



Impact of COVID-19 on animal health care services in Karnataka

G GOVINDARAJ^{1✉}, M B SHANABHOGA¹, H M SWAMY¹, G S NAVEENKUMAR¹, M NAGALINGAM¹,
 B MAHANTHESHWARA¹, V BALAMURUGAN¹, B R SHOME¹ and H RAHMAN²

ICAR–National Institute of Veterinary Epidemiology and Disease Informatics, Bengaluru, Karnataka 560 064 India

Received: 18 December 2021; Accepted: 5 April 2022

ABSTRACT

The study assessed the impact of COVID-19 associated lockdowns on animal health services, coping practices, and financial loss to livestock farmers in Karnataka. A cross-sectional survey among 170 livestock farmers and 24 field veterinarians working in the study jurisdiction were interviewed using a structured questionnaire. Descriptive statistics and repeated ANOVA were employed to assess the impact of COVID-19 lockdown. The results revealed a significant difference in the number of cases attended at different periods of lockdowns and among the veterinarians, with a decline in the number of cases attended across the species of pets (54.9%) followed by goats (35.3%), sheep (29.1%), cattle (25.5%) and buffalo (21.6%) during the lockdown. The mode of veterinarian contact through phone calls (80%) and WhatsApp (46.7%) increased significantly and veterinarian visits decreased by 27.3% and farmers' visits to veterinary hospitals decreased by 61.9% during lockdown. The livestock farmers' welfare schemes were abstracted by lockdown and the vaccine administration against diseases like PPR, ET, and HS per veterinarian declined in sheep and goats. However, targeted vaccination against FMD in cattle was found achieved. The COVID-19 and associated lockdown affected the livestock farmers in multiple dimensions. Hence, to cope with lockdown-like situations, it is recommended to engage trained personnel, practitioners, and Non-Governmental Organisations (NGOs) associated with animal health care services to provide uninterrupted health care services to livestock farmers.

Keywords: Animal health care service, Animal Vaccination, COVID-19 impact, Livestock farmer practices

Livestock plays a pivotal role among the primary sectors in India. It employs 8.8% of India's population and contributed 16% to the total income of small farm households (DAHD&F 2019). This sector significantly influences the socio-economic development of rural households by providing employment to rural youth and women (Sarkar 2020). As per the 20th Livestock Census (2019), the total livestock population in India accounts for 512.05 million which is 4.6% higher than the 19th Livestock Census (2012) (DAHD&F 2012, DAH&D 2019). In India, animal healthcare services are within the purview of the State Government/UTs. Despite the existence of well-structured organizations and institutions at the center and states/UTs, the reach of the animal health care services were disrupted during the COVID-19 lockdown. The pandemic has created a serious impact on the human health sector as well as other sectors with varying magnitude (Kumar *et al.* 2020, Raman *et al.* 2021). To mitigate the COVID-19 spread, the Government of India announced a nationwide lockdown for 21 days (March 23rd to 14th April 2020) allowing

free movement of essential commodities. Further, it was extended further from April 15th to 3rd May (Lockdown 2.0) with a provisional relaxation for agriculture and livestock activities (Adya and Adya 2020). The immediate effect of the lockdown caused supply chain disruption (Mahajan and Tomar 2020).

The actions taken by the government to contain the COVID-19 spread had negatively impacted the livestock sector, particularly disrupting the vaccination and treatment services for animals (Biswal *et al.* 2020, FAO 2021). Further, in many states, the livestock markets were also closed during the lockdown (Cariappa *et al.* 2021, Shanabhoga *et al.* 2022a). Although few studies are available on the COVID-19 impact on agriculture and livestock sector, the primary survey-based studies on the disruptions in livestock healthcare services and their associated burden on livestock farmers were limited. Hence, to address the gap, the present study was undertaken in Karnataka state, to understand and document the disruption in animal health care services and the associated financial burden on livestock farmers due to the COVID-19 lockdown.

MATERIALS AND METHODS

Study area: Karnataka accounts for 5.40% of India's livestock population (DES 2022) with 29.0 million livestock. The cattle, sheep, and goat populations had

Present address: ¹ICAR–National Institute of Veterinary Epidemiology and Disease Informatics, Yelahanka, Bengaluru, Karnataka. ²International Livestock Research Institute, South Asia Region, New Delhi, India. ✉Corresponding author email: mggraj74@gmail.com

shown a significant increase from 14.4 million during the 19th Livestock Census (2012) to 17.27 million in 2019. The share of animal husbandry and dairy sector to state Gross State Domestic Product (GSDP) was 21.81% (DES 2022). A total of 4215 veterinary institutions are operating in the state which includes 155 institutions in Chitradurga and 126 institutions in the Bellary district (DAH&VS 2017). The major stakeholders considered in the study to assess disruptions in veterinary services during the COVID-19 lockdown were farmers and veterinarians.

Sampling size and procedure: The sample size for the study was calculated using Cochran (1963) formula and the estimated sample size was 181 livestock households but we could collect data from 170 livestock households as few farmers did not participate in the survey. The multistage sampling procedure adopted for collecting the primary data is presented in Table 1. For the veterinarian's survey, the field veterinarians working in the respective dispensaries within the administrative regions of the surveyed villages were considered. A total of 24 field veterinarians were interviewed and data on service delivery during the lockdown period was collected.

Data collection: A cross-sectional survey was conducted in Chitradurga and Bellary districts of Karnataka during November and December 2020 i.e three months after the removal of lockdown restrictions. The study period

was divided into three categories, viz. before lockdown (January 2020 to March 2020), during lockdown (April 2020 to July 2020), and after lockdown (August 2020 to October 2020). The primary data on livestock management, mode of veterinarian contact, the extent of self-medication (farmers deciding the drugs/medicine themselves to treat their animals), disruptions in veterinary service delivery etc., during various periods of lockdown (before, during and after) were collected from livestock farmers. The details on the number of cases handled, number of farm visits, mode of contact for consultation/treatment, and extent of implementation of various government programmes during various periods of lockdown were collected from the veterinarians.

Statistical analysis: The collected data were coded and analyzed with descriptive statistics, viz. frequencies, percentages, means, standard deviations etc, using Microsoft Excel 2019 and ANOVA test was performed using R version 4.0.3.

RESULTS AND DISCUSSION

General information of livestock farmers and veterinarians: It was observed that the majority (88%) of the livestock farmers were males, 44.7% were illiterates and the average age of the respondents was 33 years, with an experience of 13 years in livestock rearing (Supplementary

Table 1. Sampling procedure adopted for livestock farmers and veterinarians survey in Karnataka

Stage	Selection	Unit Name/Number	Criteria/procedure
First stage	District selection in Karnataka state	Bellary and Chitradurga	The data on livestock population density, number of COVID-19 cases per lakh human population ² and number of veterinary institutions ³ were normalized and Z scores were calculated and grouped into high and low corona risk districts using Z median scores. Bellary from the high-risk group and Chitradurga from the low-risk group were randomly selected
Second stage	Two taluks ¹ (out of seven) in Bellary and two taluks (out of six) in Chitradurga	Huvina Hadagali and Kudligi taluks in Bellary district, and Hiriyuru and Challakere taluks in Chitradurga district	Taluks were selected randomly in the identified districts
Third stage	Two blocks (out of three) in Huvina Hadagali taluk and two blocks (out of four) in Kudligi taluks in Bellary	Itigi and Hire Hadagali blocks from Huvina Hadagali taluk; Gudekokte and Hosahalli blocks from Kudligi taluks	The blocks were selected randomly in each of the identified taluks
	Two blocks (out of four) in Hiriyur and two blocks (out of four) in Challakere taluk in Chitradurga	Dharmapura and Aimangala blocks from Hiriyur taluk; Parushurampura and Nayakanahatti blocks from Challakere Taluk	
Fourth stage	Villages in each of the identified blocks	Three villages from each block were selected	The villages under the jurisdiction of blocks were listed and three villages were selected randomly
Fifth stage	Households in the identified village and selection of field veterinarian	Livestock farmers and the field veterinarians	The livestock farmers were selected randomly in proportion to the number of households in each of the identified villages The veterinarians working in the dispensaries located in and around the identified villages were surveyed

¹Taluks are administrative sub-units of the district and they may vary from 2 to 10 or more depending on the geographical area of the district. *Source:* ^{2,3}Department of Animal Husbandry and Veterinary Services, as of September 2020.

Table 1). Among the surveyed veterinarians, 70.8% were males and 29.2% were females and majority (54.2%) of them had post-graduate education. The average experience of veterinarians in Bellary district was 9 years whereas it was 7 years in Chitradurga district. The average number of villages covered by the veterinarian in the survey area ranges from 4 to 41 in Bellary district and 4 to 36 villages in Chitradurga district (Supplementary Table 2).

Animal healthcare service: In Bellary district, cattle and buffalo cases and in Chitradurga district, sheep and goats' cases were the major livestock species attended by the veterinarians. The number of cases attended by veterinarians declined significantly across the animal species during the lockdown period with a major decline in pets (54.9%) followed by goats (35.3%), and sheep (29%). The poultry cases attended also declined considerably (64.2%) (Table 2). The overall number of cases attended by veterinarians had shown a considerable decline (29.67%) during the lockdown, whereas a significant increase (1198 cases) after lockdown compared to the cases during lockdown (813 cases). Further, the number of visits per week by the veterinarians decreased from 24 to 16 during lockdown (Fig. 1). However, the visits increased after the lockdown restrictions were eased, but did not reach the pre-COVID levels in both the districts. During the COVID-19 lockdown, the DAH&D, Government of India, New Delhi, instructed the states that veterinary services are on the list

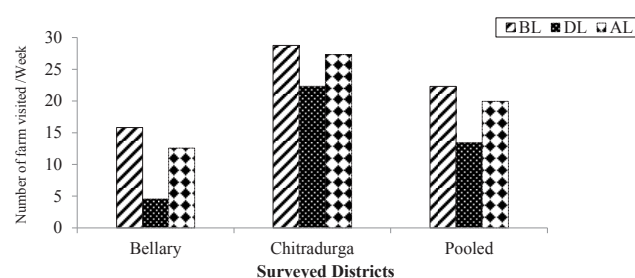


Fig. 1. Average number of farms visited by veterinarian per week during different periods of COVID-19 lockdown in the study area (BL, Before Lockdown; DL, During Lockdown and AL, After Lockdown).

of essential services and veterinary clinics, hospitals, and other establishments should function normally, but many hospitals/dispensaries had restricted their operations.

In the study region, the number of cases attended by the veterinarian across the species declined considerably and the livestock farmers' visit to dispensaries *per se* also declined due to COVID-19 panic and associated increased anxiety (Biswal *et al.* 2020). To some extent, it was also due to the limited number of staff attending the offices (based on the staff limit guidelines provided by the Government during the pandemic), travel restrictions, and entrusting additional duties to the veterinarian for COVID-19 related activities that affected the proper animal healthcare service delivery. Furthermore, some of the already existing problems in the veterinary service like higher number of animal to

Table 2. Number of cases in livestock and poultry farms attended by the veterinarian during different periods of COVID-19 lockdown during 2020 in the study area

Animal species	Bellary (n=12)			Chitradurga (n=12)			Pooled (n=24)			% Change between BL and DL	% Change between BL and AL	Repeated ANOVA (Two-Factor Without Replication)
	BL	DL	AL	BL	DL	AL	BL	DL	AL			
Cattle	195 (36.7)	151 (28.4)	185 (34.9)	111 (35.7)	77 (24.8)	123 (39.5)	306 (36.3)	228 (27.1)	308 (36.6)	-25.5	0.7	A _(f-value) = 29.38*** B _(f-value) = 7.67***
Buffaloes	69 (34.5)	56 (28)	75 (37.5)	47 (32.6)	35 (24.3)	62 (43.1)	116 (33.7)	91 (26.5)	137 (39.8)	-21.6	18.1	A _(f-value) = 44.37*** B _(f-value) = 6.89***
Sheep	151 (38.3)	111 (28.2)	132 (33.5)	286 (38.7)	199 (27)	253 (34.3)	437 (38.6)	310 (27.4)	385 (34)	-29.1	-11.8	A _(f-value) = 2.99** B _(f-value) = 4.99**
Goats	90 (37.3)	63 (26.1)	88 (36.6)	165 (40.8)	102 (25.2)	137 (34)	255 (39.5)	165 (25.6)	225 (34.9)	-35.3	-11.8	A _(f-value) = 11.93*** B _(f-value) = 3.88**
Pets	29 (40.2)	15 (20.9)	28 (38.9)	13 (40.6)	4 (12.5)	15 (46.9)	42 (40.3)	19 (18.3)	43 (41.4)	-54.9	2.4	A _(f-value) = 4.39*** B _(f-value) = 11.90**
Poultry farms	12 (70.6)	2 (11.8)	3 (17.6)	2 (33.3)	3 (50)	1 (16.7)	14 (60.9)	5 (21.7)	4 (17.4)	-64.3	-17.4	A _(f-value) = 11.47*** B _(f-value) = 5.51**

Source: Primary data collected from veterinarians. ***Significant at 1% level, **Significant at 5% level. Note: Figures in the parenthesis indicate the percentage share in different lockdown periods of each species. BL, Before lockdown; DL, During Lockdown; AL, After Lockdown; Before, during, and after lock-down period refers to January 2020 to March 2020, April 2020 to July 2020, and August 2020 to October 2020, respectively. A, Within the group (Among veterinarians); B, Between the group (BL, DL and AL).

veterinarian ratio (13000:1) and lack of infrastructure facilities caused additional burden in extending the services by the veterinarians (Channappagouda and Sasidhar 2018) during the lockdown. As per the World Organisation of Animal Health (OIE 2018) and National Commission on Agriculture (NCA 1976) guidelines, one veterinarian is needed to handle 3000-5000 livestock units for extending better and efficient animal health care services (NAVS 2015). Moreover, the general public and farmers in rural areas did not follow appropriate COVID-19 behaviour like wearing masks, sanitizing, social distancing causing concern among the veterinarians, thus reduced their activities in providing animal health care services during the lockdown.

Modes of consultation/treatment service: During the lockdown, in Bellary district, the farmers visiting veterinary hospitals for treating their animals and personal visit of veterinarians to the farm declined by 61.9% and 27.3%, respectively. However, to avail veterinary services for various ailments of animals, the phone calls and social media like WhatsApp increased by 80% and 46.7%, respectively. The digital technology had reduced the farmers' visits to veterinarians and vice versa (Mujeeb *et al.* 2022, Shanabhoga *et al.* 2022b) which reduced the burden of COVID-19 in delivering the animal health care services during lockdown. A similar pattern of change in the mode of veterinarians contact was observed among livestock farmers in the Chitradurga district (Table 3).

Government schemes implementation: In the study region, the number of applications received and processed for the *pasubhagya* and other subsidy schemes (Tribal sub-plan (TSP), Special component plan (SCP) and Special livestock development plan, etc.) were almost non-operational (as the submission of applications was stopped temporarily) during the lockdown. However, the applications processed under the livestock insurance scheme had increased (20.3%) considerably during lockdown (Supplementary Table 3). Delay or postponement in implementing the welfare schemes has short-term consequences like decreased income and increased production cost and in the long-term, due to COVID-19 burden on the government exchequer, the possibility of either stopping or further postponement of these welfare schemes might affect the livestock sector significantly (Quayson *et al.* 2020).

Vaccination services: The average vaccination per veterinarian declined against *Peste des petits ruminants* (PPR), enterotoxaemia (ET) and haemorrhagic septicaemia (HS), respectively from the planned levels in sheep and goats whereas complete planned vaccination coverage was observed against FMD in large animals during lockdown (Table 4). The least cases of deaths were observed in large ruminants (cattle and buffaloes), as vaccination against important diseases like FMD was administered effectively by the Department of Animal Husbandry and Veterinary Services (DAH&VS), Government of Karnataka in the mid-way of the pandemic. But, the death cases in small

Table 3. Modes of contact through which livestock farmers had taken veterinary services for their animals during the lockdown in Karnataka

Modes of contact	Bellary (n=76)				Chitradurga (n=94)				Pooled (n=170)				Repeated ANOVA (Two-Factor Without Replication)
	BL	DL	AL	% change (DL-BL)	% change (AL-DL)	BL	DL	AL	% change (DL-BL)	% change (AL-DL)	BL	DL	
Phone calls	15 (20.3)	27 (35.4)	22 (28.5)	80	-18.5	34 (36.6)	47 (49.6)	38 (40.6)	46.0	-19.1	50 (29.3)	73 (43.2)	A _(f-value) = 14.85*** B _(f-value) = 9.84***
WhatsApp	15 (20.2)	22 (28.3)	16 (21.2)	46.7	-27.3	8 (8)	16 (16.7)	11 (12.2)	60.9	-31.3	23 (13.4)	37 (21.9)	A _(f-value) = 9.57*** B _(f-value) = 7.66***
Personal visit of veterinarians to farms	11 (14.2)	8 (10.4)	7 (9.5)	-27.3	-12.5	19 (20.1)	9 (10)	6 (6.1)	-43.3	-33.3	30 (17.5)	17 (10.2)	A _(f-value) = 3.54*** B _(f-value) = 3.50***
Farmers visit to veterinary hospital	42 (55.4)	16 (21)	38 (50)	-61.9	137.5	52 (54.9)	27 (28.7)	49 (51.8)	-54.3	81.5	94 (55.1)	43 (25.2)	A _(f-value) = 10.90*** B _(f-value) = 3.47**

Figures in the parenthesis indicates percentage share, ***Significant at 1% level, **Significant at 5% level. Source: Compiled from the primary data collected from veterinarians. BL, Before lockdown; DL, During Lockdown; AL, After Lockdown; Before, during, and after lock-down period refers to January 2020 to March 2020, April 2020 to July 2020, and August 2020 to October 2020, respectively. A, Within the group (Among veterinarians); B, Between the group (BL, DL and AL).

Table 4. Vaccination administered by the veterinarians during lockdown (n=12)

Type of disease	Schedule Months	Sheep and Goats			Cattle and Buffaloes		
		Average No. of doses planned per veterinarian	Average No. of doses executed per veterinarian	Average change (%)	Average No. of doses planned per veterinarian	Average No. of doses executed per veterinarian	Average change (%)
PPR	April-July	5500	4500	-18.2	NA	NA	
FMD	March-April and October	*	*		1450	1450	0
HS	April-May	10750	9000	-16.3	*	*	
ET	March-June	6063	5004	-17.5	NA	NA	
Total		22313	18504	-15.7	1450	1450	0

Note: The average doses per veterinarian was calculated based on the number of responses received from the veterinarian and non-responses were excluded; NA, Not Applicable; *Data not available.

ruminants (sheep and goats) were considerably high due to the diseases like ET, HS, PPR, which are mostly seasonal. During the lockdown, a decrease in ET and HS vaccination might have increased the mortality in small ruminants and these results are in line with Eltholth *et al.* (2022) who highlighted the significant obstacles like limited access to market information and veterinarian extension services by small livestock holders in developing countries during the pandemic.

Sources of veterinary services: During the lockdown period, increase in contacting the local healer (5.9%), pharmacist (4.7%) and paravet (3.5%) and decrease in contacting the veterinary doctors (8.7%) was observed (Table 5). Managing animal health during the COVID-19 pandemic was a serious challenge to many livestock farmers due to restrictions and limited access to veterinary services. However, to overcome this limitation, the majority of the farmers had taken advice from local healers, pharmacists and para-vets. Some farmers resorted to self-medication of drugs to save the diseased animals (Jones *et al.* 2015, Patnaik *et al.* 2019). The purchase of drugs over the counter based on the pharmacist's advice also increased considerably.

Administration practices: The extent of self-administration of mouth ulcer drugs to animals by farmers

had increased by 77.1% followed by Bloating, Diarrhea and Deworming (Supplementary Table 4). Similarly, the vaccine administration against infectious diseases like *Peste des petits* ruminants (PPR), enterotoxaemia (ET), and haemorrhagic septicaemia (HS) by the farmers to their sheep and goats had increased considerably during the COVID-19 lockdown. Many small ruminant rearing farmers vaccinated their animals by themselves during lockdown without knowing the intricacies of managing the post-vaccination reaction, if any. Overall, the disease incidence in animals were managed by some of the farmers during the pandemic through self-medication, but if this practice is continued in the future without proper advice from a qualified veterinarian, will pose a severe risk. However, the extent of efficiency of these practices needs to be quantified (Singh *et al.* 2021). The COVID-19 pandemic and associated lockdown not only affected the animal health care services, but also increased the overall cost of rearing of animals, increased transportation cost, and feed and fodder cost (Swain *et al.* 2020). In addition, livestock farmers also suffered losses due to a fall in the sale price of animals due to market closure and subdued meat demand, as some consumers stopped consuming meat and meat products for a brief period during lockdown (Rzymiski *et al.* 2021, Rahman *et al.* 2021). The large flock

Table 5. Sources of veterinary services for the livestock farmers during the lockdown in Karnataka

Particulars	Pooled (N=170)											
	Before Lockdown				During Lockdown				After Lockdown			
	A	S	N	Weighted Mean (%)	A	S	N	Weighted Mean (%)	A	S	N	Weighted Mean (%)
Veterinary doctors	306 (72.7)	94 (22.3)	21 (5)	70.2	228 (61.8)	94 (25.5)	47 (12.7)	61.5	312 (74.5)	94 (22.5)	19 (3.0)	70.8
Para-veterinarian	189 (51)	150 (40.4)	32 (8.6)	61.8	252 (64.3)	108 (27.6)	32 (8.1)	65.3	135 (39.4)	132 (35.5)	59 (25.1)	54.3
Local healers	306 (71.2)	112 (26)	12 (2.8)	71.7	396 (85.2)	62 (13.3)	7 (1.5)	77.5	327 (75)	110 (23.7)	6 (1.3)	73.8
Advisory from Pharmacist	183 (49.9)	150 (40.9)	34 (9.2)	61.2	246 (62.2)	122 (30.9)	27 (6.9)	65.8	228 (59.7)	130 (33)	29 (7.3)	64.5
Self-medication*	270 (67.3)	102 (25.4)	29 (7.3)	66.8	180 (48.4)	164 (44.1)	28 (7.5)	62.0	306 (72.3)	88 (21.7)	24 (6)	69.7

Note: Figures in parenthesis indicate percentage; Weights are A; Always (3), S; Sometimes (2), N; Never (1); *indicates farmers deciding the drugs/medicine themselves to treat their animals.

holders were severely affected as routine animal health checks, treatments, vaccination services were impaired during the pandemic. In addition to this, Ejeromedoghene *et al.* (2020) reported about the inadequacy of on-farm disease surveillance, shortage of feed ingredients, and veterinary medications during the pandemic.

The pandemic and associated lockdown affected the livestock sector in multiple dimensions, viz. the delay in providing veterinary services, increased mortality and stoppage of welfare schemes, and restricted people movement. Further, the closure of the animal market prevented the livestock farmers from selling their matured animals (sheep and goats) on time, thereby increased the rearing cost and reduced their income. Hence, in case of recurrence of epidemic cycle in the ensuing period, the reach of the veterinary services to the farmers need to be ensured to reduce mortality and associated income loss to the farmers. Besides, necessary arrangements needs to be made for uninterrupted supply of healthcare services by engaging trained personnels and involving Non-Governmental Organization associated with animal welfare activities. These actions will free the veterinarian to fully engage at the workplace in treating the regular cases and monitor the administrative work efficiently. It is further suggested that the short-term and long-term impact of self-medication of drugs by the livestock farmers and their efficiency needs to be assessed and quantified to avoid possible future consequences like antimicrobial resistance and its transmission from animals to humans.

ACKNOWLEDGEMENTS

We are thankful to the Indian Council of Agricultural Research (ICAR) and International Livestock Research Institute (ILRI), South Asia Region, New Delhi for providing necessary funding through the ICAR-ILRI collaborative project on 'Animal Disease Economics' (MTO No. 069033). We also thank the ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI) and staff for their constant support and encouragement. We appreciate all the veterinarians and livestock farmers in the study area for their active participation in the survey. We express our thanks to the Department of Animal Husbandry and Veterinary Services (DAH&VS), Government of Karnataka, and their staff for providing necessary inputs during the data collection in spite of this unprecedented COVID-19 pandemic situation.

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