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RCZI: ROADMAP TO COMBAT ZOONOSES IN INDIA

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CHAPTER 1: BACKGROUND

ZOONOSES AND ITS IMPORTANCE:

World Health Organisation defined Zoonoses as those diseases or infections which are naturally transmitted from vertebrate animals to humans. Globally, Zoonoses are said to account for 60% of all infectious disease pathogens and 75% of all emerging pathogens. They are a varied group of infections with varied epidemiology, clinical features and control measures. The causative organism may be viral, bacterial, fungal, protozoan or parasitic. Presently, more than 250 zoonoses of varied etiologies have been recognized. Given the wide range of animal species involved and the usually complex natural history of the pathogens concerned, the effective surveillance, prevention and control of zoonotic diseases pose a significant challenge to public health.

Some zoonotic infectious agents have largely been in the hands of scientists and public officials associated with animal health and agriculture. These shared agents include: (1) agents that cause substantial morbidity or mortality (or diagnostic difficulty) in livestock or poultry, especially the agents that cause ‘‘foreign animal diseases’’; (2) certain classic agents, such as Mycobacterium bovis and Brucella abortus; and (3) bacteria of concern in pre-harvest food safety, such as Salmonella and Campylobacter spp. The prions also hold a unique place in this context.

Other zoonotic infectious agents have largely been in the hands of scientists and public officials associated with public health. These include, for example: (1) the rabies virus, which has served as the founding basis for veterinary public health infrastructure development; (2) many arthropod-borne viruses, bacteria and protozoa; (3) several rodent-borne viruses and bacteria; (4) primate-borne agents; (5) prions and (6) agents

considered bioterrorism threats. All of the agents dealt with by this community are the subject of increasing research funding and a barrage of public information.

IMPORTANCE OF ZOONOSES

The incidence of zoonotic disease is increasing in many countries of the world. Zoonoses occur in sporadic as well as epidemic forms and affect both sexes and all age group. In most of the countries including India, zoonoses are not officially declared as notifiable diseases; and hence exact information on their prevalence and incidence is lacking.

Zoonoses act as a double- edged weapon. One by causing fatal disease in human beings and other by undermining animal health and productivity and producing great economic losses to the livestock industry. Some of the zoonoses such as Brucellosis, Echinococcosis and Q fever produce serious illness in man and impair human health. Similarly, Foot and Mouth disease, Newcastle disease and Pasteurellosis which cause grave epizootics among animals seldom affect man. Human Toxoplasmosis in USA is estimated to be an annual economic public health burden of more than US $ 400 million. Since 1997, emerging zoonotic, highly pathogenic avian influenza viruses have caused great losses to the poultry industries in many countries and caused great worry about the next human pandemic. The Nipah virus, the zoonotic etiologic agent (with its reservoir in fruit bats) of severe, often fatal encephalitis, caused an epidemic in the Malaysian peninsula in 1999 during which more than 100 humans died. This virus has also caused outbreaks with high fatality rates in India and Bangladesh since 2003. Ebola and Marburg viruses, the etiologic agents of the most lethal hemorrhagic fevers known, are zoonotic, but their natural reservoir(s) in fruit bats is still not fully proven. These

viruses have caused several recent and substantial epidemics of Ebola and Marburg hemorrhagic fevers in central Africa.The West African Ebola virus epidemic (2013–2016) was the most widespread outbreak of Ebola virus disease (EVD) in history—causing major loss of life and socioeconomic disruption in the region, mainly in the countries of Guinea, Liberia, and Sierra Leone. Japanese encephalitis virus, the mosquito-borne etiologic agent of severe, often lethal, encephalitis is now spreading across southern Asia and has the potential for great epidemic and geographic expansion, even to North America. The prion that causes bovine spongiform encephalopathy and variant Creutzfeldt–Jakob disease has been the cause of great economic loss in the cattle industry of the United Kingdom and several other European countries as well as a cause of great public concern.

Determinants in the Emergence of Zoonotic Disease Agents

Many different determinants contribute to the emergence of new zoonotic disease agents. Rarely do such determinants act alone. Given the complexity of their interactions, there likely is no way to predict when or where the next important new zoonotic pathogen will emerge.

1. Human demographics and behavioural changes

Human activities are the most potent factors driving disease emergence. Due to changing socio-economic conditions, human population has interference in almost every sphere of nature. Urbanisation leading to mass movement of rural population into cities has led to outbreaks of Lassa fever due to increased rodent host in urban communities and of Brucellosis. Population explosion leading to intrusion of human to

new areas such as the one that occurred in South America where major outbreaks of Vampire Bat Rabies occurred when people settled in remote jungles.

2. Ecological changes

Changes due to agrarian or industrial development are most important factors which have resulted in modification of natural niches and ecosystems. Several devastating outbreaks could be attributed to the effect of change in ecosystem. Examples are of Japanese encephalitis closely associated with rice field irrigation, creating large bodies of stagnant water. Rift valley fever is associated with dam construction and irrigation in heavily populated areas having naïve ruminant population. Proliferation of the rodent reservoir and phlebotome vector due to dam construction and agriculture development has resulted in outbreak of cutaneous leishmaniasis. Kyasanur forest disease, a tick borne encephalitis emerged due to grazing of deforestated areas by cattle.

3. Microbial changes

The concept of the microbe as the cause of the disease is inadequate and incomplete. But they are among the most mutable determinants of changing status and pattern of zoonotic changes. Microbe changes to unpredictable forms either due to selective natural or man made factors. Genetic reassortments are more common in world of viruses. This is very well exemplified with influenza in which new variants due to genetic drifts and shifts are causing worldwide pandemics. Another disease agent, i.e. Western equine encephalitis virus is thought of been aroused from recombination of Sindbis-like virus and Eastern equine encephalitis. Pathogens can also acquire new antibiotic resistance genes from other, often nonpathogenic, species in the environment, selected or perhaps even driven by the selection pressure of antibiotics.

4) Technology changes

Technology is changing at a very fast pace. Food animal veterinarians and technologists over the past 30 or 40 years have adapted to revolutionary changes, driven by economics and technology, in the animal agriculture right from procurement of raw material from across the globe to processing of food up till its distribution. Food borne zoonoses are increasing day by day in both developed and developing countries. Mass food processing technology allowing contamination of meat has resulted in outbreaks of hemolytic uremic syndrome caused by E.Coli O157:H7 strain. A change in rendering process of animal feed for short term monetary gains has led to dramatic spread of BSE.

5) International travel and trade

The current volume, speed, and reach of travel are unprecedented. Introduction of bubonic plaque and Hanta viral syndrome through rats and of yellow fever through mosquitoes in ships are very well documented examples of such an event. Importation of monkeys for research was the source of first Ebola outbreak. The raccoon rabies epidemic, increase in Lyme disease cases are direct consequences of our expansion.

6) Improved Research

The "zoonotic pool" i.e. introductions of microbes from other species is an important and potentially rich source of emerging diseases, some of which might become successful if given the right conditions. The human immunodeficiency virus (HIV) is a likely example of a zoonotic introduction meeting this criterion. This virus has a very close resemblance with other primate's lentiviruses. Bovine spongiform encephalopathy (BSE) appeared as, probable interspecies transfer of scrapie from sheep to cattle.

Changes in rendering processes, allowing incomplete inactivation of scrapie agent in sheep byproducts fed to cattle, may have been responsible.

7) Breakdown in public health measures

Curtailment or reduction in preventive programmes, inadequate sanitation and vector control measures is a strong factor for emergence of infectious diseases. Vector borne diseases are important examples in this category. Examples are recent report of rabies virus transmission through organ transplantation. Medical settings are also at the front line of exposure to new diseases, and a number of infections, including many emerging infections, have spread nosocomially in health care settings. Among the numerous examples, in the outbreaks of Ebola fever in Africa, many of the secondary cases were hospital acquired, most transmitted to other patients through contaminated hypodermic apparatus and some to the health care staff by contact. Transmission of Lassa fever to health care workers has also been documented.

STATUS OF ZOONOSES IN INDIA

India having the second largest human populations, and one of the world's greatest densities of tropical livestock, possesses a favourable environment for the transmission of both known and novel diseases between animals and people. However, there is a fragmented nature of zoonoses research and control programs in India. At the government level, the Ministry of Health and Family Welfare targets zoonotic infections in humans, the Ministry of Agriculture focuses on zoonoses in domestic animals and commodities, and the Wildlife Institute of India addresses wildlife. Attempts to collaborate across these institutions and other educational, research and policy organizations suffer many challenges.

The Roadmap to Combat Zoonoses in India (RCZI) initiative was launched in June 2008 with the vision of supporting and promoting integrated zoonotic disease prevention and control.

Priority research themes for Zoonoses in India laid down by RCZI are :

1. Measure the morbidity, mortality, and economic burden of disease in humans and animals.

2. Determine the spatial, temporal, and directional interactions of transmission between wildlife, humans, and domestic animals.

3. Develop field diagnostics for zoonotic diseases.

4. Conduct cost-benefit, cost-effectiveness, and affordability analyses of zoonoses interventions.

Some of the zoonotic diseases which appear from time to time in the country and create havoc in the form of losses of man and money have been discussed below:

Rabies

Rabies is caused by Lyssa virus. It causes inflammation of brain in humans and other mammals. Violent movements, uncontrolled excitement, fear of water, an inability to move parts of the body, confusion, and loss of consciousness are some of the symptoms of the disease. Once symptoms appear, the result is nearly always death. 15 million people are bitten by animals in Indiaevery year. The total number of people dying of the disease annuallyis placed between 25,000-30,000. In more than 90% cases it is thedog (most often stray) that is involved. The incidence of the disease is estimated to be 1.7% which is considered to be on the higher side. Thecountry reports a death every 30 minutes. Stray dogs and only a partialvaccine coverage in humans and native dog population are considered to be major risk factors of the disease. Dog populationcontrol and compulsory vaccination of dogs have met with only partialsuccess. It is believed

that an intensified programme of public educationcan help in reducing the menace of disease.

Japanese encephalitis:

Japanese encephalitis is caused by a virus from the family Flaviviridae. Fever, headache and malaise are other non-specific symptoms of this disease which may last for a period of between 1 and 6 days. Signs which develop during the acute encephalitic stage include neck rigidity, cachexia, hemiparesis, convulsions and a raised body temperature between 38–41 °C (100.4–105.8 °F). Mental retardation is usually developed. It is endemic in India and many countries of Asia including China and Japan. The total number of cases reported in Asia is placed between 30,000-50,000 per year. The disease first appeared in India in1955 and the first outbreak occurred in1973 in West Bengal. However, it was only after 1978 that the disease became widespread. The disease continues to spread to newer areas. As at present, 16 states in the country have reported the disease. JE is detected among the rural children often between July-October of the year (rice cultivation) in view of high mosquito activity during this time. Unregulated swine and poultry/bird rearing and poor vaccine cover to humans pose serious risks and challenges. UP has been reporting the occurrence of the disease in its eastern districts for some time now. As many as 1,745 cases were reported from Gorakhpur alone during 2008 with 136 deaths. In 2007 more than 220 people had died in the city.

Avian influenza

The most widely quoted date for the beginning of recorded history of avian influenza (initially known as fowl plague) was in 1878 when it was differentiated from other

diseases that caused high mortality rates in birds. It is caused by Influenza A virus. Symptoms of avian flu infection in humans depend on the strain of virus.

The influenza virus in humans causes typical flu-like symptoms, such as :Cough, Diarrhoea, Trouble breathing, Fever greater than 100.4°F (38°C), Headache, General ill feeling (malaise), Muscle aches, Running nose, Sore throat

The disease is popularly known as bird flu. Increased mixed farming activity, import/export of poultry to meet excessive demands of protein and unregulated marketing in birds and other livestock in congested areas constitute major risk factors. Implementation of effective biocontrol measures and timely detection and notification of cases are serious challenges especially in the developing countries. Avian influenza strain H5N1 wreaked havoc and spread panic when it first appeared in Hong Kong in 1997.. The disease has been reported from many southeast Asian countries including India, Pakistan, Bangladesh, China, Japan and Taiwan. The disease has also been reported from many countries in Europe and elsewhere. Three outbreaks of the disease have been reported from India in poultry with no human mortalities. The disease was reported from Navapur, Maharastra (2006), Manipur (2007) and 13 districts of West Bengal (2008). The economic loss to poultry industry in India was placed at Rs. 30,000 million (2006) and Rs. 6,500 million (2007).

Leptospirosis

The disease is caused by the bacteria of the genus Leptospira. Leptospirosis is an infection caused by corkscrew-shaped bacteria called *Leptospira*. Signs and symptoms can range from none to mild such as headaches, muscle pains, and fevers; to severe with bleeding from the lungs or meningitis.

WHO (2007) described leptospirosis as an emerging outbreak prone disease in India which is associated with flooding. Outbreaks have been reported from states like Gujarat, Orissa, Maharastra and Tamil Nadu. Rural farm workers are more vulnerable to the disease. Outbreaks have also been reported from Andaman and Nicobar Islands and areas of south and west in the country. The pathogen has also been recovered from farm animals. Investigations demonstrated the presence of the disease in Delhi and adjoining areas. Prevalence was high during August and September (monsoon season). The role of rodents and domestic animals in harbouring the leptospires has been speculated. A need for intensive surveillance for leptospirosis in the northern parts of India has been suggested.

Brucellosis

The disease is caused by the ingestion of unpasteurised milk or undercooked meat from infected animals or contact with their secretions. Brucellosis in humans is usually associated with the consumption of unpasteurized milk and soft cheeses made from the milk of infected animals, primarily goats, infected with *Brucella melitensis* and with occupational exposure of laboratory workers, veterinarians, and slaughterhouse workers. Some vaccines used in livestock, most notably *B. abortus* strain 19, also cause disease in humans if accidentally injected. Brucellosis induces inconstant fevers, miscarriage, sweating, weakness, anaemia, headaches, depression, and muscular and bodily pain.

Several cases of human brucellosis have been regularly reported from various states in India. Even in a small state like Goa, many cases has been reported especially from rural part of Goa. Out of 50 samples collected from suspected human patients, 15 were found to be positive for Brucella (The Hindu, 5th Sept., 2010). However, it is now being realized increasingly that animal products such as milk and meat products also play an

important role in the disease transmission. Dairy products prepared from unpasteurized milk such as soft cheeses, yoghurts, and icecreams may contain high concentration of the bacteria and consumption of these is an important cause of brucellosis. In female animals, abortion occurs in late gestation

Anthrax

The causal agent of anthrax Bacillus anthracis is one of the largest of all bacterial pathogens. Anthrax spores are transmitted by contact with infected carcasses, hides, hairs or bone meal. It is endemic in countries like India, Pakistan, Iran, Russia, Latin America and Central Africa. The disease is endemic in Tamil Nadu, Karnataka and Andhra Pradesh (Kumar et al., 2000. . The majority of cases are cutaneous anthrax. However, human cases of intestinal, septicemic, meningeal, pulmonary and gastrointestinal anthrax have also been reported. In June, 2011, human cases of anthrax have been reported from Kandhamal district of Orrissa (near Bhubaneshwar)

Tuberculosis

Tuberculosis (TB) is one of the most widespread infectious diseases and leading cause of death due to single infectious agent among adults in the world. The tubercle bacilli that causes tuberculosis in man belong to the so-called Mycobacterium tuberculosis complex which falls under the genus – Mycobacterium and has four species namely, M.tuberculosis, M. bovis, M. africanum and M. microti.

M. tuberculosis is mainly human pathogen, whereas M. bovis is the causative agent of bovine tuberculosis which has exceptionally a wide host range and is the principal agent responsible for tuberculosis in domestic as well as wild animals. With 30% of total cases, India has the most TB patient in the world. It is the leading cause of death in India with a total of 4,21,000 deaths annually. About 1000 Indians die from TB per day

i.e. one per min (Krishnaswami, 2000) and 95% of new TB cases are seen every year. There is a financial loss of 4-7% in GDP due to TB in Asian countries. TB costs more than Rs. 13,000 crores in India (ICMR Bulletin, 2002). The Office International des Epizooties has classified bovine tuberculosis as a List B disease, a disease which is considered to be of socio economic and public health important within countries and is of significance to the international trade of animals and animal products. The symptoms of TB include cough, sometimes with mucus or blood, chills, fever, loss of weight, loss of appetite, fatigue and night sweats. It usually affects the lungs but can also affect other parts of the body.

Johne's disease

Paratuberculosis, also known as Johne's disease, is a chronic, contagious bacterial disease of the intestinal tract that primarily affects sheep and cattle (most commonly seen in dairy cattle), goats as well as other ruminant species. The disease has also been reported in horses, pigs, deer, alpaca, llama, rabbits, stoat, fox, and weasel. Paratuberculosis is characterized by a slowly progressive wasting of the animal and increasingly severe diarrhoea. The disease is caused by a bacterium called *Mycobacterium avium*subsp. *paratuberculosis* (*M. paratuberculosis*). Paratuberculosis is a disease listed under the World Organization for Animal Health (OIE) *Terrestrial Animal Health Code*. Identification of this disease is notifi able and must be reported to the OIE (OIE*Terrestrial Animal Health Code*).

Mad cow disease

Mad cow disease is a highly infectious disease caused by prions that affect the brain of cattle. It is also known as Bovine Spongiform Encephalopathy In the United Kingdom,

the country worst affected by an epidemic in 1986–1998, more than 180,000 cattle were infected and 4.4 million slaughtered during the eradication program.

The disease may be most easily transmitted to humans by eating food contaminated with the brain, spinal cord, or digestive tract of infected carcasses. However, the infectious agent, although most highly concentrated in nervous tissue, can be found in virtually all tissues throughout the body, including blood. In humans, it is known as new variant Creutzfeldt–Jakob disease (vCJD or nvCJD), and by June 2014 it had killed 177 people in the United Kingdom, and 52 elsewhere, primarily in western Europe in countries supplied with beef or beef products from the UK.

Swine flu

Swine flu is a respiratory disease caused by influenza viruses that infect the respiratory tract of pigs and result in a barking cough, decreased appetite, nasal secretions, and listless behavior; the virus can be transmitted to humans. Swine flu viruses may mutate (change) so that they are easily transmissible among humans. The 2009 swine flu outbreak (pandemic) was due to infection with the H1N1 virus and was first observed in Mexico. Symptoms of swine flu in humans are similar to most influenza infections: fever (100 F or greater), cough, nasal secretions, fatigue, and headache .Swine flu outbreaks were reported in India in late 2014 and early 2015. As of March 19, 2015 the disease has affected 31,151 people and claimed over 1,841 lives. The largest number of reported cases and deaths due to the disease occurred in the western part of India including states like Delhi, Madhya Pradesh, Rajasthan, and Gujarat. Researchers of MIT have claimed that the swine flu has mutated in India to a more virulent version with changes in Hemagglutinin protein. This has however been disputed by Indian researchers. Swine flu outbreaks were reported in Nepal in the spring

of 2015. There were seven cases of Swine flu reported in Punjab province of Pakistan mainly in the city of Multan in January 2016.

Zika virus infection

Zika virus (ZIKV) is a member of the virus family *Flaviviridae*. It is spread by daytime-active *Aedes* mosquitoes, such as *A. aegypti* and *A. albopictus*.Zika virus (ZIKV) is a member of the virus family *Flaviviridae*. It is spread by daytime-active *Aedes* mosquitoes, such as *A. aegypti*. Symptoms may include fever, red eyes, joint pain, headache, and a maculopapular rash. Symptoms generally last less than seven days. It has not caused any reported deaths during the initial infection. Infection during pregnancy causes microcephaly and other brain malformations in some babies. Infection in adults has been linked to Guillain–Barré syndrome (GBS).In early 2015, a widespread epidemic of Zika fever, caused by the Zika virus in Brazil, spread to other parts of South and North America. It is also affecting several islands in the Pacific, and Southeast Asia.

STRATEGIES TO REDUCE THE INCIDENCE OF ZOONOSES

Veterinarians play an important role in prevention and control of zoonoses by virtue of their ability to destroy or treat the diseased animals and also controlling the movement of domestic animals. There are several factors involved in the causation and transmission of disease. Correct epidemiological investigation will help to identify these various factors in order to control them during outbreak. The basic approach in controlling or preventing a disease is to identify the weak linkages in the chain of their transmission. This requires sound knowledge of epidemiology of disease, i.e. its magnitude, spatial and temporal distribution, multifactorial causation, sources of infection and the dynamics of transmission.

Prevention: Prevention implies all measures taken to exclude a disease or to protect the animals and/or humans from acquiring an infection.

Prevention can be done by following measures:

1. Quarantine
2. Immunization
3. Environmental hygiene
4. Chemoprophylaxis.
5. Education of people about disease prevention.
6. Early diagnosis and prompt treatment

Control

This is a strategy which employs all tactics useful for reducing the frequency of illnesses which are already present in a population or in other words measures to reduce the incidence of disease. It aims to reduce the morbidity and mortality caused by the disease. Control can be done by following measures

1. Effective and early diagnosis and prompt treatment
2. Isolation of diseased animals from healthy stock
3. Vaccination of healthy stock
4. Chemoprophylaxis including deworming
5. Awareness campaign
6. Separation/culling/slaughtering of disease animals or animals at risk

Approaches for prevention and control of disease:

Quarantine:

Quarantine is the restraint placed upon the movement of animals, man, plants, or goods which are suspected of being carriers or vehicles of infections or of having been exposed to infectious agent(s). Quarantine may be international, interstate or local. Office Internationale de Epizootics (OIE) was established in Paris in 1924 with a view to make uniform procedures for veterinary quarantine and develop appropriate regulations that are applicable throughout the world. The period of quarantine depends on the incubation period of the agent, the time taken for the infection to be confirmed, i.e., isolation and identification of the pathogen and the time taken for an infected animal to become infectious.

Test and Slaughter: If a disease is infectious, affected animals can be a source of infection to others. In such circumstances it may be economically and technically expedient to slaughter an ill minority of animals to protect a healthy majority. A recent outbreak of avian influenza in different states of India was tackled by depopulation of several poultry birds. Several animals in India are infected with brucella. However, in our country, cow slaughter is banned. Therefore, there is test and segregation policy to be followed. It is a big challenge to our country to prevent the spreading of Brucella to other animals. The disease is highly contagious and dangerous.

Environmental hygiene: Implementation of farm hygiene practices improves the sanitary environment of animals. The practices include excrement treatment and disposal, ventilation, availability of clean water, pest control, improvement of housing and general cleanliness. Environmental hygiene plays an important role in control of mechanical vectors, for example, house flies, mosquitoes, ticks, mites, fleas and lice.

Systematic antemortem and postmortem examination of slaughter animals has led to a substantial reduction in the risk of transmitting meat borne pathogens. Disposal of carcasses in the fields needs to be checked out for preventing the spreading of the various diseases. Deep buried or burn are the correct methods for disposal of carcasses as well as farm waste.

Mass immunization: Immunization reduces the number of susceptible in the population and thus augments herd immunity making the infection more difficult to spread. Immunization programme must be epidemiologically relevant, immunologically effective, operationally feasible and socially acceptable. The effective immunization program depends on several factors such as type of vaccine used, genotypic diversity of the pathogen in immunization area, appropriate storage facilities, proper dissemination of vaccine, acceptability by the people, mass awareness, availability of vaccine and so on.

Vector control: Vector control is very important aspect in prevention of disease from spreading. It has become extremely popular among the public health experts. The approach consists of activities concerned with environment management and source reduction, chemical control, biological control, genetic control, personal protection and health education.

a) **Environmental measures**

b) **Chemical measures**

c) **Biological measures**

Genetic manipulation of insect vectors: Transgenic technology, controlled manipulation of genome of an insect by the direct introduction of DNA into the germ

line offer a challenging potential to exploit genes and gene contents across species barriers and the ability to introduce particular sequences without the genome disruption caused by conventional cross-breeding. Transgenic technology may be useful in controlling vector borne diseases for example, by inducing insecticide susceptibility and temperature susceptibility.

Reservoir control: Reservoir is defined as "any person, animal or non-living thing in which infectious agent lives and multiplies and can be transmitted to a susceptible host". For e.g. foxes and dogs are main reservoir for rabies. Poison baiting and trapping have been among the most commonly employed techniques against reservoir hosts. Anti-rodent measures include environmental sanitation, use of rodenticides and fumigation.

Early diagnosis: In veterinary medicine the techniques of early detection have been successfully applied in the diagnosis of tuberculosis, brucellosis, mastitis, glanders and salmonellosis. Application of tuberculin skin test in domestic animals and human population, and mallein test for glanders are classic examples in this regard. The development of various immunological and molecular techniques such as enzyme linked immunosorbent assay (ELISA), radio immunoassay (RIA), immunofluorescence (IF), restriction fragment length polymorphism (RFLP), sequence analysis, DNA probes and polymerase chain reaction (PCR) has revolutionized diagnostic procedures with their wide applicability.

Treatment: Mass treatment of an affected population may be carried out under an emergency or when the disease prevalence is very high. Mass treatment is given either prophylactically or curatively. Use of coccidiostats to poultry in drinking water and

routine incorporation of anthelmintics in the ruminant salt licks or feeds are some of the examples of mass treatment.

Genetic improvement: It has been shown that the incidence of some infectious diseases can be reduced by selective breeding. For example, certain breeds of cattle in tsetse zone of Africa are known to be tolerant to trypanosomosis. In general, the local breeds of animals are resistant to various common diseases while the exotic breeds like HF and Jersey are more prone to infections. Therefore, development of new animal breeds particularly resistant to various diseases and high milk/meat producing are essential.

Health education: The health education envisages making community aware of the cause and mode of disease transmission, prevention and treatment of disease, and the role of community in combating diseases. Health education through mass media such as newspapers, radio, cinema, wall slogans, television can be very effective.

Epidemiological diagnosis: In epidemiological diagnosis, the frequency of the population event (disease), its time and place pattern of occurrence and associated factors or circumstances are ascertained. The primary purpose of epidemiological diagnosis is to determine immediate and long term needs for purposeful action against the disease. Molecular epidemiology that relates to the use of molecular techniques namely RFLP, PCR, and DNA probes is a promising field for interactions between epidemiology and the laboratory.

CHAPTER 2- INTRODUCTION

TITLE:

The Fate and Management of Sick and Dying Cattle and its Consequences on Small Scale Dairy Farmers in Peri-Urban Areas.

INTRODUCTION:

Indian livestock contributes in the form of milk, meat, egg, wool, draft and manure, providing nutritional support as well as generating income for millions of people. The value of output from livestock sector at current prices during 2013-14 has been estimated as 6238.6 billion rupees, including 4074 billion rupees from milk, 1323.6 billion rupees from meat, 224.2 billion rupees from egg, 5.7 billion rupees from wool and 414.4 billion rupees from dung. The Gross Domestic Product (GDP)/Gross Value Added (GVA) from livestock sector for year 2013-14 was estimated to be 4060 billion rupees - 3.9 percent of total GDP/GVA and 24.8 percent of GDP/GVA from total agricultural sector, at current prices. The share of livestock in the agricultural GDP has increased consistently from 15 percent in year 1981-82 to about 25 percent in the year 2013-14. Milk is the largest agricultural commodity in country.

The country has witnessed impressive growth from 17 million tons in 1950-51 to 146 million tons in 2014-15 with almost 4 percent increase annually for last two decades. The meat production in India has reached to 6.69 million tons during 2014-15 with annual growth of 5 to 7 percent in recent years. During 2007-08 to 2011-12, overall annual growth rate in meat production was observed to be 8.44 percent. The wool production of the country has been recorded as 48.14 million kg. Livestock also provide excellent draft power for agricultural works, transportation.

As livestock is, and will remain, an important source of livelihood, it is necessary to find suitable solutions to convert this industry into an economically viable enterprise, while reducing the ill-effects of global warming. In relation to climate change, livestock is part of the problem but also part of the solution where cropping becomes too risky and where livestock will serve as an important tool for risk mitigation and diversification. Increasing the efficiency of livestock production that is harvesting higher productivity from fewer numbers of livestock will play a key role in mitigating environmentally adverse effects from livestock. There are, however, ceilings to this approach mainly defined by feed resources. Feeding of livestock should not lead to competition for human food sources.

Indian feed industry is about 50 years old and it primarily consists of cattle feed and poultry feed segments. Cattle feed industry in India is gradually evolving into an organized sector a potential, given the country' stop position among the world nations in respect of livestock population and also the high expected growth rate of about 4 per cent.

The livestock plays an important role in the economy of farmers. Many farmers in India maintain mixed farming system i.e. a combination of crop and livestock where the output of one enterprise becomes the input of another enterprise thereby realize the resource efficiency. The livestock serve the farmers in different ways. Livestock is a source of subsidiary income for many families in India especially the resource poor who maintain few heads of animals. Cows and buffaloes will provide regular income to the livestock farmers through sale of milk.

This leads to an increase in sanitation cost of municipalities, incidences of diseases by exposed carcasses and hence more expenditure on avoidable health catastrophes.

Altruistic measures such as cow shelters are also unlikely, considering an existing lack of shelters catering to humans. Hence, there isn't a follow through clause of the law which would provide for the welfare of these cattle once abandoned.

Despite of fundamental duties like every citizen of India should have compassion for all living creatures according to Article 51A(g)and many legislations working on Animal Rights like: To kill or maim any animal, including stray animals, is a punishable offence (IPC Sections 428 and 429), abandoning any animal for any reason can land you in prison for up to three months.

CHAPTER 3- REVIEW OF LITERATURE

REVIEW OF LITERATURE:

Coon and Leistritz (1997)- Economic development issues have become increasingly important to rural communities that are trying to expand their economic base while reducing out-migration. The development projects may be agriculturally related, which tend to locate close to the raw materials necessary for production, or non-agricultural firms such as telemarketing, manufacturing, financial, or service firms. Disposal of dead cattle leads to an increase in sanitation cost of municipalities, incidences of diseases by exposed carcasses and hence more expenditure on avoidable health catastrophes.Altruistic measures such as cow shelters are considering an existing lack of shelters catering to humans. Hence, there isn't a follow through clause of the law which would provide for the welfare of these cattle once abandoned.

Winger (2000)- Another aspect contributing to the accessibility of rural areas for development is information and communications technology. New telecommunications tools, such as the Internet and World Wide Web, have sped up communication and made conducting information-related business easier. Businesses are able to communicate with many more people over greater distances, and there is a large amount of information that is readily available at a lower cost.Firms can easily locate anywhere in the world and, within seconds, be connected with someone across the globe.

Knowles, et al. (2008)- Overloading the Animal’s Biology Causes Suffering: Broiler poultry, laying hens, dairy cows, and pigs that are raised in intensive systems have been genetically selected over the years to provide more and more meat and milk. Some of the welfare problems caused by single minded selection for production traits have resulted in increased lameness and leg problems in dairy cows and chickens

Sheila Boniface Davies (2010)- By representing the diversity and range of possibilities for the narration of the Cattle-Killing, this study becomes part of the 'revisionist cultural history' described by de Kock that the multiple stories of our emergence into this divided state'. The dissertation achieves this sense of emergent division through an examination of the 'colonial' era only – that is, the period before the Afrikaner Nationalist victory of 1948.

BAIF Development Research Foundation Annual Report (2016-17)- The livestock development programme, the core programme of BAIF, has taken a leap with various cutting edge technologies to conserve precious native breeds on the verge of extinction and to improve the milk production and thereby enhance the economic status of small and marginal farmers. These steps have been hailed by the farmers for many of whom dairy husbandry is the only reliable source of livelihood. The satisfying progress of the cattle development programme in various regions signifies the prospects of this programme in reversing the economic and social status of thousands of families living on the edge of poverty. Modernisation of our internationally reputed Semen Freezing Laboratory has led to the production of a crore frozen semen doses of various cattle and buffalo breeds. For improving the productivity of dairy animals in the field, various technologies were introduced.

Bhatia A.k (2010)- A precise identification of a given animal as belonging to a given breed is essential for livestock census, and developing policies for selection, improvement and conservation of animal genetic resources. It consists of assigning animals to a breed on the basis of certain phenotypic traits and basically forms a classification problem. Existing computer learning algorithms require a learning data set for predicting the class of a new case. The available information on a breed consists of analysed survey data on a number of its phenotypic traits.

Blümmel M.1, Wright A.I.2, Hegde N. (2010)- Globally livestock contributes 40% to agricultural GDP, employs more than a billion people and creates livelihoods for more than 1 billion poor (Steinfeld et al. 2006). From a nutritional standpoint, livestock contributes about 30% of the protein in human diets globally, and more than 50% in developed countries. In many developing countries, livestock was also considered to be the backbone of agriculture, as they provided draught power and farmyard manure, often the sole source of crop nutrition, before promotion of modern agriculture in the middle of the 20th century. As outlined in the livestock revolution scenario (Delgado et al. 1999) consumption of animal products will rise particularly in so called developing countries in response to urbanization and rising incomes. While the increasing demand for livestock products offers market opportunities and income for small holder producers and even landless, thereby providing pathways out of poverty (Kristjianson 2009) livestock production globally faces increasing pressure because of negative environmental implications

Hegde N. G., (2010)- Livestock has an adverse impact on environment. Firstly, livestock demands huge fodder and feed. As there is a severe shortage of cultivated fodder and feed resources, farmers let their livestock for free grazing on community lands and forests. Such stray livestock not only denude vegetation but also accelerate soil erosion. Secondly, livestock, ruminants in particular, produce methane and carbon dioxide while digesting feed in their rumen. Livestock dung also releases methane and nitrous oxide during anaerobic decomposition.

Gokhale S. B., (2010)- Milk is the normal mammary secretion derived from complete milking of healthy lactating mammal without either addition thereto or extraction there from. Although milk is known from the period when first mammal was born on the earth, awareness of its utilization by the mankind grew as the domestication progressed

and association between human and animals became stronger. Milk occupies a special position among foods in being an animal food that has a vegetarian connotation. Economically poorer countries in the world are mainly dependant on agriculture and the farming families solely deriving their living from agriculture have their major share of income from animal maintenance and milk production. In India milk production has been known to be a stable income resource and therefore traditionally milk and milk producing animals have been an integrated component of family with small land holding.

Hegde N. G. and Mahuli R. K.(2010)- Goat keeping is particularly important for resource poor people to improve their livelihood conditions. Both rural men and women can effectively manage this activity. Their contribution in enriching the grazing lands through manure is grossly neglected. Improved productivity will motivate the goat keepers to reduce their herd size and ease the biotic pressure on the ecosystem, which has direct impact on ecological restoration. Close interaction among SHG members will help them to build their capabilities and initiate other socio-economic development activities. Goat development should be given priority, primarily to assist the small farmers and poor families who are dependent on goat husbandry for their livelihood.

Hegde N. G.(2010)- Problems of Small Farmers Value addition and efficient marketing determine the success of most of the production oriented development programmes. Therefore, in most of the rural development projects, particularly in the farming sector where farmers are dependent on many external agencies and marketing of the produce is not well planned, the profit margins are under severe pressure, often resulting in failures. It is indeed efficient backward and forward linkages, which play a significant role in lowering the cost of production and higher price realisation, resulting in higher returns. The problems of small farmers are lower scale of operation, outdated

technologies, lack of financial support, poor information and communication linkages with the market and exploitation by the middlemen. Small farmers are heavily exploited by series of intermediate traders, while procuring agricultural inputs as well as while marketing their fresh produce.

CHAPTER 4- METHODOLOGY

METHODOLOGY:

RESEARCH OBJECTIVE:

To study the fate of sick and failing cattle and their detailed management

To study the burden of sick and failing cattle on small scale dairy farmers.

RESEARCH QUESTION:

This research endeavors to answer the research question:

What are the consequences of sick and failing cattle on small scale dairy farmers?

What happens to sick and failing cattle and disposal of dead cattle?

STUDY-SETTING:

The study was conducted among small-holding dairy farmers in peri-urban areas of Karnal, located in the north India. The background review of literature, the formative phase and a formal consultation with the experts of the field enabled us to identify relevant stakeholders in the site as well as refine our topic guide that were used for data collection. The main phase of data collection was preceded by the formative phase which allowed us to conduct scoping interviews with key informants in the site as well as pilot our instrument.

Karnal is one of Historical Districts of Haryana. It is known all over the world for production of Rice, Wheat and Milk. It is also known for agriculture research Institutions like National Dairy Research Institute, National Bureau of Animal Genetics Resources, Sugarcane Breeding Institute etc. According to Census India, population of Karnal in 2011 is 15,05,324; of which male and female are 7,97,712 and 7,07,612 respectively. Although Karnal city has population of 4,54,810; its urban / metropolitan population is 30.21% of total population. Karnal has 49 Civil Veterinary Hospital and 134 Civil Veterinary Dispensaries.

SAMPLING AND DATA COLLECTION:

Data collection at each of the field sites was carried out in successive phases. Fieldwork was completed from 1 Mar to 1 May at the site. The dual strategies of purposive sampling and snowballing were employed to identify potential respondents with the help of the local partners in each of the field sites. This enabled us not only to identify those stakeholders we were aware of being relevant to this study but also identify specific stakeholders in the site who were involved in some capacity among small holder dairy farmers (Traders and Veterinary field assistants in Karnal).

To meet the objectives of the research a qualitative research approach was used. This particular research approach has been selected to make it possible to explore small dairy farmers' perspective on the effects, burden of sick and failing cattle and their management.

For the purpose of data collection, 15 IDI's were conducted:

Community members(small holder dairy farmers and large scale dairy farmer)	8 IDI's
Government officials from Public Health or Agriculture sector	2 IDI's
Scientists from Dairy Research Institute	3 IDI's
Municipality officials	2 IDI's

In Karnal, we identified the dairy farms based on areas where most dairy farms were clustered and fitted the project definition of a small holding dairy farm. From this list we selected the dairy farms that were spread across various clusters (north, south, east and west). Given the cyclical nature of the qualitative fieldwork conducted in phases, data collection was stopped on reaching saturation point across the various key themes of-inquiry.

Researchers with prior experience and training in conducting health related interviews conducted the interviews. Interviews with farmers were conducted at their homes whereas interviews with other stakeholders were typically conducted at their offices (viz. Veterinary clinics, Dairy Research Institutes etc.). Most of the interviews were conducted in local language. In locations where the interviewers did not know the local language, prior discussion and prior discussion and preparations were carried out with the field partner who deputed a translator to accompany the field team and act as mediator to conduct the interviews. In order to ensure that the mediator did not introduce bias and followed the topic guide faithfully, mock interviews were carried out prior to the actual field visit to minimize errors and bias.

DATA ANALYSIS TOOLS:

Data analysis is based on the contents of these audio-recorded interviews. The recordings are transcribed verbatim. After transcriptioncompletion, a content analysis was performed manually on the transcripts to identify emerging themes and interconnections.

In addition to the interviews recordings, each researcher maintained detailed field notes in field diaries. This enabled capturing of details related to key issues that emerged in each location, concerns regarding fieldwork as well as any potential trends that were emerging in the responses of the participants. The field study diary provided us with adequate details to discuss during the daily review carried out at the end of the day work and plan for the rest of the data collection. The field diary also helped in identifying early patterns as well as saturation of responses. Given that the data collection was carried out in phases. At the end of each phase, we completed data management and analysis of the previous site and summary results were prepared which enabled us to further probe in detail specific areas that emerged during the field work. This iterative process enabled us to ensure that data we collected was grounded and rich in detail and saturation was obtained prior to stopping data collection.

The qualitative method used in the present study was in-depth interview (IDI). Different interview guides were used for interviewing head of small dairy farmers, scientists, municipality officials and Government officials from dairy and agriculture background. Interview guide had questions regarding previous, perceived, future and management of sick and failing cattle, disposal of dead cattle and threats related with removal of the dead carcasses.

The data collected includes attitudes, feelings, vocal and facial expressions and other behaviors are also involved. The data will consist of interview transcripts, field notes from observations.

In addition to the interviews other data throughout the study, such as comments from the other family members, neighbors and ongoing literature review is expected. All of the taped interviews, memoranda, and field notes will be entered into computer file.

QAULITY ASSURANCE:

Interviews were conducted by trained investigated and supervised, and monitored for completeness, correctness and comprehensive transcription and transition of responses and labeling of recording. Thirty percent of the interviews from every site were randomly rechecked for transcription and translations by our supervisor. Due to inherent of interpretation of qualitative data from different parts of the country, regular consultation with the steering group was done to discuss the data and its interpretation in the social, economic, geographic and regional contents of Karnal.

CHAPTER 5- RESULT and DISCUSSION

RESULTand DISCUSSION:

In total 15 interviews (formal and informal) were carried out across the sites (**Table 1**). This includes dairy farmers, Scientist. Site specific stakeholders were also identified in snowballing process. Small holder dairy farmers, large scale dairy farmers who buy milk from farmers and sells to sweet shops and households, were interviewed in Karnal. Officials of Haryana Dairy Research Institutes, municipality officials,veterinarians were also interviewed.

Table 1: Details of the stakeholders interviewed.

Study Site	**Stakeholders interviewed**	**No.**
Karnal	Community members(small holder dairy farmers and large scale dairy farmer)	8
Karnal	Government officials from Public Health or Agriculture sector	2
Dairy Research Institutes Karnal	Scientists from Dairy Research Institute	3
Karnal	Municipality officials	2

Following are labelled as:

HOD-VET-NDRI (S1)

VET PHD NDRI(S2)

SMALL HOLDER (R1, R2, R3, R6, R7, R8)

LARGE SCALE (R4, R5)

NBAGR VET DOC (S3)

CONSULTANT NDRI (S4)

NBAGR BIOSTATS (S5)

NBAGR MUNICIPALITY (S6)

The results are presented in the following three core themes i.e.

1. Impact of low literacy and awareness levels

2. Role of informal forms of disposal

3. Preference of informal channels over MCD.

Table 2: Core themes from the inductive data analysis:

CORE THEMES:

S. No.	**THEMES**
1	**IMPACT OF LOW LITERACY AND AWARENESS LEVELS:**
2	**ROLE OF INFORMAL FORMS OF DISPOSAL**
3	**PREFERENCE OF INFORMAL CHANNELS OVER MCD**

IMPACT OF LOW LITERACY AND AWARENESS LEVELS:

Access to information has been cited to be an important factor in promoting equity in healthcare. Building awareness about disposal procedures, removal of dead carcass. An additional layer of complexity is added to irrational use of concentrate and their traditional methods by peri urban smallholder dairy farmers because of the low levels of literacy and awareness in the studied communities, which has been previously reported by studies conducted in similar settings. This implies that the farmers might be unable to interpret complex medical information even if they have access to it. This assertion receives inputs from veterinarian that they have access to veterinary dispensaries and clinics in their vicinity but are often unable to comprehend why their traditional method is inappropriate for the cattle.

The veterinary has a vital role to play in providing proper guidance to care-seeking farmers. It is essential to incorporate the small holder farmers with the right guidelines and efforts to reduce the mismanagement and other ill handling practices with sick and dying-cattle.

The shortage of such a vital part of the healthcare delivery system in the Indian setting, therefore, is of special concern. It is imperative that knowledge, awareness, and good practice habits be reinforced constantly to prevent injuries, illnesses, and fatalities.

"Health education is an important role in a student life. A chapter on zoonoses should be incorporated in the school textbooks so that the new generation is well aware of the diseases well in advance." (S1)

“If there will be awareness camps regarding zoonoses and prevalence of diseases then no cattle or humans would be suffering so bad from these fatal diseases.” (S4)

"There is no awareness about the brucellosis or any disease in the village. In the village nobody discovers that the cattleis infected till the time she is carrying and eventually aborts."(F2)

“Major diseases like Brucellosis, Anthrax farmers are well aware of, if they have witnessed any training session. The misconception is that human not affected from any diseases. Not much research on zoonosis we can see. For specific diseases only organised herd administered these vaccines. Small holder dairy Farmers. VET shops, supplier of vaccines for Brucella vaccines.”(S5)

“Our farmers are not well educated. Their awareness is very low in terms of zoonotic diseases. If they are given proper advice, they follow religiously. We need to inform the farmer.” (S2)

ROLE OF INFORMAL FORMS OF DISPOSAL:

The other aspect, peer groups sharing information about selling of cattle, directly accessible sale representatives, and easy access to over the call selling of cattle represents an informal chain through which the dairy farmers may sell their cattle. The dairy farmers preferred this informal chain as well, since it provided direct access to vendor and perceived to be effective both in terms of money and time. Consequently, the farmers often contacted these representatives directly when they needed to explore options for selling their other cattle. Slaughtering is the most common informal channel for disposal of cattle and selling of cattle. There is a de-link between scientific and traditional methods.

Mostly farmers in villages practise the traditional method of burial in the dumping ground. The official set guidelines suggest that; Burial must be no less than 6 feet deep with a minimum of 30 inches of soil cover. Burial must be in well drained soils and be at least 2 feet above the highest groundwater elevation. Burial must be at least 100 feet from a private well, 200 feet from a public well, 50 feet from an adjacent property line, 500 feet from a residence and more than 100 feet from a stream, lake or pond. Burial cannot be in a wetland, floodplain or shoreline area.

The activities of the meat sector may be divided into three stages - slaughtering, meat cutting and further processing. Each stage involves completely different technical operations which must not be viewed as separate and independent processes. There are significant interactions between the stages and shortcomings at one stage can have a serious negative impact on the product or process in a subsequent stage.

Improper slaughtering techniques such as faulty stunning, bleeding, skinning, evisceration and carcass splitting can damage parts of the carcass and certain byproducts and make them unsuitable for further use. Poor standards of hygiene during slaughtering or carcass handling result in high levels of mirobial contamination in the meat, thus reducing the shelf-life and adversely affecting the sensoric properties of products fabricated from this raw material. Although controls imposed on the meat industries have become more stringent and effective, improper treatment of slaughter animals and poor meat-handling techniques persist in many meat plants. These problems are evident in many developing countries.

"I have two cases of Brucellosis infected cattle in my house. Two cows are suffering from this. I got this cross breed from someone unknown. This one has started infecting the whole lot. If this is the fate, then I need to sell it soon."(R8)

"All the burden is on me. I am whole sole responsible for the whole lot. I have a lot of space, one of them is pregnant. We care a lot for her. We keep all things separately. Body fluids need to be taken special care of, now I am worried about the whole herd. We need to tell the truth and I will definitely confess that my cow is Brucellosis affected"(R7)

"During slaughtering, they see the weight of the buffalo. Anybody can call and sell. Cow is a problem. There are so many bans."(R6)

"When the cow is dead, according to Hindu religion- we practice burial method. In the dumping ground, we bury the cattle. Animal's life span is maximum 20 yrs. One should save, from infection."(R4)

PREFERENCE OF INFORMAL CHANNELS OVER MCD

Health is a state subject and actions regarding the same is need of the hour. It is high time now that we start thinking about the whole country per say and not just our state. There should be stringent checks and policies on the imported breeds. If it will continue to be in same manner the day is not far that it will be also be one of the major reasons for mortality and morbidity. Nobody is taking the charge and there are no formal channels for the disposal of cattle. There is presence of guidelines, but no implementation is seen. The municipality is limited upto municipality regions (not peri urban) covers just its region and there is no check in the remote areas and villages.

Management aspect is at stake, there are abundant number of landless or marginal farmers. Most of the times, they are dependent on State `government. No farmers were aware of set guidelines and policies for disposal of dead carcass. When enquired, the scientists directed that State animal husbandry department website has all the data and farmers can always contact VET dispensary for government schemes and subsidiaries.

Economics play a major role. The average price realised for field cross breed animals by the farmers was noticed to be with minimum 2000(INR) and maximum 150000(INR). The reasons for disposal as ascribed by animal owners were better price, fodder shortage, household needs, surplus animal, animal trading as livelihood, unsatisfactory milk production, old age and problems in breeding etc. The study of different factors affecting disposal revealed significant effect of season of sale, age of animal, lactation stage, type of buyer, class of animal and reasons of animal sale while effect of sale site and trading system found not important from animal sale point of view.

"Income is good in large scale, we are not dependent on government for any schemes. I have won 11 lakhs price. I keep on attending a lot of competitions. We cannot be dependent on govt schemes. For the whole year we get a maximum. Oct to march- peak is our peak season and we earn upto20,000 per day. I have 75 cow and buffalo and I am involved in cattle selling business as well which gives me lot of profit."(R4)

"I am satisfied for the whole year with my cattle selling business. 50% is spent on their feed expenditure. For about 10-20 lakhs we sell animal. I am really happy. If anybody need to know how to solve the basic ailments and diseases, I am well trained in the basics and need not to to be dependent on vet docs. I can Vaccinate my cattle, also involved in Artificial breeding. From Government, there is no screening. In India, majorly natural breeding is practiced for cattle. Freeze semen screening, we can trust and with the help of basic diagnostics like Blood test- I can judge whether the cattle is disease free or not."(R5)

"Personal level screening is done from my end. We all discuss together. Then we do a comparitive analysis. I can get my own milk. Nobody treats cattle as only business. We have an affection towards our animal. Co-operatives like Nestle dairy, Amul, open bazaar. I sell for Rs. 45 to Rs. 60- Difference is more." (R4)

"In our country there are a lot of families and farmers who are dependent upon animal selling for their livelihood. Holistic view- particularly scenario is changing. Big dairies are coming up, they are leaving small business."(S4)

CHAPTER 6- CONCLUSION

CONCLUSION:

The knowledge of reasons of animal sale is useful from many ways. When enquired there were reasons narrated by animal owners for animal sale and these were better price, fodder shortage, household need, surplus animal, animal trading as a business, unsatisfactory milk performance, old age found to be a major problem, problem breeder also one of the big reasons for selling of animal. Majorly, the study:

- Identifies gap in current practices and management of sick and dying cattle.
- Helps in policies for disposal of dead cattle, its consequences pertaining to zoonoses.
- This study will create bridge to human−animal interface by linking knowledge to the control of zoonoses of human public health and veterinary public health importance.

It was noticed that these reasons had significant effect on animal sale. The household needs narrated by animal owners were daughter's marriage, purchase of land, construction of house and animal shed, repaying of loans, paying of children higher education fees, paying of hospital bills etc.

The study also gives an understanding of how economic factors effect, how dairy farm animals are treated and will help policy makers to improve welfare. Holding people financially accountable for losses or providing incentives for low losses will greatly improve animal treatment. The wise use of the tremendous purchasing power of large meat buyers has already brought about some dramatic improvements. Unfortunately, there are also many situations where economics is detrimental to animal welfare.

CHAPTER-7 LIMITATIONS

LIMITATIONS:

- To convince the farmers for the use of guidelines.
- No stringent policy or screening for disposal.
- Equalizing technological knowledge among farmers.
- Low health camps and other related activities for dairy farmers.
- No set guidelines and policies to refer to for farmers.
- Time and resource complexity and constraint as more of data would have been compiled.

CHAPTER-8 RECOMMENDATION

RECOMMENDATION:

- Synergy between the farmers and government animal husbandry departments.
- Management of sick and dying cattle in the set procedure.
- Proper documentation for the disposal procedure.
- Improve cattles' continuity of care by ensuring implementation of checks/ screening .
- Quick addressal of complaintsfor small scale dairy farmers as well.
- Offer educational programmes to increase dairy farmer knowledge and skills.

ANNEXURE:

The fate and management of sick and failing cattle and their consequences on small scale dairy farmers in peri-urban area.

An in-depth study

Interview guide for Current small dairy farmer

My name is Shruti, postgraduate student of IIHMR Delhi. I am conducting a study on topic

'The fate of sick and failing cattle and their consequences on small scale dairy farmers'.

The study has been commissioned by ILRI and PHFI.

We solicit your participation in this study. Your responses would be kept confidential.

Participation in this study is voluntary and you can choose not to answer any question. However, we hope that you will participate in this study since your participation is important in the interest of your community.

At this time, do you have any questions about the study?

May I begin the interview now?

Thank you!

Code no. _____

A. Socio-demographic details

1. Name : _____
2. Age : _____
3. Sex :_____
4. Other business

B. Dairy farming holistic view

5. Experience in dairy farming:
6. Number of cattle:
7. Number of old and sick cattle:
8. Frequency of changing cattle:
9. Revenue from the dairy:

C. Disease of cattle

10. Has disease in your cattle caused any problems in milk production?
11. Can you name some disease?
12. Is disease in your cattle causing any loss to your business?
13. Is this disease challenge for you?

D. Management of sick and failing cattle

14. How do you manage sick and failing cattle?
15. Do you think there is an alternative for management and Why?

E. Challenges in dairy farming

16. Past challenges faced in dairy
17. Current challenges faced in dairy

F. Threats to dairy farming due to sick and failing cattle

18. What are the threats to the business due to sick and failing cattle?

G. **Status of sick and failing cattle**

19. What is current status of sick and failing cattle?

COMMUNITY LEVEL FACTORS- Farmer

1. What do you do first when your animal is dead?
2. Whom do you call for removal of the dead carcasses?
3. How much does it cost to remove the dead cattle from your farm?
4. Are you aware about any scheme or facility offered by municipality or other department for disposal of dead cattle?
5. Does any of these channels compensates you?
6. What do you think they do with the cattle?
7. Does the disposal of the dead different for cattle and buffaloes?
8. What is your preference about the disposal of the dead cattle? What according to you should be the methods of disposal.

GOVERNMENT OFFICIALS – Scientist

1. According to you, which is the most common method for disposal of dead cattle?
2. Are you aware about any scheme or facility offered by municipality or other department for disposal of dead cattle?
3. According to you, what should be the most scientific way, to minimize the infection spread, for the dead cattle?

GOVERNMENT OFFICIALS – MUNICIPALITIES

1. What is the most common practice among farmers to dispose of their dead cattle?

   -[Probe]- Where do they dispose them? (Road side, River, Pond etc)
2. Is there any facility provided by municipality to remove these dead cattles from farms?

3. If yes, this there any policy programmes or guidelines for such a procedure?
4. Which farms and area comes under municipality for this?
5. Does PERI-URBAN areas comes under the services, if any?
6. What do you think the farmers specific in peri-urban areas do with their dead cattles?

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