



Animal Diseases in the Chhattisgarh Region of India: A Critical Narrative Review of Livestock And Poultry Evidence

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Abstract

Animal health is central to milk, meat, eggs, draft power, household income and zoonotic safety in Chhattisgarh. The 2019 livestock census recorded approximately 9.98 million cattle, 1.17 million buffaloes, 4.01 million goats and 0.18 million sheep. Chhattisgarh-specific bovine brucellosis surveys, a foot-and-mouth disease investigation in Bhilai and longitudinal work in Rajnandgaon, PPR post-vaccination studies and molecular investigation of Newcastle disease in Raipur provide direct but uneven evidence. This review discusses diagnostic methods, vaccination, animal movement, biosecurity and One Health considerations. Brucellosis requires attention to reproductive losses and human exposure, whereas PPR antibody surveys require careful interpretation because vaccination and infection can both produce seropositivity. Local information is thinner for haemorrhagic septicaemia, black quarter, tick-borne infections and many poultry conditions.

Keywords: Chhattisgarh, livestock disease, brucellosis, foot-and-mouth disease, peste des petits ruminants, Newcastle disease, One Health

Introduction

Animal disease has implications not only for the incomes of households that own a handful of animals, but also for larger dairy and poultry businesses. Infection may lower milk production, affect reproduction, lead to animal losses, disrupt trade in animals and be the cause of payments for treatment and prophylactic services. These channels are most painful when animals are also eaten, acts of savings and investments and sources of income. These channels provide a rationale for defining regional animal health issues to be of research interest, but their magnitude in Chhattisgarh should be known on the basis of locally relevant data, rather than national figures.

Chhattisgarh's livestock production systems vary from village-based cattle and goat rearing to well-managed dairy farms and commercial/backyard poultry. The 20th Livestock Census indicates that in 2019 there were 9,983,954 cattle, 1,174,722 buffalo, 4,005,657 goat and 180,229 sheep in Chhattisgarh (Department of Animal Husbandry and Dairying [DAHD], 2019). Livestock numbers are used as denominators to calculate incidence for other years. Nagwanshee and Kumar (2025) Large variations in district composition and husbandry practices make the state mean less reliable to identify pockets of transmission or vaccination coverage shortfalls.

Given investigations provides an incomplete but useful picture. These include reports of the presence of bovine brucellosis antibodies, studies of foot-and-mouth disease (FMD) in organized herds, Peste des petits ruminants (PPR) vaccine and a Newcastle disease virus isolate from a poultry farm near Raipur (Jain et al. 2019; Hota et al. 2021; Govindaraj et al. 2019; Ranjan et al. 2016). The investigations differ in species, location, sampling frame, time-period and laboratory method. They cannot all be aggregated into one single prevalence value for animal disease.

This review aims to assess what can be derived from the regional literature, place results into their wider veterinary context and identify evidence gaps. Dubey and Gain (2025) Particular attention is paid to economically important and zoonotic diseases which have local notes or targeted control programmes. The paper separates surveillance priorities and confirmed local prevalence.

Animal Populations and Epidemiological Interpretation

A cattle survey does not give a risk estimate for buffalo, goats or poultry. Similarly a sample of organized dairy herds may not reflect the smallholders' movement patterns, veterinary contacts, vaccination status or level of contact. Censuses are useful for estimating denominators but should be complemented by recent herd lists at district level when estimating infection or vaccination coverage. An outbreak report provides evidence of transmission, not the proportion of all animals infected.

Test results require equal conservative interpretation. Antibodies may record any previous infection or vaccine against that disease, but test, vaccine and sampling history should be considered. A positive PCR result supports presence of pathogen nucleic acid, but not necessarily viable organism or pathway of infection. Clinical signs are often non-specific, especially in cases of fever, abortion, diarrhea or respiratory disease. Appropriate surveillance links case definitions, laboratory confirmation, animal histories and specific sampling frames.

1) Foot-and-Mouth Disease in Bovine Herds

Regional Occurrence and Biological Significance

FMD is a highly contagious infection of cloven-hoofed animals. Fever, mouth and foot lesions, lameness and production losses feature prominently. Spread between animals is achieved through contact, contaminated

objects; herd composition and movement influence how the disease spreads. A national vaccination programme has been instigated due to the disease however, herds that have been vaccinated still require monitoring due to vaccine coverage, immune responses and movement.

Chhattisgarh is represented in two scholarly lines of study on FMD. Ranjan et al (2016) investigated bovine spontaneous abortions reported coincidentally with FMD outbreaks at various locations, including the former Nuclear Fuel Complex Farm at Bhilai, Chhattisgarh and Mukteshwar, Uttarakhand. Viral evidence in fetal tissues found evidence for vertical transmission in the isolated cases. These fill gaps in the various potential reproductive effects under field conditions, but an opportunistic case series does not provide a rate of FMD-associated abortion for the state.

A systematic dairy herd in Rajnandgaon provided the site for longitudinal study of transmission and viral persistence in vaccinated animals (Hayer et al., 2018). It exemplifies why vaccination history and the lack of classical signs do not rule out transmission or infection and why the context of an intensive herd may not be relevant in village herds. The sensible practical message is that outbreak investigation, lab testing and recording of vaccination history should be adopted by all herds whether it is big or small.

Diagnostics and Control

Vesicular lesions present an early clinical indicator; investigating these lesions in the field by veterinary services in a timely manner is crucial because differentials and consequences are significant. Laboratory diagnostics encompasses detection and typing of viral genome from acutely infected animals and nonstructural-protein antibody assays, which are applicable for specific surveillance objectives. Interpretation of serological tests requires careful consideration of the interval from exposure, prior vaccination history and the assay used. Vaccination of susceptible cattle, buffaloes, sheep, goats and pigs, identification and recording, seromonitoring and outbreak investigation are part of the national FMD control framework (DAHD, 2019). These describe program goals and procedures, rather than indicate that each eligible animal in Chhattisgarh was given a dose. Estimated coverage, independent of programme data, could be calculated with matched denominator lists, date-stamped records, field verification and analyses of under- or late-vaccinated animals.

2) Bovine Brucellosis and Reproductive Disease

Regional Serological Evidence

Brucellosis is a bacterial zoonosis implicated in abortion and reproductive failure. Jain et al. (2019) analysed 374 bovine serum samples from 94 villages in six districts of Chhattisgarh by indirect ELISA, estimating a true seroprevalence of 14.17%. They found links with farm organization, crossbreeding, age and reproductive history. It provides regionally relevant information, but both the extent of the geographical area and sampling frame should be maintained when referring to the number. Hota et al. (2021) examined 920 sera from nonvaccinated cattle in plains zone during 2018-19. They found 21.3% positivity in indirect ELISA and 14.24% using Rose Bengal plate test. Variations between their tests demonstrate it is not only the assay and its threshold that determine apparent prevalence, but also the population tested. They observed variation by sex, season and district, with the latter two results adjusted analytically. These should be understood relative to enrolled cattle, not generalised across all bovine herds in Chhattisgarh.

Another study of 1,050 samples from cattle, buffalo, goats and sheep found species-specific positive serology, among the smallest sheep strata of just 35 animals (Shakya et al., 2020). While drawing the scope wider than cattle, its fine granularity in the smaller strata is not good. The three studies used different sampling frames and population definitions and their estimates should not be treated as repeated measures of one population.

One Health and Prevention

Brucellosis is important to those assisting at parturition, examining abortion material, engaging in animal contact, or the consumption of unpasteurized dairy products. The presence of bovine seropositivity warrants joint veterinary-human health vigilance, but animal surveys alone cannot estimate human cases. An investigation may include safe handling of reproductive material, laboratory confirmation, documented reporting of cases and herd risk assessment. Public messages should not insinuate all seropositives are shedding at the time of sample collection.

Bovine brucellosis is covered under the national animal disease control programme by vaccinating heifers at risk, together with FMD (DAHD, 2019). Vaccination coverage and timing and records are essential for evaluation. For research, documenting vaccination is important to inform interpretation of antibody test results. For abortion studies, differential diagnoses and testing should be used to confirm whether an individual abortion was caused by Brucella.

As reproductive effects may lag, cross-sectional antibody surveys by themselves cannot show the impact of a vaccination campaign on abortion or fertility. A more robust state programme evaluation would use identified cohorts, compare suitable defined periods or jurisdictions and include laboratory confirmation and movement history. The same design would be used to track human occupational exposure where feasible. Such a linked One Health approach is a research proposal, not an outcome of the Chhattisgarh surveys.

3) Peste des Petits Ruminants in Goats & Sheep

Small-Ruminant Risk and Vaccination Evidence

PPR: The incidence of contagious PPR in sheep and goats produces fever, signs of respiratory disease, mouth lesions, diarrhea and losses in susceptible populations. In Chhattisgarh, goats are a staple for the smallholder households and the 2019 census found more than four million goats (DAHD, 2019). National elimination goals make vaccination, cold chain integrity, animal movement and post-vaccination monitoring the programmatic focus while the district-level burden, has to be established from case and population-based data. A Chhattisgarh serosurvey measured post-vaccination PPR antibody status using a large longitudinal series of samples from 2010-16 and a smaller stratified cross-sectional component in 2016-17 (Balamurugan et al., 2018).

The goal was to evaluate vaccination in a rural small-ruminant system rather than estimate prevalence of infection. A positive antibody test (ELISA) may indicate prior vaccination or infection; where an antibody detection method is the sole assay and where vaccination histories are unknown, there should be no onward claim of active disease. Govindaraj et al. (2019) assessed a PPR mass campaign in Chhattisgarh. The state is a very unusual setting for measuring campaign delivery and field effectiveness. Evaluation requires more than doses administered: counts of target population, proportion vaccinated, timing, cold chain, serology, disease and other coverage data and possible impacts on outbreaks all give different insights and declining case counts may just be due to shift of reporting or background transmission, not improved coverage.

Monitoring and Interpretation

Post vaccination surveillance might reveal local deficits in measured antibody response, but it is not a tool for independent proof of population protection at the ultimate stage. Sampling should be designed to adjust for herd clustering and variations between goats and sheep. Vaccination date, blood sampling time, age, presence of maternal antibodies in young animals and test detection limits can alter interpretation. Sales of animals in less than 2 weeks can be missed in household surveys.

A combined surveillance system would include clinical suspect cases, lab confirmation in outbreaks, vaccination histories and periodic seromonitoring with denominators specified. Market places and communal grazing areas can link otherwise isolated flocks and herds. Extension should emphasize when farmers seek vets for oral, respiratory or diarrheal signs (not specific to PPR). District-wide mapping could be used to guide mobile services and follow up campaigns.

4) Lumpy Skin Disease and Emerging Bovine Threats

Lumpy skin disease (LSD) has reached India and should be considered for Chhattisgarh. Although an Indian publication on virus isolation documented spread to many states (including Chhattisgarh), the original cited outbreak studied in the report was not in Chhattisgarh (Kumar et al., 2021). This prevents it from being read as a prevalence survey of Chhattisgarh. Chhattisgarh-specific conclusions from other regions' multi-state investigations should not be used as representative of the district prevalence rate.

Confirmation of the skin nodules, fever and production decline by veterinary diagnosis and differential diagnosis should be added to clinical recognition. Use of a surveillance system should include data on date, age, vaccination, herd movement, insect exposure and co-incident diseases. Samples based on predominantly of clinically affected animals cannot estimate the prevalence of disease in cattle. Susan et al. (2002). Separation of confirmed, suspected and laboratory-negative investigations will improve regional estimates. Vector control, biosecurity, movement control and vaccination should be based on current guidance of a competent authority and local circulating risks. Chhattisgarh's evidence base would benefit from uniform reporting of outbreaks, animal denominators and long-term follow-up. Incidence figures for multiple states should not be presented under a single state rate category.

5) Poultry Disease in Commercial and Backyard Systems

Newcastle Disease

A virulent viral disease of poultry, Newcastle disease causes variable strains and clinical syndromes among different poultry strata. A molecular investigation of an isolate from a commercial poultry establishment in Raipur following disease and death in supposedly vaccinated poultry (2024 genomic investigation) identified a genotype VII.2 isolate. One single isolate may confirm the contribution of the isolate to that particular incident; it will not explain how widespread the genotype 7.2 is or the reason for vaccine failure.

Routes to investigation for vaccinated-flock outbreaks include storage of vaccine, first line of administration, coverage and timing of vaccine, strain questions, barriers to biosecurity and route of entry. Based on a clinical history, however, none of these can be substantiated without further investigation. As shown by the Raipur case, virus genome sequencing of a representative group of confirmed virus isolates will reveal variation within and between districts and systems.

6) Other Poultry Syndromes and Surveillance Gaps

Respiratory, enteric and immunosuppressive conditions can be problems in investigating poultry diseases and the avian influenza is required to be reported immediately and quickly under the Compounding Veterinary Services Protocol. There is no 'similar' post-mortem prevalence in the sources examined, for these conditions on an all 'Chhattisgarh' basis. They are highlighted as diagnostic and preparedness priorities and not current burden estimates.

Commercial farms and backyard flocks vary in flock size, vaccination schedule, replacement frequency and motivation to report. A surveillance system requires both sectors, notably where birds or equipment are traded between holdings and markets. Clear necropsy and sampling procedures, laboratory referral protocols and reporting channels that are feasible for farmers will ensure immediate symptoms do not go unnoticed until a catastrophe occurs.

7) Bacterial, Parasitic and Production-Related Conditions

Haemorrhagic septicaemia and black quarter are significant in the context of Indian planning and vaccine use. No source set is given in this profile, however, which can support a Chhattisgarh-wide current prevalence estimate for either. Records of past cases, diagnostic confirmation of outbreaks and vaccination history may be held on administrative files but these need to be explored for appropriate denominators and diagnosis. Abhilash et al. (2016) The review considers these conditions as issues to be more appropriately prioritized in terms of records, rather than here providing unsupported percentages.

Tick-borne diseases and haemoparasites cause fever, anemia and poor production. Their estimated prevalence varies markedly by season, exposure to ticks, breed, sampling of cases for confirmation (clinical, serology or

PCR) and time period of sampling. A national investigation of lumpy skin disease utilized Chhattisgarh in its sampling frame, but coinfection estimates of pooled cases shouldn't be generalized to the state without disaggregated estimates. District stratified studies would be far more useful than generalizations based on cases seen at a referral hospital.

Mastitis and helminthiasis can have significant impact on growth and milk yield. Clinical caseload is not equivalent to true community prevalence. Problems seen at vet colleges may be more severe or more accessible than animals in remote villages. Fecal and milk surveys should note the method of sampling, species, age, season, husbandry and prior treatment. Diagnostic stewardship and lab data are important in antimicrobial prescribing for ill health as clinical signs don't determine the cause.

Infectious disease can interact with nutrition, temperature, water, housing and reproductive management. A regional review should not lead to a pathogen explanation for everything on farm. Apart from the fact that farmer surveillance records that distinguish between infection and management/metabolic issues will give better priorities, this especially applies to abortion and the etiology of brucellosis.

Zoonotic Risk and One Health Coordination

One Health brings animal health, human health and the environment together. The brucellosis surveys from Chhattisgarh make occupational and foodborne exposure tangible, though not the extent of human cases. Veterinarians, public health workers can work together to review suspected zoonotic exposures, ensure safety of specimens, advise people and refer if needed. Communication needs to be proportional: the estimate of seroprevalence of bovines does not mean an identical proportion of humans are infected.

Other zoonotic risks may justify locally undertaken studies, but "just adding to the list of a disease does not prove the disease is emerging in the region". Priorities could be severity, experimental confirmation of animal infection, interactions and opportunities for human exposure, implementation feasibility and laboratory capacity. Villages can help us understand. How is milk processed, who attends calving and do they have access to veterinary services. Ethical household studies should anonymize location and not stigmatise.

Animal Movement, Markets and Seasonal Risk

Live-animal movement links otherwise disconnected farms. Animals may be acquired for dairy replacement, sold after a health event, or congregate at markets and grazing collection points; such may subject vaccinated and unvaccinated animals to disparate risks. The established dairies and village network in Chhattisgarh means data on movement history is a promising investigation factor, but none of the publications reviewed characterize the broader movement network across the state. A case-control study could record source district, the date of arrival, pasture surface disinfectant and clinical health status at the point of acquisition to shed light on actionable routes.

Season needs to be precisely recorded, too. Rain, temp, humidity may impact vector populations, husbandry practices, congregation of animals and access to vets. Hota et al. (2021) found bovine brucellosis seropositivity varied by season among their enrolled sample but serology captures both exposure and current conditions. If a cross-sectional sample has seasonality it doesn't necessarily imply seasonality of transmission without sampling repeatedly and analysis of outbreak-time data.

Surveillance and Diagnostic Infrastructure

i) A Proposed Regional Framework

A feasible surveillance system would collect data from a number of separate, yet connected sources – farmer or veterinarian reporting of suspected cases, confirmatory laboratory testing on carefully chosen or high-consequence cases, occasional probability-based serosurveys, vaccination registries and mortality or production data. Each type of data set provides a unique answer. Notifiers depend on service availability; surveys rely on denominators and sampling strategies. None would be perfect on their own.

A district-stratified design may choose villages, then herds, then animals, with probabilities logged at each stage. Species and production system should be defined as explicit strata. Survey analysis would make allowance for clustering and examine the effect of sensitivity and specificity; results must be reported with dates and confidence intervals. Outbreak case-control studies could identify risk factors related to movement and management; cases and controls must be drawn from a relevant source population.

Laboratory network sample protocols, transport times, cold-chain and returning results to field vets are also essential. Molecular testing, culture and serology each have different roles and biosafety issues. A positive result should be mapped to a clinical case definition; in some diseases stage-specific sampling is required. Digitally identifiable records should include the animal ID, location at an appropriate level of resolution, species, age, clinical signs, date of sample, vaccination history, test used and result.

Evaluation of Vaccination

Coverage, the product of a vaccination programme, does not equate with protection or reduction of disease. Coverage estimates should specify numbers of eligible animals, doses of vaccine administered, repeat doses, if necessary and independently validated final numbers. Where practical, sero-monitoring can provide useful biological confirmation and sudden, large-scale disappearance of outbreaks offers external corroboration.

Changes over time are also likely to be influenced by scope of reporting, migration, herd composition and pathogen circulation. The Chhattisgarh PPR investigations illustrate the utility of post-vaccination assessment (Balamurugan et al., 2018; Govindaraj et al., 2019).

Disease-specific syndromic surveillance can be incorporated into future investigations. For instance, abortion investigations could verify a defined differential panel, explore herd-level management decisions and georeference case clustering; vesicular disease investigation can include FMD typing and the vaccination history; small-ruminant respiratory and enteric outbreaks can be substantiated with PPR testing and other

causes. In poultry, a series of isolates from multiple farms give better information on circulating lineages than one genome.

Limitations of the Review

The review focuses on livestock and poultry and does not seek to be an encyclopaedic account of companion animals, wildlife or aquatic animals. Its conclusions are about the reliability and the limitations of evidence, not an ordered estimate of the disease burden across all animals. In particular, a disease being present in one herd, a positive antibody test and a population prevalence estimate are three different assertions.

Future Chhattisgarh publication reports need to describe the sampling sufficiently. Per-respondent reports can include number of districts and villages sampled, herds and animals sampled and included, inclusion and exclusion criteria, date of specimen collection and whether animals were vaccinated. Per-specimen reports should report the laboratory assay as well as the test's diagnostic intent explain the degree of uncertainty in the estimated proportions and describe if and how data is reported separately on animals and herds.

Conclusion

Chhattisgarh data include published evidence on bovine brucellosis, FMD outbreaks and within-herd patterns, PPR vaccination survey and poultry isolate of Newcastle disease. All highlight utility of locally-available lab testing and highlight gaps in state-wide, comparable surveillance. The most justified next step is species- and district-specific surveillance with clear denominators, confirmed case criteria, linked immunization information and One Health collaboration when human infection risk is significant. Preventive strategies can be evaluated clearly only when coverage, immune response and disease are studied as distinct outcomes.

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