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Research Article

Factors Influencing Smallholder Farmers' Preference for Veterinary Services Providers in Zimbabwe

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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=106), 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, with coordination enabling 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.

1. Introduction

Livestock production plays a crucial role in the livelihoods of smallholder farmers in Zimbabwe, contributing to food security and income generation. However, the presence of animal diseases poses a significant threat to the productivity and profitability of livestock enterprises in this sector. Access to quality veterinary services is essential for the prevention,

control, and treatment of animal diseases, ensuring the health and well-being of livestock.

In Zimbabwe, smallholder farmers have access to multiple veterinary service providers, including government veterinary services, private sector entities, and Community Animal Health Workers (CAHWs). The preferences of smallholder farmers for these different 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 problem at hand is the limited understanding of the factors that shape smallholder farmers' preferences for veterinary service providers in Zimbabwe. Previous research has primarily focused on the availability and accessibility of veterinary services in rural areas (Kusina & Kusina, 2018; Scoones et al., 2010). However, there is a dearth of empirical studies that systematically examine the factors influencing smallholder farmers' decision-making process when selecting a preferred veterinary service provider.

This study aims to address this research gap by comprehensively analyzing the factors that influence smallholder farmers' preference for veterinary service providers in Zimbabwe. By identifying these factors, policymakers and stakeholders can develop targeted interventions to enhance the utilization of veterinary services and improve livestock health management practices.

The objectives of this study are two-fold: (1) to identify the key variables that significantly influence smallholder farmers' preferences for veterinary service providers, and (2) to assess the relative importance of these factors in shaping farmers' decision-making process. By achieving these objectives, this study will contribute to the existing literature on veterinary service provision and provide practical insights for policymakers and practitioners.

To accomplish these goals, a mixed-method approach will be employed, integrating quantitative data from a survey questionnaire and qualitative data from in-depth interviews. The survey questionnaire will collect information on farmers' demographic characteristics, livestock management practices, satisfaction levels with different service providers, and their preferences for specific attributes of veterinary services. The in-depth interviews will provide a deeper understanding of farmers' decision-making processes and the contextual factors that influence their preferences.

By examining the factors influencing smallholder farmers' preference for veterinary service providers, this study will generate valuable knowledge to inform policy and practice. It will help policymakers and stakeholders design targeted interventions that cater to the specific needs and preferences of smallholder farmers, ultimately improving access to quality

veterinary services and enhancing livestock health outcomes in Zimbabwe.

2. Background to the problem

Zimbabwe has suffered from multiple animal disease outbreaks, which have threatened the livelihoods of rural households (DVS, 2022). For smallholder farmers, the loss of livestock has a devastating impact on the family's livelihood and curtails socio-economic development (Ilukor et al, 2015). The risks posed by animal diseases are believed to be higher for smallholder livestock producers as compared to their commercial counterparts (Hernandez-Jover et al. 2015). This is partly attributed to the poor infrastructure and limited resources, which makes the provision of veterinary services particularly very difficult in smallholder areas (Jilo et al 2016). Inadequate or weak veterinary systems exacerbate the extent of livestock losses and the negative impact animal diseases have on the sustainability of livelihoods.

The veterinary services sector consists of a range of service providers with varying technical qualifications offering animal health services in different forms. One fundamental requirement for the delivery of quality veterinary services is that the system is appropriately staffed, by personnel (veterinarians and paraprofessionals) with appropriate competencies to allow for their functions to be undertaken effectively and efficiently and an effective structure and supportive legislative framework (WOAH, 2019). The underlying principle of an effective arrangement of veterinary services is to ensure that all service providers are performing their responsibilities effectively, in a sustainable, coordinated, and coherent manner to effect animal disease prevention measures and ensure early detection and early response to diseases.

The main veterinary services institutions in Zimbabwe are the public sector, private sector, paraprofessionals, and Community-based Animal Health Workers. The public sector through DVS has traditionally been the main provider of veterinary services in smallholder farming areas. The dominance of the public sector in the delivery of veterinary services to smallholder farmers appears to derive its justification from the preposition that smallholder farmers are poor and as such will not be able to pay for commercially orientated private services (Mangesho et al. 2021). Considering that veterinary services play an important role in supporting the livelihoods of

livestock-dependent resource-poor people, thereby contributing towards poverty reduction, and given the fact that poverty reduction is a public good, governments consider it their responsibility to provide these services.

The challenges of the public veterinary services are well documented and were the reason behind some of the reforms that were undertaken in the past. These include among others, inadequate numbers and absenteeism of professional and technical staff from their duty stations, poor resources and poor investment in the sector, which has resulted in DVS providing inadequate services (WOAH, 2014). Smallholder livestock owners with low resources may 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). 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).

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 the smallholder farming sector. 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).

Veterinary pharmaceuticals are one of the most critical means of controlling livestock diseases as prophylaxis and cure. The shortage of suppliers of quality pharmaceuticals in the smallholder farming areas has created opportunists who ride on the information asymmetry of the farmers to sell falsified and substandard drugs. Leonard et al 2017 noted in their research of veterinary services in the Congo that more than 40 per cent of the veterinary products on the market in South Kivu were of substandard quality. The supply of veterinary pharmaceuticals is one area where the private sector may play an important role.

3. Literature Review

Animal diseases are one of the major constraints on livestock production in the smallholder sector of Zimbabwe (Mutambara et al 2013). A large number of livestock in the smallholder sector do not achieve their productivity potential because of death due to diseases, or their productivity is negatively affected by production-limiting diseases and disorders (Donadeu et al 2019). The risks posed by animal diseases are believed to be higher for smallholder livestock producers as compared to their commercial counterparts (Hernandez-Jover et al. 2015). This is partly attributed to the poor infrastructure and limited resources, which makes the provision of veterinary services particularly very difficult in smallholder areas (Jilo et al 2016). Inadequate or weak veterinary systems exacerbate the extent of livestock losses and the negative impact animal diseases have on the sustainability of livelihoods.

Veterinary services can be classified as curative services, preventive services, production of pharmaceuticals, human health protection, and advisory and extension services (Desta 2015). Curative veterinary services involve the diagnosis and treatment of diseased animals and the control of production-limiting disorders (Amankwah et al 2014). Preventive veterinary services include all interventions to prevent the transmission or occurrence of disease (Amankwah et al 2014). Production of pharmaceuticals refers to the production of veterinary vaccines and medicines used for preventive and curative purposes and the supply of biological products such as semen (Smith 2001). The availability and quality of veterinary pharmaceuticals are at the core of animal disease control and present a lot of opportunities for public-private partnerships. Human Health protection, also referred to as veterinary public health encompasses all sanitary measures aimed at protecting humans from diseases of animal or animal source foods origin. Inspection of live animals at the markets and meat inspection at abattoirs are examples which fall under this category (Amankwah et al 2014). Veterinary Advisory and Extension Services, which is sometimes referred to as promotive veterinary services includes all management measures designed to increase the productivity of the animal and its general health. Extension services capacitate the farmers to practice livestock management measures which reduces disease risks within the herd and becomes an effective first responder.

Choice of Veterinary Services Providers

The farmers' choice of veterinary service providers is influenced by a number of factors or variables. Onono et al., (2013) empirically analysed the determinants for the choice of animal health providers in Kenya using descriptive statistics and the Cox proportional hazard regression model. Their results showed that the time spent when seeking animal health services and transport costs positively influenced the probability of choice for service providers. The distance covered negatively influenced the probability of choice for service providers. Analysis of the factors that affect farmers' choice for major actors among veterinary service providers in village areas of the Kaski district of Nepal showed that village animal health workers (VAHWs) were the most preferred service providers followed by veterinarians and mid-level technicians (Lamichhane and Shrestha, 2012). The farmers' age and education level had a significant

inverse relationship with the probability of choosing any of the three service providers. From the study findings, the main choice-specific attribute with a significant impact on the choice probability was the distance to the preferred service provider. Since there was a high preference for VAHW, this suggests the possibility of poorly trained service providers dominating the veterinary service market in village areas of the Kaski district.

On the other hand, results from an exploration of veterinary service supply to rural farmers in Namibia by Haakuria et al. (2020) identified themes that were access to veterinary services and advice, veterinary medicines supply chain, farmer knowledge and understanding. The study results indicated weaknesses in the veterinary medical products distribution channel and the corresponding availability of communicated advice and guidance. In a study of the importance of socio-economic and institutional factors in the use of veterinary services by smallholder dairy farmers in India, Singh et al. (2013), indicated a proportional relationship between veterinary services available within the village and the use of these services. The study revealed that the distance of availability of veterinary services positively influences the farmer's decision to use the same. Moreover, the educational status of the head of a household, formal training in agricultural practices and continuation of agriculture as a profession had a positive influence on the use of veterinary services.

Mangesho et al (2021), used a mixed methods approach to identify and understand animal health-seeking practices among Maasai pastoralists in Tanzania. The results indicate that increasing age, education, observance of treatment failure, and herd disease burdens were associated with greater odds of seeking out health services. The study findings argue that patterns of animal health seeking among the Maasai are partially the consequence of their high confidence in their own abilities in livestock disease and treatment and generally low confidence in the skills of animal health service providers. The results link this high sense of self-efficacy to the culturally engrained process by which Maasai develop mastery of animal health and how the roles and norms in Maasai culture surrounding animal health influence Maasai perceptions of animal health professionals. K'Oloo et al (2015), examined the perceptions of livestock farmers regarding service providers and analysed the factors that influence their choice of alternative service providers in Kakamega County. The empirical analysis shows that private animal health

assistants (PAHAs) were preferred more than government animal health assistants (GAHAs) and non-trained service providers (NTSPs) due to accessibility; attitude; access to information; and service provision on credit. However, in terms of treatment cost, PAHAs were perceived to be more expensive than GAHAs and NTSPs.

Gizaw et al. (2021) described the key public and private sector service providers identified through household surveys included livestock extension agents, public/official veterinarians and CAHWs, drug shops, traditional healers, and private veterinarians. The survey results clearly showed that livestock keepers' access to, use of and satisfaction with animal health services significantly varied across livestock production systems, geographic locations, socioeconomic strata, and service providers. Wealth (measured by livestock owned), gender and age also had significant effects on the use of services and expenditure on services. Satisfaction with services was evaluated based on four measures, namely availability, accessibility, quality, and timeliness of services.

In Zimbabwe, Mutambara et al. (2012) established a relationship between socio-economic factors and expenditure on veterinary services. The demand for veterinary services had a positive correlation with the number of livestock units owned, income levels, level of education and assets owned. In another study again in the Gutu District of Zimbabwe, Mutambara et al. (2013) established that the demand for the services of CAHW (45%) was much higher than that of DVS (20%) and that the CAHW system was a viable alternative animal health delivery system already embraced and being used by smallholder farmers.

4. Materials and methods

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.

Sampling Procedure

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 in those areas. A multi-stage sampling procedure was adopted to ensure the chosen samples were representative of the districts and their respective production systems.

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 purposively selected, with 3 AHMCs from the East and 2 from the West for each district. From each AHMC, at least two dip tank catchment areas were randomly selected. Finally, a minimum of 4 villages served by a dip tank were randomly chosen, and within each selected village, households were systematically sampled for the interviews.

Data Collection

This study employed a mixed-methods approach to understand and explore the arrangements for the provision of veterinary services to the smallholder sector in the two districts. Combining quantitative and qualitative methods allows for a comprehensive understanding of the phenomenon under study, surpassing the insights provided by using only one method (Panya and Nyarwath, 2022). In this study, a convergent parallel design was utilized, where both quantitative and qualitative data were collected simultaneously to obtain multiple perspectives on the variables influencing farmers' preferences for veterinary service providers. The integration of data occurred during the analysis phase, where the two datasets were merged for triangulation and complementarity of the findings.

Data collection involved the use of a semi-structured questionnaire administered to 382 respondents, 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. Throughout the data collection period, observations of relevant issues were also recorded.

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 allowed for a better understanding of 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.

Additionally, multivariate probit regression analysis was used to identify the significant factors influencing farmers' preferences for veterinary service providers. This statistical technique allowed for the examination of multiple independent variables simultaneously while accounting for potential correlations among the dependent variables. By estimating the coefficients of the independent variables, the analysis determined the strength and direction of their effects on the probability of preference for a particular service provider (Gujarati & Porter, 2009).

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 (Maddala, 1983).

The results of the analysis provided valuable insights into the factors that significantly influenced smallholder farmers' preferences. This information can be utilized to inform policy and decision-making processes aimed at improving veterinary service provision for smallholder farmers in Zimbabwe. Understanding the factors that drive farmers' preferences can help tailor interventions and support systems that meet their specific needs and improve the overall effectiveness of veterinary services in the smallholder sector (Wooldridge, 2010).

5. Results

Demographic data and resources

A total of 382 livestock farmers made up of 59.2% (n=226) were 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.

Livelihoods

The majority of the respondents (96.6%), selected crop production as the main source of livelihood, followed by livestock production (87.7%) and in third place was remittances (44.2%). 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.

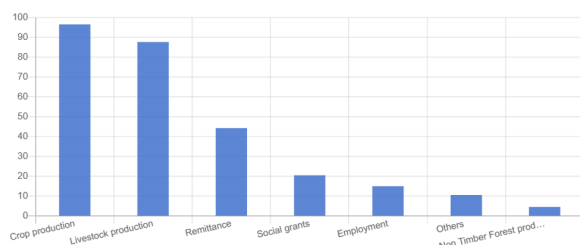


Figure 1. Major livelihoods sources

Livestock serves multiple functions within the two districts, which included draught power (94%), 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.

Major constraints to livestock production

Animal diseases were identified by the majority (67.5%) of the respondents as the major constraint to livestock production in the two districts. This aligns with the finding of Mutambara et al. (2013) in Gutu District where 100% percent of the respondents, identified livestock diseases as the major constraint to animal production. The most common diseases reported are tick-borne diseases, heartwater,

babesiosis, anaplasmosis and theileriosis, with heartwater being the single most prevalent tick-borne disease rated the most predominant tick-borne disease by 57.3% of the respondents. Other diseases of significant importance include black leg (selected by 57.6% of the respondents), Lumpy skin disease (51.8%), internal parasites (49%), mastitis, New Castle Disease, Fowlpox, internal and external parasites, pulpy kidney, rabies, and abscesses. All the common diseases reported are preventable either through vaccination, dipping or prophylactic treatment. The occurrence of the diseases was categorised primarily as seasonal (63.6%) with 28% regarded as infrequent without a defined pattern. During FGDs, it was highlighted that apart from nutrition-related disorders, most of the diseases occurred between November and April.

The other animal health-related constraints include irregular and ineffectiveness of the dipping services. Shortages of dipping chemicals and water were cited by DVS officials as some of the issues affecting dipping services. There were also issues of shortage of staff with some dip tanks not having dip attendants. The farmers also expressed dissatisfaction with the dipping services. During focus group discussions, farmers bemoaned the lack of transparency in the mixing of the dipping chemicals and non-replenishment of the acaricide during dipping sessions, raising suspicion that inadequate chemicals were probably being applied to the dip tanks.

The supply of veterinary drugs was also a major 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 is forcing them to buy drugs from roadside markets popularly known as “baccosi” risking buying counterfeit or improperly handled drugs. Often the sellers have limited or no knowledge of the drugs and do not offer appropriate instructions for use resulting in an improper use of veterinary drugs. In interviews with the veterinary drugs supply companies on why they were not supplying the smallholder sector, they also cited issues of distance and other attendant transaction costs against the anticipated volume of business. They were open to some public-private partnership to stock veterinary drugs at AHMCs although they expressed concerns about accountability issues and security.

Veterinary Services Providers

The main veterinary service provider in the two districts was the government veterinary services (86.7% of the respondents) through the veterinary technical staff at the AHMCs supported by a dip attendant, whose role is exclusively cattle dipping and inspection. The services offered include preventive veterinary services mainly in the form of dipping services and mass vaccinations. They provide veterinary advisory services and treatment of diseases. In some of the areas, as articulated during FGDs, they were the only service provider available. At the time of the study, all the veterinary technicians had been provided with motorcycles. In interviews with some of the technicians, they highlighted their main challenges were inadequate fuel allocation, lack of veterinary kits or equipment and other resources, poor supply of veterinary drugs and the area covered by one veterinary technician was too big, which in some cases were up to a radius of 50 km, and depending on the service demand makes them not always be available. This also affected their response time. Veterinary technicians were neither allowed to charge a fee for their services nor sell personal veterinary drugs.

CAHWs were reported to have provided preventive veterinary services to 13.9% of the respondents and curative services to 24.4% of the respondents. They were also identified as one of the providers of veterinary advisory services. The presence of CAHWs was limited only to certain specific areas where non-governmental organisations had run some livestock projects. By virtue of their location, CAHWs responded much quicker. There is no standard curriculum for training CAHWs and their work is not governed by any policies or regulations and as such often work under no supervision. Those trained by NGOs had veterinary kits, with basic equipment and drugs. One of their key challenges as alluded to during the interviews is the availability of veterinary drugs. Mixed feelings about CAHWs were expressed by government veterinary officials and the private sector. Some within government services view CAHWs as competition while others see huge potential if they were to be formalised. The private sector views them as a potential veterinary drugs distribution conduit and would be happy to work with them.

Other service providers included ethnoveterinary practitioners, drug supply companies and non-governmental organisations. Distance to the nearest service provider for preventive, curative and promotive veterinary services was less than 10km for

66.5% of the respondents. This is considered a walkable distance. At the other extreme end, 4.7% of the respondent had their nearest service provider more than 21km away. The main means for contacting the service provider was through cell phone (83%) or simply walking there (56.02%) a few respondents have to either use their own transport or catch public transport. The average cost of reaching a service provider was US\$1.58.

The government veterinary services were selected as the main provider of veterinary advisory services by 80.4% of the respondents. The availability of veterinary drugs was rated as not available or rarely available by 34.3% of the respondents, sometimes available by 38% and available by only 27.7%. Distance to service centres or towns where most of the veterinary drugs are found was the main challenge and constituted the highest transaction cost. The main source of drugs was the drug supply shops (67.8%), animal health management centres (18.7%), and informal traders (10.7%). Only 1% of the respondents obtained veterinary drugs from CAHWs and 2% from other farmers. The choice of source of drugs was influenced by the ability to supply a wider range of products offered (29.6%), quality of drugs (20.9%), nearest source or no alternative source (26.6%) and offering best price or credit terms (8.9%). The average distance to the preferred drug suppliers was more than 21km for 43% of the respondents. The transaction costs of accessing the drugs were said to be very high. Only 25% of the respondents had accessed some subsidised drugs either provided by the government (91.6%) such as tick grease or by NGOs (6.3%) or veterinary drugs supply companies during feed days or promotions (2.1%). The average amount spent on the purchase of vet drugs in the past 12 months was US\$20.09. Distance to service providers was rated as the major constraint (49.2%) followed by an inadequate number of service providers (41.3%) and the cost of the services (40.7%).

Determinants of preferred Veterinary Services providers

A multivariate analysis of the three significant service providers namely government veterinary services, CAHWs and private sector veterinary drugs supply companies were conducted. The Wald chi-square test (Wald chi-square (36) = 142.77; Prob > chi-square = 0.0000) is highly significant at a 1% level, showing all regression beta coefficients jointly significant and all the explanatory variables significant. The simulated

maximum likelihood ratio test (LR test: Chi-square (3) = 21.2081; Prob > chi-square=0.0001) is strongly significant at a 1% level indicating that the multivariate probit model fits well with the data. Consequently, the null hypothesis that all (rho) values are jointly equal to zero is rejected, signifying the model's goodness of fit and supporting the use of the multivariate probit model over single probit or logit model. This shows that a single estimation of veterinary service providers' choices tends to be biased, and those household decisions when choosing the three veterinary service providers are not mutually independent.

As illustrated in Table 1 below some of the variables used in the MVP model were significant at more than one veterinary service provider whilst other variables were significant for some veterinary service providers but not for the others. Seven of the twelve explanatory variables included in the MVP model significantly affected government veterinary services choice, three variables significantly affected CAHW; and three variables significantly affected private veterinary services choice at 1, 5 and 10 percent significance levels. Subsidised veterinary drugs and repeat treatments influence positively the probability of choosing government veterinary services. This was so due to the availability of government-provided tick grease which was accessible by farmers from DVS at AHMCs

Distance to the nearest veterinary service provider influences positively the likelihood choice of government and private veterinary service providers at 1% and 5% significant levels, respectively. Both government and private veterinary services are vital in livestock health and productivity; consequently, an increase in distance to veterinary services, increases transactional costs, such as transport costs. These findings echo Onono et al., (2013) and Okello et al., (2021) who found a positive effect of distance to a veterinary clinic on veterinary services utilization. On the other hand, distance to the nearest veterinary service provider influences negatively CAHW at a 1% level of significance. These results suggest that livestock farmers located within the same villages with CAHW are more likely to prefer CAHW. These findings are in tandem with the results of Onono et al., (2013), which found an inverse relationship between distance to veterinary clinic and veterinary services provider.

Repeat treatment: Expectedly, the repeat treatment variable is significant at 10% with a negative likelihood in the choice of both government and

private veterinary service providers. Additional transactional costs likely to be incurred when seeking second treatment from other service providers give preference to nearby service providers. This is an acknowledgement of the technical expertise within these SPs to come up with a correct diagnosis and correct use of appropriate veterinary drugs. The result is in support of Lamichhane and Shrestha, (2012) who postulated that professional qualification is not critical in the choice of the service provider when farmers opted for alternative sources of paraveterinary. Age: Expectedly, the age of the household head highly significantly influences the probability of choosing the government veterinary service provider option at a 1% significance level. Older age links to knowledge accumulation on veterinary service provision, and thus older livestock farmers use government veterinary services, who have been always in the area. This could be a reflection of the level of trust placed built over years as in some cases they are the only service provider available.

When the level of satisfaction with services is considered, quality information from service providers positively influences the choice of Government Veterinary Services. 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 supported sustainable dipping model pilot. Farmers also expressed distrust and dissatisfaction with the lack of transparency in the manner in which dipping services were handled by the government veterinary services.

The number of TLU had a positive relationship with the choice of CAHW at a 1% level of significance. This could be a reflection of 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 may align 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.

Multivariate probit (SM, # draws = 5)		Number of obs = 382				
		Wald chi2(40) = 170.89				
Log pseudolikelihood = -414.77878		Prob > chi2 = 0.0000				
	Coefficient	Robust std. err.	z	P> z	[95% conf. interval]	
Government_Veterinary_Services						
Age_hhd	.7979513	.2997636	2.66	0.008	.2104254 1.385477	
A2_Gender_of_respondent	-.1428451	.182044	-0.78	0.433	-.4996447 .2139544	
A4_Education_Level	-.4494475	.3278975	-1.37	0.170	-.1.092115 .1932198	
B8_In_the_past_12_months_did	.7541388	.5296483	1.42	0.154	-.2839528 1.792223	
cell_call_sp	.805674	.2074145	3.88	0.000	.399149 1.212199	
E2_dist_to_vetinary_service_pro	.9200313	.1955294	4.71	0.000	.5368088 1.303262	
E7_time_sp_respond	-.3439376	.3564774	-0.96	0.335	-.1.04262 .3547453	
E13_second_treatment_dummy	-.4624555	.1849466	-2.51	0.012	-.826734 -.1017569	
F11_Do_you_have_access_to_subs	-.9344862	.2615082	-3.57	0.000	-.1.447017 -.4219553	
remittances	-.815249	.0743269	-1.06	0.287	-.0431292 .0128133	
E19_Are_you_satisfie_tion_you_ar	.6590077	.1852281	3.51	0.000	.2878673 1.013948	
E6_cost_to_SP	.7810811	.3555436	2.20	0.028	.0842284 1.477934	
_cons	.0146447	.0385208	0.38	0.704	-.0608547 .0901441	
E4_CAHW						
Age_hhd	-.4619597	.2393734	-1.93	0.054	-.931123 .0072036	
A2_Gender_of_respondent	.236793	.1572112	1.51	0.132	-.0713354 .5449214	
A4_Education_Level	-.0147201	.2803606	-0.05	0.958	-.5642168 .5347765	
B8_In_the_past_12_months_did	.264766	.3970715	0.67	0.505	-.5134797 1.043012	
cell_call_sp	.0860552	.2009101	0.43	0.668	-.3077214 .4798318	
E2_dist_to_vetinary_service_pro	-.6040592	.1152369	-5.27	0.000	-.8257393 -.3823791	
E7_time_sp_respond	.4670643	.3158233	1.48	0.139	-.1519381 1.086667	
E13_second_treatment_dummy	-.2167168	.1604901	-1.35	0.177	-.5312716 .097838	
TLU	.0404606	.0126236	3.21	0.001	.0157187 .0652024	
remittances	-.1704421	.1517214	-1.12	0.262	-.4780897 .1372462	
E19_Are_you_satisfie_tion_you_ar	-.1702575	.3169087	-0.54	0.591	-.7915282 .4510133	
_cons	-.9347478	.58225	-1.61	0.108	-.2.075937 .2064412	
Pvt_veterinary_						
Age_hhd	-.3090528	.3507977	-0.88	0.378	-.9960837 .3784081	
A2_Gender_of_respondent	.063489	.2004762	0.32	0.751	-.3294372 .4564151	
A4_Education_Level	.1440155	.4030448	0.36	0.721	-.6459378 .9339688	
B8_In_the_past_12_months_did	.2217719	.5800409	0.38	0.705	-.9267963 1.370534	
cell_call_sp	.4251861	.3024892	1.41	0.160	-.1676817 1.018054	
E2_dist_to_vetinary_service_pro	.932391	.3678333	2.53	0.011	.2114509 1.653331	
E6_cost_to_SP	.0548246	.0509839	1.08	0.282	-.045102 .1547511	
E7_time_sp_respond	.1060839	.3394738	0.31	0.755	-.5927325 .7744402	
TLU	.0150182	.0190666	0.79	0.431	-.0223598 .0523801	
remittances	-.1385326	.189348	-0.73	0.464	-.5096478 .2325826	
E19_Are_you_satisfie_tion_you_ar	.7538426	.0441304	1.87	0.061	.1.547924 .0362385	
pvt_vet_att_cost	-.0014825	.0013146	-1.13	0.259	-.004059 .0016041	
F6_How_preferred_veterinary_drug	-.2238055	.2824217	-0.79	0.428	-.7773418 .3297308	
cost_to_vet_drug_supplier	.0242235	.0142621	1.70	0.089	-.0521768 .0037297	
F1_vet_drug_cost_exp	.0023714	.0066312	0.36	0.721	-.0106256 .0153084	
E13_second_treatment_dummy	.8489378	.2187783	3.88	0.000	.4177332 .1.2841437	
_cons	-.1473838	.8259021	-1.78	0.074	-.3.091776 .1457009	
Likelihood ratio test of rho21 = rho31 = rho32 = 0:						
chi2(3) = 19.8706 Prob > chi2 = 0.0002						
Likelihood ratio test of rho21 = rho31 = rho32 = 0:						
chi2(3) = 19.8706 Prob > chi2 = 0.0002						
/athrho21	-.3043696	.0994423	-3.06	0.002	-.4992729 -.1094662	
/athrho31	-.290166	.1639791	-1.77	0.077	-.6115591 .0312271	
/athrho32	.3709725	.1272421	2.92	0.004	.1215826 .6206323	
rho21	-.2953063	.0907704	-3.25	0.001	-.4615452	-.109031
rho31	-.2822876	.1509122	-1.87	0.061	-.5452327	.0312169
rho32	.354842	.1112286	3.19	0.001	.120897	.5513802

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

6. Discussion and conclusion

The findings of this study highlight the complex interplay of various variables in the decisions made by smallholder farmers when selecting veterinary service providers and accessing veterinary services. These decisions are influenced by situation-specific contextual factors, including the farmers' own experiences, age, socioeconomic status, and historical dynamics. 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. It demonstrates that when these key service providers are properly coordinated, synergies can be built, leading to more effective service delivery. While the Department of Veterinary Services (DVS) alone does a commendable job under the prevailing circumstances, it is clear that a collaborative approach involving multiple stakeholders is necessary to adequately meet the demand for veterinary services by smallholder farmers.

An ideal arrangement suggested by the study is 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, it is recommended to integrate CAHWs into the formal government veterinary system, with a direct reporting line to the local government veterinary technician. This integration can 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, under the supervision of Mazowe Veterinary College, is crucial. 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. Additionally, improving security and acquiring storage equipment, such as refrigerators, at the AHMCs is necessary.

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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