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Abstract

Community-based poultry health management (CBM) is a strategy for village poultry improvement based on the installment of “poultry interest groups” in experimental villages. These groups serve as a channel for the dissemination of village poultry improvement technologies. The use of CBM is due to the fact that village poultry farming is practiced in a total or partial scavenging system which gives the impression that all the birds in the village belong to the same flock. Accordingly, actions that target all farmers of the same village may have a larger impact on the village poultry’s survival rate than actions that target individual producers. The objective of this study is to assess the impact of CBM on the survival rate of village poultry. Based on data collected on 353 poultry keepers, the study shows that CBM significantly improves the survival rate of village poultry. The adoption of technologies – poultry vaccination, construction of henhouses, and improved feed – disseminated through the CBM also significantly improves the survival rate. The access to markets for inputs and veterinary services is also important in improving the survival rate of poultry. Finally, the study suggests that governments and development agencies can improve village poultry survival rates by investing in the dissemination of information regarding best husbandry management practices through approaches that rely on the community such as CBM because CBM groups serve as channels for the dissemination of village poultry improvement technologies.

Key words: Benin; Community-based management; Survival rate; Two-limit Tobit; Village poultry.

JEL codes: O13, Q12, Q16

1. Introduction

Village poultry plays an important role in food security and income generation in rural areas of many developing countries. Indeed, in most developing countries, village poultry contributes up to 90% of poultry production (Alabi et al., 2006). In Benin, 84% of farm households own village poultry (Kherallah et al., 2001) and it represents the second most common source of meat after beef (DE/MAEP, 2008).

In village poultry farming, birds from different village dwellers can scavenge together and sometimes even share the same shelter. Birds are raised with no or few inputs (corn, sorghum, cassava). Productivity is low while breeding levels are poor and mortality rates high. Losses constitute an important problem in village poultry production and are due to several factors of which diseases, particularly Newcastle Disease (ND), are the most significant (Sonaiya, 2009). ND affects more chickens than other types of village poultry and prevails all year round. Other loss factors include predators and road accidents.

To help reduce these losses, various programs have been implemented by the government of Benin and various development agencies (e.g. Danish International Development Agency). The approaches used by these institutions mainly rely on the village community (Community-Based Management, CBM), with the installment of a ‘poultry interest group’ (or CBM group) in each experimental village. The members of these groups usually have weekly meetings during which they receive training in the basic techniques of village poultry management, including village poultry improvement technologies including housing, feeding based on locally available compounds, and disease control. To facilitate the use of these techniques and technologies, each CBM group was asked to select two members (normally a woman and a man) to be sent on a course to become a Village Poultry Vaccinator (VPV). These members received five-day’s training, which not only focused on the techniques of poultry vaccination and treatment against major diseases such as ND, but also on the technical aspects of village poultry management. Their role was to help farmers with the treatment of diseases and to advise them, notably on good village poultry farming practices. The introduction of VPVs is justified by the fact that private and government veterinarians are located far from villages and are not usually interested in village poultry.

The objective of this study is to assess the effect of the CBM, including the adoption of various technologies (vaccination, improved feed, henhouse, chick-house), on the survival rate of chicken. Indeed, since the main problem that farmers face in village poultry production is a high loss rate, identifying the factors that influence the birds' survival rate can facilitate the implementation of future actions, which aim to further improve village poultry performance.

2. Materials and methods

2.1. Area of study, sampling and data collection

This study focuses on village chickens that are raised in total or partial scavenging systems in rural areas in Benin. The data used were collected by Sodjinou (2011) in two provinces: Donga in the North and Mono in the South. In each province, two districts where the CBM has been implemented during the past ten years were considered. In each district, two experimental villages and one non-experimental village were selected. Thus, in total, eight experimental villages and four non-experimental villages were selected. In each village, a census of households which produce poultry was carried out. For experimental villages, breeders were grouped into two categories: participants and non-participants in CBM and 25 participants and 8 to 10 non-participants were randomly selected. In each non-experimental village, 20 breeders were randomly selected. In total, data were collected on 353 poultry-keepers using two main tools: focus group discussions (two in each village) and structured questionnaires.

The dataset includes breeders' management practices, the adoption of various poultry improvement technologies (vaccination, chick-house, henhouse, and the use of improved or complementary feed), the distance between the breeder's household and the nearest market, and changes to the flock during the observation period (July 2008 through June 2009), i.e. number of chicks that hatched, number of chicks (less than one month of age) that died, total number of chickens that died, the flock size at the beginning and the end of the observation period, the number of chickens purchased or received, and the number of chicken sold or slaughtered.

About 27% of interviewed farmers had a chick-house and 67% had a henhouse (table 1). The minimum distance between the producer's household and the nearest market was 0.99 km and the maximum was 15.58 km, with on average 6.38 km. Among the producers, 43% were located in Northern Benin, and 42% were members of CBM. Also, 30% of the farmers used improved feed and 49% vaccinated their poultry against diseases, notably ND. The so-called improved feed (served mainly to adult birds) consisted of a combination of various locally available products such as milled corn, bones, snail shells, small fishes, soy, salt, and peanut oil by-products. The average survival rate was 65% for chicks and 70% for chicken.

Table 1. Description of the data used

Variable	Label	Number of observations	Minimum	Maximum	Mean[(a)]
CHIKHOUS	Have chick-house (1=yes, 0=no)	353	0	1	27.2%
HENHOUSE	Have henhouse (1=yes, 0=no)	353	0	1	67.4%
IMPFEED	Make improved or complementary feed for chickens (1=yes, 0=no)	353	0	1	30.0%
VACCIN	Vaccination of chicken (1=yes, 0=no)	353	0	1	49.3%
MARKET	Distance from household to the nearest market (km)	353	0.99	15.58	6.38 (4.33)
CBM	Participation in CBM group (1=yes, 0=no)	353	0	1	41.6%
EXPVIL	Residence in experimental village (1=yes, 0=no)	353	0	1	77.3%
REGION	Region (1=North, 0=South)	353	0	1	43.1%
CSR	Chicks’ survival rate (for chicks less than 1 month of age)	329	0	1	0.65 (0.23)
SR	Chickens’ survival rate	353	0	1	0.70 (0.20)

(a) Numbers in parenthesis are standard deviations.

2.2. Data analysis

2.2.1. The dependant variables

Two types of survival rates were calculated: the chicks' survival rate and the overall (chicks + adult poultry) survival rate. The chicks' (less than one month of age) survival rate (CSR) is given by:

$$CSR_i = [1-(NCD_i / TNC_i)], \tag{1}$$

where NCD_i is the number of chicks of breeder *i* that died during the observation period, and TNC_i is the total number of chicks hatched during the same period. For a given producer *i*, the overall survival rate, or simply chickens' survival rate (SR), is defined as:

$$SR_i = [1-(Loss_i /(FB_i + TNC_i + CP_i))], \tag{2}$$

where $Loss_i$ is the total number of chickens (chicks and adults) which died during the observation period, FB_i is the flock size at the beginning of the observation period, TNC_i is the total number of chicks hatched during the observation period, and CP_i is the total number of chickens purchased or received during the observation period.

2.2.2. The model used

The survival rates calculated in equations 1 and 2 are censored at both an upper and a lower limit, i.e. they range from $L_1 = 0$ (no bird survived) to $L_2 = 1$ (no bird died). For chickens, 0.6% and 5.1% of the breeders have a survival rate of 0 and 1, respectively. For chicks, 2.4% and 7% of the breeders have a survival rate of 0 and 1, respectively. Since our dependant variables are bounded below by $L_1 = 0$ and above by $L_2 = 1$, the appropriate analytical approach is the two-limit Tobit model. This model is specified as follows (Greene, 2012, p. 889):

$$y_i^* = x_i'\beta + \varepsilon_i \tag{3}$$

$$\text{and} \quad y_i = L_1 \text{ if } y_i^* \le L_1$$
$$= y_i^* \text{ if } L_1 < y_i^* < L_2$$
$$= L_2 \text{ if } y_i^* \ge L_2,$$

where i indicates the breeder, x_i represents the vector of the explanatory variables, β is a vector of unknown parameters, ε_i is an error term which is assumed to be normally distributed with mean 0 and variance σ^2, and y^* is a latent variable that is not observed for values less than zero and greater than one. The latent variable satisfies the classical linear model assumption; notably, it has a normal, homoskedastic distribution with a linear conditional mean (Wooldridge, 2005, p. 605).

For the two-limit Tobit model specified in equation 3, there are different types of conditional mean functions. One commonly used conditional mean function is the expected value of the latent variable y^*, i.e. $E(y_i^* \mid x_i) = x_i'\beta$. However, if the dependent variable is always censored, then this conditional mean is usually not useful (Greene, 2012, p. 888). An alternative conditional mean function for an observation that is randomly drawn from the population and which may or may not be censored is $E(y_i \mid x_i)$ (Greene, 2012, p. 889). Theoretically, it is not clear which conditional mean function should be used for calculating predicted values for the two-limit Tobit, but Greene (2012, p. 888) argues that "intuition suggests that $E(y_i \mid x_i)$ is correct, but authors differ on this point."

2.2.3. Hypothesized factors which determine poultry survival rate

The explanatory variables in the Tobit regression were (table 1):

- *participation in community-based management (CBM), with 1 for participation and 0 otherwise.* As stated above, CBM groups serve as a channel not only for the dissemination of village poultry improvement technologies, but also for the training of participants in the basic techniques of village poultry management. This may contribute to a positive change in behavior amongst producers regarding the management of their flock, which could translate into the improvement of their birds' survival rate. Accordingly, we assume that participating in CBM groups will have a positive effect on the chickens' survival rate.

- *residence in experimental village (EXPVIL), with 1 for residence in experimental villages and 0 otherwise*. The services of the VPV can be used by all residents in experimental villages (i.e. participants and non-participants in CBM). For example, in some villages where the CBM has been implemented, the VPVs were even able to sell 50% of veterinary drugs to farmers, who were not members of CBM (Nielsen et al., 2003). This can contribute to a positive change in behavior amongst producers regarding the management of their flock, which in turn may boost their birds' survival rate. For this reason, we expect that the implementation of CBM in a village will have a positive spill-over effect on the survival rates of the birds of all residents of this village.

- *availability of chick-houses (*CHIKHOUS*) and henhouses (*HENHOUSE*).* Village poultry survival can be affected by natural factors such as rain, but also by predators such as snakes, rats, dogs, and cats. The availability of shelter can reduce the effect of these factors and increase the poultry survival rate. In particular, overnight housing is an important way to reduce this loss (Sonaiya and Swan, 2004). Thus, we assume that the availability of chick-houses and henhouses will have a positive effect on the survival rate of chicks and chickens.

- *improved feeding (IMPFEED).* As well as better housing, Wilson (2010) argues that regular supplies of some supplementary feeding would greatly increase the survival rate of chicken and chicks and thus reduce economic losses. Better nutrition for young stock boosts their immune response to disease challenges and to vaccine inoculation by developing full immunity (Sonaiya and Swan, 2004). We expect the effect of this variable to be positive.

- *vaccination of poultry (VACCIN).* A previous study in Benin (Chrysostome and Sodjinou, 2005) has shown that breeders who vaccinate their birds have a much lower poultry mortality rate (8% to 20%) than those who do not vaccinate (more than 80%). Also, Wilson (2010) argues that vaccination against ND would greatly increase chicken's survival rates. Accordingly, we expect the effect of the vaccination on the chickens' survival rate to be positive.

- *logarithm of the distance (LNMARKET) to the nearest market (km).* There is usually a State or private veterinarian installed near the largest rural market in each surveyed district. This could be a source of supply for vaccines and other veterinary drugs for farmers and VPVs in particular. To account for this, the logarithm of the distance between the breeders' houses and the nearest market is used as a proxy for accessibility to veterinary agents as well as access to a market. We assume that LNMARKET will have a negative effect on poultry's survival rate, meaning that farmers who are located further away from a market will have a lower poultry survival rate. Indeed, the distance to the veterinary agents (from whom the VPVs usually buy products) is a decisive factor for determining the degree to which small-scale breeders rely on veterinary services (Chilonda and van Huylenbroeck, 2001).

- *regional dummy (REGION), with 1 = North and 0 = South*. We include a dummy variable for the region as an explanatory variable. This allows us to control for agro-climatic differences that could affect the survival rate of village poultry. This variable can have either a positive or a negative effect on poultry's survival rate.

2.2.4. Hypothesis tests and marginal effects

In order to evaluate the suitability of the entire model, we use a likelihood-ratio test to test the (null) hypothesis that all coefficients β except for the intercept are simultaneously equal to zero. The coefficient β_k of an explanatory variable x_k indicates the partial effect of this variable x_k on the latent variable y^*. We use t-tests to test the statistical significance of each explanatory variable x_k by checking whether we can reject the (null) hypothesis $\beta_k = 0$.

It is worth noting that the coefficients of the two-limit Tobit model (β) do not coincide with the marginal effects of the explanatory variables on the expected survival rate $E(y_i \mid x_i)$. The marginal effect can be calculated by (Greene, 2012, p. 889):

$$\frac{\partial E(y \mid x)}{\partial x_k} = \beta_k \left(\Phi\left(\frac{1 - x'\beta}{\sigma} \right) - \Phi\left(\frac{-x'\beta}{\sigma} \right) \right), \tag{4}$$

where $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution. The approximate standard errors of these marginal effects can be calculated with the Delta method. We used the R statistical environment (R Development Core Team, 2012) with the add-on package “censReg” (Henningsen, 2012) to estimate the two-limit Tobit model with the maximum likelihood method.

3. Results

Participating in CBM has a positive and significant effect on the survival rate of chickens (at 5% level) and chicks (at 1% level) (see table 2). When the breeder participates in CBM, the survival rate of chickens and chicks is expected to increase by 5.1 percentage points and 8.7 percentage points, respectively. However, residing in experimental villages without participating in CBM has no statistically significant (at 10% level) effect on the survival rates of chickens and chicks.

Vaccination positively and significantly influences (at 5% level) the survival rate of chickens. The use of vaccination is likely to increase chickens’ survival rate by 5.4 percentage points.

Having a henhouse has a positive and statistically significant effect on the survival rate of chickens (at 1% level) and chicks (at 5% level). More precisely, the utilization of a henhouse is expected to increase the probability of a chicken’s survival by 8.9 percentage points and a chicks’ survival by 6.1 percentage points. On the other hand, having a chick-house negatively and significantly influences (at 1% level) the survival rate of chickens and chicks. The survival rate of chickens is likely to decrease by 6.7 percentage points and chicks by 8.7 percentage points.

The use of improved feed, often made of locally available products, has a positive and significant effect (at 5% level) on the survival rate of chickens. The use of this technology increased the poultry survival rate by 5.6 percentage points. However, the use of improved feed has no statistically significant (at 10% level) effect on chicks’ survival rate.

The negative and significant coefficients of variable LNMARKET indicate that farmers who live close to a market (everything else equal) have a higher survival rate amongst their chickens (at 5% level) and chicks (at 1% level) than farmers who live far away from a market. Doubling the distance to the nearest market, *ceteris paribus*, results in a decrease in the survival rate of chickens by 2.8 percentage points and a decrease in the survival rate of chicks by 4.6 percentage points.

The regional location has a significant effect on chickens' survival rate (at 5% level), but not on chicks' survival rate (at 10% level). The survival rate for chickens amongst breeders in the North is, *ceteris paribus*, 4.7 percentage points higher than it is for chicken kept by breeders in the South.

Table 2. Estimation results of a two-limit Tobit model for factors which influence the survival rate of chickens and chicks

Variable	Label	All Chickens		Chicks	
		Coefficient[a]	Marginal effect[a]	Coefficient[a]	Marginal effect[a]
CHIKHOUS	Have chick-house	-0.072***	-0.067***	-0.094***	-0.087***
		(0.026)	(0.025)	(0.034)	(0.032)
HENHOUSE	Have henhouse	0.095***	0.089***	0.065**	0.061*
		(0.026)	(0.025)	(0.033)	(0.031)
IMPFEED	Make improved or complementary feed for chickens	0.059**	0.056**	0.008	0.007
		(0.028)	(0.026)	(0.034)	(0.032)
VACCIN	Vaccination of chicken	0.058**	0.054**	Not Included	Not Included
		(0.023)	(0.021)		
LNMARKET	Logarithm of the distance from household to the nearest market (km)	-0.029**	-0.028**	-0.049***	-0.046***
		(0.014)	(0.013)	(0.018)	(0.017)
CBM	Participation in CBM group	0.054**	0.051**	0.093***	0.087***
		(0.026)	(0.025)	(0.034)	(0.031)
EXPVIL	Residence in experimental village	0.011	0.010	0.004	0.003
		(0.029)	(0.027)	(0.036)	(0.033)
REGION	Region	0.050**	0.047**	0.035	0.032
		(0.024)	(0.022)	(0.029)	(0.027)
(constant)	Constant	0.608***		0.656***	
		(0.037)		(0.047)	
Number of observations		353		329	
Likelihood Ratio chi-square		78.65***		35.26***	
Log likelihood		56.05		-27.38	

*** Significant at 1%, ** Significant at 5%, * Significant at 10%

(a) Numbers in parenthesis are standard errors

4. Discussion and conclusion

Community-based management is a participatory approach in which village dwellers get together to brainstorm the improved management of traditional poultry farming. This often gives rise to an internal network in which farmers exchange their experience and especially problems in poultry farming as well as the endogenous and exogenous solutions to solving these problems.

It is worth noting that breeders were free to participate in the CBM and to adopt the poultry improvement technologies promoted through CBM. In other words, breeders (partly) decide for themselves whether they participate in the CBM and adopt the technologies. Thus, their decisions may be related to the benefits derived from CBM and the technologies. Furthermore, breeders have different intrinsic characteristics that cannot be measured through a cross-sectional study (Gertler et al., 2011), e.g. some breeders will always participate in CBM (if offered in their villages) and will adopt one or more of the technologies promoted through the CBM; some breeders will never participate in CBM and will never adopt one or more of the technologies (i.e. vaccination, improved feed, henhouse, chick-house), and finally, some breeders will only adopt one or more of the technologies if they are promoted by CBM/VPV. The random selection of interviewees among participants and non-participants in CBM suggests that our study sample is representative. Hence, the marginal effects of participation in CBM and of adopting certain technologies that we presented above might not only include the causal effects of CBM and the technologies, but also differences in the intrinsic characteristics between participants/adopters and non-participants/non-adopters in the population.

In order to measure the overall causal effect of the program, we removed all explanatory variables that were influenced by the program (i.e. participation in CBM and the four technologies) and re-estimated the models. The results show that the introduction of the program in the experimental villages significantly increased the chickens' survival rate by 8.4 percentage points and the chicks' survival rate by 5.8 percentage points (Table 3). This overall causal effect was achieved through the participation of some households in CBM and through the increased adoption of poultry improvement technologies in experimental villages.

Table 3. Estimation results of a two-limit Tobit model for assessing the overall causal effect of the program on the survival rate of chickens and chicks

Variable	Label	All Chickens		Chicks	
		Coefficient[(a)]	Marginal effect[(a)]	Coefficient[(a)]	Marginal effect[(a)]
LNMARKET	Logarithm of the distance from household to the nearest market (km)	-0.010 (0.015)	-0.009 (0.014)	-0.035** (0.018)	-0.033** (0.016)
EXPVIL	Residence in experimental village	0.090*** (0.026)	0.084*** (0.024)	0.063** (0.031)	0.058** (0.029)
REGION	Region	0.088*** (0.023)	0.081*** (0.021)	0.070** (0.027)	0.065** (0.025)
(constant)	Constant	0.613*** (0.039)		0.630*** (0.046)	
Number of observations		353		329	
Likelihood Ratio chi-square		29.45***		18.91***	
Log likelihood		31.46		-35.55	

*** Significant at 1%, ** Significant at 5%, * Significant at 10%

(a) Numbers in parenthesis are standard errors

Our results show that the introduction of CBM in the experimental villages had a positive and significant effect on the survival rate of chickens and chicks. It follows that the implementation of CBM and the resulting relationships between farmers reduced the loss of birds, in particular because of the improvement in poultry management practices. Indeed, CBM allows the community to develop a management strategy which is more likely to meet local needs and conditions (Dey and Kanagaratnam, 2007). The knowledge and experience (for example, diagnosis of avian diseases and their prevention, cleaning of henhouses, and housing) that the farmers gained over time from CBM obviously helped them to improve the survival rate of chickens and chicks. This result is in line with the observations of Msoffe et al. (2010) who argue that CBM is well-suited to free-range poultry and social features of rural areas, where village free-range poultry appears as a single flock. In this context, Msoffe et al. (2010) argue that the principles of disease bio-security require that all the farmers whose poultry co-mingles take collective action to prevent diseases in the village flock. Thus, coordinated community action is imperative to improve village poultry survival rates. In short, CBM is an important tool for improving survival rates amongst village poultry, which in turn may lead to the improvement of poultry production and even its profitability. Better, in the evaluation of the overall socioeconomic impact of this program, Sodjinou (2011) shows that CBM improved the wellbeing of the participants' households, i.e. higher income from poultry production (more than 100% increase compared to what it would have been without the programs) and a reduction in poverty.

Vaccination improves the survival rate of chickens. This result is in accordance with Rodríguez et al. (2011) who found that vaccination campaigns not only significantly reduce the mortality rate of village poultry, but also have a positive effect on producers' income. Reducing mortality through vaccination leads to larger flock sizes of indigenous chicken (Rodríguez et al., 2011). Also, studies in several other countries have shown that suitable vaccination campaigns against poultry diseases can have positive effects on the survival rate of poultry and the breeders' well-being. For instance, in Bangladesh, a ND vaccination campaign reduced mortality from 41% to 19% in one year (Clarke, 2004). In Benin, the introduction of vaccination against ND and other management measures resulted in a general decrease in the mortality rate of participating smallholders' poultry flocks (Nielsen et al., 2003). Most village poultry producers, however, have poor access to veterinary and extension services, and hence are either unaware of the benefits of disease control, or unable to access the vaccines and drugs needed to protect their birds. When animal health services are unavailable and bird mortality is high, awareness and interest in improved husbandry practices does not generally exist (Kryger et al., 2010). In short, targeting village poultry vaccination could be an important way of increasing the survival rate of chickens. This is particularly interesting since Rodríguez et al. (2011) show that the gap between the profitability of indigenous and exotic breeds reduces after a vaccination campaign.

The utilization of a *henhouse* has a positive effect on the survival rate of chickens and chicks. This result implies that building a shelter for poultry is an important factor in increasing their survival rate. In fact, a henhouse reduces deaths due to road accidents and predators such as snakes, shrews, and rats. The policy implication of this result is that the provision of housing for poultry is important for the development of traditional poultry farming as an income generating activity. Henhouse construction, however, requires financial resources – not only for the construction, but also for the purchase of equipment such as troughs.

Having a *chick-house* negatively influences the survival rate of chickens and chicks. This negative sign is in contrast to the expected positive sign. According to the interviewed producers, this may be due to the fact that chicks are frequently killed by ants, shrews, and snakes (particularly during the night) when the small birds are sheltered without special precautions (e.g. the use of carbide from welding to surround the shelter). According to the breeders surveyed, the mortality rate increases when chicks are fed directly in the chick-house, since the feed attracts “army ants”. The explanation is that farmers tend not to clean the chick-house properly after feeding. Therefore, it is important that breeders either clean their chick-houses more frequently, especially after feeding, in order to avoid food scraps attracting predators, or feed their chicks outside the chick-house.

According to Rodríguez et al. (2011), interventions that target the improvement of village poultry survival rates in Benin should be accompanied by investments to improve the quality and the quantity of feeding resources. Indeed, as noted by Aboe et al. (2006), even if village poultry vaccination is successful, feeding the birds may be a problem as many breeders are not able to appropriately feed their birds. Our findings suggest that the use of *improved or complementary feed* made from locally available products has a positive effect on the survival rate of chickens. This result is consistent with the finding of Tung (2007), who showed that feed which was based on the use of concentrated feed in village poultry production in Vietnam had a positive effect on the survival rate of chickens. He explains this success by highlighting the use of improved feed that increases feed intake and hence improves birds’ resistance to diseases. Clarke (2004) claimed that supplementary feeding can greatly improve the poultry’s performance, but care must be taken to ensure that the provided feed is affordable and locally available. When supplementary feed is scarce, Clarke (2004) suggests that farmers should ensure that chicks up to the age of one month have access to additional feed, as young chicks are the first to suffer from food shortages. As our study suggests that *improved* supplementary feed does not increase the survival rate of young chicks, it seems that chicks benefit from traditional supplementary feed in the same way as they do from improved supplementary feed. We presume that the improved supplementary feed which is provided by the breeders in our study is not optimally suited to young chicks. However, the main implication of our study is that the use of improved supplementary feed improves the birds' overall survival rate and performance.

Farmers who live close to markets are more likely to have a high poultry survival rate than farmers who live far away from markets. In other words, access to markets for inputs and veterinary services is a significant factor in improving the survival rate of poultry (chickens and chicks). This result is in accordance with the finding of Tung (2007), who states that access to veterinary services has a positive effect on poultry's survival rate.

In short, community-based management significantly improves the village poultry survival rate. Thus, governments and development agencies can improve village poultry survival rates by investing in the dissemination of information regarding best husbandry management practices through approaches that rely on the community such as CBM, because CBM groups serve as channels for the dissemination of village poultry improvement technologies.

Although our study area is limited to Benin (a tropical West African country between the 6th and 12th parallels of north latitude, and between the 1st and 4th Meridian of longitude), many other developing countries have similar climatic conditions and similar poultry rearing systems. Therefore, we expect that our results are relevant far beyond our study area.

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