

# Poultry health services in Ethiopia: availability of diagnostic, clinical, and vaccination services

Yohannes T. Asfaw,<sup>\*,†,‡,1</sup> Gobena Ameni,<sup>†,§</sup> Girmay Medhin,<sup>†</sup> Balako Gumi,<sup>†</sup> and Barbara Wieland<sup>\*</sup>

*\*Animal and Human Health, International Livestock Research Institute (ILRI) 5689, Addis Ababa, Ethiopia; †Aklilu Lemma Institute of Pathobiology, Addis Ababa University 1176, Addis Ababa, Ethiopia; ‡College of Veterinary Sciences, Mekelle University 8024, Mekelle, Ethiopia; and §Department of Veterinary Medicine, College of Food and Agriculture, United Arab Emirates University 15551, Al Ain, United Arab Emirates*

**ABSTRACT** Currently, there is a need for more and better poultry health services in Ethiopia. However, nationwide data showing the weaknesses of poultry health services are scanty. Hence, availability of diagnostic, vaccination, and clinical services for poultry was assessed. Focus group discussions and household questionnaire survey were conducted with poultry keepers in 10 districts. Lack of poultry health experts, clinical services, drugs, vaccination, and knowledge and skills were identified as top five key findings. In total, 31.6% of respondents reported availability of poultry diagnosis service. Having flock size of 11-20 chickens had higher probabilities of accessing better diagnosis service (AOR = 2.77; 95% CI: 1.12-3.64). Access to diagnosis was directly linked with the availability of veterinary clinics in their localities (AOR = 2.65; 95% CI: 1.16-6.63). Moreover, low access to treatment services (22.98%) was reported and traditional remedies with priority index of 0.68 were reported to be the most commonly used. Chicken flocks with a history of disease occurrence were more likely to have a decision to go for modern

treatment services (AOR = 4.26; 95% CI: 2.28-7.95). Only 35.7% of chicken keepers had their flocks vaccinated, and this was irregularly and randomly given, mainly against Newcastle disease. Only 52.9% of them were vaccinated by trained animal health experts. Chicken flocks with availability of veterinary clinics within 5 km were more likely (AOR = 1.62; 95% CI: 1.03-2.54) to have access to vaccination services. Only 53.0% of the chicken flocks had availability of clinics and chicken flocks in Tigray (AOR = 2.15; 95% CI: 1.03- 4.52) and Oromia (AOR = 5.74; 95%CI: 2.51-13.10) had better availability of clinics. Chicken flocks found in Bako district were less likely (AOR = 0.41; 95% CI: 0.18-0.92). The low availability of diagnostic, vaccination, and clinical services shows that poultry health services in Ethiopia have not received attention despite its top national agenda. Hence, the existing low poultry health services need to be solved through public-private partnership, producing adequate poultry health experts, availing vaccines, diagnostics, and therapeutics in the local markets.

**Key words:** Ethiopia, poultry, health, service

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## BACKGROUND

In Ethiopia, acknowledging the multiple advantages of poultry subsector, it has been identified as a strategic subsector to be strengthened in the approved livestock masterplan plan of the government (Shapiro et al.,

2015). It has been also observed that small-scale poultry businesses run by smallholder producers, and medium-level poultry investors are flourishing and growing across the country, mainly in urban and peri-urban areas (Mazengia, 2012). Despite such good progress, it was well noted that sustainably productive and profitable poultry business without readily available disease diagnosis, treatment, and vaccination and availability of veterinary clinics is impossible (Shapiro et al., 2015). In support of this, it was described that poultry enterprises in Ethiopia have experienced problems with the disease because of unavailability of locally produced vaccine (Wubet et al., 2019). Moreover, it was reported that in

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<sup>1</sup>Corresponding author: [john.asfaw@yahoo.com](mailto:john.asfaw@yahoo.com)

Ethiopia, vaccinating the whole flock against economically important diseases, such as Newcastle disease (ND), fowl typhoid, and fowl pox, although not practiced, helps prevention of mortality in the smallholder poultry system (Habte et al., 2017).

However, nationwide scientific evidence on overall status of poultry health services in terms of accessibility and effectiveness of poultry disease diagnosis, treatment, and vaccination services as well as availability of veterinary clinics is missing. Hence, it is argued herewith that with such unavailability of evidences, it has been difficult to convince policy-makers and other actors of poultry value-chain so as to design appropriate poultry health packages and strategies that help address the higher poultry mortalities (31.87%) and morbidities (58.1%) reported in the country (Asfaw et al., 2021; CSA, 2018). For instance, evidence show that there has been neither a policy to control village poultry diseases nor adequate information available to policy-makers, despite continued high prevalence and severe impact of infectious diseases among village chicken populations in the country (Terfa et al., 2015). This is against the global practices that efficient poultry health services and full access to veterinary services are crucial for successful poultry development and to achieve the high productivity expected to be attained by improved chicken breeds as well as to keep poultry-originated zoonotic diseases under control. Similarly, it was indicated that vaccines and medicaments are the most important inputs for improved poultry production in Ethiopia (Tamir et al., 2015).

In connection to the aforementioned facts, it has not yet been known how types of actors engaged in poultry health service delivery result in poultry health challenge or not and how the system's weaknesses translate into accessibility and coverage of poultry health service challenges for poultry farmers. Except from governmental annual reports and general reports on some types of vaccines produced in the country, little information is available on the status of poultry veterinary service and its coverage, accessibility, and effectiveness, as well as the type of the service providers and their roles and existing challenges and limitations of the service.

To this end, it is argued that the mentioned lack of evidences could be the reason for the unavailability of organized poultry health services in the country. This has led to the statement that the poultry subsector of the country contributes less to solve the overwhelming poverty, malnutrition, stunting child growth, unemployment, lack of women and youth empowerments, low income, and the overall poor livelihood status of the poultry producers and the general public (Mazengia et al., 2012; Shapiro et al., 2015; Hagos, 2019).

Hence, this study aimed at exploring weaknesses of poultry veterinary services at a wider scope so as to inform policy-makers, professionals, service providers, poultry producers, and poultry business operators/investors. The specific objectives were 1) identify weakness of poultry health service system and 2) explore underlying factors influencing weakness of poultry health

services related to access to diagnostic, treatment and vaccination services, and availability of veterinary clinics.

## MATERIALS AND METHODS

### Study Areas, Period, and Study Design

The study was conducted from 2018 to 2019 on the following study districts which are found across Ethiopia (Figure 1).

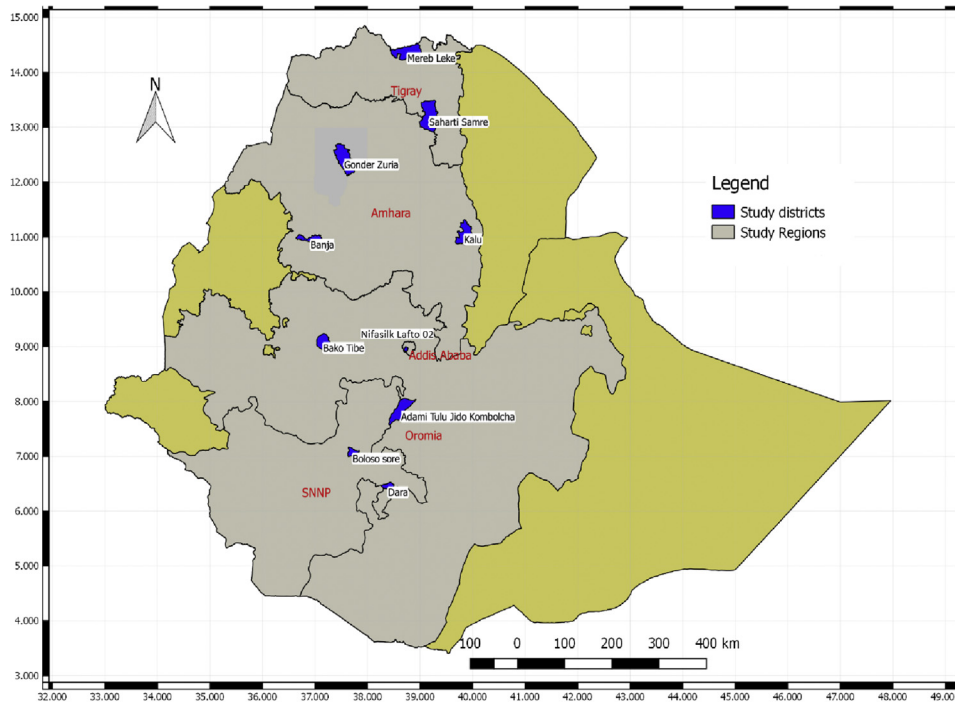
A cross-sectional study was conducted on chicken flocks and their owners enrolled in the African chicken genetics gain (ACGG) project implemented by the International Livestock Research Institute in 4 regions of Ethiopia (Tigray, Amhara, Oromia, and Southern Ethiopia Nations, Nationalities and People's) and Addis Ababa city Administration. As per the sampling framework of the project (ILRI-ACGG, 2015), 10 districts from the total 22 districts within these 4 regions and Addis Ababa city administration were randomly selected. The 10 randomly selected districts were *Sahrta Samre* and *Mereb Leke* from Tigray Region, *Banja Shekudad*, *Gondar Zuria*, and *Kalu* from Amhara Region, *Bako Tibe* and *Adami Tulu* from Oromia Region, *Dara* and *Boloso Sore* from Southern Ethiopia Nations, Nationalities and People's Region, and *NifasSilk Lafto* from Addis Ababa City Administration (Figure 1).

In the aforementioned 10 study districts, there were 1,120 chicken-owning households (HH) included in the ACGG project and served as a source population for this study. HHs that reared chickens of all age groups, both sexes, and all breeds managed under extensive and semi-intensive production systems in the selected districts were eligible. The sample size for this study was determined using *EpiTools* epidemiological calculators (Sergeant, 2009) and based on the study by Charan and Biswas (2013). In addition, a 50% estimated proportion of chicken flocks with access to health service, 5% desired precision, and 95% confidence level were used as bases to calculate the sample size. Hence, the total sample size for all the study districts was calculated and adjusted to be 600 chicken-owning HHs (i.e., 60 HHs per district). With this, some replacement for unwilling randomly selected HHs to participate in the survey was also sampled from their neighbors.

Moreover, to conduct focus group discussion (FGDs) in each of the study district except one, purposively selected 10-15 participants were included.

### Data Collection

**Questionnaire-Based HH Survey** A semi-structured questionnaire was developed and translated into local languages (Tigrigna, Amharic, Afaan Oromo). Enumerators working for the ACGG project in each of the study district were recruited and trained to serve as data collectors. The developed questionnaire was pretested in nonparticipating HH equivalent to 4% of the total



**Figure 1.** Map of Ethiopia with the 10 study districts which were included in the study. (Source: Adopted from [Asfaw et al., 2021](#)).

sample size, to evaluate its logical flow and time it takes for the interview. Appropriate modifications were made on the questionnaire based on the feedback from the pretesting. The questionnaire captured data on weaknesses, critical challenges, accessibility, effectiveness and actors of availing health services (diagnosis, treatment, vaccination, and clinics), geographic location (region and district), demographic characteristics of respondents, flock characteristics, and production system. All respondents were asked to give consent before the interview and encouraged to freely respond to the questions included in the questionnaire.

**Focused Group Discussions** To generate more detailed data and triangulate the data obtained from the questionnaire-based HH survey, 9 FGDs were conducted at *Mereb leke*, *Sahrti Samre*, *Gondar Zuria*, *Banja Shekudad*, *Kalu*, *Adami Tulu*, *Nifasik Lafto*, *Boloso Sori*, and *Dara* districts. In all the 9 FGDs, a total of 113 poultry farmers, of which 58 females, participated to discuss weaknesses of poultry health services related to diagnosis, treatment, vaccination, and availability of veterinary clinics. For each FGD, 10-15 persons, as representatives of chicken farmers, were selected by ACGG field workers in consultation with livestock experts of each district. Hence, the groups were purposively heterogeneous to generate reliable data. Members of the FGDS were selected from poultry producers who were reported to be capable of answering questions related to poultry diseases and health services so as to collect accurate information or data in the study area.

To avoid language barrier during the FGDs, different local languages, such as *Amharic*, *Tigrigna*, *Oromigna*, *Agewigna*, *Sidamigna* and *Wolayteigna*, were used in

respective study area, and all points raised in the FGDs were recorded and later translated into English. The discussions were facilitated and monitored by the researcher, and 2 note-takers closely followed the discussions. The discussants were allowed to freely express themselves with minimal interruptions on issues raised, and the facilitators ensured that every member of the group was given fairly equal chances to express his/her ideas. A checklist guided the sequence of information to be collected from the FGDs. Discussion started with introduction of the study team and explanation of the purpose of the study.

Participants were then asked to discuss the challenges and constraints they face in their poultry flocks. Initially participants were asked to identify possible measures that could be used to reduce disease entry to their flocks and spread. Finally, the status of poultry veterinary services focusing on accessibility, affordability, and effectiveness of the service was discussed. Discussions included the range of services available (both traditional and formal veterinary services) and constraints to accessing veterinary services (diagnosis, treatment and vaccination services, and availability of veterinary clinics). Finally, the FGD outputs were summarized qualitatively.

### **Definition of Disease Occurrence and Crude Mortality**

Disease occurrence was defined as a “yes response” of respondents when they were asked about whether their chicken had been sick in the last 12 mo before the interview or not and when they were able to mention any of the

predefined main clinical signs that could be observed in sick chickens (Asfaw et al., 2021). Similarly, the respondents were asked to report the total number of dead chickens in their respective flocks over a 12-month time-frame before the interview. Accordingly, crude mortality was defined as the total number of chickens dead because of any disease occurred over 12 mo before the interview divided by the total flock size and then multiplied by 100.

## Data Management and Analysis

Excel Microsoft version 2013 and a STATA (version 14; StataCorp, College Station, TX) were used to manage the generated data and their statistical analysis. Descriptive and priority index (PI) were used to generate descriptive statistics, and the results were presented in counts and percentage and PI. A PI was performed using the following formula as described by Musa et al. (2006).  $PI = (F1*3) + (F2*2) + (F3*1)/FT$ , where F1 = frequency of the first rank, F2 = frequency of second rank, F3 = frequency of third rank, FT = frequency of total respondents.

The relationships between the explanatory variables and the outcome variables were further assessed using chi-square test and a pairwise correlation matrix. Accordingly, all independent variables that were reported to have significant relationship with each of the 4 outcome variables (access to diagnosis service, treatment service, vaccination service, and availability of clinic within 5 km) at  $P < 0.05$  were considered for regression analysis. To detect the effects of different predictor variables on the outcome variables, binary logistic regression models were built using a step-wise model-building approach. The models were assessed using a Hosmer-Lemeshow goodness-of-fit test, and they were found well fitted at  $\chi^2 = 139.16$ ,  $P = 0.8814$ . Finally, the results of the influences were reported in the form of adjusted odds ratios (OR). For all analyses, a  $P$  value  $< 0.05$  was used as cutoff point for significance.

## Ethical Considerations

This work was approved by institutional ethical review board of Aklilu Lemma Institute of Pathobiology, Addis Ababa University (ref. no.: ALIPB/IRB/007/2017/18), and consents from study participants were also obtained.

## RESULTS

### HH Survey

The HH survey revealed that the coverages of poultry diagnostic service, modern treatment, vaccination, and veterinary clinic were 31.63% (130/411), 22.98% (125/544), 18.32% (107/584), and 52.98% (302/570), respectively.

**Overall Challenges of Poultry Health Services** It was revealed that poultry farmers consider lack of poultry drugs as the most important challenge (PI of

0.47), followed by lack of poultry health experts (PI = 0.41) and lack of vaccines (PI = 0.41) (Figure 2).

**Poultry Diagnostic Services** The survey revealed that 31.63% (130/411) of respondents witnessed that their sick chickens had access to diagnosis services while the rest did not. Moreover, only 14.52% (62/427) reported that their chickens get diagnosed through laboratory methods.

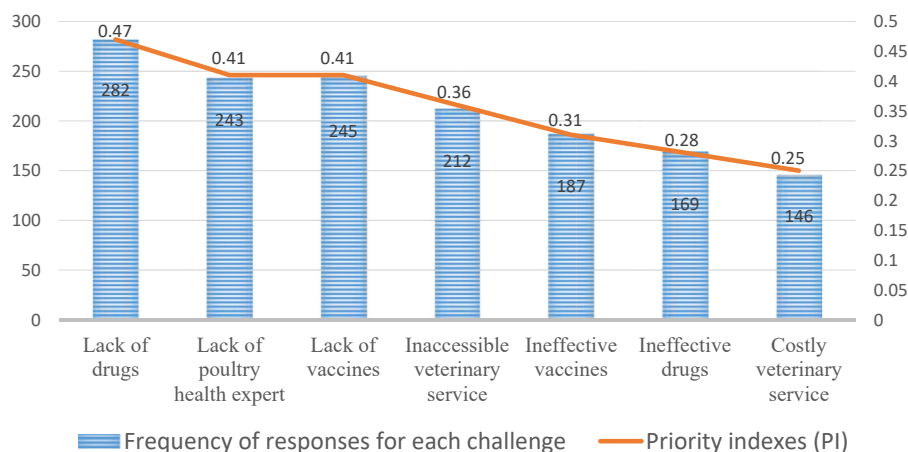
The less access to professional diagnosis services delivered to sick chickens depended on different predictor variables (Table 1). Lower percentage frequency of access to diagnosis service was reported in Gondar Zuria district (23.73%), among female producer-owned chicken flocks (37.40%), single-age chicken flocks (22.83%), and if the flock size was 11-20 (31.16%); in areas where there is no veterinary clinic (31.42%); and among chicken flocks with a mean mortality of  $17.63 \pm 24.32$  (Table 1).

To further investigate association of the access to diagnosis service with different predictor factors, a multiple variant binary logistic regression model was fitted. The adjusted OR from the multivariate logistic regression analysis showed that chicken flocks found in Banja Shekuda district and chicken flocks with multiple-age groups were 3.85 (adjusted OR = 3.85; 95% CI: 1.21-12.31) and 2.02 (adjusted OR = 2.02; 95% CI: 1.12-3.64) times more likely to have access to diagnosis service as compared to those flocks found in Kalu district and have single-age groups, respectively (Table 2). Similarly, the adjusted OR revealed that chicken flocks with a flock size of 11-20 chickens and chicken flocks with availability of veterinary clinics were 2.77 (adjusted OR = 2.77; 95% CI: 1.16-6.63) and 2.65 (adjusted OR = 2.65; 95% CI: 1.68-4.19) times more likely to get access to diagnosis service than those flocks with a size of more than 20 chickens and those without availability of veterinary clinics. Moreover, the adjusted OR results of access to diagnosis service were 2% (adjusted OR = 0.98; 95% CI: 0.97-0.99) and 1% (adjusted OR = 0.99; 95% CI: 0.99-0.10) times decreased whenever there is a unit increase in the means of mortality and financial loss, respectively (Table 2).

**Poultry Treatment Services** Although 70.59% of the respondents said that their chickens received minimum treatment service, only 22.98% of them indicated that their chickens received adequate treatment services when they were sick. It was also reported that 32.28 and 37.68% of the respondents reported that the treatment given to their chicken was adequately effective and mostly cure their sick chickens, respectively (Figure 3). However, they indicated that the use of traditional treatment/remedy (PI = 0.68) is the top priority action practiced by poultry producers, followed by consulting animal health experts (PI = 0.35) and use of purchased drugs (PI = 0.34) from nearby drug shops (Figure 4).

As it is indicated in Table 1, the highest access to treatment services was reported in Banja Shekudad district (89.83%), among multiple age group of chicken flocks (78.34%), in chickens from a flock size of  $< 5$





**Figure 2.** Prioritized poultry health challenges in Ethiopia.

(79.50%), chicken flocks with a history of disease occurrence (80.86%), and those that had a mean mortality of  $28.84 \pm 28.10$ .

The multivariate logistic regression model confirmed that chicken flocks with multiple age groups were 2.03 (adjusted OR = 2.03; 95% CI: 1.34-3.08) times more likely to have access to treatment services than those flocks with single-age groups (Table 2). Similarly,

chicken flocks with a history of disease occurrence had higher odds to have access to treatment (adjusted OR = 4.26; 95% CI: 2.28-7.95) than those flocks without a history of disease occurrence. In addition, the adjusted OR of the chicken flocks with access to treatment service was 1.01% (adjusted OR = 1.01; 95% CI: 1.00-1.02) increased with a unit increase in mean of mortality (Table 2).

**Table 1.** Accessibility to diagnosis, treatment, and vaccination services and availability of clinic stratified by selected characteristics.

Predictor variables	Access to diagnosis service		Access to treatment service		Access to vaccination service		Availability of clinic within 5 km	
	N	Yes (%)	N	Yes (%)	N	Yes (%)	N	Yes (%)
Region								
Tigray	-	-	-	-	-	-	114	58 (50.88)
Amhara	-	-	-	-	-	-	166	75 (45.18)
Oromia	-	-	-	-	-	-	116	80 (68.97)
Addis Ababa	-	-	-	-	-	-	59	23 (38.98)
SNNP	-	-	-	-	-	-	115	66 (57.39)
Mereb leke	58	19 (32.76)	59	41 (69.49)	60	45 (75.00)	57	25 (43.86)
Sahrti Samre	56	27 (48.21)	60	42 (70.00)	60	42 (70.00)	57	33 (57.89)
Gondar Zuria	59	14 (23.73)	59	48 (81.36)	59	40 (67.80)	56	29 (51.79)
Banja	59	31 (52.54)	59	53 (89.83)	58	43 (74.14)	56	22 (39.29)
<i>Shekudad</i>								
Kalu	56	22 (39.29)	59	37 (62.71)	58	39 (67.24)	54	24 (44.44)
Bako	56	25 (44.64)	57	41 (71.93)	60	44 (73.33)	60	36 (60.00)
Adami Tulu	54	26 (48.15)	57	42 (73.68)	57	46 (80.70)	56	44 (78.57)
<i>NifasSilk Lafto</i>	59	23 (38.98)	61	46 (75.41)	57	43 (75.44)	59	23 (38.98)
Boloso Sore	52	21 (40.38)	58	40 (68.97)	58	49 (84.48)	57	37 (64.91)
Dara	53	31 (58.49)	57	49 (85.96)	57	40 (70.18)	58	29 (50.00)
Sex of respondents								
Male	308	144 (46.75)	-	-	-	-	-	-
Female	254	95 (37.40)	-	-	-	-	-	-
Age-group of chicken flocks								
Multiple age-groups	423	205 (48.46)	434	340 (78.34)	433	341 (78.75)	-	-
Single age-group	127	29 (22.83)	139	89 (64.03)	138	82 (59.42)	-	-
Flock size								
≤5 chickens	155	70 (45.16)	161	128 (79.50)	-	-	-	-
6-10 chickens	152	72 (47.37)	160	123 (76.88)	-	-	-	-
11-20chickens	138	43 (31.16)	141	100 (70.92)	-	-	-	-
>20 chickens	96	46 (47.92)	101	67 (66.34)	-	-	-	-
Disease occurrence								
Yes	-	-	465	376 (80.86)	-	-	-	-
No	-	-	74	32 (43.24)	-	-	-	-
Availability of vet clinic within 5 km distance								
Yes	281	156 (55.52)	-	-	296	236 (79.73)	-	-
No	261	82 (31.42)	-	-	265	180 (67.92)	-	-
Chicken mortality	536	17.63 ± 24.32	560	28.84 ± 28.10	557	23.31 ± 26.19	-	-
Financial loss due to disease	562	289.69 ± 414.64	586	639.54 ± 685.07	559	0.61 ± 0.49	-	-
Overall	562	239 (42.53%)	544	384 (70.59)	429	153 (35.66)	570	302 (52.98)

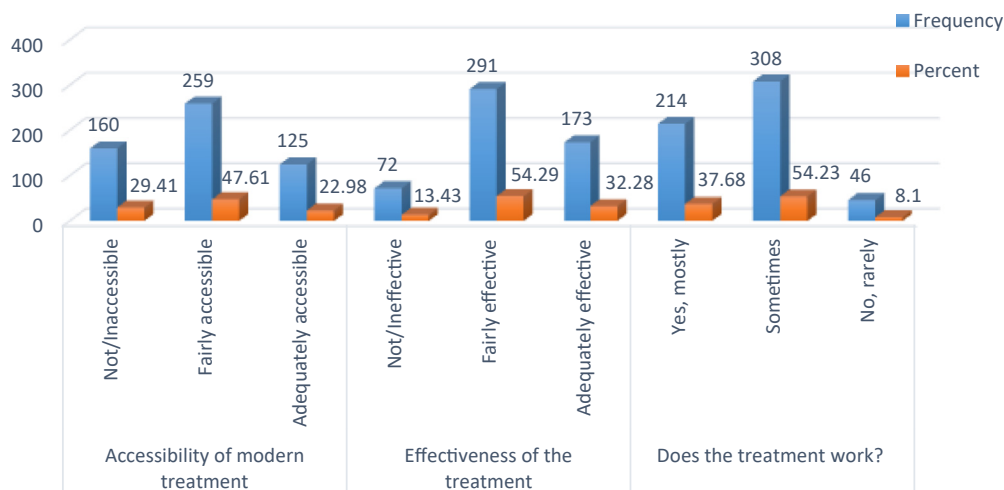
**Table 2.** Accessibility to diagnosis, treatment, and vaccination services and availability of clinic and results of logistic regression analysis of the effects of independent variables.

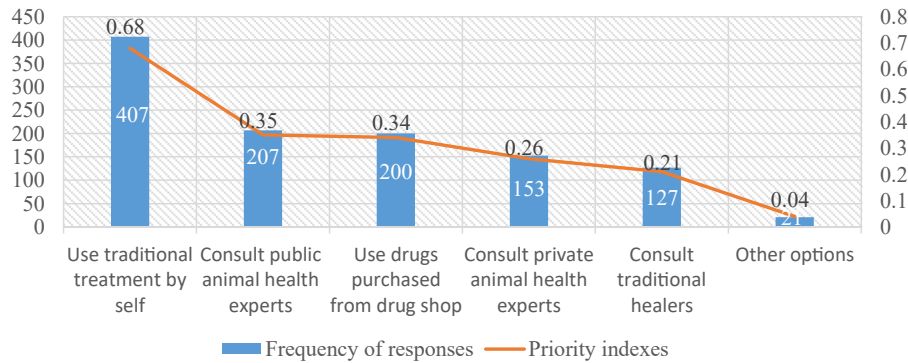
Predictor variables		Access to diagnosis service	Access to treatment service	Access to vaccination service	Availability of clinic within 5 km
		Adjusted odds ratio, (95% CI)	Adjusted odds ratio, (95% CI)	Adjusted odds ratio, (95% CI)	Adjusted odds ratio, (95% CI)
Region	Tigray	-	-	-	2.15 (1.03-4.52)
	Amhara	-	-	-	1.01 (0.48-2.14)
	Oromia	-	-	-	5.74 (2.51-13.10)
	Addis Ababa	-	-	-	Ref
	SNNP	-	-	-	1.57 (0.75-3.26)
District	Mereb leke	0.62 (0.22-1.80)	1.30 (0.44-3.82)	1.09 (0.42-2.83)	0.57 (0.27-1.19)
	Sahrti Samre	0.94 (0.33-2.66)	1.23 (0.42-3.66)	0.60 (0.24-1.52)	-
	Gondar Zuria	0.52 (0.17-1.52)	1.25 (0.44-3.59)	0.75 (0.30-1.93)	1.66 (0.78-3.51)
	Banja <i>Shekudad</i>	3.85 (1.21-12.31)	4.22 (0.93-19.13)	1.50 (0.57-3.95)	Ref
	Kalu	ref	Ref	ref	1.24 (0.58-2.64)
	Bako	1.05 (0.39-2.79)	1.36 (0.50-3.67)	0.93 (0.37-2.36)	0.41 (0.18-0.92)
	Adami Tulu	1.04 (0.29-3.70)	1.24 (0.38-3.98)	2.77 (0.91-8.39)	-
	<i>NifasSilk Lafto</i>	1.02 (0.33-3.18)	0.81 (0.27-2.45)	1.79 (0.65-4.93)	-
	Bolosso Sore	0.94 (0.31-2.87)	0.91 (0.30-2.74)	2.22 (0.76-6.52)	1.85 (0.87-3.91)
	Dara	2.01 (0.59-6.82)	1.08 (0.45-0.95)	0.70 (0.27-1.83)	-
	Sex of respondents	Male	0.89 (0.56-1.43)	-	-
Female		Ref	-	-	-
Age-group of chicken flocks	Multiple age-groups	2.02 (1.12-3.64)	0.32 (0.18-0.57)	0.54 (0.33-0.89)	-
	Single age-group	Ref	Ref	Ref	-
Flock size	≤5 chickens	0.97 (0.46-2.07)	1.48 (0.54-4.03)	-	-
	6-10 chickens	1.58 (0.82-3.06)	1.48 (0.58-3.75)	-	-
	11-20chickens	2.77 (1.16-6.63)	0.97 (0.42-2.21)	-	-
	>20 chickens	Ref	Ref	-	-
Disease occurrence	Yes	-	4.26 (2.28-7.95)	-	-
	No	-	Ref	-	-
Availability of vet clinic within 5 km distance	Yes	2.65 (1.68-4.19)	-	1.62 (1.03-2.54)	-
	No	Ref	-	Ref	-
Chicken mortality		0.98 (0.97-0.99)	1.01 (1.00-1.02)	0.99 (0.98-0.99)	-

**Poultry Vaccination Services** Only 35.66% of them reported that their chickens had access to vaccination service during the 12 mo. Of these respondents, 35.30, 18.3, 19.61, and 19.61% of them reported that their chickens were vaccinated once, twice, 3 times, and 4 times in the past year, respectively (Figure 5). It was also reported that 52.94% of chicken flocks were

vaccinated by animal health experts. Moreover, 81.05% of respondents indicated that disease occurs despite the vaccination (Figure 6).

Table 1 shows that the highest access to vaccination was reported in Bolosso Sore district (Southwest Ethiopia) (84.48%), in chicken flocks with multi-age groups (78.75%), and in those chicken flocks in vicinity

**Figure 3.** Accessibility, effectiveness, and efficacious of poultry treatments.



**Figure 4.** Prioritized actions taken by poultry producers when their chickens get sick.

of a veterinary clinic (79.73%). Similarly, chicken flocks reported to have  $23.31 \pm 26.19$  means of mortality had higher access to vaccination service.

Upon further analyzing the influences of different predictor factors on access to vaccination, multivariate logistic analysis revealed that chicken flocks with multiple age groups were less likely (adjusted OR = 0.54; 95% CI: 0.33-0.89) to have access to vaccination service than those flocks with single-age group. In contrast, chicken flocks with availability of veterinary clinics had higher odds (crude OR = 1.62; 95% CI: 1.03-2.54) to have access to vaccination service than those flocks without a veterinary clinic (Table 2).

In addition to this, the adjusted OR for chicken flocks with access to vaccination service was 1% (adjusted OR = 0.99; 95% CI: 0.98-0.99) times increased with a unit increase in the means of mortality (Table 2).

**Availability of Veterinary Clinic** A bit more than half of the respondents (52.98%) indicated that there is a veterinary clinic within 5 km distance. However, it was noted that these veterinary clinics mainly serve large animals, and poultry are rarely served for obvious reasons that only limited types of services are available for poultry.

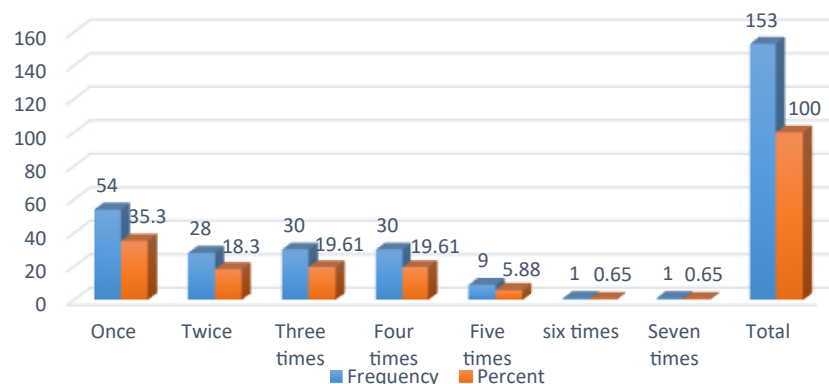
As indicated in Table 1, higher accessibility of vaccination service was reported in the Oromia region (68.97%) and Adami Tulu district (central Ethiopia) (78.57%) than in other regions and districts.

Among the regions, chicken flocks in Tigray and Oromia regions were more likely (adjusted OR = 2.15; 95% CI: 1.03-4.52 and adjusted OR = 5.74; 95% CI: 2.51-13.10, respectively) to have veterinary clinics than those flocks found in the reference region, Addis Ababa. Differences were also found at district level, with chicken flocks found in Bako district (central Ethiopia) being less likely (adjusted OR = 0.41; 95% CI: 0.18-0.92) to have veterinary clinics than those flocks found in reference district, Banja Shekudad (northwest of Ethiopia) (Table 2).

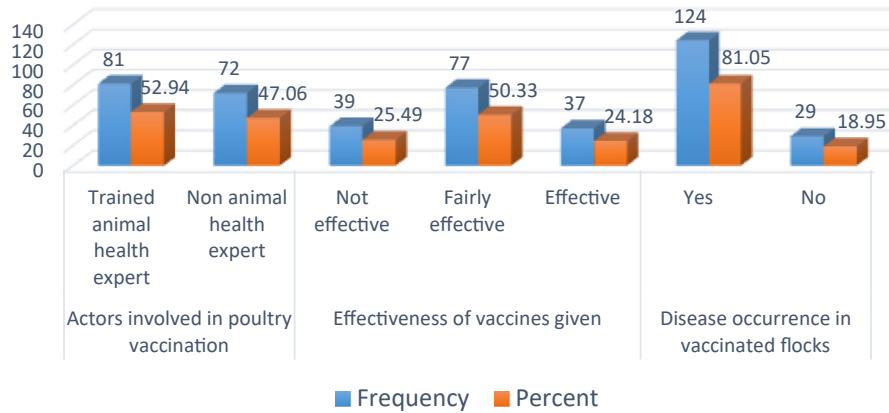
## Focus Group Discussion

**Overall Poultry Health Services** When asked about the overall status of the poultry health services, discussants reported that except in Dara and *NifasSilk Lafto* districts, no poultry health services/clinics serving poultry is available. In relation to this, FGDs in Banja and Gondar Zuria districts indicated that it is difficult for them to carry sick chickens to veterinary clinics given the distances involved. Hence, there are frequent chicken deaths. Moreover, the service they get is also costly as several chickens get sick at a time. In some districts such as Kalu and Adami Tulu districts, there is service provided by private service providers. However, it is reported to be costly, and hence, the poultry producers tend to use traditional remedies.

**Poultry Diagnostic and Treatment Services** FGD participants in all the 9 districts agreed that they try



**Figure 5.** Household survey-based poultry vaccination frequencies per annum.



**Figure 6.** Vaccination service providers and perceived effectiveness of vaccine.

different practices to treat their sick chickens and to keep their chickens healthy. However, a majority of them said no professional diagnosis service is available for their sick chickens.

It was learnt that poultry producers have good experiences in chicken treating despite the unavailability of drug supply and costly drugs. Moreover, it was noted that the poultry producers treat their chickens by themselves with the drugs purchased from district veterinary clinics and private drug vendors, without prior diagnosis. However, in some districts such as Banja, Gondar Zuria, Sahrti Samre, and Mereb Leke, discussants discovered that there is limited drug availability in the market and treated sick chickens do not usually recover. Specifically in Boloso Sore district, lack of drugs, drug suppliers, and nearby clinics was reported. Improper use of drugs in terms of treatment duration and dosage was reported in different districts and considered a weakness of the poultry treatment services. In addition, discussants from Banja, Adami Tulu, and *NifasSilk Lafto* districts said that they lack knowledge and skill on use of drugs, which has led to improper dosing and treatment duration because of lack of advice from health experts. Moreover, discussants in Boloso Sore and Dara districts said that early treatment helps chickens to recover from clinical sickness; however, if treatment is late, sick chicken will not recover.

The FGD discussants indicated that they take the following measure to keep their chickens healthy. The first most popularly practiced immediate solution for chicken sickness includes traditional remedies. The different types of traditional remedies, mainly herbal preparations, are used to treat sick chickens mainly because of 3 reasons: lack of modern veterinary services in the localities of the poultry producers, carrying sick chickens to the available veterinary clinics is difficult, and the fact that there is no door-to-door access to poultry services. However, FGD discussants in Banja district said the use of traditional remedy is just a try but normally does not work. Similarly, the FGD discussants in Adami Tulu District underlined that they first give traditional remedy to their sick chickens, and if that does not work, they take the chickens to the clinic.

The second most important measure taken by poultry producers in almost all the 9 districts was to treat their sick chickens using modern veterinary drugs purchased mainly from veterinary pharmacy or drug vendors and sometimes from veterinary clinics found in close-by towns. The producers give the purchased drugs to their chickens mainly with feed and water.

As a third most common poultry health-care practice, poultry producers reported to practice isolation of sick chickens from the respective flocks to help stop disease spread. Similarly, the FGD discussants in Banja, Gondar Zuria, and Sahrti Samre districts said that they practice burring of cadaver of died chickens so as to stop disease spread to other susceptible flocks in the future.

Moreover, the FGD discussants in Kalu, Gondar Zuria, Sahrti Samre, Dara, and Adami Tulu districts said that they practice chicken vaccination as part of poultry health care. However, only FGDs in Mereb Leke and Dara districts indicated that they consult animal health experts during the sickness of their chickens.

Finally, FGD discussants of Kalu and *NifasSilk Lafto* districts reported giving feed supplements to their sick chickens to help recover from their sickness. FGD discussants in Adami Tulu and Dara and *NifasSilk Lafto* districts practiced poultry house cleaning, smoking, and drying bedding materials to prevent parasites. Similarly, the FGD discussant of Kalu district reported spraying poultry house with acaricides.

**Poultry Vaccination Practice** The discussants in almost all the districts reported that they are very willing to get their chickens vaccinated; however, there is no regular poultry vaccination calendar/schedule. Currently, the district veterinary offices provide irregular vaccination services, mainly for ND. Hence, no timely vaccination service and no vaccine against other diseases is given. However, for Kalu and Adami Tulu districts, it was reported that there is no practice of chicken vaccination at all, and no actor is available to vaccinate the chickens.

**Availability of Poultry Health Experts** Regarding availability of poultry health experts, the discussants in all the FGDs said that no poultry health expert is available in their localities although the producers would



be willing to use the service. In Dara and *NifasSilk Lafto* districts, general animal health experts are available, and the experts come on call whenever need arises. On top of that, experts are also available in the clinic. However, no door-to-door service is given in all the other districts.

### **Roles and Types of Actors of Poultry Health Service Delivery**

In almost all the districts, it was noted that producers, government actors, and private pharmacies/drug vendors are the leading actors in the delivery of poultry health services. Trained female vaccinators were also reported as poultry vaccination service providers in Merab Leke and Sahrti Samre districts.

The government actors mainly provide vaccination service while the private pharmacies/drug vendors mainly supply drugs. The roles of the poultry producers themselves were identifying sick chickens and treating them and taking care of the sick chickens. In line with this, the discussants stressed that they are highly willing to use a door-to-door health services for their chickens. They also witnessed that private service providers are more accessible than public service providers; however, the services provided by private wing are relatively costly compared with public services. Therefore, they finally opted to use door-to-door poultry health services at fair price.

Generally, the identified top 5 priority poultry health service weaknesses and challenges were lack of poultry health experts, clinics (health service), drugs, vaccination, and knowledge and skills.

## **DISCUSSION**

The low coverages and access of poultry diagnostic, modern treatments, and vaccination services and availability of veterinary clinics indicate that the country is not in a position to support substantial growth of the poultry sector. Although farmers are highly willing to use health services for their chickens, the available and very limited types of poultry health services are provided irregularly, usually after very serious chicken disease outbreaks. As a result, frequent chicken deaths and associated losses are encountered as a regular phenomenon. In line with this finding, [Terfa et al. \(2015\)](#) reported that only 58.1% animal health clinics give poultry curative health services. Similarly, [Hooper \(2016\)](#) reported that the use of veterinary services is generally low in Ethiopia. [Alemneh and Getabalew \(2019\)](#) also reported that low supply of veterinary drugs and vaccines is the major bottleneck for production of village-based exotic chickens in Ethiopia. Moreover, [Habte et al. \(2017\)](#) reported that a lack of veterinary service or an organized village level health service delivery system is a major barrier in Ethiopia. [Mengesha and Tsega \(2011\)](#) suggested that improvement in veterinary and advisory service could help achieve control of diseases at village level. Similarly, [Emebet \(2016\)](#) reported that access to veterinary services is limited where only 32.4% of respondents in Mehurena Aklile district (Southwest Ethiopia) reported that they consult a veterinary person in treating

their sick birds. In addition, [Sambo et al. \(2015\)](#) reported that lack of accessibility/availability of veterinary services and lack of the necessary expertise are major problems for poultry businesses run in Bishoftu (central Ethiopia). [Sebho \(2016\)](#) also reported that the most important constraints impairing the exotic chicken production system under farmer's management condition in Ethiopia were disease and lack of veterinary health service.

Besides low coverage of overall diagnostic service (31.63%), access to laboratory-supported diagnosis is extremely low with 14.52%. This shows that a large proportion of sick chickens in Ethiopia were never diagnosed and relative importance of many diseases is unknown and likely underestimated. The lack of proper diagnosis also fuels a practise of mistreatment and likely overuse of antibiotics and results in ineffective treatments causing unnecessary costs and probably development of drug resistance. Previous authors supported the current findings. For example, [Habte et al. \(2017\)](#) indicated that lack of correctly identifying/diagnosing diseases is a major problem in the country and hence contributes for vaccination failure, and this in turn can cause farmers to lose trust in vaccines in general. Moreover, we found significant differences in access to diagnostic services across districts, indicating that improvements are possible and that poultry health may have gained more attention in some districts than in others.

Although farmers have good experiences in chicken treating, there is low access to professionally assisted treatment services which show that most sick poultry flocks do not get proper treatment. This also goes with the finding that the use of traditional treatment/remedy as a top priority action practiced by most poultry producers to treat sick chickens. Moreover, for the reasons that there is lack of professionally assisted treatment service, farmers tend to purchase drugs and treat their chickens by themselves which again resulted in poor treatment outcomes and bearing unnecessary costs. The unavailability of drugs and costly drugs and improper use of drugs in terms of treatment duration and dosage indicated that the poultry treatment services are very weak. Hence, sick chickens are neither properly diagnosed nor properly treated which results in higher chicken mortalities and all other associated losses ([Asfaw et al., 2021](#)). This fact substantiates that the low access to and coverage of diagnosis and treatment services result in more frequent occurrence of disease in majority of the studied HHs leading to various negative impacts on the poultry business of the country ([Shapiro et al., 2015](#); [CSA, 2018](#); [Asfaw et al., 2019](#)). From the studied factors, occurrence of disease significantly predicts chicken flocks to have access to treatment and the reason could be due to the fact that poultry producers might be forced to seek for treatment service for their sick chickens by the occurrence of the disease in their flocks. Moreover, increased chicken mortality significantly increases access to treatment of chicken flocks.

In support of the present finding, [Habte et al. \(2017\)](#) reported that poultry producer frequently uses local medicinal treatments but with unproven efficacy and medicines formulated for human use, such as tetracycline. Similarly, [Emebet \(2016\)](#) reported that traditional treatments are used by majority of chicken owners (73%) against ND and other killer diseases while 18.9% respondents do not use any treatment against any disease. In addition, [Sambo et al. \(2015\)](#) reported a widespread use of ethno-veterinary medicine by backyard and semi-intensive poultry producers in Bishoftu (central Ethiopia). On the other hand, Central Statistical Agency of Ethiopia estimated that about 58.37% of the country's poultry population became sick, but only 27.16% of them were treated ([CSA, 2018](#)).

The actual overall vaccination coverage seemed low with only 18.32%, and often chicken would get irregularly vaccinated for one disease only (i.e., ND), despite the fact that several diseases are important to be vaccinated for. This is in line with the findings of FGD that although farmers are highly willing to get their chickens vaccinated, there is no timely vaccination against other diseases. This could be due to lack of strategic vaccination for chicken flocks owned by farmers and urban dwellers. Except engagement of private actors in some districts, there is no regularly engaged poultry vaccination actors in almost all the studied districts and beyond. This might be because of lack of licensed and registered poultry vaccination service providers in the country, who can particularly deliver door-to-door vaccination services. It is also important to note that only a small majority of flocks are vaccinated by trained animal health professionals (58.72%), which reflects lack of monitoring and control mechanisms of vaccination delivery. On top of the low access to and coverage of poultry vaccination, disease was reported to occur in 59.23% of the vaccinated chicken flocks. This is another good indicator of poor vaccination outcomes and vaccine failure. Therefore, the higher disease occurrence in vaccinated chickens could be due to the lower access to and quality of vaccination. This is really a worrisome finding that despite many of the prevailing diseases in the country being vaccine preventable, frequent disease occurrence and resulting chicken mortalities are biggest bottlenecks of the poultry subsector in the country.

In line with our findings, [Habte et al. \(2017\)](#) reported that chicken vaccination is not commonly practiced in Ethiopia; however, vaccination against ND might be carried out whenever there is disease outbreak. The same authors also reported that the major factors affecting implementation of vaccination programs are poor animal health services and farmers' poor perception of vaccine efficacy. Moreover, [Sambo et al. \(2015\)](#) reported that poultry vaccines are only intermittently available and then only in inappropriate volumes. In line with these findings, [Mengesha et al. \(2011\)](#) reported that 96.4% of village chicken owners had no culture of vaccination against poultry diseases in northwestern Ethiopia.

It is interesting to note that single-age flocks had better vaccination services. This could indicate that poultry producers with multiple-age flocks might be less aware of chicken vaccination than those who keep single-age flocks, which might have a more professional business-oriented chicken production. We also found that vicinity to veterinary clinics improved access to vaccination. The potential reason is that the available animal health experts and vaccines at clinics are used to mainly vaccinate chicken flocks found nearby the clinics. In addition, a unit increase in the means of crude mortality and financial loss increases the adjusted OR of the access to vaccination of chicken flocks by 1% each. This indicates that farmers might be more vigilant to get their chickens vaccinated in times of chicken mortalities and associated financial losses.

While a small majority of 53% HHs indicated that veterinary clinics are available within 5 km of distance, the available clinics mainly served for large animals and had limited chicken services. This could be due to the reasons that transporting sick chickens to the available clinics is not suitable for owners, and it could be due to unavailability of poultry-specific services, drugs, and poultry expertise in the clinics. This is in line with the findings of FGD which reported that in majority of studied districts, no clinics serving poultry are available. Moreover, the FGDs clearly showed that poultry services, drugs, and poultry health experts were not available in most of the studied districts.

Availability of veterinary clinics varied across regions and districts. This may reflect differences in attention of the local government toward availing clinics, and moreover, it could be due to the lack of national standards on accessibility of veterinary clinics. To summarize, unavailability or low coverage of veterinary clinics is a major problem which led to low access to poultry health services in terms of diagnosis, treatment, and vaccination services. Because of this practical problem, frequent disease occurrence and higher crude chicken mortalities and associated financial losses are reported.

As to the conclusion and implications of this study, the low coverage of poultry health services explained by low access to and coverage of diagnostics, treatment, and vaccination services and unavailability of clinics in the country might result in more frequent disease occurrence and higher mortalities and associated financial losses ([Asfaw et al., 2021](#)). This implies that poultry health service in Ethiopia has not received adequate due attention by the government and other stakeholders. The implications could be further explained that organized private poultry health service providers accessible to all types of production systems and scales, door-to-door poultry health service delivery modalities, poultry health inputs, and legal frameworks are lacking. In addition, poultry farmers might not afford to hire private veterinarians although unemployed veterinarians are available in the market. Moreover, the existing private poultry health service providers mainly sell drugs and are mainly available in the urban or town

settings, and hence, they are not accessible to the farmers in the rural areas. There is also low public-private partnership and unnecessary competitions between the 2 which resulted in discouragement and low engagement of the private sector. Within this framework, very interestingly, there is growing but unmet demand for poultry health services in the presence of unemployed veterinary graduates in the market. Above all, poultry health-sensitive policy, strategy, and programs are missing and might result in low poultry health coverage. For instance, Ethiopia does not have poultry vaccination strategy and calendar. With this, the ambitious targets of the poultry transformation plan of the country could never be met.

Therefore, the following are recommended to strategically solve the reported weaknesses.

- ✓ There must be a holistic and inclusive poultry health service delivery system supported by appropriate policy, institutional platforms, and legal frameworks.
- ✓ Private sector engagement should be the focus of the poultry health service delivery improvement, and in connection to this, there must be incentive mechanisms, enabling easy business-doing environments for private poultry health service delivery.
- ✓ Special poultry health service modalities such as licensed and registered mobile service/door-to-door service and stationed village-level private clinical service should be introduced and implemented. Hence, chickens must be treated with professionally prescribed drugs following proper diagnosis made by trained poultry health experts.
- ✓ Adequate number and type of poultry health experts should be employed at different levels that is post-graduate diploma/certificate, MSc, and PhD programs. Moreover, adequately trained poultry health experts must be deployed in both private and public poultry health delivery system.
- ✓ The government should encourage in-land manufacturing of poultry health inputs (vaccines, drugs, diagnostic, and therapeutic products) and facilitate their importation as priority inputs and ensure fair distribution and trading of those inputs. Moreover, research and development work to scientifically study and use traditional remedies is another area of interest to improve poultry treatment services.
- ✓ There must be periodic assurance of quality of poultry health inputs (vaccines, drugs, diagnostic, and therapeutic products) by a responsible body.
- ✓ Devising nationally implementable vaccination delivery strategies and calendars for all production systems and scales against all vaccine-preventable diseases are highly recommended.
- ✓ The government is expected to make poultry health standards and formalized service protocols/guidelines to scientifically and legally monitor the proposed services.

- ✓ Capacity building and awareness creation of poultry farmers and allied paraprofessionals shall be made as part of continuous professional development.

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## DISCLOSURES

The authors declare that there is no conflict of interest related to this work.

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