name of the Beneficiary	Name of father / Husband	Mobile no.	Gender	Age	KFD Vaccination status						
							1st dose	2nd dose	1 Booster dose	Yearly Booster dose	Yearly Booster dose	Yearly Booster dose	Yearly Booster dose								1st dose	2nd dose	1 Booster dose	Yearly Booster dose	Yearly Booster dose	Yearly Booster dose	Yearly Booster dose
1														11													
2														12													
3														13													
4														14													
5														15													
6														16													
7														17													
8														18													
9														19													
10														20													

Total Population of village:		KFD Vaccination status		
Total House holds surveyed		1st dose coverage	2nd dose coverage	Booster dose coverage
Total Target Beneficiaries:				

Signature of Health Assistant

Govt. of Karnataka

Kyasanur Forest Disease Vaccination Progress

PHC / Taluk / District name:

Month of reporting:

Sl. No.	PHC/ Taluk / District	Total Population	6-14 years									> 14 years									Total target	Total Achievement
			Primary doses							Yearly Boosters		Primary doses							Yearly Boosters			
			Target Population	Achievement						Target Population	Population Covered	Target Population	Achievement						Target Population	Population Covered		
				1st dose	2nd dose	1st Booster	1st dose (%)	2nd dose (%)	1st Booster (%)				1st dose	2nd dose	1st Booster	1st dose (%)	2nd dose (%)	1st Booster (%)				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

**Vaccination format to be filled by respective level: PHC or Taluk or District

Govt. of Karnataka

Kyasanur Forest Disease
Vaccine and Syringes Requirement

District: _____ Block/Taluka:_____

Sl. No	Name of PHC	Name of Subcenter	Name of village	Population	Target Beneficiaries (above 6 yrs)	Target Beneficiaries 6-14 yr for KFD Vaccination						Target Beneficiaries above 15 yr for KFD Vaccination						KFD Vaccine vials required (K+Q)	Insulin syringe (L+R)
						1st dose	2nd dose	Booster dose	Total doses	KFD Vaccine vials (10 dose vial) (J x 1.11)/20	Insulin syringe (H x 1.11)	1st dose	2nd dose	Booster dose	Total doses	KFD Vaccine vials (10 dose vial) (N x 1.11)/10	Insulin syringe (Q x 1.11)		
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Total																			

Signature of the Medical officer

Vaccination card

ಆರೋಗ್ಯ ಮತ್ತು ಕುಟುಂಬ ಕಲ್ಯಾಣ ಸಚಿವಾಲಯ
ಭಾರತ ಸರ್ಕಾರ

ಜಿಲ್ಲಾ ಆಡಳಿತ, ಜಿಲ್ಲಾ ಪಂಚಾಯತ್ ಹಾಗೂ ಆರೋಗ್ಯ ಮತ್ತು ಕುಟುಂಬ ಕಲ್ಯಾಣ ಇಲಾಖೆ, ಶಿವಮೊಗ್ಗ
ಉಪ ನಿರ್ದೇಶಕರು, ಪರಿಮಾಣಾತ್ಮಕ ಪರಿಶೋಧನಾ ಪ್ರಯೋಗಶಾಲೆ, ಶಿವಮೊಗ್ಗ
ದೂರವಾಣಿ : 08182 222050

ಕೆ.ಎಫ್.ಡಿ. ವ್ಯಾಕ್ಸಿನೇಷನ್ ಕಾರ್ಡ್

ಹೆಸರು .....ವಯಸ್ಸು/ಲಿಂಗ .....

ವಿಳಾಸ .....

ದೂರವಾಣಿ ಸಂಖ್ಯೆ .....

ಉಪಕೇಂದ್ರ .....

ಪ್ರಾ.ಆ.ಕೇಂದ್ರ ..... ತಾಲ್ಲೂಕು .....

ಜಿಲ್ಲೆ .....

ಲಸಿಕೆ	ಲಸಿಕೆ ಕೊಟ್ಟ ದಿನಾಂಕ	ಮುಂದಿನ ವರಸೆಯ ದಿನಾಂಕ
ಮೊದಲನೇ ವರಸೆ		
ಎರಡನೇ ವರಸೆ		
ವರ್ಧಕ ವರಸೆ 1		
ವರ್ಧಕ ವರಸೆ 2		
ವರ್ಧಕ ವರಸೆ 3		
ವರ್ಧಕ ವರಸೆ 4		
ವರ್ಧಕ ವರಸೆ 5		

ನೆನಪಿಡಿ

1. ಮೊದಲನೇ ಮತ್ತು ಎರಡನೇ ವರಸೆಯ ನಡುವಿನ ಅಂತರ 30 ದಿನಗಳು.
2. ಎರಡನೇ ವರಸೆ ಹಾಗೂ ಮೊದಲನೇ ವರ್ಧಕ ವರಸೆಯ ನಡುವಿನ ಅಂತರ 6 ರಿಂದ 9 ತಿಂಗಳು.
3. ನಂತರದ ವರ್ಧಕ ವರಸೆಗಳ ನಡುವಿನ ಅಂತರ 1 ವರ್ಷ.
4. ಮಂಗ ಸತ್ತ ಪ್ರಕರಣ ಕಂಡುಬಂದಲ್ಲಿ ಹತ್ತಿರದ ಆರೋಗ್ಯ, ಅರಣ್ಯ ಹಾಗೂ ಗ್ರಾಮ ಪಂಚಾಯತಿ ಸಿಬ್ಬಂದಿಗಳಿಗೆ ತಕ್ಷಣ ಮಾಹಿತಿ ನೀಡುವುದು.
5. ಮಂಗ ಸತ್ತ ಪ್ರದೇಶದಲ್ಲಿ ಮನುಷ್ಯರ ಹಾಗೂ ಜಾನುವಾರುಗಳ ಓಡಾಟವನ್ನು ಕನಿಷ್ಠ 1 ತಿಂಗಳವರೆಗೆ ನಿರ್ಬಂದಿಸುವುದು.
6. ಇಂತಹ ಪ್ರದೇಶದಲ್ಲಿ ವಾಸವಿರುವ ಜನರಲ್ಲಿ ಜ್ವರ ಕಂಡುಬಂದಲ್ಲಿ ತಕ್ಷಣ ಆರೋಗ್ಯ ಕೇಂದ್ರಕ್ಕೆ ಭೇಟಿ ನೀಡುವುದು.

Specification tick repellent: *N,N*-Diethyl-meta-toluamide (DEET)

Sl. No.	Particulars	Technical requirements
1	Description of stores	Di ethyl toluamide – (DEET) – Tick Repellent (Technical DEET)
2	IUPAC name	*N,N*-Diethyl -3-methylbenzamide ($C_{12}H_{17}NO$)
3	Composition and physical requirements	95% to 98% concentration and potency on application should last and protect against insects including hard tick bites, for atleast 8–10 hrs. Ingredients Minimum Maximum DEET content 95% Acidity 0.03% Water content 0.3% Relative density (@25^{0}C) 0.992 0.999 Refractive index 1.520 1.524 *(Ref. WHO/SRpT/I.R2)* The repellent may be in the form of liquid or Convenient spray for application on exposed skin parts and should be free from skin irritants.
4	Expiry	Minimum of One Year from the date of formulation
5	Packing, marking and inspection	The packing, marking, shall be as per pesticide packing and labelling norms. Suitable antidote in case of emergencies may also be mentioned on the label, along with details such as Manufacturer's Name, Product Name, Composition, Registration / Licence no. for Manufacturing of product, Batch no. and date of Manufacture and Date of Expiry, Net content (Wt. or Vol.) and mode of application details along with 'Caution' indications as 'for external use only' should be clearly and boldly printed. Each batch should accompany quality inspection report (Analytical lab report) from any authorized Laboratory. Each unit of 100ml bottles should be packed in a suitable carton box of 50 bottles each and both unit pack and the carton box should contain the labels as mentioned above.

Specification of tick repellent: Dimethyl Phthalate Oil (DMP Oil)

Sl. No.	Parameters/ examined	Norm	Method of testing
1	Physical Properties		
	Color	Colorless oily liquid	Physical
	Clarity	Clear	Physical
	Homogeneity	Viscous liquid	Physical
	Odour	Slight aromatic	Physical
2	Water content	0–0.1% max	Dean and Stark/Karl Fischer
3	Acid value (acidity as phthalic acid)	0–0.01%	Volumetric /titration method (20ml requires not more than 4.2 ml of N/100 Sodium Hydroxide solution for neutralization
4	Purity	99.5%	Gas Liquid Chromatography
5	Assay	99.5–99.8%	Iodometric/ GC Method
6	Specific Gravity @ 27^0 C	1.191–1.195	Hydrometer
7	Refractive Index @27^0 C	1.512–1.515	Infrared Spectrum
8	Ester Value	571–580	Volumetric

Technical Specification of Mist/dust Blower

Name of item	**Ultra Low Volume Sprayer (Mist/dust blower)**
BIS mark and specification	The Machine shall conform to IS: 14855 (Part 1)/2000 Specifications.
Technical specification	Back-Pack ULV Mist blower with engine working on petrol having displacement (piston) capacity of 56.5 cm^3; Engine Power output 2.6 kW/3.5 HP. Fuel tank capacity: 1.5 lt. Solution tank capacity: 10–14 lt. Horizontal spraying range: 12-14 m, Vertical spraying range:10-12 m. With standards Nozzle and suitable airflow adjustments positions. Particle size to be 50 nm and less used for both water-based and oil-based insecticides (ULV fogging chemicals) and for cold fogging. The equipment should be of light weight and compact construction.
Droplet size	The size of the droplet of chemical at a distance of 5 m during cold fog shall be <50 microns in normal wind conditions.
Accessories	The blower shall be supplied with all attachments suitable for vertical and horizontal spray, along with adjustment values, electric switch, and standard nozzle, On/Off mechanism for chemical solution, trigger and filters. Eloastro start arrangement for easy starting of Engine. Comfortable padded back plate and harness.
Test report	A satisfactory type test report for each category/type of machine from a registered laboratory should accompany the unit.

Insecticide formulations used for tick control

Sl. No.	Ectoparasiticide/ acaricide	Concentration	Purpose	Application dilution and technique
1.	Amitraz (not recommended for horses, cats and pups)	12.5% w/v (125 mg/mL)	Treatment on animals (cattle, sheep, goat, cat, dog)	2 ml of 12.5 % solution in 1 L of water (Pour-on)
		5% w/v (50 mg/mL)		6–10 ml of 5 % solution in 1 L of water (Pour-on)
2.	Cypermethrin	10% w/v (100 mg/mL)		1 ml of 10 % solution in 1 L of water (Pour-on)
				5 ml of 10 % solution in 1 L of water (Spray-on)
3.	Deltamethrin	1.25% w/v (12.5 mg/mL)		2–3 ml of 1.25 % solution in 1 L of water (Pour-on)
4.	Flumethrin/ Permethrin	6% w/v (60 mg/mL)		1 mL of 6 % solution in 2 L of water (Pour-on)
5.	Fenvalerate	20% w/v (200 mg/mL)		4–6 mL of 20 % solution in 1 L of water (Pour-on)
6	Malathion 25% wp or Malathion 5% wp	1-g active ingredient deposit	Dusting / spraying in hotspots	Refer guidelines for management of hotspots
7	Cypermethrin	10% w/v (100 mg/mL)	Floor of houses, porches, verandas, sites where pet animals sleep and nearby fields	20 ml in 1-liter of water for animal house / resting place.

Note:

- Pour-on: Liquid containing active ingredients that are applied to animals by pouring it along the backline. Spray-on: Liquid containing active ingredients that are sprayed along the backline of animals. Animals are to be kept outside while spraying of shed is done.
- All synthetic pyrethroids are extremely toxic to fish and aquatic invertebrates. Don't contaminate dams, streams, or waterways with products or used containers. Store original container tightly closed in a safe place under lock and key.
- Liquid should be allowed to dry thoroughly before human / animals re-enter the area.

Roles and responsibilities of various departments in KFD prevention and control

Department of Health and Family Welfare Services

- Carry out human and vector surveillance activities
- Clinical management of cases and referral of cases to higher center by ambulance
- Field investigation
- Laboratory diagnosis
- Vaccination
- Encourage personal protection measures
- Reporting to higher institutes
- Media management
- Engagement with all stakeholders
- Training and capacity building
- IEC and advocacy
- Planning, monitoring and supervision
- Organize 'Monkey Necropsy Committee' meeting at PHC levelto discuss the action plan for the year, review of monkey deaths, autopsy conducted, review of stocks, support required from Gram Panchayath, etc.
- Initiate and co-ordinate research activities.
- During hotspot management:
    - Ensure all the team members are vaccinated.
    - Provide tick repellent to all the members.
    - Carry all the logistics required for transportation of viscera and tick pool samples.
    - Conduct tick collection in the hotspot area and transport to the laboratory.
    - Collect the necropsied viscera carcass from Veterinary team and transport to the laboratory immediately (ensure filling of the formats).
    - Conduct Malathion spraying / dusting at the hotspot area with the help of Forest and Gram Panchayath Personnel.
    - Establish fever clinic and initiate fever survey in the immediate 'at risk population'.
    - Intensify IEC in the high-risk village.
    - Dissemination of results to all the stake holders.

Animal Husbandry and Veterinary Department

- Surveillance of domestic animals visiting forest.
- Tick surveillance among domestic animals.
- Carry out tick reduction activities among domestic animals using acaricides.
- Certification of cattle's as tick free cattle's while transporting to non-KFD region from KFD region.
- IEC: Discouraging collection of dry leaves of forest in cattle sheds and backyard
- During hotspot management:

- Should carry necropsy dissection set
- Conduct necropsy and collect 2–4 g each of viscera samples like: brain, liver, lungs, heart, spleen, gastro-intestinal tract (preferably duodenum) and kidney in a separate polypropylene container without adding any preservative. Label with the details and handover to the Health team for transportation.
- Ensure proper disposal of all PPE.

Forest Department

- Ensure personal protection of all laborers and their families in forest.
- Ensure vaccination of forest officials, laborers and their families.
- Referring sick forest personnel to nearby health institution.
- Detect and report unusual monkey deaths to the Gram Panchayath (PDO).
- Monitoring deaths of small animals inside the forest.
- Controlled burning of forest boundaries.
- Guide all investigating teams into the deep forest areas.
- Implementing regulatory provisions in co-ordination with Gram Panchayath.
- Assist Gram Panchayath Zin spraying of acaricides(during outbreak): 3-meter-wide area along the roads of the forest with the technical guidance from Health department.
- Strict vigil on all entering/ leaving reserve forest areas.
- Widespread IEC displayed in hotspots and advisories for people visiting forests.
- During hotspot management:
    - Once necropsy is completed by the Veterinary team, fully burn off carcass in co-ordination with other stake holders (Gram Panchayath and Health).
    - Assist the Health team and Gram Panchayath Team in Malathion insecticide application.
    - Create forest line in and around Hotspot.
    - Cordon off the 'Hotspot' and make sure no one moves around.

RDPR-Gram Panchayat

- Financial support for the prevention and control of KFD.
- Spraying of insecticide (if necessary during outbreak): 3-meter-wide area along the roads of the forest may be considered for spraying Acaricide with the technical guidance from Health department and assistance Forest department.
- Implementing regulatory provisions in co-ordination with the Forest Department.
- Supporting IEC activities like miking, hand bills printing and displaying flex and banners.
- During hotspot management: The PDO will be the Nodal Officer for the entire operation.
    - Once the information about the monkey death is received, PDO shall summon all the team to the hotspot and co-ordinate the activities.
    - Ensure the availability of logistics required for hotspot management.
    - Mobilize Gram Panchayath personnel to assist the Health team in Malathion application in hotspot.
    - Organize vehicle-mounted loud-speaking announcement (IEC) about monkey death incidence in 5-km radius of hotspot to create awareness about the monkey death incidence and precautions that everyone should follow.

- Arrange for the logistics in short supply.
- If the monkey death has taken place in a village; the activities of forest team like burning the carcass, etc. should be done by the Gram Panchayath.

Education department

- Support vaccination activities in schools.
- Conducting IEC activities in the schools like organizing Rallies, Role Plays, etc.

Women and Child Welfare

- Co-ordination with the Health Department to conduct KFD vaccination session in Anganwadi Centers.
- Mobilizing the due beneficiaries to the vaccination booth.

Sensitizing the Mothers regarding KFD Vaccination.

Department of Information and Public Relation

- Dissemination on IEC regarding KFD.

Non-Government Organization / Self-Help Group

- Support surveillance like reporting of clustering of cases, monkey death reporting, etc.
- Motivating beneficiaries for KFD Vaccination and addressing vaccine hesitancy / refusals.
- Supporting IEC activities.

Committees for Prevention and Control of KFD

(A) District level Co-ordination Committee Meeting

1st meeting in the month of October: to brief about preparedness, action plan and seeking co-operation from other departments.

2nd meeting in the month of January: During the transmission season to review the situation and to plan the further course of action.

3rd meeting in the month of Feb–March: To review the situation.

4th meeting in the month of May–June: To brief the events of entire transmission season and newer strategies for the next season based on the lessons learnt in the current season.

The committee comprises:

1. The Deputy Commissioner / The CEO—Chairman
2. The District Health and FW Officer, Health Department
3. The District Surgeon, Medical Education Department
4. The Deputy Director, Animal Husbandry
5. The Deputy Conservator, Forest Department
6. The Deputy Director, Women and Child Welfare Department
7. The Deputy Director, Education Department
8. The District Information Officer, Information Department
9. The District Surveillance Officer—Member Secretary

(B) District Rapid Response Teams / Technical Advisory Teams

District Rapid Response teams shall comprise of the following members and shall act immediately to any unusual occurrences and shall give necessary technical inputs:

1. The District Surveillance Officer—Team Leader
2. The District Vector Borne Disease Control Officer
3. The Physician
4. The Pediatrician
5. The Epidemiologist
6. The Entomologist
7. The Microbiologist
8. The Veterinary Officer
9. The Forest Officer
10. The Statistician, DHO Office

(C) Death Audit Committee to confirm KFD deaths

Suspected KFD deaths must be audited at district level by the existing District H1N1 Death Audit Committee.The confirmed deaths at Districts Death Audit Committee shall be sent to the Deputy Director, VDL, Shivamogga which in turn will be audited at State level. At state level, deaths shall be confirmed by the State H1N1-death audit committee.

1. The District Health and FW Officer—Chairman
2. The District Surveillance Officer—Member Secretary

3. The District Surgeon
4. The Physician
5. The Paediatrician
6. The Microbiologist
7. The Entomologist

(D) State-level Technical Advisory Committee for KFD

The state-level Technical Advisory Committee shall meet at least twice in a year to discuss and take decisions on technical aspects of KFD control.

1. The Director—Chairman
2. The Joint Director (CMD)—Member Secretary
3. The Joint Director (NVBDCP)
4. The Sr. Regional Director, ROH&FW, Bengaluru
5. The Director, Institute of Animal Health & Veterinary Biologicals, Hebbal, Bengaluru
6. The HOD, Dept. of Parasitology, Veterinary College, Bengaluru
7. The HOD, Dept. of Public Health, Veterinary College, Bengaluru
8. The Deputy Director, NVBDCP, DH&FWS, Bengaluru.
9. The Deputy Director, SSU, DH&FWS, Bengaluru.
10. The Deputy Director, Virus Diagnostic Laboratory, Shivamogga
11. The Microbiologist, Virus Diagnostic Laboratory, Shivamogga
12. The Epidemiologist, State Surveillance Unit, Bengaluru
13. The Entomologist, State Surveillance Unit/VDL, DH&FWS, Bengaluru.
14. The Veterinary Consultant, State Surveillance Unit, DH&FWS, Bengaluru
15. The Officer in Charge, NCDC, Bellary Road, Bengaluru
16. The Officer-in-Charge, NIV Field Unit, Bengaluru
17. The Head of the Department, Dept. of Virology, NIMHANS, Bengaluru

(E) Members of Monkey Necropsy Committee at PHC

PHC Medical Officer shall organize the meeting at PHC level. The meeting should be conducted quarterly. But, during transmission period, the meeting should be conducted once in a month to review number of monkey deaths, autopsy conducted, review of stocks, audit of issues related to autopsy, support required from Gram Panchayath, plan of action, etc.

1. Medical Officer of the PHC—Chairman
2. Veterinary Officer of the area
3. Range Forest Officer
4. Panchayat Development Officer of the Gram panchayat—Member secretary

Annual activity plan for KFD

Sl. No.	Activity	Timeline
1	Surveillance, outbreak investigation and indent for vaccination to VDL. Submission of microplan for KFD mass vaccination from districts to DD-VDL copying to PD-IDSP, JD-CMD and SSU	Jan–Feb
2	(a) Mass KFD vaccination in high-risk areas: 1st booster dose (b) Annual booster dose	(a) Feb–April (b) Feb
3	Planning and procuring vaccine, drugs, logistics like tick repellent, Malathion, PPE, sample shipment carriers, etc.	Mar–June
4	Development of month-wise activity plan for different departments	Apr–June
5	Monthly State, District and Taluk-Task Force Meetings	June onwards
6	(a) Mass KFD vaccination in high-risk areas: 1st dose (b) Mass KFD vaccination in high-risk areas: 2st dose completion	(a) June–July (b) Aug
7	Training and capacity building	Aug–Sept
8	Sensitization to elected representatives, sensitization to media personnel	September
9	Intensification of tick surveillance	Oct. onwards
10	Intensified tick control measures	Oct. onwards
11	(a) Intensification of Active and Passive Surveillance of KFD (b) Outbreak response activities in response to Human positive case or Monkey Autopsy positive or Tick positive cases (c) Transition to daily reporting	Oct–June
12	(a) Activation of the District and Taluk Control Room (b) Activation of District and Taluk RRT at high -risk taluks	October onwards
13	(a) Setting up of KFD clinics in high-risk sub-centers (b) Setting up of KFD wards in Secondary and Tertiary Hospitals	October onwards

Scope for research

The present surveillance guidelines are framed based on the research studies conducted during early days of KFD till 1990s. However, the recent epidemiological data demands further research on the following:

1. Epidemiological and vaccine related studies

(a) Patients are presenting with different symptoms in different areas but are diagnosed as KFD positive. Common symptoms (a decade ago) were Severe (Pulsating) Head-ache accompanied with fever, Redness of Eyes and Semi-comatose state (after 48/72 hrs) complete recovery by 7–10 days. At present, the positive cases presenting with neurological disorders (though reversible in most cases) in some specific areas, along with common symptoms. Reported increase in mortality rate triggers research studies with respect to probable co-relation on mutation (or virulence change) of Virus as with respect to 1954–56 strain of KFD (P-9605).

(b) Considerable number of vaccinated persons have contracted KFD, hence needs an evaluation on the potency/efficacy of Vaccine used in the field (prepared from Chick embryo fibroblast culture – formalin killed vaccine). The following protocol may be used:

Serum samples have to be collected from selected Subjects (sero-negative, 15-50 years age group who have regular exposure to forest) as follows:

I. 1st Sample of Serum to be collected before administration of 1st dose of Vaccine.

II. 2nd Sample of Serum should be collected between 28th day and 30th day after administration of 1st dose (i.e. prior to administration of 2nd dose), from the same Subjects.

III. 3rd Sample of Serum should be collected between 15th day and 21st day from the day of administration of 2nd dose (i.e. between 45th day and 51st day from the date of administration of the 1st dose).

IV. 4th Sample to be collected between 15th day and 21st day from the day of administer the 1st booster dose.

Subsequent yearly collections of Serum samples can also be collected from the same subjects for assessing the level of immunity acquired in case the subjects are further available for Yearly booster dose. However, this Yearly collection of Serum is optional and for any further studies only, since the same persons may be covered in the yearly administration of Vaccine.

In case more than one batch of Vaccine is simultaneously used, for taking up the Vaccination programme during the year, then separate serum collection protocols for each batch of Vaccine, should be taken up for assessment.

Selection of Subjects:

About 45 to 50 healthy persons between the age group of 25–40 yrs may be selected and should be well informed about the purpose of serum collection and the periodicity. A declaration from each Subject should be obtained about his or her willingness to collect blood samples (5 ml each time). All the subjects who are willing to provide the samples, are to be line listed and submitted to the Joint Director (CMD), for

obtaining a formal approval of the Director of Health & FW Services, atleast 10 days prior to the starting of the Vaccination activity. As this is a part of the Vaccination program of the department of Health & FW, the approval of the Ethical Committee / Technical Committee is deemed to be obtained by the Director of Health & FW Services who is the Chairman of the Committee.

Considering the dropouts of the subjects, at least 40 serum samples have to be collected during every stage which is the minimum requirement for assessment of the Vaccine efficacy. The serum samples collected, shall be properly labeled, recorded in a register and sent to the designated laboratory in cold chain as per standard protocol, for further process and analysis.

A protocol on Serum survey should be prepared well in advance by the Taluk Health Officers, in consultation with the Deputy Director, VDL, Shivamogga and submitted along with the line-list of the Subjects to the Joint Director (CMD) for further process.

No other Agency shall take up such Serum-studies during or after the Vaccination programme, unless otherwise directed by the Director of Health & FW Services.

(c) Study on Persistence of Humeral immunity in KFD (Natural immunity) – for up to 10 years or more

2. Transmission related studies

a. Sero-surveillance of amplifying hosts and reservoirs.
b. Study of Movement of reservoirs hosts and amplifying hosts with respect to change in weather conditions/ecological conditions.
c. Study of behavioural changes among infected monkeys (during illness).

3. Studies on Interruption of Transmission, Vector Control and Personal Protection

a. Susceptibility of ticks for different insecticides used in the vector control program.
b. New vectors involved in the disease transmission.
c. Study on vector control especially adults on grazing animals and its implication.
d. Studies of ticks aimed at developing better vector control and predicting outbreaks.
e. Establishment of critical (threshold) value for tick density / tick infestation.

PHOTOS
IEC

ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ಆರೋಗ್ಯ ಇಲಾಖೆ ಪ್ರಕಟಣೆ

ಕ್ಯಾಸನೂರು ಕಾಡಿನ ಕಾಯಿಲೆ ಅಥವಾ ಮಂಗನ ಕಾಯಿಲೆಯ ಬಗ್ಗೆ ಮಾಹಿತಿ

1956ರಲ್ಲಿ ಶಿವಮೊಗ್ಗ ಜಿಲ್ಲೆಯ ಸೊರಬ ತಾಲ್ಲೂಕಿನ ಕ್ಯಾಸನೂರು ಕಾಡಿನಲ್ಲಿ ಈ ಕಾಯಿಲೆ ಪತ್ತೆಯಾದ್ದರಿಂದ ಈ ರೋಗಕ್ಕೆ ಕ್ಯಾಸನೂರು ಕಾಡಿನ ಕಾಯಿಲೆ ಎಂದು ಕರೆಯಲಾಯಿತು. ಮಂಗನ ಕಾಯಿಲೆಗೆ ಕಾರಣ ಫ್ಲಾವಿ ವೈರಾಣು ಜಾತಿಗೆ ಸೇರಿದ ವೈರಾಣು.

ಈ ಕಾಯಿಲೆಯು ಕಾಡಿನಲ್ಲಿರುವ ಸೊಂಕಿತ ಉಣ್ಣೆಗಳು ಕಚ್ಚುವುದರಿಂದ ಮಾತ್ರ ಬರುತ್ತದೆ. ಈ ಕಾಯಿಲೆಯು ಮನುಷ್ಯರಿಂದ ಮನುಷ್ಯರಿಗೆ ಹರಡುವುದಿಲ್ಲ. ಕಾಡಿನಲ್ಲಿ ಮಂಗಗಳು ಸಾಯುವುದೇ ಈ ಕಾಯಿಲೆಯ ಮುನ್ಸೂಚನೆ.

ರೋಗದ ಮುಖ್ಯ ಲಕ್ಷಣಗಳು :

1. ಏಕಾಏಕಿ ಏಳು ದಿನಗಳವರೆಗೆ ಬಿಡದೇ ಬರುವ ಜ್ವರ
2. ತಲೆನೋವು, ಮೈಕೈ ನೋವು, ಕೀಲು ನೋವು, ನಿಶ್ಯಕ್ತಿ, ವಾಂತಿ ಭೇದಿ ಹೊಟ್ಟೆ ನೋವು, ಕಣ್ಣು ಕೆಂಪಾಗುವುದು.
3. ಜ್ವರ ಬಂದ ಕೆಲವು ದಿನಗಳ ನಂತರ ಮೂಗು, ವಸಡು, ಬಾಯಿ, ಗುದದ್ವಾರದಲ್ಲಿ ರಕ್ತಸ್ರಾವವಾಗಬಹುದು.
4. ಸನ್ನಿವಾತ/ಮೆದುಳಿನ ಹೊದಿಕೆಯ ಜ್ವರ ಲಕ್ಷಣಗಳು
5. ರೋಗದ ತೀವ್ರತೆಯು ರೋಗಿಯ ಪ್ರತಿರೋಧಕ ಶಕ್ತಿಯ ಮೇಲೆ ಅವಲಂಬಿತವಾಗಿರುತ್ತದೆ.
6. ಮಧ್ಯವಯಸ್ಕರಿಗೆ ಹಾಗೂ ಅನಿಯಂತ್ರಿತ ಮಧುಮೇಹಿಗಳು ಹೆಚ್ಚು ಜಾಗರೂಕತೆ ವಹಿಸುವ ಅವಶ್ಯಕತೆ ಇರುತ್ತದೆ.

ಮುಂಜಾಗ್ರತಾ ಕ್ರಮ :

1. ಈ ಕಾಯಿಲೆಯ ಲಕ್ಷಣಗಳು: ಮಂಗ ಸಾಯುತ್ತಿರುವ ಕಾಡಿನಲ್ಲಿ ಜಾನುವಾರುಗಳು ಹಾಗೂ ಮನುಷ್ಯರ ಸಂಚಾರವನ್ನು ಕನಿಷ್ಠ ಒಂದು ತಿಂಗಳು ನಿರ್ಬಂಧಿಸುವುದು.
2. ಕಾಡಿನಲ್ಲಿ ಸಂಚರಿಸುವಾಗ ಮೈತುಂಬಾ ಬಟ್ಟೆ ಧರಿಸಿ ಆರೋಗ್ಯ ಇಲಾಖೆಯಿಂದ ಉಚಿತವಾಗಿ ವಿತರಿಸುವ ಉಣ್ಣೆ ನಿವಾರಕ ತೈಲಗಳನ್ನು ಅಥವಾ ಇತರೇ ಸಾಂಪ್ರದಾಯಿಕ ತೈಲಗಳು (ಬೇವಿನ ತೈಲ, ನಿಲಗಿರಿ ತೈಲ) ಕೈಕಾಲುಗಳಿಗೆ ಲೇಪಿಸಿಕೊಂಡು ಹೋಗಬೇಕು. ಈ ತೈಲಗಳ ಪ್ರಭಾವ 3–4 ಗಂಟೆ ಮಾತ್ರ ಇರುವುದರಿಂದ ಒಂದು ದಿನದಲ್ಲಿ ಒಂದಕ್ಕಿಂತ ಹೆಚ್ಚು ಬಾರಿ ತೈಲವನ್ನು ಬಳಸುವ ಅವಶ್ಯಕತೆ ಬರಬಹುದು.
3. ಕಾಡಿನಿಂದ ಬಂದ ನಂತರ ಬಿಸಿ ನೀರಿನಿಂದ ಸೋಪು ಹಚ್ಚಿ ಸ್ನಾನ ಮಾಡಬೇಕು ಬಟ್ಟೆಗಳನ್ನು ಬಿಸಿ ನೀರಿನಿಂದ ಸೋಪು ಹಚ್ಚಿ ತೊಳೆಯಬೇಕು.
4. ಮಾಸ್ಕ ಸ್ಕಳದ ಸುತ್ತಮುತ್ತ /ಊರಿನಲ್ಲಿ ಮಂಗ ಸತ್ತಿರುವುದು ಕಂಡುಬಂದಲ್ಲಿ ಸ್ಥಳೀಯ ಆರೋಗ್ಯ ಇಲಾಖೆ, ಆರೋಗ್ಯ ಇಲಾಖೆ ಹಾಗೂ ಗ್ರಾಮ ಪಂಚಾಯತ್‌ಗೆ ತಕ್ಷಣ ತಿಳಿಸುವುದು.
5. ಜಾನುವಾರುಗಳ ಮೈಮೇಲೆ ಉಣ್ಣೆಗಳು ಇರದಂತೆ ಪಶು ಸಂಗೋಪನಾ ಇಲಾಖೆಯ ಸಹಾಯದಿಂದ ಕ್ರಮ ವಹಿಸುವುದು.
6. ಚುಚ್ಚುಮದ್ದು
   ಅ. ಈ ಕಾಯಿಲೆ ತಡೆಯಲು ಸರ್ಕಾರಿ ಆಸ್ಪತ್ರೆಗಳಲ್ಲಿ ಉಚಿತ ಲಸಿಕೆ ಲಭ್ಯವಿರುತ್ತದೆ.
   ಆ. ಈ ಲಸಿಕೆಯಿಂದ ಯಾವುದೇ ತೀವ್ರತರವಾದ ದುಷ್ಪರಿಣಾಮ ಇರುವುದಿಲ್ಲ
   ಇ. ಈ ಲಸಿಕೆಯನ್ನು ಆರೋಗ್ಯವಂತರಾದ ವ್ಯಕ್ತಿ ಸರಿಯಾದ ಪ್ರಮಾಣದಲ್ಲಿ ಒಂದು ತಿಂಗಳ ಅಂತರದಲ್ಲಿ 2 ಬಾರಿ ಲಸಿಕೆ ತಡೆಯುವುದು. 2ನೇ ಚುಚ್ಚು ಮದ್ದು ಹಾಕಿಸಿಕೊಂಡ 30 ದಿನಗಳ ನಂತರವೇ ನಿರೋಧಕ ಶಕ್ತಿ ಬರುತ್ತದೆ.
   1. ಪ್ರತಿ ವರ್ಷ ಬಲ ವರ್ಧಕ (Booster) ಲಸಿಕೆಯನ್ನು ಹಾಕಿಸಿಕೊಳ್ಳಬೇಕು.
   2. ಗರ್ಭಿಣಿ ಸ್ತ್ರೀಯರು ಈ ಚುಚ್ಚುಮದ್ದನ್ನು ಹಾಕಿಸಿಕೊಳ್ಳಬಾರದು.

ಗಮನಿಸಬೇಕಾದ ಮುಖ್ಯ ಅಂಶಗಳು :

1. ಈ ಕಾಯಿಲೆಯನ್ನು ಗುಣ ಪಡಿಸಲು ಯಾವುದೇ ನಿರ್ದಿಷ್ಟವಾದ ಔಷಧಿ ಇರುವುದಿಲ್ಲ.
2. ಕಾಯಿಲೆಯು ಬರದಂತೆ ತಡೆಯುವ ಮುಂಜಾಗ್ರತಾ ಕ್ರಮಗಳೇ ಸಾವು ನೋವುಗಳನ್ನು ತಡೆಯುವ ಪ್ರಮುಖ ವಿಧಾನವಾಗಿದೆ.

ಉಪನಿರ್ದೇಶಕರು
ಪರಿಮಾಣು ಕ್ರಿಮಿ ಪರಿಶೋಧನ
ಪ್ರಯೋಗಾಲಯ, ಶಿವಮೊಗ್ಗ
ದೂರವಾಣಿ : 08182–222050

ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ನಿರ್ದೇಶನಾಲಯ, ಆರೋಗ್ಯ ಮತ್ತು ಕುಟುಂಬ ಕಲ್ಯಾಣ ಸೇವೆಗಳು, ಬೆಂಗಳೂರು

ಉಪ ನಿರ್ದೇಶಕರ ಕಛೇರಿ, ಪರಿಮಾಣು ಕ್ರಿಮಿ ಪರಿಶೋಧನಾ ಪ್ರಯೋಗಶಾಲೆ, ಶಿವಮೊಗ್ಗ

ಜಿಲ್ಲಾ ಆರೋಗ್ಯ ಮತ್ತು ಕುಟುಂಬ ಕಲ್ಯಾಣ ಇಲಾಖೆ

ಮಂಗನ ಕಾಯಿಲೆ (ಕೆ.ಎಫ್.ಡಿ.) ಲಸಿಕೆ ಅಭಿಯಾನ

ಮಾರಣಾಂತಿಕವಾದ ಮಂಗನ ಕಾಯಿಲೆಯನ್ನು ತಡೆಯುವ ಏಕೈಕ ಪರಿಣಾಮಕಾರಿಯಾದ ವಿಧಾನ

ಲಸಿಕೆ ಪಡೆಯಿರಿ, ಮಂಗನ ಕಾಯಿಲೆ ತಡೆಯಿರಿ

ದಿನಾಂಕ :

ನಮ್ಮ ಸಂಕಲ್ಪ

"ಮಂಗನ ಕಾಯಿಲೆ ಮುಕ್ತ ಮಲೆನಾಡು"

ಉಣ್ಣೆಗಳ ಕಡಿತವನ್ನು ತಡೆಯಿರಿ!

ದೇಹವನ್ನು ಅದಷ್ಟು ಬಟ್ಟೆಯಿಂದ ಮುಚ್ಚಿ ಮತ್ತು ಉಣ್ಣೆ ನಿವಾರಕವನ್ನು ಬಳಸಿ. ಬೂಟುಗಳು, ಪ್ಯಾಂಟ್ ಮತ್ತು ಉದ್ದನೆಯ ತೋಳುಗಳ ಬಟ್ಟೆಗಳನ್ನು ಧರಿಸಿ. ಪ್ಯಾಂಟ್ ಅನ್ನು ಕಾಲು ಚೀಲದೊಳಗೆ ಟಕ್ ಮಾಡಿ. ವಿಶೇಷವಾಗಿ ಪಾದಗಳು, ಮುಂಗಾಲು, ತೋಳುಗಳು ಮತ್ತು ಕತ್ತಿನ ಸುತ್ತಲೂ ಉಣ್ಣೆ ನಿವಾರಕವನ್ನು ಹಚ್ಚಿಕೊಳ್ಳಬೇಕು. ಪ್ರತಿ 2 ಗಂಟೆಗಳಿಗೊಮ್ಮೆ ಮತ್ತೆ ಮತ್ತೆ ಹಚ್ಚಬೇಕು. .

ಬಟ್ಟೆಗಳನ್ನೂ ತೊಳೆಯಬೇಕು ಹೊಲ ಹಾಗೂ ಕಾಡಿನಲ್ಲಿ ತಿರುಗಾಡಿ ಅಥವಾ ಕೆಲಸ ಮಾಡಿ ಬಂದ ನಂತರ ಅಥವಾ ಒಣ ಎಲೆಗಳನ್ನು ಮುಟ್ಟಿದ್ದರೆ, ಮನೆಗೆ ಪ್ರವೇಶಿಸುವ ಮೊದಲು ಬಟ್ಟೆಗಳನ್ನು ತೆಗೆದುಹಾಕಿ, ರಾತ್ರಿಯಿಡೀ ಸಾಬೂನು ನೀರಿನಲ್ಲಿ ನೆನೆಸಿಡಿ. ಹೀಗೆ ಒಗೆದ ಬಟ್ಟೆಗಳನ್ನು ಕನಿಷ್ಠ 6 ಗಂಟೆಗಳ ಕಾಲ ಬಿಸಿಲಿನಲ್ಲಿ ಉಣಗಿಸಿ ಉಪಯೋಗಿಸಬೇಕು.

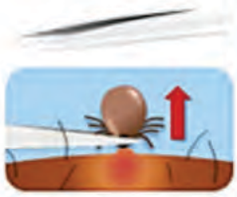
ನಿಮ್ಮ ಮೈಮೇಲೆ ಉಣ್ಣೆ ಇದೆಯೇ ಪರಿಕೀಲಿಸಿಕೊಳ್ಳಿ
ಸ್ನಾನ ಮಾಡುವುದರಿಂದ ದೇಹಕ್ಕೆ ಅಂಟಿಕೊಂಡ ಉಣ್ಣೆಗಳು ಬಿಡುವುದಿಲ್ಲ. ನಿಮ್ಮ ದೇಹವನ್ನು ಎಚ್ಚರಿಕೆಯಿಂದ ಪರಿಕೀಲಿಸಿ, ಬೆನ್ನು ಮತ್ತು ಕುತ್ತಿಗೆಯನ್ನು ಪರೀಕ್ಷಿಸಲು ಯಾರನ್ನಾದರೂ ಕೇಳಿಕೊಳ್ಳಿ . ನಿಮ್ಮ ಮಕ್ಕಳ ದೇಹವನ್ನು ಉಣ್ಣೆಗಳಿಗಾಗಿ ಪರಿಕೀಲಿಸಿ

ವಿಶೇಷವಾಗಿ ಈ ಭಾಗಗಳನ್ನು ಪರಿಕೀಲಿಸಿ:
- ತಲೆಯ ಮೇಲೆ ಮತ್ತು ಕುತ್ತಿಗೆಯ ಭಾಗ
- ಕಿವಿಗಳ ಹಿಂದೆ
- ಕಂಕುಳ ಸಂದಿ
- ಸೊಂಟ ಮತ್ತು ನಡು
- ತೊಡೆಗಳ ನಡುವೆ
- ಕಾಲುಗಳ ನಡುವೆ
- ಮೊಣಕಾಲುಗಳ ಹಿಂದೆ

ಉಣ್ಣೆಗಳನ್ನು ಕಿತ್ತು ಹಾಕುವುದು ಹೇಗೆ!!

ಉಣ್ಣೆಗಳು ನಿಮ್ಮ ಚರ್ಮಕ್ಕೆ ಹಚ್ಚು ಹೊತ್ತು ಕಚ್ಚಿ ಹಿಡುದುಕೊಂಡಷ್ಟೂ ಅಷ್ಟೇ ನಿಮಗೆ ರೋಗವನ್ನು ಹರಡುವ ಅಪಾಯವನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ. ಅದ್ದರಿಂದ ಅದಷ್ಟೂ ಬೇಗನೆ ಅವನ್ನು ದೇಹದಿಂದ ಕಿತ್ತು ಬಿಸಾಡಬೇಕು.

1. ಚೂಪಾಗಿರುವ ಪುಟ್ಟ ಚಿಮಟವನ್ನು ಚರ್ಮವನ್ನು ಸವರುವಂತೆ ಹಿಡಿದು ಉಣ್ಣೆಗಳನ್ನು ಹಿಡಿದು ಕೀಳಬೇಕು.



2. ಉಣ್ಣೆಗಳನ್ನು ಚಿಮಟದಿಂದ ಹಿಡಿದ ಮೇಲೆ ಬಲವಾಗಿ ಮೇಲೆಳೆಯಬೇಕು. ಅದನ್ನು ತಿರುಚಿ ಕೀಳಬಾರದು.

3. ಅನಂತರ ನಂಜುಮುರಿ ಅಥವಾ ಸಾಬೂನು ಮತ್ತು ನೀರಿನಿಂದ ಗಾಯವನ್ನು ಸ್ವಚ್ಛಗೊಳಿಸಿ.

- ✗ ಉಣ್ಣೆಗಳ್ಳನು ಬೆರಳಿನಿಂದ ಕೀಳಬೇಡಿ. ಉಣ್ಣೆಗಳ್ಳನು ಒತ್ತುವುದರಿಂದ ಇಲ್ಲವೇ ಜಜ್ಜುವುದರಿಂದ ಅಪಾಯ ಹೆಚ್ಚು.
- ✗ ಉಣ್ಣೆಗಳ್ಳನು ಬೆಂಕಿ ಕಡ್ಡಿ ಇಂದ ಸುಡಬಾರದು.
- ✗ ಪೆಟ್ರೋಲಿಯಂ ಜೆಲ್ಲಿ, ಸೋಪ್ ಇತ್ಯಾದಿಗಳ್ಳನ್ನು ಉಪಯೋಗಿಸಿ ಉಣ್ಣೆಗಳ್ಳನು ಮುಚ್ಚಬೇಡಿ.
- ✗ ಉಣ್ಣೆ ಮೈಮೇಲಿರುವಾಗ ಉಜ್ಜುವುದು ಅಥವಾ ತುರಿಸಿಕೊಳ್ಳುವುದನ್ನು ಮಾಡಬಾರದು.

ಉಣ್ಣೆಗಳು ಕಚ್ಚಿದ ನಂತರ ಜ್ವರ ಅಥವಾ ಅನಾರೋಗ್ಯ ಕಾಡೆಸಿಕೊಂಡರೆ ನಿಮ್ಮ ಸ್ಥಳೀಯ ಸಾರ್ವಜನಿಕ ಆರೋಗ್ಯ ಕೇಂದ್ರಕ್ಕೆ ಭೇಟಿ ನೀಡಿ.

Hotspot management






Vaccination



Surveillance





Training




Present Virus Diagnostic Laboratory, Shivamogga

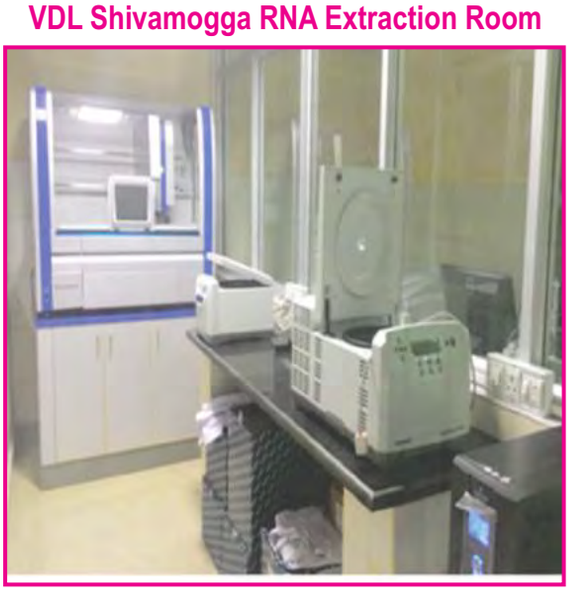
Preservation of specimen in the refrigerator

Technician opertaing water bath

Inoculation of mice with sera for KFD antibody test (Neutralization test)

KFD Vaccine Production Unit - Tissue Culture Lab

Newly Established Molecular Lab at VDL Shivamogga RNA Extraction Room



Newly Established Molecular Lab at VDL Shivamogga, Post PCR Room

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