# Factors Influencing Smallholder Farmers' Preference for Veterinary Service Providers in Zimbabwe

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## Abstract

Animal diseases pose significant challenges to livestock production in Zimbabwe's smallholder sector. This study analyzed the variables influencing smallholder farmers' preferences for veterinary service providers. Data from a mixed-method approach, including a questionnaire (N=382), focus group discussions (N=8), interviews (N=16), and observations, were analyzed using descriptive statistics and multivariate probit regression. The findings revealed that access to veterinary services is complex and context-dependent, influenced by factors such as experiences, age, proximity to the provider, communication, remittances, satisfaction, repeat treatments, socioeconomic status, historical dynamics, and access to subsidized drugs. Government veterinary services, private sector entities, and Community Animal Health Workers played critical roles in the provision of veterinary services. Better coordination among the different service provides could enable provision of cost-effective services. The study highlights the multifaceted nature of smallholder farmers' decision-making, emphasizing the importance of situational factors and collaboration among service providers to meet their diverse needs effectively. These insights inform policymakers and stakeholders in developing strategies to enhance veterinary services in Zimbabwe's smallholder communities, ultimately improving livestock productivity and welfare.

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## 1. Introduction

Livestock production plays a critical role in the livelihoods of smallholder farmers in Zimbabwe, contributing to food security and income generation (Ikdal et al., 2020). However, the presence of animal diseases poses a significant threat to the productivity and profitability of livestock enterprises in this sector (Mudimba et al., 2019). The risks posed by animal diseases are believed to be higher for smallholder livestock producers compared to their commercial counterparts (Hernandez-Jover et al., 2015). This is partly attributed to the poor infrastructure and limited resources, which make the provision of veterinary services particularly difficult in smallholder areas (Jilo et al., 2016).

In 2020, a total of 23,000 cattle died of Theileriosis alone, acknowledging the inadequacy of dipping services, which had become irregular (Ministry of Lands, Agriculture, Fisheries, Water, and Rural Development (MLAFWRD), 2021). Access to quality veterinary services is essential for the prevention, control, and treatment of animal diseases, ensuring the health and well-being of livestock.

Effective veterinary services require an appropriately staffed system with competent personnel delivering coordinated services (WOAH, 2018). In Zimbabwe, veterinary care is provided through a diverse range of service providers, including the public sector, private sector, and Community-based Animal Health Workers (CAHWs). The challenges faced by these service providers are explained below;

The public sector, through the Department of Veterinary Services (DVS), has traditionally been the main provider of veterinary services to smallholder farmers most of who are resource-poor and unable to pay commercial rates (Mangesho et al., 2021). Governments view veterinary services as a public good that supports poverty reduction. However, DVS faces issues like inadequate staffing, absenteeism of professional and technical staff from their duty stations, poor resources and poor investment in the sector, has resulted in DVS providing inadequate services (WOAH, 2014). Public veterinary institutions have limited geographic coverage, due to scarce resources against increased animal health demands such that optimal health care cannot be achieved with reliance on the public sector alone (Mutambara et al 2013). It has been known that smallholder livestock owners with low resources are likely to have less access to veterinary services, as the officials spend more time on those farmers who have better resources and can provide incentives to the officials (Amankwah et al 2014). Officials prioritize farmers able to provide incentives (Amankwah et al., 2014). Therefore, assumption by the public sector that smallholder farmers are poor and cannot afford commercially oriented private

services may not be accurate, as smallholder farmers may be willing to pay for quality services if they are available and affordable.

While the private sector has potentially, an important role to play in the provision of veterinary services in the smallholder areas, there are low levels of private sector investment in smallholder farming sectors. The reasons for this are many, ranging from low levels of farmer productivity, high transactional costs, and poor rural infrastructure to support business development among others (Kasanda 2017). Due to the high fixed costs required to set up veterinary services, the private sector finds it difficult to venture into the smallholder areas unless they are assured of a market large enough to sustain profitable operations. The aggregate demand for private veterinary services in the smallholder sector often falls short of the levels required to sustain profitable private veterinary service operations (Leonard 2000). Due to the high transaction costs of service delivery in these areas, the services may become too costly resulting in farmers being unwilling to pay for the services (Kasanda 2017). Free provision of veterinary services by the public sector has also had the effect of crowding out alternative providers and suppressing the development of a free market system within the smallholder sector. It may not be accurate to assume that smallholder farmers are not willing to pay for services at all (Lwapa et al 2019; Onono et al. 2013). Rather it may be a lack of adequate information.

One group of veterinary services providers, the Community Animal Health Workers (CAHWs) has gained prominence in third-world countries through donor-driven programmes. CAHWs are lead farmers who are selected by their communities to undergo training so that they can provide primary animal health care services at the community level (Fedlu et al 2019). While community animal health programmes have demonstrated to have great potential for providing cost-effective veterinary services in remote areas, their sustainability beyond the funding period of the supporting projects has been questionable. Proponents of CAHWs argue that they can provide cost-effective services by virtue of their being resident in their areas of operation and do not have to recover the high investment in education that a university-trained veterinarian would have incurred (Ilukor et al 2015). Critics, however, feel that the dominance of non-veterinarians in veterinary service delivery has been a significant cause of the decline in the quality of veterinary services (Ilukor & Birner 2014) leading to food insecurity (Bonnet et al., 2011).

The quality of veterinary services is also affected by the shortage of suppliers of quality pharmaceuticals in smallholder farming areas, which has created opportunities for the sale of falsified and substandard drugs. The preferences of smallholder farmers for different service providers can significantly influence their utilization of veterinary services and the overall effectiveness of disease management strategies. Therefore, understanding the factors that influence smallholder farmers' preference for veterinary service providers is crucial for optimizing service delivery and improving livestock health outcomes.

The veterinary services sector in Zimbabwe faces significant challenges in delivering quality services to smallholder farmers. The dominance of the public sector, the limited investment of the private sector, and the challenges faced by CAHWs have resulted in inadequate services being provided to smallholder farmers. Addressing these challenges and understanding the factors that influence smallholder farmers' preferences for veterinary service providers can help optimize service delivery and improve livestock health outcomes (Lamichhane & Shrestha 2012).

## 1.1. Statement of the problem

Zimbabwe has suffered from multiple animal disease outbreaks, which have threatened the livelihoods of rural households (Department of Veterinary Services (DVS), 2022). Smallholder farmers are particularly vulnerable to the impact of animal diseases, as they rely heavily on their livestock for income and food security. The loss of livestock has a devastating impact on the family's livelihood and curtails socio-economic development (Ilukor et al., 2015). Inadequate or weak veterinary systems exacerbate the extent of livestock losses and the negative impact animal diseases have on the sustainability of livelihoods.

## 1.2. Aim and objectives

This study aims to understand the key factors that influence smallholder farmers' preferences for veterinary service providers in Zimbabwe. Specifically, the objectives are:

- To identify the available veterinary service provider options for smallholders.
- To determine the relative preferences of smallholders for different provider types.
- To examine how farmer, livestock, provider, and contextual factors shape preferences.

By understanding the factors that influence smallholder farmers' preferences for veterinary service providers, this study contributes to the development of effective strategies to improve the delivery of veterinary services and enhance the productivity and sustainability of smallholder livestock systems in Zimbabwe.

## 2. Literature Review

### 2.1. Choice of Veterinary Services Providers

The choice of veterinary service providers is influenced by several factors, as evidenced by various studies. Onono et al. (2013) analyzed the determinants of animal health service providers in Kenya and found that time spent searching for services and transport costs positively influenced the choice of providers, while distance negatively influenced the choice. In Nepal, Lamichhane and Shrestha (2012) found that farmers preferred village animal health workers (VAHWs) over veterinarians and mid-level technicians, with farmers' age and education level having a significant inverse relationship with the preference for these service providers. Haakuria et al. (2020) identified access to veterinary services and advice, veterinary medicine supply chain, and farmer knowledge and understanding as key factors influencing veterinary service supply to rural farmers in Namibia.

In India, Singh et al. (2013) found that the distance of availability of veterinary services positively influenced the farmers' decision to use these services, with educational status, formal training in agricultural practices, and continuation of agriculture as a profession also influencing the use of veterinary services. Mangesho et al. (2021) identified increasing age, education, treatment failure, and herd disease burdens as factors associated with greater odds of seeking out health

services among Maasai pastoralists in Tanzania. K'Oloo et al. (2015) found that private animal health assistants (PAHAs) were preferred over government animal health assistants (GAHAs) and non-trained service providers (NTSPs) due to accessibility, attitude, access to information, and service provision on credit, but were perceived to be more expensive than GAHAs and NTSPs.

In Ethiopia, Gizaw et al. (2021) identified livestock extension agents, public/official veterinarians, and CAHWs as key service providers, with wealth, gender, and age also influencing the use of services. In Zimbabwe, Mutambara et al. (2012) found a positive correlation between socio-economic factors and expenditure on veterinary services, with the demand for veterinary services increasing with the number of livestock units owned, income levels, level of education, and assets owned. Mutambara et al. (2013) also established that the CAHW system was a viable alternative animal health delivery system already embraced by smallholder farmers.

## 2.2. Gap in literature

Overall, the choice of veterinary service providers is influenced by a range of factors, including multiple socio-economic factors, farmers' demographic characteristics geographic or accessibility, and provider-related factors such as attitudes, information availability, provision of services on credit terms, herd size, disease burden, treatment failures and demand and likelihood of utilizing services. While socio-economic and geographic accessibility factors are well-studied, few address livestock production systems or how preferences may differ by system. Additionally, most focus on a single country context without comparison.

This study contributes new information by exploring provider preferences among smallholders in Zimbabwe through a mixed-methods approach. Zimbabwe faces unique challenges including effects of land reform on farm sizes. This study captures additional nuanced dynamics like the role of subsidies, historical relationships with providers, and communication channels.

By evaluating preferences across districts with varied agro-ecologies, this research fills gaps around how production context may shape choices. The multi-provider focus considering interactions between provider types also provides novel insight into optimizing pluralistic service models. Overall, this study enhances understanding of factors influencing access within Zimbabwe's smallholder sector.

## 3. Materials and methods

### 3.1. Study Area

The study was conducted in Mwenezi District, located in Masvingo Province, and Mberengwa District, situated in the Midlands Province of Zimbabwe. These districts fall within agroecological regions IV and V, characterized by highly erratic rainfall of less than 650mm per year. As a result, livestock production, including cattle and goats, as well as wildlife production, forestry, and tourism, are the primary sources of livelihood in these regions (Manatsa et al., 2020). Livestock

in the area is predominantly kept under extensive management practices, with communal grazing during the day and kraaling at night during the cropping season. In the dry season, some farmers allow their animals to graze freely overnight.

## 3.2. Sampling Procedure and sample size

A multi-stage sampling procedure was adopted to ensure the chosen samples were representative of the districts and their respective production systems. Both purposive and stratified cluster sampling techniques were employed to obtain representative samples of households for the survey. The selection of the two districts was based on the prominence of livestock production activities.

First, the districts were divided into east and west regions, with the Mwenezi River serving as the dividing line for Mwenezi District and the Mundi River for Mberengwa District. Each half of the district was further divided into clusters based on the established Animal Health Management Centres (AHMCs) serving the communities, with dip tank catchment areas as sub-clusters. A total of 10 AHMCs (5 for Mwenezi and 5 for Mberengwa) were selected based on livestock production and animal disease profiles. From each AHMC, at least two dip tank catchment areas were randomly selected. Finally, a minimum of 4 villages served by each dip tank were randomly chosen, and within each selected village, households were systematically sampled for the interviews. For the purposes of administering the questionnaire, a total of 382 livestock owning households' representatives from the two districts were interviewed. The sample size was calculated using Sample Size Calculator by Raosoft, Inc. from an estimated population of 35 500 households and based on the 95% confidence level. (http://www.raosoft.com/samplesize.html). A total of 106 livestock farmers (55 males and 51 females) participated in focus group discussions (FGDs). Four sites per district within the areas where the survey was being conducted were purposively selected for FGDs. Participation in FGDs was voluntary and considered the first, up to a maximum of 15 participants to arrive at the site of the FGD. Key informants were selected based on their roles in veterinary services provision to smallholder farmers. The key informants were drawn from among livestock health experts, service providers, community leaders, regulatory authorities, and local government authorities. These included: Veterinary Department Officials, Medicines Control Authority, Local Government Authorities, Community Animal Health Workers and private companies involved with veterinary services. A total of 17 key informants were interviewed.

## 3.3. Ethical clearance and Data Collection

Ethical clearance for this study was obtained from the Women's University in Africa, and approval to enter into the study area was given by the Department of Veterinary Services. To gather data, a mixed-method approach was employed, integrating both qualitative and quantitative data. A convergent parallel design was used, where both quantitative and qualitative data were collected simultaneously to obtain multiple perspectives on the variables influencing farmers' preferences for veterinary service providers.

Data collection involved the use of a semi-structured questionnaire administered to 382 respondents using ODK collect, 8 focus group discussions (FGDs) with 106 participants, and interviews with 16 key informants. To be eligible for

participation, respondents had to be adults (over 18 years old), reside in the household for most of the year, and possess knowledge about the household's information. Prior to the interviews, the purpose of the survey was explained, and consent was obtained from all participants. Four FGDs, two for males and two for females, were conducted in each district to understand community animal health challenges, farmers' knowledge, attitudes, and perceptions of veterinary service provision, and their envisaged collective responsibility in the preferred system and sustainability mechanisms. Key informants included government and private veterinary service providers, as well as regulatory authorities. Verbal consent was obtained from all participants before each FGD or interview, and audio recordings were made. Participants' identities were kept anonymous to protect their privacy. The FGDs were conducted in the local Shona language, while interviews were conducted in the preferred language of the interviewee. Observations of relevant issues were also recorded throughout the data collection period. These included observations of livestock-related activities, such as cattle dipping sessions, livestock treatments, livestock management practices, and the state of veterinary and community infrastructure.

To ensure the validity and credibility of the findings, several due diligence measures were undertaken. All data collection instruments, such as questionnaires, interview, and focus group discussion guides, were pilot-tested to ensure that instructions for the interviewer were clear, respondents understood questions as intended, and the questions flowed smoothly. Any questions perceived as inappropriate or that made respondents uneasy were eliminated. During the study, the credibility of the qualitative findings was safeguarded through triangulation of methods, sources, and data collectors. This involved using multiple data sources, such as documented data, interviews, and focus group discussions, and using diverse methods to decrease the deficiencies and biases that come from any single method. The results from one method were used to enhance and clarify the results of another method.

The ethical clearance and data collection methods used in this study ensured the validity and credibility of the findings. The mixed-method approach, convergent parallel design, and triangulation of methods, sources, and data collectors were employed to gather comprehensive data on farmers' preferences for veterinary service providers.

## 3.4. Data Analysis

Descriptive statistics were employed to summarize and describe the characteristics of the sample, providing a comprehensive overview of the collected data. This included measures such as mean, median, standard deviation, and frequency distributions. Descriptive statistics were used to better understand the demographic and socioeconomic profiles of the smallholder farmers participating in the study, as well as their preferences for veterinary service providers (Hair et al., 2019). It provided insights into the distribution of variables and the central tendencies of the data, enabling a clear depiction of the farmers' preferences and characteristics.

To determine the factors influencing the preference of veterinary service providers by smallholder farmers, a Multivariate Probit (MVP) model was used. A multivariate probit model was ideal for this study as it simultaneously indicates the influence of a set of explanatory variables on choices of a veterinary service provider while accounting for potential correlations between unobserved disturbances and the nexus between veterinary service providers (Cappellari-Jenkins 2003, and 2006; Belderbos et al., 2004).

However, the MVP model has some inherent limitations. It assumes independence of irrelevant alternatives, meaning the ratios of choice probabilities are unaffected by addition or removal of alternatives. This may not always hold for this context as availability of different provider types varies locally. In addition, unobserved heterogeneity cannot be controlled for in MVP. This could bias estimates if related to observed factors.

The analysis was based on cross-sectional data, limiting ability to determine causal impact. The MVP also assumed correlations in disturbances across outcomes followed a multivariate normal distribution, which may not always be accurate.

Livestock farmers in this study had different veterinary service providers to choose from, including government, CAHW, and private sector. Considering the possibility of concurrent selection on veterinary service providers and potential correlations on the veterinary service providers, a multivariate probit model was appropriate to capture livestock farmers' variation in veterinary services selection and estimate several binary outcomes jointly.

Empirically, the following equation 3.1 shows the MVP.

$$Y^{*}_{ij} = \beta_{ij}X_{ij} + \varepsilon_i \left( j = Y_1, Y_2, Y_3 \right)$$

where $Y_{ij}^{*}$ is the latent variable, $Y_{ij}$ is the observed dummy variable for all the options such as;

$$Y_{ij} \int_0^1 \text{if } Y^{*} \, i^{0} \text{ otherwise } \forall j = Y_1, Y_2, Y_3 \quad j = Y_1, Y_2, Y_3$$

where $X_{i}j$ is a set of explanatory variables, $\beta_{ij}$ are the coefficients to be estimated, $Y_{i1}$ = 1 if a livestock farmer chooses government veterinary service provider, 0 = otherwise, $Y_{i2}$ = 2 if a livestock farmer chooses CAHW service provider, 0 = otherwise, $Y_{i3}$ = 3 if private veterinary service provider is chosen, while $\varepsilon_i$ is the error term.

The analysis was based on cross-sectional data. Before performing the multivariate probit, a Breusch-Pagan test was used to test the presence of heteroscedasticity. The results indicated the presence of heteroscedasticity, therefore, multivariate probit with robust standard errors was performed.

The multivariate probit regression analysis considered a range of variables that could potentially influence farmers' preferences. These variables included age, distance to the service provider, communication methods (e.g., cell phone usage), remittances, satisfaction levels, repeat treatments, socioeconomic status, historical dynamics, and access to subsidized veterinary drugs. By examining the coefficients and significance levels of these variables, the analysis identified the key drivers shaping farmers' choices of veterinary service providers.

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Qualitative data was analyzed using theoretical thematic analysis to identify the main themes and synthesized to distil the main messages echoing throughout.

## 4. Results and discussion

### 4.1. Demographic data and resources

A total of 382 livestock farmers made up of 59.2% (n=226) males and 40.8% (n=156) females, of which 78.3% were married participated in the household survey. A total of 106 people made up of 55 males and 51 females participated in eight focus group discussions. The majority (65.45%), of the survey respondents were the household heads. The main occupation of the respondents (85.6%) were full-time farmers, while 8.9% were in formal employment and 3.7% running some form of business. In terms of education, 5% never went to school, 25% were primary school dropouts, 64.8% did secondary education, 7% had some tertiary qualification, and 1% held a college degree. There was no significant difference between the availability and access to veterinary services providers among the different gender groups.

Veterinary infrastructure in the two districts included dip tanks, livestock handling facilities, livestock markets and boreholes which were shared with humans. Most of the infrastructure is not in a very good state and requires maintenance. Some areas had perennial rivers and dams which provided water for livestock.

### 4.2. Livelihoods

The respondents had multiple sources of livelihoods. The main sources of livelihoods of the respondents in terms of contribution were ranked in first place crop production, second was livestock production and in third place was remittances. A significant number of households in the two districts have at least a family member in South Africa, from where they get remittances and occasionally some veterinary inputs. On average livestock ownership was 9.7 Tropical livestock units (TLU) per household. TLUs are livestock numbers converted to a common unit. The majority of the HH (78.8%) generate income of less than $100 per month, with more than half of these having monthly incomes of below $50 a month. Figure 4.1 shows the major livelihood sources for the smallholder farmers in Mberengwa and Mwenezi Districts.
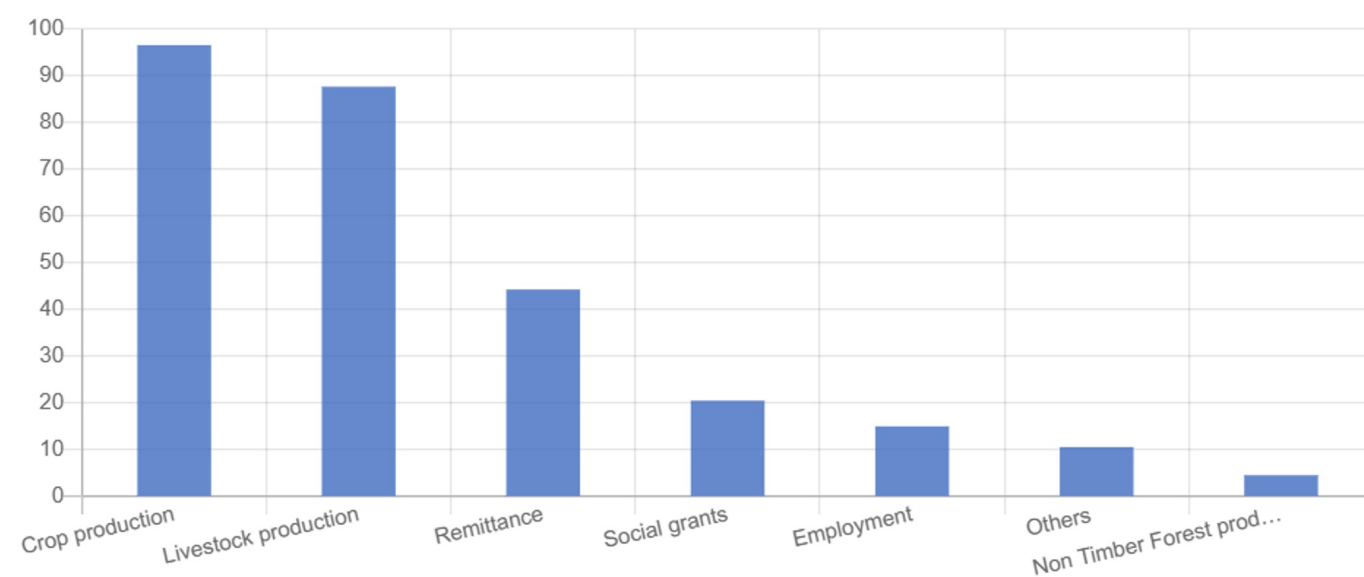


Figure 4. Major livelihoods

**Figure 1.** Major livelihoods sources

Livestock serves multiple functions within the two districts, which included draught power (94% of respondents), cash sales (87.2%), manure (78%), meat (66.8%) and milk (65.7%). This aligns with the findings from FGDs, where it was made clear, that apart from poultry, the greatest value derived from livestock is in its role in promoting food security through supporting crop production (draught power, manure and transport), while income is generated from the small ruminants and poultry. The sale of cattle was very rare and often only done under special circumstances.

## 4.3. Major constraints to livestock production

Animal diseases were identified by the majority (67.5%) of respondents as the major constraint to livestock production in the two districts, aligning with the findings of Mutambara et al. (2013) in Gutu District. The most common diseases reported were tick-borne diseases, heartwater, babesiosis, anaplasmosis, and theileriosis, with heartwater being the most prevalent tick-borne disease, rated as the most dominant by 57.3% of the respondents. Other significant diseases included black leg, Lumpy skin disease, internal parasites, mastitis, New Castle Disease, Fowlpox, internal and external parasites, pulpy kidney, rabies, and abscesses. All these diseases are preventable through vaccination, dipping, or prophylactic treatment.

The occurrence of these diseases was primarily categorized as seasonal (63.6%), with 28% regarded as infrequent without a defined pattern. During FGDs, it was highlighted that most of the diseases occurred between November and April, which is the rain season.

Other animal health-related constraints include irregular and ineffectiveness of dipping services. Shortages of dipping chemicals and water were cited by DVS officials as issues affecting dipping services. There were also issues of shortage of staff, with some dip tanks not having dip attendants. Farmers expressed dissatisfaction with the dipping services, citing the lack of transparency in the mixing of dipping chemicals and non-replenishment of acaricides during dipping sessions, raising suspicions of inadequate chemical application.

The supply of veterinary drugs was also a significant challenge. Historically, AHMCs used to stock veterinary drugs for smallholder farmers to buy, but this arrangement has since been abandoned. During FGDs, farmers indicated that the unavailability of veterinary drugs through formal supply channels forces them to buy drugs from roadside markets, popularly known as "baccosi," risking counterfeit or improperly handled drugs. sellers often have limited or no knowledge of the drugs and do not provide appropriate instructions for use, resulting in improper drug use. In interviews with veterinary drug supply companies, they cited issues of distance and other attendant transaction costs against anticipated business volume. They expressed openness to public-private partnerships to stock veterinary drugs at AHMCs, but raised concerns about accountability issues and security.

## 4.4. Veterinary Services Providers

A multivariate analysis of the three significant service providers, namely government veterinary services, CAHWs, and private sector companies, was conducted. As depicted in Table 1 below, some of the variables used in the MVP model were significant at more than one veterinary service provider, while other variables were significant for some providers but not for others. Seven of the twelve explanatory variables included in the MVP model significantly affected government veterinary services choice, three variables significantly affected CAHW choice, and three variables significantly affected private veterinary services choice at 1%, 5%, and 10% significance levels.

It is important to situate access to veterinary services within the broader livelihood challenges smallholder farmers face in Zimbabwe. Smallholder agriculture is the mainstay of the national economy, contributing over 70% of employment. However, farmers contend with recurrent droughts exacerbated by climate change, degradation of agricultural lands, lack of financing and inputs, and limited infrastructure. Average landholding sizes have declined significantly since the fast-track land reform program in the late 1990s. As a result, most smallholders practice marginal subsistence agriculture characterised by low productivity.

Livestock plays a crucial role in household food security and resilience given the risks associated with crop production. However, animal diseases pose a major threat within the context of smallholder farmers' limited resources and vulnerability. Access to effective and affordable veterinary services is thus critical not only for livestock health and productivity, but also for supporting smallholder livelihoods and agricultural development more broadly. The factors influencing farmers' choice of veterinary provider options must be understood through this overarching lens of poverty, constraints on agricultural production, and rural livelihood insecurity.

Subsidized veterinary drugs and repeat treatments positively influenced the likelihood of choosing government veterinary services. This was due to the availability of government-provided tick grease, accessible by farmers from DVS at AHMCs. Distance to the nearest veterinary service provider positively influenced the likelihood of choosing government and private veterinary service providers at 1% and 5% significance levels, respectively. This contradicts the findings of other scholars (Onono et al., 2013; Lamichhane & Shrestha, 2012; Singh & Datta, 2013), who all found that distance would influence the likelihood of choosing CAHWs. The finding may reflect improved communication facilities, such as cell phones, which have made distance less relevant. Both government and private veterinary services are vital in livestock health and productivity due to their technical expertise, which may be given more consideration than cost.

On the other hand, distance to the nearest veterinary service provider negatively influenced CAHW choice at a 1% level of significance. The findings may have been influenced by the lack of availability of CAHWs in some study areas. These results suggest that farmers located within the same villages as CAHWs are more likely to prefer CAHWs. This finding echoes Okello et al.'s (2021) findings, who found a positive effect of distance to a veterinary clinic on veterinary services utilization when technical competence is crucial.

Repeat treatment was significant at 5% and 1% significance levels with a negative likelihood in the choice of both government and private veterinary service providers. This result signifies that there are treatment failures that have occurred due to delayed response times of service providers. Additional transaction costs are likely to be incurred when

seeking second treatment from other service providers, giving preference to nearby service providers. The result is in support of Lamichhane and Shrestha's (2012) postulation that professional qualification is not critical in the choice of service provider when farmers opt for alternative sources of para-veterinary.

Age of the household head significantly influenced the probability of choosing government veterinary services at a 1% significance level. Older farmers are more likely to choose government veterinary services due to their knowledge accumulation on veterinary service provision. This could reflect the level of trust built over years, as government veterinary services have been the only available service provider in some areas. CAHWs were only recently introduced in most areas, and older farmers might be less amenable to change compared to younger generations. This agrees with Lamichhane and Shrestha's (2012) findings, who found age to have an inverse relationship with the probability of choosing CAHWs.

Quality information from service providers positively influences the choice of government veterinary services, as expected due to their superior technical knowledge and skills. Government information on livestock is crucial from the farmer's experience with livestock keeping. The variable decreases the likelihood of choosing private veterinary service providers at below 1% significance level. This finding contradicts K'Oloo and Ilatsia's (2015) findings, who found that farmers prefer private veterinary services due to their availability and quality of service and information they offer. During FGDs, participants expressed satisfaction with the quality of veterinary drugs and advice on the use and consistency of supply of dipping chemicals for those in the private sector, which supported sustainable dipping models. Farmers also expressed dissatisfaction with the lack of transparency in the manner in which dipping services were handled by government veterinary services.

The number of TLU had a positive relationship with the choice of CAHW at a 1% level of significance. This could reflect the frequency of service requirements which makes them prefer a service provider with the least transaction costs. From the study, the respondents highlighted that as the TLU increases, routine control measures are required to maintain a healthy and productive stock, increasing the need for vaccination and services so it was ideal to choose CAHWs who are the closest. These results are in contrast with the findings of K'Oloo and Ilatsia, (2015), who found that TLU had a positive relationship with the demand for government service providers. Farmers who receive remittances and those with cell phones are more likely to use the services of government veterinary service and the two variables were not significant for other service providers. The remittances may act as incentives for Government veterinary technicians who may be providing preferential service provision. This is in tendem with the findings of Amankwah et al., (2014), who postulated that government veterinary officials in Ghana, provided preferential services to well-to-do households who are able to provide them some incentives.

Table 1 shows the pairwise correlation coefficients between the error terms of the three equations of veterinary service providers. All the three pairs of the estimated correlation coefficients were statistically significant implying an interdependence among the three veterinary service providers.

**Table 1.** MVP estimations for determinates of livestock farmers' choice of service providers.

| | Government Veterinary | | E4_CAHW | | Pvt_veterinary_ | |
|---|---|---|---|---|---|---|
| | Coefficient | RSE | Coefficient | RSE | Coefficient | RSE |
| Age_household head | 0.7980*** | 0.2998 | -0.4620* | 0.2394 | -0.3091 | 0.3508 |
| A2_Gender_of_respondent | -0.1428 | 0.1820 | 0.2368 | 0.1572 | 0.0635 | 0.2005 |
| A4_Education_Level | -0.4494 | 0.3279 | -0.0147 | 0.2804 | 0.1440 | 0.4030 |
| B8_In_the_past_12_months_did | 0.7541 | 0.5296 | 0.2648 | 0.3971 | 0.2218 | 0.5860 |
| cell_call_sp | 0.8057*** | 0.2074 | 0.0861 | 0.2009 | 0.4252 | 0.3025 |
| E2_dist_to_veterinary_service_provider | 0.9200*** | 0.1955 | -0.6041*** | 0.1523 | 0.9324** | 0.3678 |
| E7_time_sp_respond | -0.3439 | 0.3565 | 0.4671 | 0.3158 | 0.1061 | 0.3395 |
| E13_second_treatment_dummy | -0.4642*** | 0.1849 | -0.2167 | 0.1605 | -0.8489* | 0.3188 |
| F11_Do_you_have_access_to_subs | -0.9345*** | 0.2615 | | | | |
| TLU | -0.0152 | 0.0143 | 0.0405*** | 0.0126 | 0.0150 | 0.0191 |
| Remittances | 0.6509*** | 0.1852 | -0.1703 | 0.1517 | -0.1385 | 0.1893 |
| E19_Are_you_satisfie_tion_you_ar | 0.7811** | 0.3555 | -0.1703 | 0.3170 | -0.7558* | 0.4041 |
| E6_cost_to_SP | 0.0146 | 0.0385 | | | 0.0548 | 0.0510 |
| pvt_vet_att_cost | | | | | -0.0015 | 0.0013 |
| F6_How_preferred_veterinary_drug | | | -0.2238 | 0.2824 | | |
| cost_to_vet_drug_supplier | | | -0.0242* | 0.0143 | | |
| F1_vet_drug_cost_exp | | | | | 0.0024 | 0.0066 |
| _cons | 0.8989 | 0.9136 | -0.9347 | 0.5823 | -1.4730 | 0.8259 |
| Number of obs | | | | | 382 | |
| Log likelihood | | | | | -414.8 | |
| Wild χ2 (40) | | | | | 170.89 | |
| Prob > χ2 | | | | | 0.0000 | |

*Likelihood ratio test of Likelihood ratio test of rho21 = rho31 = rho32 = 0: chi2(3) = 19.8706 Prob > chi2 = 0.0002*

## 5. Conclusion and policy implication

The findings of this study provide valuable insights into the factors that significantly influence smallholder farmers' preferences when selecting veterinary service providers and accessing veterinary services in Zimbabwe. The study highlights the complex interplay of various variables in the decision-making processes of smallholder farmers, including socio-economic factors, accessibility, and farmers' knowledge and understanding of the services available. By employing a mixed-method approach, the study gained an in-depth understanding of the social norms that shape farmer decision-making processes while quantifying the challenges and transaction costs involved.

The study emphasizes the critical and specific roles that different service providers, namely government veterinary services, private sector entities, and Community Animal Health Workers (CAHWs), play in the veterinary service provision landscape. The study suggests that a collaborative approach involving multiple stakeholders is necessary to adequately

meet the demand for veterinary services by smallholder farmers. An ideal arrangement would be to establish a structure starting at the village level, with community-based cadres such as CAHWs serving as the first line of reporting. With further training, dip attendants can be converted into CAHWs who would act as first responders.

To enhance the delivery of quality and cost-effective veterinary services, the study recommends integrating CAHWs into the formal government veterinary system, with a direct reporting line to the local government veterinary technician. This integration could be modeled after the village health worker system implemented in the human health sector. Standardizing the training curriculum for CAHWs and administering it through the DVS is crucial. This will help ensure uniformity of skills and knowledge, which can pave the way for their legal recognition. Any non-governmental organizations (NGOs) involved in promoting CAHW programs should only do so in collaboration with the DVS and adhere to the standard curriculum.

The study also identifies an opportunity to revitalize the veterinary drug supply through public-private partnerships. Ensuring that Animal Health Management Centres (AHMCs) are well-stocked with quality veterinary drugs and tick control remedies, as recommended in the sustainable dipping strategy, can be achieved through partnerships. The Medicines Control Authority of Zimbabwe (MCAZ) should delegate authority to the DVS for the control of drug sales in rural areas. Supplying drugs through AHMCs would significantly reduce transaction costs for veterinary drug supply companies and farmers. This can be facilitated through a commission or profit-sharing mechanism between the drug companies and the DVS.

In terms of policy and legislation, there is a need to review the current framework governing veterinary services provision. Recognizing para-professionals and CAHWs within the legal and policy framework is important. Policies and legislation should promote pluralism in the provision of veterinary services, fostering collaboration among different service providers (Mangesho et al., 2021). An integrated referral system that incorporates CAHWs, government veterinary services, and the private sector would be instrumental in providing cost-effective veterinary services to smallholder farmers.

In conclusion, this study underscores the multifaceted nature of smallholder farmers' decision-making processes when choosing veterinary service providers and accessing veterinary services. It highlights the significance of considering situational and contextual factors and fostering collaboration among various stakeholders to effectively address the diverse needs of smallholder farmers. The recommendations put forth in this study provide valuable insights for policymakers, stakeholders, and organizations involved in enhancing veterinary service provision and supporting the livestock sector in Zimbabwe's smallholder communities.

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