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Mastitis treatment in Karnataka

Results from a qualitative scoping survey

Arpita Hiremath, Vivian Hoffmann, Manaswini Rao, and Ashish Shenoy

Introduction

Bovine mastitis, inflammation of a cow's mammary gland, is estimated to cost Indian dairy farmers approximately 1.5 billion US dollars each year through the reduction of milk production and quality (Banal and Gupta, 2009). Milk production may decrease by as much as 17.5% before any noticeable signs of infection are present (Krishnamoorthy et al., 2021), with even larger losses in the case of clinically observable mastitis (Singh and Singh, 1994). Prevalence of sub-clinical mastitis in India has been estimated at 42% and is increasing with warming global temperatures (Krishnamoorthy et al., 2021; Jingar, Mehla, and Singh, 2014).

Farmers in India typically treat animals for mastitis only once clinical signs appear, using broad-spectrum antibiotics that may accelerate development of resistant pathogens (Chauhan et al. 2018; Mutua et al., 2020). Diagnostic methods for mastitis are often expensive, time-consuming, and generally used for retrospective herd-level testing, limiting their effectiveness for preventing economic losses.

A recently developed mastitis screening test, feasible for farmers to conduct themselves, is available in India for INR 30. A bacterial identification and antibiotic sensitivity test, conducted by a para-veterinarian, costs INR 250 and yields results within 6 hours. Neither of these tests is widely used.

Barriers to the use of mastitis testing technology include lack of awareness about the importance of sub-clinical mastitis (FAO, 2014; Nimbalkar et al., 2020), and the widespread availability and low cost of broad-spectrum antibiotics. Individual farmers are likely unaware that indiscriminate use of such drugs can lead to antimicrobial resistance (AMR) and eventual failure of these drugs. Moreover, from the individual farmer's perspective, the benefit of using a course of broad-spectrum antimicrobials to combat a costly case of mastitis may outweigh the relatively small contribution of that course of treatment to the development of resistance.

Dairy producers as a whole, however, are likely to perceive these costs and benefits differently. The Karnataka Co-operative Milk Producers' Federation (KMF), for example, comprises over 2.6 million

households spread over more than 24,000 villages throughout the state of Karnataka. The costs of reduced antimicrobial efficacy are felt by all of KMF's members. Large cooperatives like the KMF could therefore be ideal partners for the scaling of rapid mastitis testing and improved targeting of veterinary antimicrobial drugs.

In this note, we describe scoping research facilitated by the KMF and conducted in 5 villages across 2 districts of Karnataka State. The goal of this work was to characterize the institutional structures, costs, and practices related to treating bovine mastitis, to inform potential intervention-based research on the impact of improved access to mastitis screening and antibiotic susceptibility testing technologies.

Methods

Through introductions provided by the Karnataka Co-operative Milk Producers' Federation (KMF), the research team interviewed district-level Milk Union managers in Mandya and Chikkaballapur using a structured interview guide. Through contacts provided by the Milk Union managers, farmers in five villages (three in Mandya and two in Chikkaballapur), and eight veterinarians serving these farmers were likewise interviewed. In total, 25 farmers and 8 veterinarians were interviewed.

In addition to open-ended questions about their interactions with farmers, veterinarians were asked to select the medicines they prescribed to treat mastitis from a list taken from the WHO's AwARE classification of antibiotics for evaluation and monitoring of use (WHO, 2023).

Findings

Farmers' reported prevalence of bovine mastitis and access to veterinary care, as well as veterinarians' antibiotic prescribing practices, awareness of stewardship guidelines, and use of laboratory testing, were similar across Mandya and Chikkaballapur, as were the record-keeping practices of Milk Unions.

Prevalence and farmer response to clinical mastitis

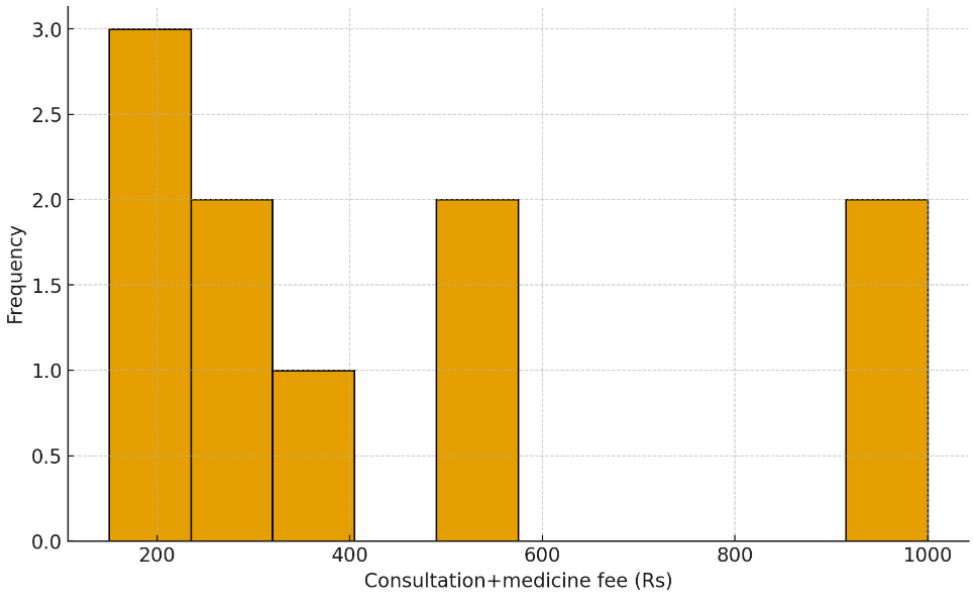
On average, the farmers interviewed kept three head of dairy cattle. Most farmers (76%) reported that their cattle experienced at least one case of clinical mastitis on a yearly basis, with 36% reporting at least two episodes. The condition is identified by swelling of the udder and changes to the quality of milk. Most farmers reported applying traditional remedies to the infected area, such as aloe vera, lemon, turmeric, castor oil, and lime paste. Several reported purchasing pharmaceuticals directly from a pharmacy, though most sought veterinary care. Clinical mastitis was generally treated promptly and was on average resolved with treatment in three days.

Access to Veterinary Care

Across both districts, veterinary services operate through a dual system consisting of a subsidized channel through the dairy cooperative structure and direct contact with veterinarians. When one of their cattle needs treatment, a farmer will normally contact the local Dairy Cooperative Societies (DCS), the local entity within the district Milk Union. The DCS provides a coupon to the farmer at the subsidized price of ₹50 or ₹60 depending on district and notifies taluk-level (sub-district) veterinary administrators, who dispatch a government-empaneled veterinarian to the farmer's home. The farmer redeems the coupon with the veterinarian, who provides treatment, including any required medicines at no additional charge.

The cooperative system does not always function with the speed or flexibility farmers require. In both Mandya and Chikkaballapur, farmers regularly bypass the cooperative pathway and instead call known veterinarians directly, particularly in emergencies or when rapid intervention is needed. Some farmers also report procuring drugs directly from pharmacies without veterinarian advice. The cost of obtaining veterinary care, shown in Figure 1, is typically much higher than that of going through the cooperative structure. However, the modal cost, at INR 200 including medicine, is still below that of the test for bacterial identification and antibiotic sensitivity.

Figure 1: Cost of veterinary care for mastitis outside of cooperative structure



Source: Data from farmer interviews

The fact that farmers opt to contact vets directly suggests that public veterinary staffing is often insufficient to respond promptly to all coupon-based calls. In Chikkaballapur, where seeking of private veterinary care was more common, official staffing shortages are substantial, with only two-thirds of sanctioned veterinarian posts filled.

Record-keeping

In both districts, record-keeping was limited, especially at the DCS level. One village-level DCS maintained records of payments received for veterinary coupons. Paper records of veterinary services provided to farmers are maintained at the taluk level. The data collected through these forms included farmer name, coupon number, timing of visit, vet name, and the veterinary concern spurring the visit.

Antibiotic Prescription Practices and Stewardship Awareness

Mastitis treatment in both districts relies heavily on broad-spectrum antibiotics, with intramammary infusions and injectable antibiotics being the standard tools prescribed by veterinarians. Across the two districts, farmers and vets mentioned a wide range of commercial products. Notably, treatment is typically applied only to the affected quarter of the udder, not all four, a practice that is widely accepted by both farmers and vets in the sample. This contradicts the recommendation found in international mastitis treatment guidelines (NMC, 2025).

Familiarity with the WHO AWaRe classification for antibiotic stewardship was extremely low among the veterinarians interviewed. Only one of four veterinarians in Mandya reported any knowledge of AWaRe. In Chikkaballapur, district-level officials of the Milk Union had not heard of the classification and no practicing veterinarians the framework to guide prescribing.

When asked to indicate which medicines they typically prescribed against mastitis, a total of 46 were mentioned by the eight veterinarians interviewed. Of these, 21 were in WHO's 'Watch' category. These antibiotics have a higher risk of selecting for bacterial resistance, and the WHO recommends that their use should be limited to specific, carefully monitored indications, generally for sicker human patients, in a hospital setting or when no drugs in the lower resistance-potential Access group are suitable. Most of the drugs used (38 of the 46) were classified as broad-spectrum through an AI-assisted scan of the literature (OpenAI, 2025). These drugs, the number of veterinarians who mentioned each, and their AWaRe as well as broad vs. narrow spectrum classification are shown in Appendix Table 1.

Use of and Interest in Diagnostic and Susceptibility Testing

Neither diagnostic nor susceptibility testing are used, except in rare circumstances cases that do not respond to treatment. The primary barriers are practical: laboratories are located far from most villages (often 50–60 km away), results require 24–48 hours, and the benefits are perceived as limited. Some vets remarked that test results often recommend the same drugs they would have used empirically, making the process too slow and too costly to justify. Both farmers and veterinarians expressed interest in the idea of a simple, rapid, on-farm diagnostic test. While stated demand may be upward-biased by a surveyor demand effect, it is nonetheless encouraging that no reservations were expressed.

Preventive Practices and District Programs

Milk Unions in both districts support mastitis prevention and control through farmer training programs. In Chikkappur, a district-level training program runs quarterly, and there are weekly mastitis awareness programs in high-prevalence taluks. Mandya runs a monthly program focused on detection and prevention of sub-clinical mastitis. This district also distributes udder hygiene kits to farmers. Further, veterinarians typically provide farmers with advice on how to prevent mastitis from recurring.

Farmers are generally aware of mastitis prevention practices including the maintenance of good hygiene of cows' environments, disinfecting the quarters with an antiseptic spray, and preventing the cow from sitting for a period of time after milking.

Conclusions

In both Mandya and Chikkaballapur districts, mastitis is recognized as a serious problem by farmers and dairy cooperatives, which invest significant resources to educate farmers on prevention. This suggests potential latent demand for a farmer- administered rapid test to identify subclinical mastitis.

Widespread availability and usage of low-cost, broad-spectrum antibiotics means that private demand for a bacterial identification and antibiotic sensitivity test is likely to be more limited. Milk Unions may be interested in mandating the use of such a test, and the prescription of a narrow-spectrum antibiotic targeting the identified pathogen, in order to preserve the efficacy of antibiotics for mastitis treatment. However, the existence of a private market for veterinary care may limit farmers' compliance with such a requirement. Unless similar restrictions can be imposed on private providers, farmers will likely turn to private veterinarians if testing implies significant additional costs or delays within the cooperative system.

Testing costs could be defrayed through the cooperative, but this would require the allocation of substantial resources.

Research on the use of antimicrobials for treatment of dairy cattle in the study districts could potentially utilize administrative data on farmers' interactions with veterinary care providers engaged through the cooperative system. This data would need to be digitized for research use and would be incomplete due to farmers' use of private veterinarians.

Dairy cooperatives in India play a key role in farmers' access to veterinary information and care. As these institutions embody the collective interests of their members, they are important potential partners in the promotion of antibiotic stewardship for use in veterinary settings. However, the existence of private veterinary markets implies the need for a broader approach. Coordination with non-cooperative veterinary care and drug providers, as well as regulatory authorities, will likely be necessary to achieve meaningful changes in farmers' use of antimicrobials for the treatment of mastitis.

Appendix Table 2: Antibiotic drugs prescribed by veterinarians to treat mastitis

Antibiotic	Class	WHO classification	Spectrum	# Vet mentions	Source for spectrum classification
Gentamicin	Aminoglycosides	Access	Broad	8	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4888811/
Amoxicillin	Penicillins	Access	Broad	7	https://www.ncbi.nlm.nih.gov/books/NBK482250/
Amikacin	Aminoglycosides	Access	Broad	6	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4888811/
Oxytetracycline	Tetracyclines	Watch	Broad	6	https://www.merckvetmanual.com/pharmacology/antibacterial-agents/tetracyclines
Amoxicillin / clavulanic-acid	Beta-lactam/beta-lactamase-inhibitor	Access	Broad	5	https://www.ncbi.nlm.nih.gov/books/NBK459125/
Ampicillin	Penicillins	Access	Broad	5	https://go.drugbank.com/drugs/DB00415
Ceftriaxone	Third-generation-cephalosporins	Watch	Broad	5	https://www.ncbi.nlm.nih.gov/books/NBK551517/
Ampicillin/sulbactam	Beta-lactam/beta-lactamase-inhibitor	Access	Broad	4	https://pubmed.ncbi.nlm.nih.gov/18154545/
Cefoperazone	Third-generation-cephalosporins	Watch	Broad	4	https://www.ncbi.nlm.nih.gov/books/NBK551517/
Cloxacillin	Penicillins	Access	Narrow	4	https://www.essentialmeds.org/eml/medicine/296.2
Metronidazole_IV	Imidazoles	Access	Narrow	4	https://pubmed.ncbi.nlm.nih.gov/9360057/
Neomycin_IV	Aminoglycosides	Watch	Broad	4	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4888811/
Ceftizoxime	Third-generation-cephalosporins	Watch	Broad	3	https://www.ncbi.nlm.nih.gov/books/NBK551517/
Ciprofloxacin	Fluoroquinolones	Watch	Broad	3	https://www.merckmanuals.com/professional/infectious-diseases/bacteria-and-antibacterial-medications/fluoroquinolones
Sulfadimidine	Sulfonamides	Access	Broad	3	https://www.merckvetmanual.com/pharmacology/antibacterial-agents/sulfonamides-and-trimethoprim
Tazobactam	Beta-lactamase-inhibitors	Watch	N/A*	3	https://go.drugbank.com/drugs/DB01606
Cefotaxime	Third-generation-cephalosporins	Watch	Broad	2	https://www.ncbi.nlm.nih.gov/books/NBK551517/
Cefuroxime	Second-generation-cephalosporins	Watch	Broad	2	https://www.ncbi.nlm.nih.gov/books/NBK551517/
Chloramphenicol	Amphenicols	Access	Broad	2	https://en.wikipedia.org/wiki/Chloramphenicol

Chlortetracycline	Tetracyclines	Watch	Broad	2	https://www.merckvetmanual.com/pharmacology/antibacterial-agents/tetracyclines
Levofloxacin	Fluoroquinolones	Watch	Broad	2	https://www.merckmanuals.com/professional/infectious-diseases/bacteria-and-antibacterial-medications/fluoroquinolones
Metronidazole (oral)	Imidazoles	Access	Narrow	2	https://pubmed.ncbi.nlm.nih.gov/9360057/
Sulbactam	Beta-lactamase-inhibitors	Access	N/A	2	https://en.wikipedia.org/wiki/Sulbactam
Sulfadiazine / trimethoprim	Sulfonamide-trimethoprim-combinations	Access	Broad	2	https://www.merckvetmanual.com/pharmacology/antibacterial-agents/sulfonamides-and-trimethoprim
Sulfadimidine/ trimethoprim	Sulfonamide-trimethoprim-combinations	Access	Broad	2	https://www.merckvetmanual.com/pharmacology/antibacterial-agents/sulfonamides-and-trimethoprim
Tetracycline	Tetracyclines	Access	Broad	2	https://www.merckvetmanual.com/pharmacology/antibacterial-agents/tetracyclines
Azithromycin	Macrolides	Watch	Broad	1	https://pubmed.ncbi.nlm.nih.gov/22017558/
Cefalexin	First-generation-cephalosporins	Access	Broad	1	https://www.drugs.com/tips/cephalexin-patient-tips
Cefixime	Third-generation-cephalosporins	Watch	Broad	1	https://www.ncbi.nlm.nih.gov/books/NBK551517/
Cefmenoxime	Third-generation-cephalosporins	Watch	Broad	1	https://www.ncbi.nlm.nih.gov/books/NBK551517/
Cefozopran	Fourth-generation-cephalosporins	Watch	Broad	1	https://en.wikipedia.org/wiki/Cefozopran
Ceftazidime	Third-generation-cephalosporins	Watch	Broad	1	https://www.ncbi.nlm.nih.gov/books/NBK551517/
Clindamycin	Lincosamides	Access	Narrow	1	https://en.wikipedia.org/wiki/Lincomycin
Doxycycline	Tetracyclines	Access	Broad	1	https://www.merckvetmanual.com/pharmacology/antibacterial-agents/tetracyclines
Fusidic-acid	Steroid antibacterials	Watch	Narrow	1	https://bpac.org.nz/BPJ/2014/October/topical-antibiotics.aspx
Ofloxacin	Fluoroquinolones	Watch	Broad	1	https://www.merckmanuals.com/professional/infectious-diseases/bacteria-and-antibacterial-medications/fluoroquinolones
Pefloxacin	Fluoroquinolones	Watch	Broad	1	https://www.merckmanuals.com/professional/infectious-diseases/bacteria-and-antibacterial-medications/fluoroquinolones

*β-lactamase inhibitors are considered neither broad nor narrow spectrum.

Source: Data from veterinarian interviews

ABOUT THE AUTHORS

Arpita Hiremath is an independent research consultant based in Dharwad, Karnataka, India.

Vivian Hoffmann is a Senior Research Fellow with the Markets, Trade & Institutions Unit at the International Food Policy Research Institute, based in Ottawa, Canada.

Manaswini Rao is an Assistant Professor of Economics at the Alfred Lerner College of Business and Economics, University of Delaware.

Ashish Shenoy is an Associate Professor of Agricultural and Resource Economics at the University of California at Davis.

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1201 Eye Street, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: ifpri@cgiar.org | www.ifpri.org | www.ifpri.info