



**Animal Health Service Delivery
Systems in Kenya's Marginal Areas
Under Market Liberalization:**

*A Case for Community-Based
Animal Health Workers*

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Foreword

Whether by design or by default, profound changes are underway in delivery systems for animal health inputs and services in much of Africa. In many countries, public provision outside markets is being replaced by private delivery in increasingly liberalized markets, with local communities exerting increasing influence on market outcomes. Understanding how opportunities and constraints in delivering alternative animal health inputs and services are affected by privatization and liberalization is crucial to gauging prospects for successful livestock disease control, and thus for sustained productivity growth in this crucial agricultural sub-sector.

Improving livestock productivity under conditions of market liberalization emerged as an important research theme in a number of countries comprising the IFPRI 2020 Vision Network for East Africa. This excellent study by Messrs. Mugunieri, Omiti, and Irungu fit perfectly with that priority and was duly selected for funding under the first round of the Network's Competitive Grants Program.

IPAR take great pride in noting that this is the first study to be completed under the Competitive Grants Program. IPAR's knowledge base, along with that of IFPRI, has been greatly enhanced by this collaborative effort. Capacity to undertake future research, either using similar methods or further exploiting the data collected, has also been significantly strengthened.

We hope that this report will prove informative and relevant to researchers and policy makers seeking ways to better serve the millions of small-scale livestock keepers currently suffering under the effects of a range of livestock diseases in Kenya, elsewhere in East Africa, and in other parts of Africa.

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ACRONYMS

ASAL	Arid and semi-arid lands
BI	Breeding index
BR	Birth ratio
CBAHW	Community-based animal health worker
CBPP	Contagious bovine pleuro-pneumonia
CBS	Central Bureau of Statistics
DANIDA	Danish International Development Agency
DfID	Department for International Development
ECF	East Coast fever
FAO	Food and Agriculture Organization of the United Nations
GAA	German Agro Agency
GTZ	German Agency for Technical Co-operation
IFPRI	International Food Policy Research Institute
IPAR	Institute of Policy Analysis and Research
ITDG	Intermediate Technology Development Group
KARI	Kenya Agricultural Research Institute
KETRI	Kenya Trypanosomiasis Research Institute
KIPPRA	Kenya Institute of Public Policy Research and Analysis
KVB	Kenya Veterinary Board
NGO	Nongovernmental organization

SUMMARY

Following the slow growth of many African economies in the late 1970s, the World Bank and other international donors sought to move the delivery of services, wherever possible, from the public domain to the private sector. Among the activities targeted for privatization was the delivery of animal health services. International experts made bold efforts to retain veterinary regulation and management of epizootic diseases within the public domain but pushed curative animal health care into a private market.

The theories that formed the basis for this shift were neoliberal, with origins in neoclassical economics. This restructuring was, however, effected before the establishment of alternative suppliers within the private sector and the enactment of policies and regulations that could assure the quality of animal health services. Given that markets in Sub-Saharan Africa are thinly spread, institutions for contract enforcement are weak, and infrastructure is underdeveloped, the veterinary service privatization program has had varied impact in different regions, with marginal areas receiving minimal attention.

One means of delivering livestock health services in marginal areas has been the introduction of community-based animal health workers (CBAHWs). This initiative has involved training community-selected representatives in basic animal health care and livestock production techniques. The primary objective has been to supplement and support existing systems for delivering such services to communities in marginal areas. Government statutory bodies in many developing countries have opposed the establishment of these CBAHW programs on the basis that these programs have not fit within the existing technical, legal, and policy framework in the countries concerned. The problem has been compounded further by lack of information on program effectiveness in animal health service delivery.

This study was designed to help understand the nature, characteristics, and activities of CBAHW programs in marginal areas and their influence on livestock productivity. Our aim was to generate information that would guide policy debate about integrating CBAHWs into formal health delivery systems where appropriate. We used CBAHWs operating in Makueni district, Kenya, as a case study.

The performance of the CBAHWs was assessed based on multiple regression analysis, with the number of cases CBAHWs handled during the calendar year preceding the survey as the dependent variable. Significant explanatory variables included those capturing recent participation in professional development courses, proximity to roads and retail service and input outlets, and non-farming income. Factors that are likely to keep CBAHWs in active practice were identified using logistic regression. The key factors include accurate record-keeping and human capital development management refresher courses. Analysis of variance was used to investigate the differences in productivity between livestock keepers using different animal health delivery systems. This productivity analysis was based on the premise that improved animal management—e.g., regular deworming and disease prevention—may increase livestock productivity.

The study finds that these CBAHWs provide mainly curative health services. However, sustainability continues to be a problem. For trainees to continue actively providing services to livestock keepers, the study finds, continual professional development through regular refresher training was important. Furthermore, a commitment to work, shown for example through proper record keeping, is likely to help keep trainees in active practice. Years of stock raising experience and formal education of trainees are found to have a positive but not significant

effect on their likelihood of remaining in active practice. Total income has a negative but insignificant influence on the likelihood of a CBAHW's remaining in active practice.

The study also establishes that CBAHWs provide services to farmers who have fewer resources than do the farmers served by professional veterinarians. In comparing livestock productivity, the average annual live births per mature female (birth ratio) in cattle and goats herds under the care of CBAHWs were significantly higher than those under the care of professional veterinarians. Although the livestock of clients of CBAHWs attained improved fertility, this did not translate into a higher ratio of young stock to females (breeding index) compared with the clients of veterinarians. This suggests that young stock within the CBAHW clientele may suffer from higher mortalities than do stock of the veterinarians' clientele. This study also found that, besides providing clinical services at a fee, CBAHWs also created positive externalities through the participatory learning enjoyed by neighboring livestock keepers who later dispensed with their services.

Policy attention is needed to appropriately integrate the activities of CBAHWs within the existing formal animal health delivery system in marginal areas of Kenya. Interventions that improve the professional development of these workers, with emphasis on areas pertaining to care of young stock, would not only promote sustainability of their activities but also improve livestock productivity in marginal areas

1. INTRODUCTION

1.1 Background

Livestock health service delivery in many developing countries is undergoing privatisation as part of an international restructuring for economic development. One widely publicised initiative to refocus livestock health service delivery has been the introduction of community-based animal health workers (CBAHWs). This initiative involves training community-selected representatives in basic animal health care and livestock production techniques. The primary objective is to supplement and support the existing but overstretched professional system for delivering such services to communities in marginal areas of many developing countries.

Community-based livestock services in developing countries have received increasing attention during the past decade. This attention has come not only from the communities concerned, but also from international agencies such as Food and Agriculture Organisation of the United Nations (FAO) (FAO 1997; Jackson and Ward 1999), the German Agency for Technical Co-operation (GTZ) (Kleemann 1999), the United Kingdom's Department for International Development (DfID) (Holden 1997), and the World Bank (De Haan and Bekure 1991).

The concept of community participation and its role in animal health services delivery has been reviewed (Leyland 1991; Catley and Leyland 2001; Oakeley 2001). Relevant stakeholder workshops have been organised to facilitate development of community-based projects in dry-land areas of Chad, Ethiopia, Kenya, Sudan, Uganda, and Tanzania (Young 1992). Experiences from community-based approaches have frequently appeared in the informal development literature. The *Arid Lands Information Network* has published experiences from Chad (Hammel 1995), Kenya (Grant 1992), and Senegal (Obel-Lawson 1992). The 1993 issue of *Journal of Appropriate Technology* was dedicated to community-based animal health, and it describes experiences from Afghanistan (Leyland 1993), Chad (Peters 1993), Kenya (Blakeway 1993), and Sudan (Dahir 1993). The role of CBAHWs in the Central African Republic, Chad, Niger, and Somalia has been reviewed (De Haan and Bekure 1991). They have concluded that community-based approaches offer a viable alternative to the resource-constrained and poorly functioning public veterinary services in developing countries. Other similar programmes documented outside Africa include the village animal health workers in Nepal (Moktan, Mitchelhill, and Joshi 1990), the Anyamara veterinary technicians in southern Peru (Johnson and Chahuares 1990), and the village-based parasite control programme for swamp buffalo in Thailand (Meemark 1988).

In implementing these community-based programmes, different countries have adopted different approaches, presumably to tailor the programmes to the specific needs of livestock farmers in varied environments. Although numerous terms have been used to describe these differing programmes, Hüttner et al. (2001) and Oakeley (2001) have emphasized that most of them share similar features and goals such as:

- Individuals are selected for training by the communities within which they work;
- Technical training in animal health is short, usually less than a month;
- Low-cost strategies concentrate mainly on important livestock health and management issues of the farming community; and
- Payment for services provided comes directly from clients.

Experiences from these programmes indicate that, by using existing traditional knowledge, CBAHW programmes encourage the participation of the local communities in the design and delivery of animal health care services. The CBAHW model also empowers the local people to determine the type of animal health services they receive. In some areas conditions may exist that would permit full privatisation using this approach. This community-based approach has shown that pastoralists and agropastoralists, for example, can organise themselves to select CBAHWs for training and offer animal health services.

In many areas where these programmes have been developed, however, no accompanying studies have been undertaken to assess their impact and to establish factors that may influence their success and sustainability. These community-based projects have tended not to collect quantitative data because of resource and logistical constraints, and the need to demonstrate positive impact on animal health to local communities is becoming more apparent. CBAHW programmes have become crucial yet controversial components of the privatisation design (FAO 1997). This study addresses this gap in the literature by assessing the impact of this community-based approach on animal health service delivery, with the objective of evaluating it as a model of animal health delivery in arid lands of the developing world.

1.2 Objectives of the study

The overall objective of this study is to produce information that can strengthen policies for facilitating viable and sustainable CBAHW programmes for efficient delivery of animal health services in arid lands of Kenya. Specifically, this study was aimed at:

- Documenting the evolution and structure of CBAHW programmes following the privatisation of animal health services;
- Assessing the performance of CBAHW programmes in the delivery of animal health in arid and semi-arid lands (ASAL);
- Assessing the investment opportunities in informal animal health delivery systems in ASAL; and
- Offering suggestions for policy changes to improve animal health delivery systems in ASAL.

Several CBAHWs programmes have been established and documented in Kenya which provided a wide range of information on their operations.

1.3 Area of study

The CBAHWs studied are based in Mtito Andei division, one of the 14 divisions in Makueni district, which lies approximately midway on the Mombasa-Nairobi road (Figure 1). The region is semi-arid and is covered with dense shrub vegetation. Farmers practice rain-fed agriculture and keep varying sizes of flocks of sheep and herds of goats and cattle. This area borders the Tsavo National Park and suffers from a high level of tick-borne disease and trypanosomiasis transmitted from the park by ticks and tsetse flies, respectively.

Makueni district is one of the 12 districts in the Eastern Province of Kenya covering an area of 7,440 square kilometres. It is divided into 14 administrative divisions and 52 locations. It is generally low lying and rises in altitude from 600 metres at Tsavo in the east to about 1,900 metres in the Kilungu hills in the west. A large part of this district is of low agricultural potential. Major livestock products, in order of economic importance, are beef, hides and skins, goat and sheep meat, honey, chicken, and eggs.

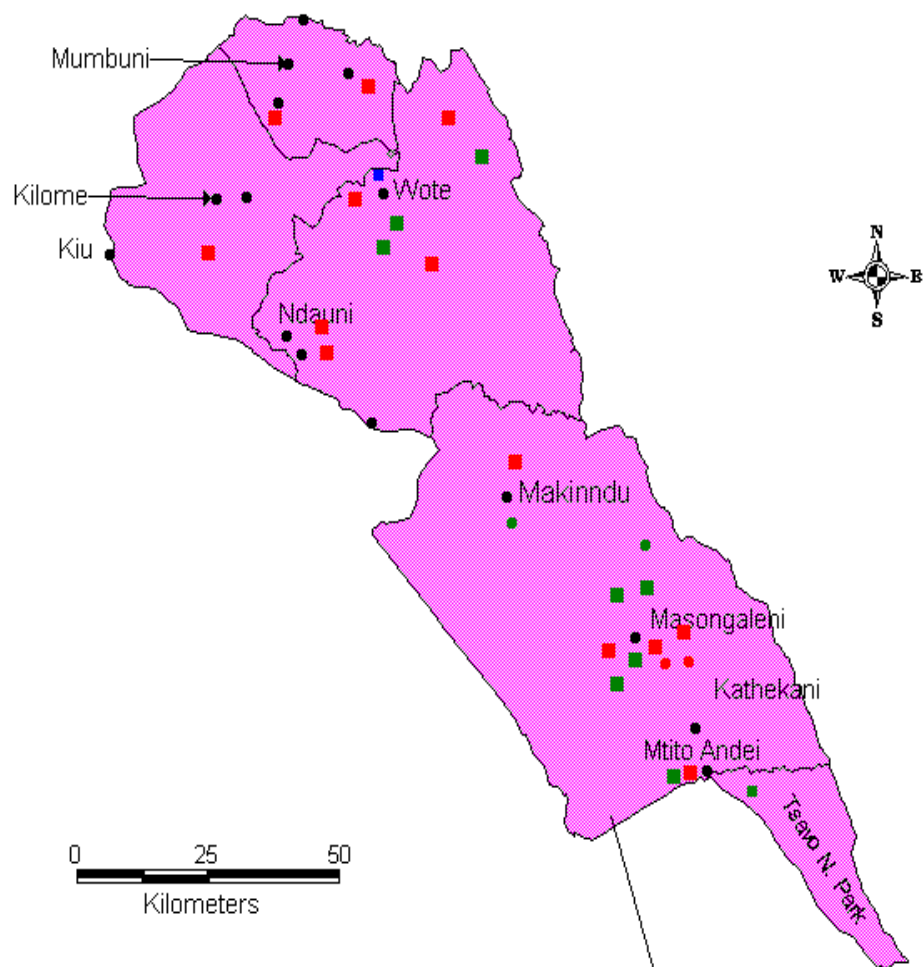
Crop farming is mainly for subsistence purposes. The main crops grown in the area are maize, pigeon peas, and cowpeas. Irrigated horticultural farming also takes place in smallholdings along some rivers. The main cash crops include coffee and cotton and are mainly found in the high-potential parts of the district.

Several organisations have been involved in development programmes in the district in the past. These programmes have included education, crop and livestock production, livestock health, forestry, water, human health, credit, and infrastructure development. Some of the programmes that have targeted livestock production include the following:

- German Agro-Action (GAA), an agricultural project initiated under GTZ in 1995 covering Kibwezi, Makindu, Mtito Andei, and Nguu divisions. Among other objectives, the project focused on livestock production including the promotion of improved production practices, upgrading of livestock, and training of farmers. It was also involved in training CBAHWs for management of livestock health.
- Intermediate Technology Development Group (ITDG) programme that focused on training the community on animal health and control of animal diseases and their vectors, among other issues. The programme started in 1994 in Mtito Andei division and has been instrumental in training CBAHWs.
- The University of Nairobi and Government of Kenya community-based animal health care project initiated in 1996 in Kibwezi division.

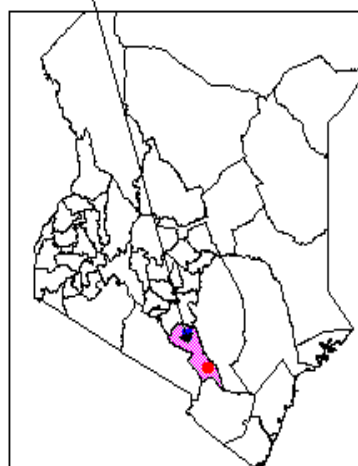
Makueni district was selected because of these programmes promoting the concept of CBAHWs in managing animal health.

Figure 1. Makueni District



LEGEND

- DONOR/GOK AGENCIES
- NGOS
- COMMUNITY BASED ORGANISATION
- PRIVATE ORGANISATIONS
- COOPERATIVE SOCIETIES



MAP OF KENYA SHOWING THE LOCATION OF
MAKUENI DISTRICT

Because of limited funds, one division (Mtito Andei) was purposively selected for implementation of the study. This is the largest division in the district with the highest concentration of CBAHWs and is easily accessible. The division covers an area of 1,809 square kilometres with a population of about 70,000 people (CBS 2001). Experience has shown that CBAHWs operating in agropastoral areas, like Makueni have similar modes of operation. These CBAHWs attend to their neighbours' animal health problems in addition to their own, whereas CBAHWs found among pastoralists concentrate more on treating their own animals and only sell drugs to other pastoralists (ITDG 2000a). Therefore, it is assumed that the findings of this case study could be applicable to other CBAHWs working within agropastoral communities.

1.4 The conceptual framework

The market for livestock health services responds to the needs of livestock keepers with products that are either tangible (such as drugs and vaccines) or intangible (such as diagnosis). The structure and strengths of each of the suppliers of health services generate complex and often competing behaviour, which in turn shapes the dynamics of power relationships within the animal health market. Variations in the types of interventions and responsibilities offered by each health service provider (or channel) shape these relations. The restructuring of the livestock health sector is likely to lead to emergence of new animal health delivery channels. With each emerging or persisting health delivery channel, livestock keepers' expectations, behaviours, and responses to the forms, types, and prices of these health delivery channels determine the pace and success of the restructuring process.

The transition from the old to the new market is of fundamental importance. Livestock keepers' participation in the new market must be assessed, and based on this assessment, any innovations in the market need to be reshaped before a conclusion is drawn with confidence that the veterinary service system is effective and sustainable.

Following the restructuring process, there exist four distinct, yet related animal health delivery channels within Kenya's marginal areas. They include:

- The traditional system of government veterinary professionals and their accompanying paraprofessionals, who exist on a reduced scale owing to decline in government funding;
- The CBAHWs who have been promoted by nongovernmental organisations (NGOs);
- The village veterinary drug shops (popularly known as agrovets) that supply drugs, often with advice, to livestock keepers;
- A limited extent of purely private veterinarians and para-veterinarians; and
- Ethno-veterinary practices undertaken by some community members.

All these veterinary service providers exist today in marginal areas, sometimes in a single geographic area, and interact in a variety of ways with other economic and institutional factors to affect animal health service delivery and livestock productivity (Figure 2).

CBAHWs appear to be an innovation in this veterinary market. Although this study assesses the performance of this innovation and how it interacts with other systems to improve livestock health delivery and livestock productivity, it is important to note that positive results will be attained only if the other components in the environment work.

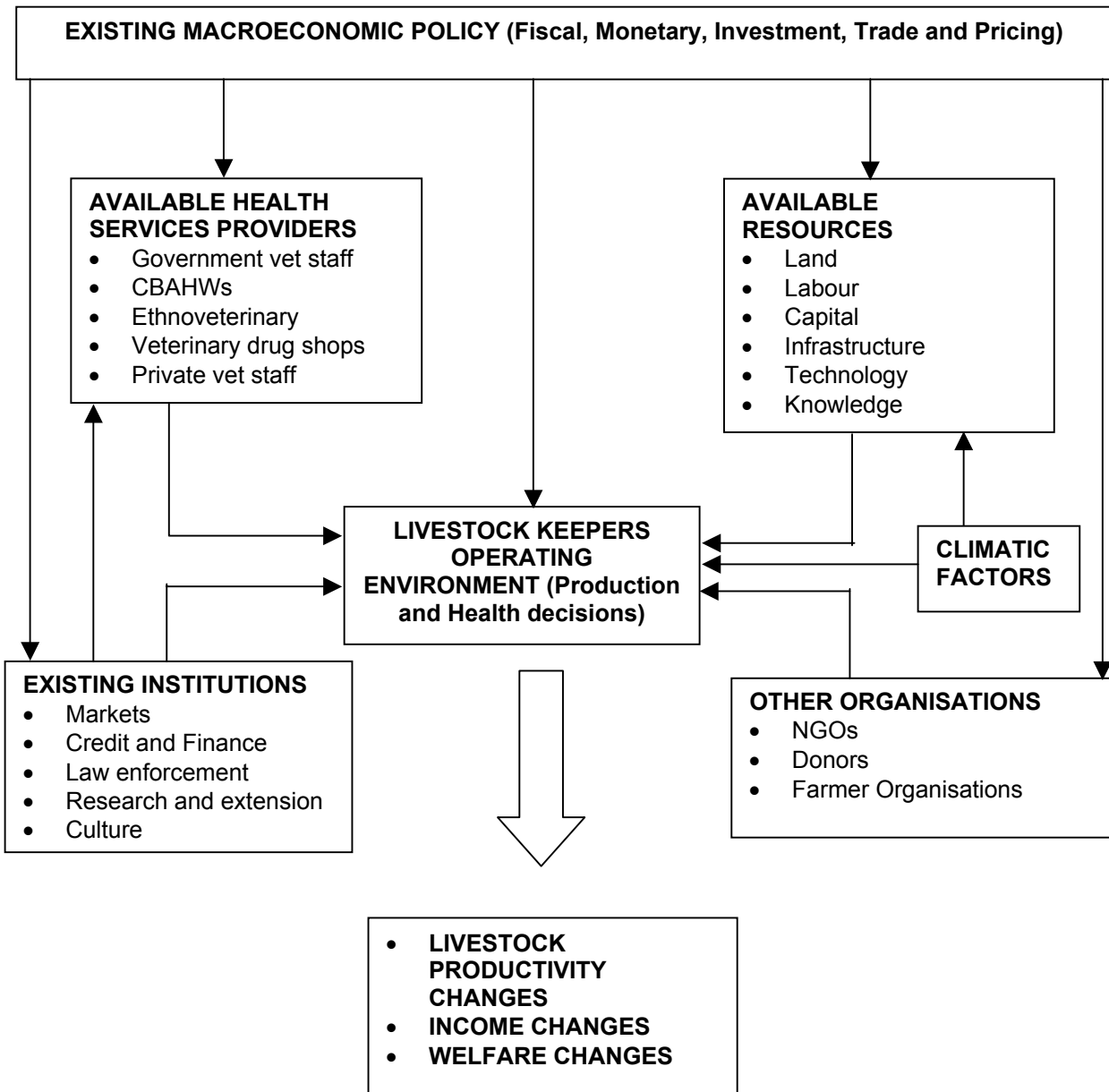
1.5 Justification of the study

The privatisation process and livestock keepers' choice of veterinary services is best understood through the principal/agent framework. Principal/agent theory is a framework that has been expanding rapidly and is devoted to explanations of micro-analytic organisational details. It explains social organisational phenomena using assumptions derived from transaction cost economics. The literature describes it as an analytical tool, joining aspects of law, economics, and organisational theory to observe and understand the organisational variety involved in economic activity (Williamson 1984; Leonard 1993, 2000).

Principal/agent theory can be used to analyse situations in which there is severe imbalance (asymmetry) in information between consumers and suppliers. In the veterinary field, clients (livestock keepers) are at a disadvantage in dealing with the health practitioners (veterinarians and their associated paraprofessionals). The veterinarians are consulted because they have specialised knowledge, but clients cannot be sure that the veterinarians' skills are appropriate to their problem (Ly 2000). Unless this problem is solved, clients lose confidence in the quality of services offered by the practitioners. Clients may reduce their consumption of the services, or they may be prepared to pay no more than the value of the lowest-quality services available in the market, because they fear that this is the service level they are likely to receive. If this information asymmetry is not eliminated, it will lead to what Akerlof referred to as a "market of lemons," a situation in which transaction costs are dominated by inferior products (Akerlof 1970). Possible mechanisms for assuring clients that they are getting high-quality service from their agents are the incentive systems. These include professional supervision, information supply, and strict legislation enforcement that will maximise the agents' effort.

If left alone, the market for veterinary services in Kenya's marginal areas may evolve toward a situation similar to Akerlof's market of lemons, in which clients demand low-quality services. This situation is likely to produce suboptimal results for livestock keepers, animal health practitioners, and the society at large. With several players in the ASAL veterinary market, a quantitative assessment of the efficiency of comparative service delivery, level of outreach, and benefits to livestock keepers of each of these service systems is essential. This study explains how the livestock keepers respond to the particular veterinary service system they face and how well that system responds to their demands and expectations. This is important since the veterinary services market is quite prone to distortions and inelasticities as much as opportunistic behaviour of participants is concerned (Ly 2000). It is hoped that this information will guide policy debate regarding veterinary service delivery in the marginal areas.

Figure 2 — The operating environment of livestock keepers



Source: Adapted from Ly (2000); Omiti *et. al.* (2000)

1.6 Organisation of the study

The remainder of this study is organised as follows. Chapter 2 gives a brief account of the evolution, structure, and constraints facing CBAHW programmes. Chapter 3 contains details on the methodologies employed in data collection and analysis. Chapter 4 assesses the performance of CBAHW programmes in the delivery of animal health services. It also examines the criteria for selection of trainees for these programmes and the correlation of these selection criteria to the success rate of the trainees. Chapter 5 describes the clientele of CBAHWs and compares the productivity of livestock served by CBAHWs with that served by other professional services. Chapter 6 assesses the priorities of livestock keepers and the investment opportunities available to strengthen CBAHW programmes. This chapter also reviews existing government policy regarding the role of CBAHWs in animal health delivery. Finally, Chapter 7 offers suggestions for changes in policy to improve animal health delivery in arid lands of Kenya in particular and in comparable situations in other developing countries in general.

2. THE EVOLUTION OF COMMUNITY-BASED ANIMAL HEALTH WORKERS

2.1 The changing structure of animal health service delivery

Beginning in the early 1980s the Government of Kenya instituted several economic and institutional reforms aimed at improving economic performance and microeconomic stability. In general, the reforms sought to reduce government support and its direct participation in various sectors of the economy. Such measures included price deregulation, trade liberalisation, withdrawal of subsidies, and nonparticipation in input and services provision, among others. The government expected these reforms to permit the forces of supply and demand to determine the production, distribution, and marketing of various goods and services in the economy and in essence to promote efficiency and economic growth.

The government's reduced participation in the provision of veterinary services, however, gained momentum in the early 1990s. Until then, the government had been the main provider of animal health services, either free of charge or at a highly subsidised level (Leonard 2000). Major success had been achieved in the control of epizootic and transboundary animal diseases such as rinderpest and contagious bovine pleuro-pneumonia (CBPP). With the growth of the livestock sector, the range and volume of veterinary services to be provided increased tremendously. Consequently, a full range of heavily subsidised services was to be made available to livestock producers ranging from clinical services, extension services, artificial insemination (AI), disease surveillance, and vector control to the production and distribution of drugs and vaccines.

By the mid-1980s various structural reforms were being implemented in the public sector. Consequently, budgetary allocations were reduced to most public-sector activities, and animal health service delivery was no exception (Umali, Feder, and De Haan 1994). As budgets failed to keep pace with costs, the government found it easier to make cuts in the operating expenses than in the number of service providers (Anteneh 1984). In some areas, therefore, state-provided veterinary services effectively ceased to exist, and in most areas they fell below the level needed and expected by producers.

In response the state engaged in interesting and commendable experimentation with the aim of finding new models for animal health delivery that would be adapted to the prevailing financial reality. These innovative approaches, which principally entailed privatisation, were undertaken after considerable prodding from donors, mainly the World Bank and European Union (De Haan and Bekure 1991). With the broad-based market reforms and the scaling down of government expenditures, the private sector was expected to play a greater role in this field (Otieno-Oruko, Upton, and Mcleod 2000). This privatisation, which reflected the neoliberal thinking of the 1980s, was considered more or less a panacea for redressing government failure in providing animal health services. It was argued that the private sector would outperform the public sector even under imperfect market conditions (Bos 1991). Besides efficiency considerations, input delivery through the private sector was considered more sustainable (Leonard 1993; Umali, Feder, and De Haan 1994). Against this

background, the privatisation of activities hitherto regarded as the domain of the public sector gained credibility.

Privatisation broadly entails transferring ownership of resources and responsibilities for provision of services from the public to the private sector (James and Upton 1995). The perfectly competitive market structures that are required for privatisation to work, however, are rarely obtainable in the real world (Otieno-Oruko, Upton, and Mcleod 2000). In addition, given Sub-Saharan Africa's thinly spread markets with dispersed producers (or service providers), weak institutions for contract enforcement, and underdeveloped infrastructure, questions remain regarding the performance of the private sector in service delivery. Therefore, the veterinary service privatisation programme has had varied impact in Kenya depending on range of circumstances.

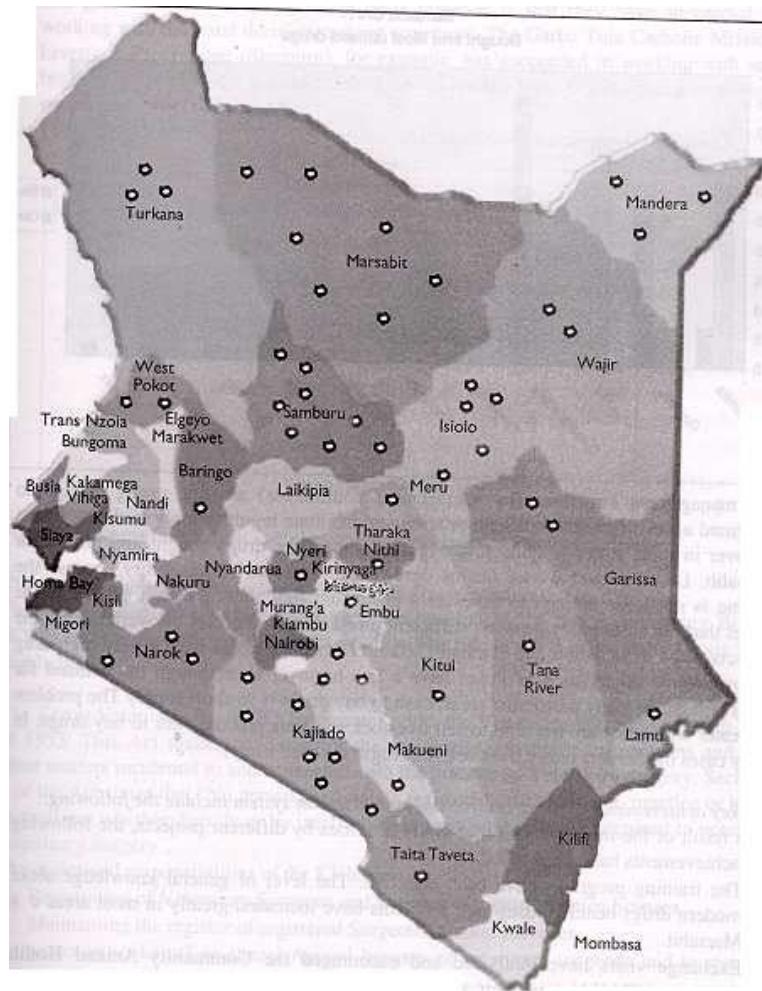
2.2 The evolution of community-based animal health workers in Kenya

The effect of economic restructuring on animal health service delivery has been largely dictated by a location's production system, which in turn depends on the existing agroclimatic conditions. Livestock producers in Kenya inhabit areas with diverse agroclimatic and socioeconomic conditions. Dairying activities have traditionally been concentrated on large-scale ranches in the high-potential areas of the country, but they are now spreading to areas hitherto considered unsuitable for dairy production.

Producers in the high- and medium-potential areas keep crossbred and purebred animals, and herd health has increasingly been handled by private practitioners following the restructuring process. Even in cases where government services are available, they are provided at a fee. In these areas, therefore, both beneficiaries and service providers well understand the concept of privatised animal health (Otieno-Oruko, Upton, and Mcleod 2000).

In the arid and semi-arid lands (ASAL), however, which make up to 71 percent of Kenya's total land mass (Mbogoh and Mukhebi 1998) and hold about 70 percent of Kenya's livestock, herd management has mostly been in the hands of livestock owners and the public sector (Leonard 1987). Farmers keep predominantly indigenous breeds of animals under either pastoral or agropastoral production systems. These areas are characterised by poor infrastructure, harsh climate, low household incomes, and low literacy levels. Qualified veterinary personnel have not set up private practices here, given the cost of establishment and the low demand for these services (Umali, Feder, and De Haan 1994). To meet the needs of livestock owners in ASAL, various groups, particularly NGOs and farmer associations, have initiated community-based animal health delivery systems targeting specific project areas. More than 40 such projects have been initiated in Kenya's marginal areas (Figure 3). These community-based initiatives have tended to be decentralised and privatised animal health delivery services using local traditional knowledge (Leyland and Akabwai 1998). The common feature of these initiatives has been the involvement of local people in identifying key problems, selection of local people for training as CBAHWs, and support of these workers through schemes such as surcharges on veterinary medicines and establishment of a system of drug supply that could easily be accessed (Catley 1999). These CBAHWs are informally trained but complement official professional services.

Figure 3 — Location of CBAHWs projects initiated in Kenya



Available literature suggests that CBAHWs have continued to provide animal health services in ASAL (Catley, McCauley, and Delaney 1998; Catley 1999; Akabwai, Shean, and Irungu 2000). The CBAHWs are therefore regarded as one approach that can be used in providing animal health services in the vast and remote areas that are not conducive for private practitioners. These studies, though informal, suggest that CBAHWs are evolving to fill the gap of basic animal health service delivery in most ASAL. These studies have mainly been conducted by NGOs and have used qualitative data. However, policymakers have not quickly recognised or used the information arising from most NGO projects (Catley 1999). They need research-based information that can guide policy regarding the CBAHW model.

2.3 Constraints on the development of the CBAHW model

One constraint to using CBAHWs as a model of animal health service delivery in marginal areas of Kenya is that this approach has not fit within the existing legal and policy framework for animal health. CBAHWs are prohibited by law from administering veterinary drugs or keeping these drugs for purposes of trade. The evolution of CBAHWs has been in contravention of existing policy guidelines on veterinary service delivery systems in Kenya. Available literature emphasizes the need for a clear legal framework setting out the relationship between CBAHWs, veterinarians, and the other animal health practitioners. Lack of defined roles for CBAHWs within the policy framework is a key factor in professional veterinarians' reservations about CBAHWs in Kenya in particular and in other developing countries in general. These technicalities, compounded by the lack of scientific evidence that CBAHW programmes are effective, has led to active resistance to CBAHW programmes.

The viability and effectiveness of CBAHW programmes is dependent upon communication, support, and cooperation with the professional veterinary system (De Haan and Bekure 1991). These professional systems consist of:

- Professional veterinarians consisting mainly of degree holders; and
- Two cadres of para-veterinarians (or paraprofessionals) who include diploma holders trained in animal health and certificate-level paraprofessionals trained at the animal health training institutes (AHITI).

If CBAHWs are to provide livestock health services efficiently, they need to be an integral part of these services (Oakeley 2001). The appropriate roles of CBAHWs must be recognised by law and incorporated into the regulations governing animal health services. However, poor cooperation between CBAHWs and these traditional veterinary service providers has commonly left CBAHW programmes reliant on structures set by the infrastructure of nongovernmental that established them (Sikana et al. 1992). Since one of the cornerstones of these programmes is the referral of more complex cases and notifiable diseases to the professional veterinary system, the reporting of such cases has been patchy and ineffective because the professional system has low regard for CBAHW system. Oakeley (2001) reports that CBAHWs in Ghana carry an annually renewable license, which helps clarify the roles of these workers to all stakeholders, including other veterinarians and farmers.

In Kenya the legal status of CBAHWs is particularly important with regard to the sale and use of veterinary drugs. Drug sales to livestock keepers are an important source of income, and restrictive drug controls constrain the role that CBAHWs are able to play (De Haan and Bekure 1991). If livestock keepers must go to veterinary drug shops for medicines, they are unlikely to seek the advice of CBAHWs who cannot provide the drugs they prescribe. The argument against liberalisation of drug regulations is that it will risk the misuse of these drugs by poorly trained operators and farmers. This risk could be minimised by careful training and supervision of CBAHWs. Moreover, the existence of unofficial markets for veterinary drugs undercuts this argument against liberalisation. These unofficial markets enable livestock keepers to buy and administer drugs unsupervised. The potential

misuse of drugs obtained from unofficial markets could be minimised through the enhanced activities and accessibility of adequately trained CBAHWs.

Oakeley (2001) argues that while the literature discusses how to engender community participation, it offers few insights into facilitating their institutional participation. Available literature reveals that key stakeholders such as field veterinary staff are not adequately involved in the planning and operation of some CBAHW projects (Sikana et al. 1992).

NGOs have set up many projects to fund and support the early stages of implementation. Consequently, government services are not involved and thus feel no control or ownership when attempts are made to institutionalise the CBAHW model. Further complication arises from the fact that there exists little information as to whether these programmes are effective and impact positively on animal health service delivery. The dependence of these programmes on external support leads to serious questioning of their sustainability.

3. IMPLEMENTATION OF THE STUDY

3.1 Data collection methods

Both primary and secondary data were collected from farmers and other stakeholders in the livestock industry in Makueni district. We collected these data via literature review, reconnaissance visits, and formal surveys.

3.1.1 Literature review

Review of official and research documents was the main source of secondary data. These were collected from official documents from the various ministries, policy documents from the veterinary department and Central Bureau of Statistics (CBS), and other relevant sources. District development plans and articles from various organisations including NGOs that have been involved in implementing CBAHW programmes were also reviewed. The literature review allowed us to obtain a general picture of the environment, to understand the socioeconomic setting of study area, and to make a preliminary mapping of this area. At the same time, the review was undertaken to illuminate the nature and evolution of the participants in the animal health service market in the study area.

3.1.2 Reconnaissance visits

We made reconnaissance visits to introduce ourselves to various stakeholders, to inform them of the aims of the study, and to make appointments for either discussion or document access, retrieval, and perusal. These visits also involved the following:

1. *Consultations with key stakeholders:* These consultations were undertaken to assess what stakeholders think about CBAHW programmes in their places of jurisdiction and how these programmes should be strengthened. Consultations (interviews) were undertaken with key stakeholders from government departments, local communities, and district-based NGOs.
2. *Individual farmer interviews:* We held informal discussions with some selected farmers focusing on the various sources of animal health services, their availability, reliability, cost, and effectiveness. The aim was to assess farmers' opinion on the quality of information disseminated by CBAHWs.
3. *Interviews with implementers of CBAHW programmes:* These interviews focused on the training package of the CBAHW. This step involved examining the training manuals for the CBAHW programmes and observing the calibre of the training personnel.
4. *Interviews with veterinary officers and paraprofessionals:* These interviews included information on the views of veterinary officers and paraprofessionals regarding CBAHWs, what they think CBAHWs should do, what they should not do, and how this programme could be improved. The aim was to highlight points of conflict between

CBAHWs and veterinary staff and areas of investment for improved performance of the CBAHW programmes.

3.1.3 Formal surveys

The information gathered by informal methods was evaluated and quantified in the formal surveys. Two comprehensive questionnaires were drawn up and pretested. The *first* was a questionnaire targeting all CBAHWs resident in the study area. In total, 35 respondents were interviewed. This questionnaire had major sections on: (1) the personal characteristics of CBAHWs; (2) the training, activities, and constraints faced by CBAHWs; and (3) the relations between CBAHWs and livestock keepers and between CBAHWs and highly trained paraprofessionals and veterinarians. The questionnaire was pretested on five CBAHWs and amended before it was applied in this study. Interviews lasted about 45 minutes, it took five days to complete the 35 CBAHWs (June 2001). A team of six enumerators and one research assistant supervised by one of the researchers conducted the interviews.

The second questionnaire targeted livestock keepers. Data were collected from a randomly selected sample of 182 farmers using a comprehensive questionnaire that had been pretested and amended. The questionnaire sought information on various aspects including:

- Information on the livestock keepers' approaches to the management of animal health;
- Knowledge of CBAHW programmes as well as other animal health service (AHS) delivery systems in the area;
- The household head's opinion on the type of services provided by the CBAHWs, their reliability and benefits, and how the services could be improved; and
- Information on herd dynamics including mortality, morbidity, births, receipts, and sales between 1998 and 2000.

Interviews took about one hour, and completing 182 visits took three months (June to August 2001). Like the CBAHWs' questionnaire survey, a team of six enumerators and one research assistant supervised by one of the researchers conducted the interviews.

3.2 Sampling methods

Sampling was done in two stages—that is, for CBAHWs and for livestock keepers. Total sampling was done for the resident CBAHWs. To select respondents for the livestock keepers interviews, a sampling frame for the whole district was obtained from the Central Bureau of Statistics based on the 1999 population census (CBS 2001). Based on these figures, Mtito Andei division had a population of 66,663 people in 13,354 households. These households were clustered in 228 villages. Twelve villages were randomly selected. From these villages 180 households were then randomly sampled, with probability proportional to

population size of village. The selected households were visited, and the household head interviewed.

3.3 Data analysis

Descriptive statistics were used to describe the characteristics and activities of CBAHWs and the farm and personal characteristics of the livestock keepers. The relationship between the characteristics of the CBAHWs and their level of success was established using correlation and regression analysis.

In assessing the success of the CBAHWs, the study tracked their performance through activity analysis and used level of activity as a performance measure. Generally in such estimations, relations are often modelled simply as structural relations between the traditional factors perceived to be influencing activity levels and the variables representing output. Once a decision about candidate variables is made, the specific relationship can then be modelled. The quadratic model was selected in this case because of its computational ease, ease of interpretation, interpolative and extrapolative robustness, and consistency with data.

The estimated model was of the form:

$$X = [\beta][Z] \quad (1)$$

where,

X is the level of activity of CBAHWs, estimated as the number of cases handled in the one-year period preceding the survey;

β is a vector of estimated coefficients; and

Z is a vector of independent variables describing the characteristics of CBAHWs.

An ordinary least squares stepwise regression approach was used in estimation of the model.

Factors that are likely to keep CBAHWs in active practice were identified using a logistic regression. The dependent variable in this case was observed as a binary indicator—that is, whether or not a CBAHW is still providing services. Although it is possible to use dummy variables as dependent variables to see such a dichotomous choice, ordinary least squares regression is not appropriate in such circumstances for several econometric reasons. Nonlinear estimation techniques have been developed to overcome some of the major statistical problems. Two techniques most commonly used in this instance are probit and logit analyses. The probit uses the cumulative normal function whereas the logistic function uses the logit model. Although both use the maximum likelihood estimation method,

the logistic function¹ was thought to capture the distribution of the data better and thus used in this study (Maddala 1983; Greene 1993).

The estimated model was of the form:

$$I = \beta Z \quad (2)$$

where,

$I = 1$, if CBAHW is active, otherwise zero;

Z is the vector of exogenous variables (those describing CBAHW characteristics); and

β is a vector of estimated coefficients.

The method of backward-stepwise variable selection was used to identify significant determinants of the likelihood of a CBAHW's remaining active.

Analysis of variance (ANOVA) was used to investigate differences in productivity between livestock keepers using different animal health delivery systems. This productivity analysis was based on the premise that improved animal management, including regular deworming and disease prevention, may increase productivity of both cattle and goats (CARD 1989). The animal health service in use could improve animal production by enhancing both the levels of health and the production management standards. The impact of animal health services can be analysed by relating the size and productivity of herds to the type of service used. The degree of success that livestock keepers have achieved under each delivery channel in increasing livestock fertility and decreasing calf mortality can be obtained by calculating a breeding index (BI). The BI compares the percentage of young animals in a farmer's herd with the percentage of adult females.

$$BI = \frac{\%YA}{\%AF} \quad (3)$$

where,

BI = breeding index;

YA = young animals; and

AF = adult females.

Woods (2000) used this approach to estimate the productivity of goats in relation to distance from the source of animal health services in Zimbabwe. This study adopted Woods' approach to estimate and compare the productivity of cattle and goats under the different health delivery channels. In addition, this study also estimated the ratio of live births to the

¹ Some of the outputs of the logistic procedure and their interpretation are given in the Appendix.

number of adult females in the herd in each year between 1998 and 2001.² This was named the birth ratio (BR).

$$BR = \frac{LB}{AF} \quad (4)$$

where,

BR = birth ratio;

LB = number of live births; and

AF = number of adult females.

The BR and BI were compared for livestock keepers using different animal health delivery channels.

² Initially during the design of the study, milk output had been targeted as the indicator of herd productivity and a switching regression model as a tool to assess differences in productivity between users and nonusers of CBAHWS services. It became clear as the study progressed that milk was not the main objective of livestock keepers in the study area. Only 3.8 percent of the livestock keepers regarded milk as an important product of their livestock enterprise. Most livestock keepers did "partial" milking, leaving some for suckling calves. The data obtained for milk production did not therefore reflect the actual output. Furthermore, using milk as the productivity parameter would have excluded goat keeping that was undertaken by 97 percent of livestock keepers, compared with 77 percent for cattle.

4. FEATURES OF COMMUNITY-BASED ANIMAL HEALTH WORKERS

4.1 Characteristics of the CBAHWs

The criteria for choosing CBAHWs vary, but there is general agreement on the need for community choice and control over candidate selection. Many programmes offer basic guidelines for selecting appropriate candidates based on personal characteristics. Although personal characteristics are hard to define and measure, they are critical, since sustained support and respect within a community depends on them. In traditional societies individuals occupy specific positions, and the roles they play are determined in advance by their social positions. Consequently, the discharge of such functions and roles does not generate differentiated existence but simply confirms it. For this reason, individuals perform specific tasks in accordance with an *a priori* rule defining their social identity (Platteau 1994). With respect to CBAHWs, some of the personal characteristics that could determine social position include literacy, gender, age, and experience of stock raising (Holden 1997; Leyland and Akwabai 1998; Oakeley 2000).

Literacy is seen as a prerequisite for learning, recording, and drug handling activities and therefore forms an important ingredient of a CBAHW candidate. One school of thought, however, speculates that a higher level of education is associated with higher income and career expectations among the trainees, and these expectations could make them more likely to emigrate from the area. The net effect of literacy on the success rate of an individual as a CBAHW will therefore be determined by the relative strengths of these two opposing forces and is therefore indeterminate.

Experience in stock raising, measured as years of stock-keeping experience, appears to be an obvious criterion and may go together with livestock ownership. There is, however, no evidence that limited experience with livestock would preclude an individual from becoming a successful CBAHW. It is therefore reasonable to anticipate that trainees' stock-raising experience will have a positive impact on their likelihood of becoming successful CBAHWs.

Opinions differ regarding the appropriate age of trainees, although health and fitness requirements may exclude some older candidates. Older candidates, however, may enjoy greater respect and trust within the community and may be less likely to move away. Currently, there is no evidence in the literature to suggest that younger candidates cannot perform equally well. The net effect of age on the likelihood of success as a CBAHW is therefore indeterminate.

Gender remains a sensitive issue. Programmes implemented in many regions have shown a male bias in the selection of trainees. There is little discussion about why this should be the case, despite the fact that many programmes actively discuss the important role of women in raising livestock and thus their potential as CBAHW candidates. Therefore, it would be difficult to determine the effect of gender on the likelihood of one's becoming a successful CBAHW.

To capture the varying levels of literacy among these workers, the research team recorded the highest level of education completed. They found that 74.3 percent of the workers had a primary level education, 22.9 percent had attained a secondary level education, while the remainder had attended adult literacy schooling. All the workers could read and write. Years of farming experience ranged from 4 to 40, with a mean of 18.2 years and a standard deviation of 1.71. Years of experience depended mainly on the age of the workers. The mean age was 50.7 years with a standard deviation of 10.6. As for gender, out of the 35 sampled CBAHWs, only 7 were females, confirming the gender bias toward male candidates as reported in the literature.

Besides gender, education level, years of farming experience, and age, researchers also collected information on the number of refresher courses undertaken, possession of business skills, and total income of these workers. Information on refresher training was collected because available literature indicates that refresher courses provide a forum for the continued professional development of these workers (Holden 1999). To remain in business, these workers need to remain more knowledgeable than ordinary farmers on animal health matters. Given the limited initial training offered to these workers, it could only be a matter of time before livestock keepers in the surrounding area acquired equivalent animal health knowledge and—having done so—then dispense with their services. The level of professional development should have a positive effect on likelihood of success as a CBAHW. Thirty-two of these workers had attended refresher training, ranging from one to nine times.

It can be argued further that for CBAHWs to continue to provide services, they must be able to price their products competitively so as to run their services profitably. In order to remain financially viable and become successful workers, CBAHWs must possess business skills, possession of these skills is postulated to have a positive effect on success. To capture this factor, researchers asked the workers whether they had undertaken any training in business skills. The results showed that 45.7 percent of the workers had undertaken such training.

Other factors that may impede success for some trainees could be lack of credit and the difficulty of receiving prompt payment for their services (Holden 1997). This study assumed that under such circumstances, these workers may rely on their own capital as a stopgap measure to finance their activities. Own income could therefore have a positive effect on level of success. Consequently, the total income of each CBAHW from farm and nonfarm activities was recorded. This income ranged from Kshs 2,000 to 217,200 per year and did not show significant variation between villages, gender, or possession or lack of business skills ($p < 0.05$). The effect of these hypothetical micro-level institutions on the likelihood of trainees' becoming successful CBAHWs is summarised in Table 1.

CBAHWs provide a localised service consisting mainly of clinical services. The survey results indicate that 60 percent of these workers keep records of their activities. These records include disease cases handled, drugs used, and the prices of the drugs. These workers handle diseases and ailments in cattle, sheep, goats, and poultry. Table 2 summarises some of the diseases and ailments that were handled by these workers in the one-year period preceding the survey.

Table 1 — Hypothetical impacts of personal characteristics on level of activity of CBAHWs

<i>Variable</i>	<i>Direction of impacts</i>
Gender	±
Age	±
Education level	±
Years of farming experience	+
Number of refresher courses	+
Possession of business skills	+
Total income	+

4.2 Activities of CBAHWs

The most common ailments and diseases handled by CBAHWs were gastrointestinal parasites in all stock types, trypanosomiasis and tick-borne diseases in cattle, and coughing in small stock. Information was sought on the type of the last case handled by each worker (Table 3). Ninety-one percent of these workers reported that they attended to the last case after being called by the owner of the animal, while the rest indicated that they had come across it during their routine visits to farmers. Eighty-six percent of the workers had attended to their last case within a period of one year preceding the survey. Those who had not attended to any case for a period exceeding one year had ceased practicing, citing either lack of interest by livestock keepers in their services or their own interest engaging in other activities.

These workers handled about 2,963 cases during this period, giving a mean of 92.6 cases per worker per year. The number of cases handled by each worker varied widely. The reason for this could lie within individual-level attributes. Factors that are common to all CBAHWs, such as cultural attitudes, the prevailing demand for animal health services, and regulations could not be causes since they affect all CBAHWs across the board.

Available literature suggests that the effectiveness of a CBAHW programme depends upon support and cooperation with the professional veterinary system (De Haan and Bekure 1991). It is argued that these workers need to be an integral part of the veterinary delivery system by acting as a link between farmers and veterinary staff. The level of contact between these two pathways, however, will be dictated by several factors, some of which include the working rapport, the distance between them, and the professional challenges encountered by the less-qualified group (CBAHWs) in their day-to-day activities. If the CBAHWs handle less-challenging tasks, then there is bound to be less contact. Seventy-one percent of these workers reported that they had made one or more referrals to professionally trained animal health workers during the period they had been practicing. Total cases referred for each livestock type for all the workers is given in Table 5. A total of 83 referrals had been made since the inception of the programme, giving an average of 6.4 cases per year. It is difficult to judge the effectiveness of the programme on the basis of the number of referrals, unless the nature of cases handled is also evaluated. Nonetheless, this study establishes that there is some level of professional exchange between the two channels of animal health delivery.

Table 2 — Types of diseases and ailments handled by CBAHWs in the one-year period preceding the survey

Livestock category	Disease or ailment	% of CBAHWs who report handling this disease or ailment
Cattle	Tick-borne diseases	69
	Trypanosomiasis	60
	GIT parasites	51
	Coughing	43
	Wounds	31
	Severe diarrhea	28
	Foot rot	17
Sheep	GIT parasites	49
	Coughing	31
	Foot rot	14
Goats	GIT parasites	57
	Coughing	40
	Severe diarrhea	26
	Foot rot	26
	Wounds	14
	Difficulty in kidding	11
	Eye infection	6
	Pneumonia	6
Poultry	GIT parasites	17
	Coccidiosis (bloody diarrhea)	6
	New Castle (greenish diarrhea)	6

Source: Survey data, 2001.

Note: GIT = gastrointestinal.

Table 3 — Type of last case handled by CBAHWs

Disease or ailment	% of CBAHWs reporting this as last case they handled
Tick-borne diseases	37
Trypanosomiasis	37
GIT parasites	20
Coughing	6

Source: Survey data, 2001.

A summary of the mean number of cases handled by CBAHWs for each livestock type for a period of one year prior to the survey was recorded (Table 4).

Table 4 — Mean number of cases handled by CBAHWs for a period of one year prior to the survey for different types of livestock³

Livestock type	Mean number of cases	Std. deviation
Cattle	26.7	43.43
Goats	35.8	47.55
Sheep	13.8	36.55
Poultry	16.3	30.01

Source: Survey data, 2001.

Table 5 — Total number of cases per livestock type referred to professionals by CBAHWs since inception of the programme

Livestock type	Total number of cases referred
Cattle	52
Poultry	19
Sheep	7
Goats	5

Source: Survey data, 2001.

CBAHWs were on average 33.5 kilometres from the nearest trained veterinary personnel and 13.5 kilometres from the nearest veterinary drug shop (Table 6). It would be better to establish whether these two channels complement or constrain the activities of CBAHWs. Trained veterinary personnel could either be an avenue for CBAHWs to enhance their professional capability, or they could be an alternative source of animal health services. The same applies to veterinary drug shops, which could act as accessible sources of drugs to enhance the activities of CBAHWs, or they could be an alternative channel of health services delivery to livestock keepers. These issues are addressed in the next section.

Table 6 — Accessibility of CBAHWs to personnel and facilities that could influence their work

Personnel or facility	Mean distance (km)	Standard deviation	Minimum distance (km)	Maximum distance (km)
Town	12.10	10.33	1	40
Veterinary officer	33.50	22.30	1	65
Para-veterinarian	21.20	13.61	2	60
Road open all year round	12.82	15.81	0	62
Seasonal road	7.94	12.17	0	40
Market	8.10	8.02	0	32
Veterinary drug shop	13.50	10.73	1	40

Source: Survey data, 2001.

³ Data from three workers were found insufficient and were not used in the analysis.

4.3 Factors influencing the level of activity of CBAHWs

On the assumption that the criteria for selecting trainees is crucial to their success as CBAHWs, the research team undertook a further analysis to identify the relationship between trainee personal characteristics (in Table 1) and their level of activity as CBAHWs. Currently, there is limited understanding of the interaction between selection and success. Until success is clearly defined, the role of selection and the criteria employed cannot be adequately assessed. As a starting point, the assessment of CBAHWs' success should incorporate their level of activity, technical competence, role and coverage within the community, commitment to work, motivation, and sustainability (Oakeley 2001). This study took the level of activity to be an indicator of success. The level of activity was measured as the number of cases handled by a CBAHW in a given period, which in this case was the one-year period preceding the survey. The correlation between the level of activity and personal characteristics revealed that the number of refresher courses undertaken, which is an indicator of professional development, had a significant and positive relationship with the level of activity of CBAHWs (Table 7). No other variables appear to significantly correlate with the level of activity of CBAHWs.

Table 7 — The relationship between level of activity and characteristics of CBAHWs

Variable	Correlation coefficient	Significance level
Refresher courses attended	0.6244	0.000
Distance to open road	0.3692	0.038
Distance to town	0.3287	0.066
Distance to a veterinarian	0.3228	0.072
Distance to drug shop	0.3118	0.082
Total nonfarm income	-0.2646	0.143

Source: Survey data, 2001.

Analysis was also undertaken to establish if there were differences in level of activity based on gender and possession or lack of business skills. There were no significant differences in the number of cases handled between male and female workers ($p = 0.05$). Business skills were assessed at two levels: first by training and second by management or commitment to work as a CBAHW. Training entailed courses undertaken in business skills, and management encompassed proper day-to-day running of health care practice by keeping records. Intuitively, one would guess that those who had undergone training in business skills were more likely to keep records and thus that the two variables were likely to be correlated. This was not the case, however, for this set of data. There were significant differences in the number of cases handled by workers who kept records and those who maintained no records ($p = 0.05$) (Table 8). Significant differences also existed in the number of cases handled by those workers trained in business skills and those without training ($p = 0.05$). Therefore, it appears that CBAHWs with training in business skills are more active than those without, and gender had no significant influence on level of activity of these workers.

Table 8 — Differences in level of activity of CBAHWs based on commitment to work and possession of business skills

Variable	Sample size	Mean cases	T-value	P-value
<i>Business skills</i>				
Trained	16	134.62	2.01	0.05
Not trained	16	50.56		
<i>Commitment to work</i>				
Keeps records			4.00	0.00
Keeps no records	18	156.00		
	14	11.07		

Source: Survey data, 2001.

4.4 Building personal characteristics into performance analysis

A linear regression was fitted to determine the strength of each of these variables on the level of activity of CBAHWs (Equation 1). Independent variables used were distance to veterinary drug shop, total annual income from other activities, gender, and the number of refresher courses attended. Distance to nearest veterinary personnel was not used in the estimation procedure (despite being significant at $p < 0.10$) because of its high correlation to distance to nearest veterinary drug shop. Possession of business skills and keeping of records were entered as dummy variables (one indicates training in business skills and keeping of records; zero indicates none). The results are given in Table 9, which shows model build up from model 1 to model 3.

The number of cases handled by the workers was significantly influenced by the number of refresher courses attended and also by whether the worker keeps records or not. All other hypothesised influencing factors (business skills training, income, gender, and distance to drug shop) were not significant.

These results indicate that the CBAHWs who kept records could handle about 98 cases per year more than those who did not, other things being equal. In addition, an extra refresher course undertaken could increase the level of activity by up to 25 more cases per year. These findings show that continual professional development through refresher courses and commitment to work indicated by keeping records are important factors in determining the success of the community-based animal health workers model.

Table 9 — Factors influencing the level of activity of CBAHWs in Mtito Andei

Variable	Model 1		Model 2		Model 3	
	b	S.d.	b	S.d.	b	S.d.
Constant	-35.4640	76.9665	-48.3666	44.4537	-28.4151	26.6491
Possession of business skills (dummy: skills = 1, no skills = 0)	27.7412	44.0604	13.4627	35.7998	—	—
Years of farming experience	2.1995	2.2668	0.8773	1.7149	—	—
Distance to nearest veterinary shop (km)	0.8248	2.2824	—	—	—	—
Keeps practice records (dummy: keeps records = 1, no records = 0)	95.5141*	55.3631	97.0706***	37.5977	97.8637***	34.7738
Refresher courses (number attended)	20.2964**	10.4363	24.3706***	8.2004	25.1278***	7.7756
Male gender, (dummy: male = 1, female = 0)	-18.5412	57.0640	—	—	—	—
Income (Kshs per year)	-0.00051	0.00096	—	—	—	—
R2	0.5563		0.5272		0.5207	
Adj. R2	0.3950		0.4572		0.4876	
F- value	3.4483		7.5277		15.7541	
D.W. test	1.8866		1.8742		1.8863	

Source: Survey data, 2001.

Note: Level of significance: *** = 0.01; ** = 0.05; * = 0.10.

4.5 Factors determining the sustainability of the activities of CBAHWs

A logistic regression was used to analyse the effects of personal characteristics, indicators of income, and competition on the likelihood of a CBAHW's remaining in active practice (equation 2). The independent variables included annual income from other activities, distance to veterinary drug shop, years of farming experience, number of refresher courses attended, possession of business skills as a dummy variable (dummy = 1 if trained in business skills and 0 for none), and maintenance of practice records (dummy = 1 for keeping records and 0 for none). Age of the CBAHW and distance to a trained veterinarian were not included because of their high correlation with years of farming experience and distance to veterinary drug shop respectively. The results are given in Table 10.

Table 10 — Factors determining the likelihood of a CBAHW's remaining in active practice in Mtito Andei

Variable	Model 1		Model 2		Model 3	
	β	S.d.	β	S.d.	β	S.d.
Constant	-12.9467	7.9998	-10.0410	5.9311	-3.8016	1.6892
Possession of business skills (dummy)	2.1471	2.2494	1.6951	1.9645	—	
Years of farming experience	0.2048	0.1590	0.1766	0.1410	—	
Distance to veterinary shop (km)	0.0638	0.0935	—	—	—	
Keeping of practice records (dummy)	6.6088**	3.0838	6.6141**	2.8875	0.9480***	0.5762
Refresher courses (number attended)	2.4166*	1.4686	1.9216*	1.1122	4.7015**	1.5388
Income (Kshs per year)	0.000017	0.000022	—	—	—	
-2Log likelihood/Goodness of fit	12.395 /20.454		12.752 /25.592		15.018 /25.988	
Chi-squared	30.84 ($p = 000$)		30.48 ($p = 000$)		28.21 ($p = 000$)	

Source: Survey data, 2001.

Note: Level of significance: *** = 0.01; ** = 0.05; * = 0.10.

Model 3 in Table 10 was chosen as describing the data best. The model showed that the number of refresher courses and the keeping of practice records positively and significantly influenced the likelihood of a CBAHW's remaining in active practice. These are the same variables that were found to influence the level of activity. In this study, it was difficult to capture all the hypothesised variables in an econometric model, and further investigations are required in this area.

The odds ratio indicates that after attending refresher training three times, a CBAHW is 17.2 times more likely to remain in active practice than one who has attended only once. Furthermore, a CBAHW keeping records is 110 times (95 percent confidence interval 107.10, 113.12) more likely to remain in active practice than the one who keeps none. Table 11 shows that CBAHWs are more likely to remain active with repeated attendance of refresher courses.

Table 11 — The odds ratio of a CBAHW's remaining active by attending repeated refresher courses

Number of refresher courses	Odds ratio	95% C.I.
One	2.5805	(1.4511, 3.7098)
Two	6.6592	(5.5298, 7.7886)
Three	17.1844	(16.055, 18.3137)

Source: Survey data, 2001.

Possession of business skills did not significantly influence the probability of a CBAHW's remaining in active practice ($p < 0.05$) even though the CBAHWs who had business skills training attended to more cases than those without (Table 8).

5. THE CLIENTELE OF COMMUNITY-BASED ANIMAL HEALTH WORKERS

5.1 Farm and farmer characteristics

Livestock keepers interviewed were on average 49 years of age. They owned an average of 27.8 acres of land (ranging from 2 to 268). All of the households kept some livestock, which included cattle, goats, sheep, and chicken. Table 12 gives the current numbers of livestock kept and estimates of income from various major cropping activities in the previous season.

Table 12 — Current mean numbers of livestock owned and the estimated income from crop enterprise of the previous season

Enterprise type	% of farmers undertaking the enterprise (n = 182)	Sample mean	Sample std. dev.
Cattle	77	5.960	9.80
Goats	97	27.30	29.75
Sheep	32	3.040	7.59
Maize income (Ksh/year)	97	15499	22777
Cow peas income (Ksh/year)	71	2679	4680
Sorghum income (Ksh/year)	30	836	2539
Millet income (Ksh/year)	10	179	1108

Source: Survey data, 2001.

Sample farmers kept about 5,523 small ruminants (goats and sheep) and 1,085 cattle during the year preceding the survey. This gave a sample average of 30 small ruminants and about 6 cattle per household. More goats were kept than sheep, at a ratio of 9:1. An analysis of the trends in livestock numbers following the privatisation of veterinary services in 1991 showed that the proportion of farmers keeping cattle, sheep, and goats slightly increased between 1992 and 2001 (Figure 4), while the total number of livestock fell slightly (Figure 5). This reduction, however, may not be entirely attributable to changes in animal health service delivery.

About half of the household heads interviewed engaged in some form of additional income generation besides crop sales and livestock off-take. These other activities included running small informal enterprises (30 percent) and employment in the government or private

sector (20 percent). Furthermore, about 10 percent of spouses of household heads were also engaged in off-farm income generation. The mean annual nonfarm and farm incomes were Kshs 10,464 and Kshs 43,155, respectively. The total farm income, computed as sum of farm and nonfarm income, was not significantly different between male- and female-headed households ($p < 0.05$). Female-headed households formed 21 percent of the sample. The majority of household heads interviewed had a primary school education (Figure 6), and about 87 percent of the household heads visited were literate.

Figure 4 — Trends in percentage of farmers keeping livestock, Mtito Andei division

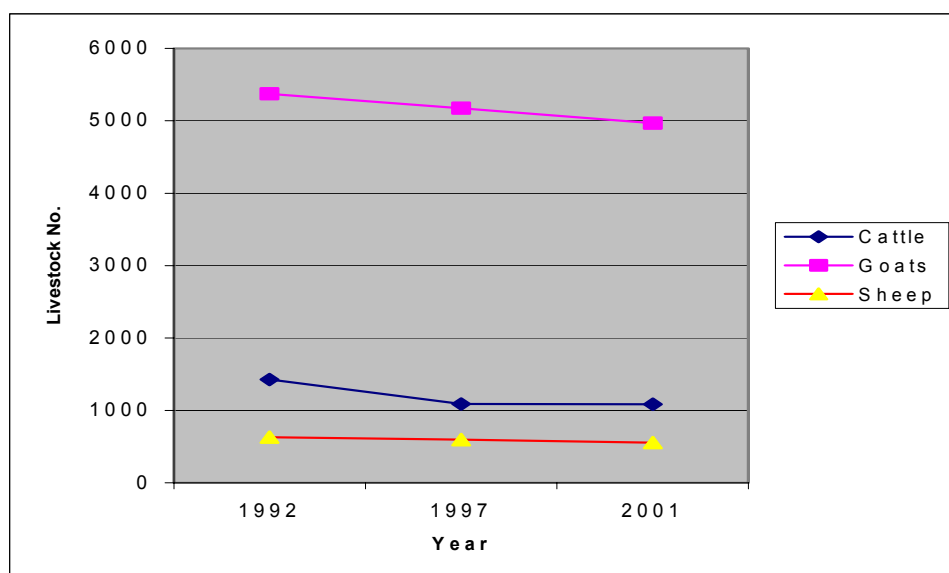


Figure 5 — Trends in sample livestock numbers (1992 - 2001), Mtito Andei

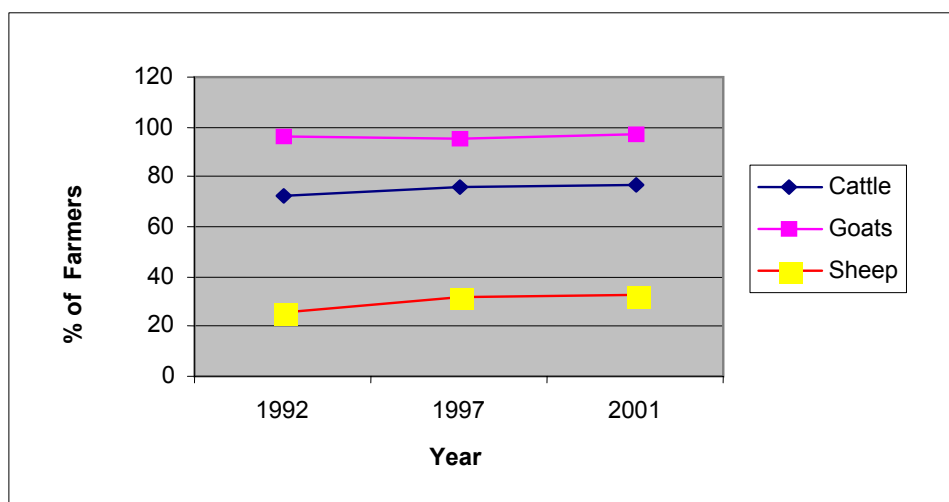
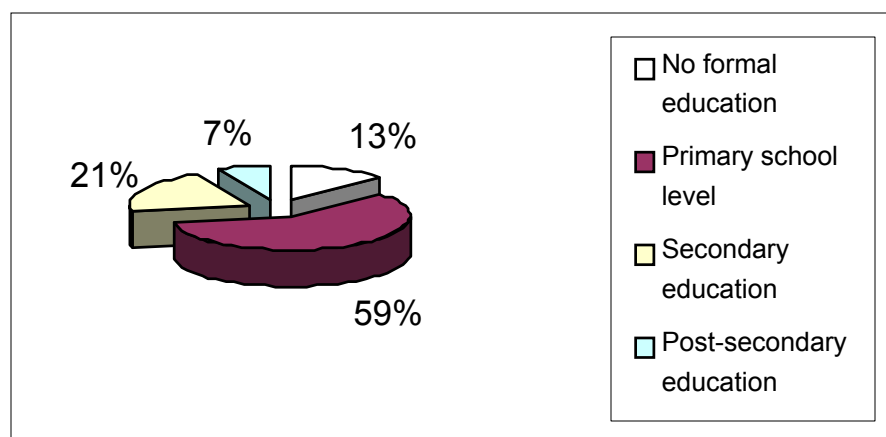


Figure 6 — Percentage of household heads with varying levels of education



Source: Survey data, 2001

Information was also collected on possession of assets to give an indication of wealth. Assets included housing and means of transport owned such as animal-drawn cart, bicycle, or motorised vehicle (Table 13).

Table 13 — Percentage of livestock keepers owning different assets

Type of asset	% of farmers owning the asset
Bicycle	90.70
Permanent house (brick/stone wall and iron sheet roof)	64.30
Animal-drawn cart	13.70
Motorised transport	4.70

Source: Survey data, 2001.

The farmers in the study region rely mostly on bicycle transport owing to a poor road network. The average distance from the farms to a seasonally passable road was 7.6 kilometres (range: 0–58 kilometres, standard deviation = 7.10), whereas the average distance to a road passable all year round was estimated at 13.10 kilometres (range: 0–63 kilometres, standard deviation = 20.90).

5.2 Access to and utilisation of animal health services delivery channels

The animal health delivery systems identified in the region included government veterinary services (one veterinarian and one para-veterinarian commonly known as an animal health assistant, or AHA), private veterinary practice undertaken by a para-veterinarian, the veterinary drug shops, and CBAHWs. The mean distances from the livestock keepers' farms to each of these health delivery source points are summarised in Table 14.

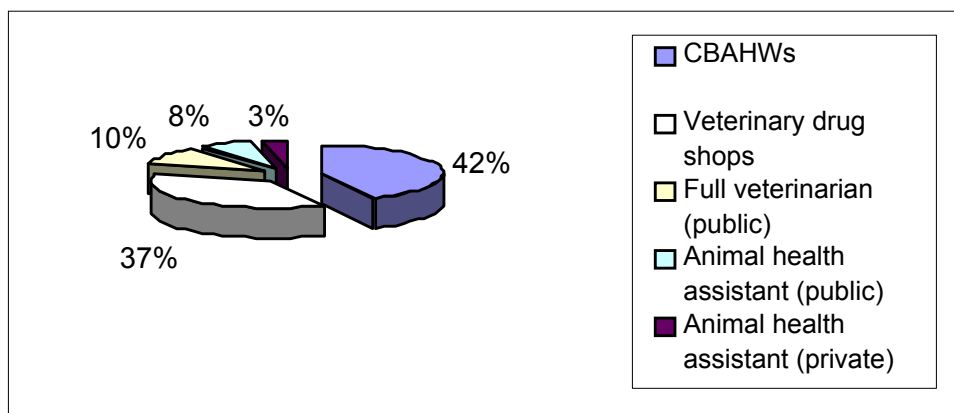
Table 14 — Mean distances to nearest sources of different animal health delivery services

Type of service	Mean distance (km)	Range	Std. dev.
Veterinarian	33.79	1 – 61	31.88
Animal health assistant	21.91	1 – 64	8.72
Veterinary drug shop	12.46	1–36	9.05
CBAHW	2.00	0–15	1.72

Source: Survey data, 2001.

Information was gathered to determine how livestock keepers used each of these health delivery services during the year preceding the survey. The proportion of livestock keepers who had made contact with each of these health delivery services is shown in Figure 7.

Figure 7 — Percentage of livestock keepers that made contact with various animal health delivery systems



Source: Survey data, 2001

CBAHWs were the most utilised channel, whereas private para-veterinarians were the least used. It appeared that the public veterinary staff were acting in their private capacity and charging lower fees than the private practitioners. It was difficult to compare the charges imposed by these health delivery channels, however, because of differences in the nature of the cases they handled. Otieno-Oruko, Upton, and Mcleod (2000) noted that public veterinary personnel could be using government facilities to engage in private practice (popularly known as semi-private practice) and thus constraining the development of private veterinary practice.

Each respondent was asked to give the most preferred health delivery channel based on a number of parameters, particularly cost, effectiveness, availability, and reliability. The findings are summarised in Table 15.

Table 15 shows that CBAHWs was the most preferred channel. About 44 percent (n = 171) of the respondents indicated that their most preferred channel was not the most utilised channel. The main reasons given were that the most preferred channel was either not readily available (75 percent, n = 76) or it was expensive (24 percent).

Table 15 — Ranking of the health delivery channels by livestock keepers

Animal health delivery channel	% of respondents mentioning the channel as the most preferred
CBAHWs	40
Public veterinary services	34
Drug shops	21
Private veterinary services	1
Ethnoveterinary	1

Note: Not all percentages add up to 100 because of nonresponses in some cases.

Source: Survey data, 2001.

Table 16 gives the main ailments encountered by the livestock keepers and the type of health delivery channel used to manage these ailments for the three years prior to the survey. The main ailments were defined as those for which a case was likely to be encountered on a monthly basis in any livestock type and for which preventive measure had to be taken to avoid recurrence. Trypanosomiasis and tick-borne diseases were the most reported diseases. These are vector-transmitted diseases, infecting both domestic and wild animals. The presence of wild animals in the settled areas could not be ruled out as contributing to high incidences of these diseases. GIT parasites, infecting mainly the young stock and small ruminants, were also common. CBAHWs were the delivery channel used most often for all categories of diseases in this area.

Table 16 — Main ailments reported by livestock keepers and the health delivery channels used to manage the ailments between 1998 and 2001

Main ailment	% (n = 171) of livestock keepers using:		
	CBAHWs	Professionals ^a	Drug shops ^b
Trypanosomiasis ^c	64.2	20.8	32.4
Tick-borne diseases	63.7	24.0	41.7
GIT parasites	60.4	14.8	49.3
Coughing	51.0	14.7	39.5
Stock diarrhea	28.5	4.4	31.1
Wounds	4.9	1.5	4.8

Source: Survey data, 2001.

^aProfessionals in this case refers to formally trained animal health personnel, including veterinarians and para-veterinarians in private and public practice.

^bUse of veterinary drug shops entailed purchase of drugs from these outlets to facilitate own treatment.

^cLivestock keepers' knowledge about trypanosomiasis and tick-borne diseases in the area could stem from the activities of NGOs (like ITDG, GAA) and government institutions (like KETRI, KARI) that have been actively involved in creating community awareness on disease and vector identification and control (KETRI 2000).

About 66.1 percent (n = 171) of the livestock keepers indicated that they had undertaken own treatment of their livestock during the year preceding the survey. Further investigations to identify the source of knowledge that enabled them undertake own treatment revealed that 45 of these livestock keepers (representing 39.8 percent of those undertaking own treatment) had learnt this skill from CBAHWs. The rest had either attended training (not linked to CBAHW programmes), participated in farmer field days organised by drug companies, or learned from the extension staff. The drugs used in own treatment were purchased from veterinary drug shops, CBAHWs, and veterinary personnel. This implies that besides providing curative services, CBAHWs are also a source of animal health knowledge and veterinary drugs for other livestock keepers.

5.3 Characteristics of farmers using specific animal health delivery systems

Information collected on access to and use of different health delivery channels revealed that livestock keepers could be stratified in specific groups based on their health service channel preference and use. Of the 182 livestock keepers interviewed, about 43 percent used a combination of different health delivery channels, 29.1 percent used CBAHWs exclusively, 18.6 percent used only veterinary drug shops, and 4.4 percent used only trained veterinary personnel.⁴ Table 17 shows the trends in the mean numbers of

⁴ Eleven of these livestock keepers could not be conclusively classified in any of these categories.

livestock kept for these groups of livestock keepers stratified by health service delivery channel.

Users of veterinarians' services had significantly higher numbers of animals than users of other health delivery channels, for all types of livestock. This finding was observed for all years from the onset of restructuring of animal health services in Kenya in 1991. Yet between 1992 and 2001 the number of cattle owned fell for all users of health service delivery channels. It declined by 19.5 percent for CBAHW users, by 15.9 percent for veterinary personnel users, by 37.7 percent for drug shop users, and by 32.8 percent for mixed service users.

Users of CBAHWs, however, registered a 7.3 percent increase in goats for the same period, despite reductions for users of the other health delivery channels. These reductions in goats were 27.9 percent, 9.6 percent, and 26.1 percent for veterinary staff, drug shops, and mixed service users, respectively. This finding could be explained by the fact that CBAHWs more often attended to goats than to other animals (Table 4). On the other hand, the finding could be purely a sample phenomenon. For the mixed service users, the order of preference of use of these services was not investigated.

Table 17 — Mean livestock owned stratified by health service delivery channel for 1992, 1997, and 2001

Mean	CBAHWs (s.d.)	Veterinary staff (s.d.)	Drug shops (s.d.)	Mixed service users (s.d.)
Cattle 1992	4.1 ^{a, b} (5.5)	19.4 ^a (17.8)	11.4 ^b (19.4)	8.1 ^a (13.03)
Cattle 1997	3.35 ^{a, e} (4.1)	17.9 ^{a, b, c} (22.8)	7.8 ^{b, e} (9.7)	5.75 ^c (7.96)
Cattle 2001	2.85 ^a (3.4)	13.5 ^{a, b, c} (27.0)	6.41 ^b (8.2)	5.44 ^c (7.74)
Goats 1992	22.0 ^a (22.1)	74.0 ^{a, b} (85.7)	32.3 ^b (45.3)	38.0 (62.1)
Goats 1997	25.4 ^a (26.5)	73.5 ^{a, b, c} (82.2)	30.4 ^b (29.2)	23.7 ^c (27.5)
Goats 2001	23.6 ^a (22.3)	53.0 ^{a, b, c} (74.1)	29.2 ^b (39.2)	28.1 ^c (22.8)
Sheep 1992	2.1 ^a (5.5)	15.4 ^{a, b, c} (15.9)	3.5 ^b (7.7)	3.6 ^c (8.9)
Sheep 1997	2.5 ^a (6.5)	13.1 ^{a, b, c} (21.6)	3.6 ^b (7.6)	2.9 ^c (6.3)
Sheep 2001	3.2 (7.3)	7.6 (16.5)	4.0 (10.7)	2.0 (4.8)

Source: Survey data, 2001.

Note: Values with the same superscript in a row are significantly different between groups using Kruskal-Wallis test; n =171; s.d. = standard deviation.

Table 18 summarises the level of income and land held by the respondents stratified by animal health delivery channel. Users of veterinary staff had significantly higher aggregated crop income and total income than did users of other channels. On average, they also had larger (but not significant) parcels of land than users of other health channels ($p = 0.05$). Larger livestock herd or flock size and land owned are often associated with wealth. Therefore, users of services of CBAHWs had significantly less wealth than users of trained veterinary personnel. On the other hand, there was no significant difference in income level between users of the other health delivery channels. Given that the farmers share a similar habitat, it appears that the choice of a health service channel is influenced by, among other factors, the wealth status of livestock keepers. Past studies have established that clients of veterinarians are usually better resource endowed (Wamukoya, Gathuma, and Mutiga 1995). Similarly, Holden (1997) found that richer farmers tended to use CBAHWs more frequently than poor farmers, when users and nonusers of CBAHWs were compared. Her assessment, however, considered only CBAHWs and did not compare users of CBAHWs and with users of veterinarian services.

Table 18 — Levels of incomes and land size stratified by health service channel choice

Description of Income	CBAHWs Users	Vet Staff users	Drug shops users	Mixed users
Mean annual total farm income (Kshs)	25,688.27 ^a	350,062.50 ^{a, b}	23,327.48 ^b	25,907.97 ^c
Mean annual total income (Kshs)	35,654.53 ^a	385,912.50 ^{a, b, c}	28,746.84 ^b	36,977.18 ^c
Mean land acreage	19.84	42.37	22.45	35.78

Source: Survey data, 2001.

Notes: Values with the same superscript in a row are significantly different between groups using Kruskal-Wallis test; $n = 171$. US\$1 = Kshs 78 (June 2001).

Table 19 summarises the characteristics of the livestock keepers stratified by health service delivery channel.

There were no significant differences between different health channel users as far as age, formal education, and years of farming experience were concerned. Users of veterinary drug shops were nearer to drug outlets than users of other delivery channels. However, users of CBAHWs and veterinary personnel were not more advantaged than users of other channels in terms of their physical access to their sources of animal health services. This result could imply that factors other than physical access play a significant role in the choice of health delivery channel.

Table 19 — Characteristics of livestock keepers stratified by health service channel choice

Characteristic	CBAHWs users (s.d.)	Vet staff users (s.d.)	Drug shops users (s.d.)	Mixed service users (s.d.)
Mean distance to nearest Veterinary drug shop	8.9 ^b (6.0)	14.3 ^a (10.8)	7.9 ^{a, b} (6.0)	17.3 ^b (8.8)
Mean distance to nearest Veterinary personnel	26.7 ^{a, b} (17.6)	44.0 ^a (20.1)	25.0 ^{a, b} (19.9)	40.6 ^b (17.7)
Mean distance to nearest CBAHW	1.87 (2.43)	2.13 (1.81)	1.79 (0.82)	2.23 (1.64)
Mean age in years	46.5 (11.2)	56.1 (15.5)	51.9 (14.3)	48.5 (14.5)
Years of formal education	2.3 (0.9)	2.6 (1.5)	2.2 (0.7)	2.2 (0.9)

Source: Survey data, 2001.

Note: Values with the same superscript in a row are significantly different between groups using Kruskal-Wallis test; n =171; s.d. = standard deviation.

5.4 Variation in livestock productivity among users of different health delivery channels

Table 20 summarises the breeding index (BI) and birth ratios (BR) stratified by health delivery channel.

On average, the number of births per cow for livestock keepers using veterinary personnel was lower than that of those using CBAHWs ($p = 0.10$). On the other hand, the breeding index for cattle herds belonging to users of veterinary personnel was not significantly different from that of users of CBAHWs ($p = 0.10$). This finding could be an indication that the absolute calf mortality rate was higher in herds of livestock keepers using services of CBAHWs than those using services of veterinary personnel. It appears that the higher average calving per cow, which has been attained within CBAHW users, is countered by lower calf survival.

The case for goats was no different. The number of births recorded per doe was also lower among livestock keepers who used veterinary personnel compared with that of livestock keepers who used CBAHWs ($p = .10$). The BI between these two groups of livestock keepers was, however, not significantly different ($p = 0.10$).

Table 20 — Breeding indexes and birth ratios of cattle and goats among livestock keepers stratified by health service delivery channel

Productivity parameter	Animal health delivery channel			
	CBAHWs users (s.d.)	Vet staff users (s.d.)	Drug shops users (s.d.)	Mixed service users (s.d.)
Cattle				
Breeding Index (2001)	0.3466	0.6625	0.3595	0.3840
	(0.4115)	(0.4749)	(0.3837)	(0.3955)
Birth ratio ^a	0.4272 ^{1,2}	0.3347 ¹	0.3149 ²	0.4094
	(0.3847)	(0.2950)	(0.2695)	(0.3698)
Goats				
Breeding Index (2001)	0.4545	0.4022	0.5563	0.5853
	(0.2972)	(0.3111)	(0.4292)	(0.3897)
Birth ratio ^a	0.4997 ¹	0.2485 ^{a,1,2}	0.4016 ^{b,2}	0.6136 ^{a, b}
	(0.4532)	(0.1547)	(0.2227)	(0.4117)

Source: Survey data, 2001.

Note: Values with the same alphabetical and numerical superscripts in a row are significantly different at $p = 0.05$ and $p = 0.10$ respectively between groups using Kruskal-Wallis test; $n = 161$ for goats and 101 for cattle; s.d. = standard deviation.

*Birth ratios are averages for the years 1998/99, 1999/2000, 2000/01.

Based on this comparison, CBAHWs appeared to provide services that enhanced the fertility of their clients' herds, probably because they are trained to handle common diseases and ailments in their area of operation and because of their proximity to their clients. Thus, they appear to have had a positive impact on herd productivity.

Livestock keepers who used a combination of health delivery channels had the highest birth ratio in goats, which was significantly different from that of veterinary personnel and veterinary drug shop users. In the year 2000 the proportion of livestock keepers that made contact with CBAHWs was 76.4 percent ($n = 182$). Fifty-three of them used CBAHWs exclusively. This implies that all the livestock keepers who used a combination of services (together with those who could not be categorised) used the services of CBAHWs, in addition to other channels.

6. PRIORITIES FOR PARTICULAR ANIMAL HEALTH SERVICES

Understanding the health service priorities of livestock keepers and the capabilities of CBAHWs should reveal ways of strengthening animal health service delivery through CBAHWs. Therefore, the CBAHWs who were assumed to be knowledgeable livestock keepers were asked to rank 10 health and production services in order of priority. This approach was used to minimise divergent priorities arising from differences in level of knowledge on livestock health among livestock keepers. The responses are given in Table 21. These were the services that had been mentioned as being important during the exploratory stage of this study. CBAHWs gave higher priority to preventive than to curative measures in management of livestock health, and these priorities are in accordance with newer veterinary practice philosophy.

The priorities mentioned by CBAHWs, however, seemed to downgrade those aspects of veterinary medicine that provide collective rather than private benefits. As shown in Table 21, on average, CBAHWs mentioned tick control as top priority, followed by preventative (prophylactic) and curative management of killer diseases and pasture improvement. These services offer private gains to livestock keepers undertaking them. Tsetse control and immunisation against epizootic diseases have a strong public gain component and received lower ranking. Services with a private gain component that do not pose a great risk of death to livestock also received a lower ranking.

Table 21 — CBAHWs' ranking of specific veterinary services (n = 35)

Type of service	% of CBAHWs ranking the service as			Average rank
	1 st	2 nd	3 rd	
Tick control	100.0	0.0	0.0	1.00
Preventive management of killer diseases like trypanosomiasis	80.0	20.0	0.0	1.20
Training in pasture improvement and management	80.0	20.0	0.0	1.20
Curative treatment of killer diseases like ECF, trypanosomiasis	80.0	20.0	0.0	1.20
Tsetse control	74.3	25.7	0.0	1.25
Surveillance of notifiable diseases	65.7	34.3	0.0	1.30
Immunisation against killer diseases like CBPP, CCPP	62.9	17.1	7.0	1.57
Artificial insemination for upgrading of local breeds	48.6	25.7	25.7	1.77
Curative treatment of nonkiller diseases like GIT parasites	28.6	60.0	11.4	1.80
Immunisation against nonkiller diseases like FMD	34.3	54.3	11.4	1.80

Source: Survey data, 2001.

Note: ECF = East Coast Fever; CBPP = Contagious Bovine Pleuroneumonia; CCPP = Contagious Caprine Pleuroneumonia; FMD = Foot and Mouth Disease

The CBAHWs were then requested to give their opinion on who should offer the services prioritised and who should meet the cost. Their responses are given in Table 22.

Table 22 — CBAHWs' opinions on delivery channels and financing sources of specific veterinary services

Type of service	Delivery channel and financing institution (mentioned by more than 65% of respondents)
Tick control	Public veterinary channel and CBAHW financed by livestock keepers
Preventive management of killer diseases like trypanosomiasis	Public veterinary channel and CBAHW financed by livestock keepers
Training in pasture improvement and managements	Mainly through CBAHWs with improvement costs met by livestock keepers
Curative care of killer diseases like ECF, trypanosomiasis	Mainly through CBAHWs with costs met by livestock keepers
Curative care of nonkiller diseases like GIT parasites	Mainly through CBAHWs with costs met by livestock keepers
Tsetse control	Mainly through CBAHWs with costs met by government
General notifiable diseases surveillance	Mainly through CBAHWs with costs met by government
Immunisation against killer diseases like CBPP, CCPP	Public veterinary channel and CBAHW financed by livestock keepers and the government
Artificial insemination for upgrading of local herds	Public veterinary channel and CBAHW financed by livestock keepers and the government
Immunisation against nonkiller diseases like FMD	Public veterinary channel and CBAHW financed by livestock keepers and the government

Source: Survey data, 2001.

The responses indicated that CBAHWs were willing to provide veterinary services for which livestock keepers pay and also for those that they expect the government to finance. CBAHWs seemed to evaluate veterinary services solely in terms of perceived benefit to stock keepers, with little regard to whether or not they are able to pay for them. They have a good understanding of the perceived benefits associated with these services. Assuming that this is representative of livestock keepers' opinions, it can be concluded that the perceived benefits of these services are clear and that the payment method does not seem to have a strong effect on livestock keepers' priorities as would be expected from standard economic analyses.

In order to identify likely areas for strengthening the CBAHW programmes, the CBAHWs were asked to group these services into:

- Services that they currently provide and for which veterinarians and para-veterinarians approve;
- Services that they currently provide and for which veterinarians and para-veterinarians do not approve;
- Services that they think they can provide (but currently they do not provide them) and for which veterinarian and para-veterinarians would perhaps approve; and
- Services that they think that they can offer (but currently they do not offer them) and for which veterinarians and para-veterinarians would ordinarily not approve.

The results, given in Table 23, show that CBAHWs can offer more services than they currently do.

Table 23 — Classification of services undertaken by CBAHWs

		Veterinarians and para-veterinarians	
		Approve	Disapprove
CBAHWs	Services currently provided	Disease diagnosis and treatment (80%) Providing information on notifiable diseases (74.3%) Drug handling and use (57.1%) Livestock extension services	1. Managing drug stocks for sale (17.2%) 2. Herbal medicine (17.1%) 3. Castration services
	Services not currently provided (but which could be provided)	1. Handling cases of complicated deliveries (57.1%) 2. Basic surgical procedures (45.7%) 3. Artificial insemination (34.3%) 4. Participation in vaccination campaigns (31.4%) 5. Handling and administering of vaccines (31.4%) 6. Organisation of field days and demonstrations (31.4%)	1. Food hygiene (meat inspection) (20%) 2. Providing veterinary services outside the CBAHW project area (2.9%)

Source: Survey data, 2001.

Note: Figures in parentheses show the proportion of CBAHWs mentioning the response.

The services that CBAHWs could offer with the assistance of veterinarians and para-veterinarians include:

- Participation in vaccination campaigns and handling and administering of vaccines;
- Undertaking of basic surgical procedures;
- Organizing of field days and demonstrations to improve livestock keepers' knowledge;
- Provision of artificial insemination services; and
- Handling of some cases of complicated deliveries.

The CBAHWs currently offer mainly clinical services, but CBAHW participation in vaccination campaigns is not new. It has been tried successfully in the Afar region of Ethiopia and in southern Sudan (Catley and Leyland, 2001). In the case of the Afar region, Mariner (1996, quoted by Catley and Leyland, 2001) noted that CBAHWs achieved 84 percent vaccination efficiency using a heat-stable vaccine against rinderpest. This exceeded the 72 percent vaccination efficiency of Ethiopian government vaccination teams and compared favourably with conventional rinderpest vaccination campaigns in Africa generally, which achieved vaccination efficiency of 60–85 percent. Participation of CBAHWs in vaccination campaigns has also been reported in Senegal (Ly 2000), where they played a supportive role to the official veterinary technicians and also undertook nonmandatory immunisations.

Basic surgical procedures that can be undertaken by CBAHWs include de-horning, castration, and handling of wounds and fractures. Some of the CBAHWs in Senegal (also known as auxiliaries) were reported to own castration clips and scissors. The presence of these veterinary instruments within their toolkits indicated that their services were diversified and not limited to drug sales and injection services. The same can be applicable to CBAHWs in Kenya. Furthermore, these workers can offer artificial insemination services that are currently being promoted by government.

Advocating for management of drugs for the purposes of sale is likely to generate conflict between CBAHWs and veterinary personnel. Currently, there are at least 16 acts of Parliament that affect the veterinary profession in Kenya (Hubl, Gathuma, and Kajume 1998). Two of these acts have a significant impact on the practice of the veterinary profession in ASAL, namely the Veterinary Surgeons Act (Cap. 366) and the Pharmacy and Poisons Act (Cap. 244) of the laws of Kenya (Cap. 366) describes the qualifications required for registration by the Kenya Veterinary Board (KVB) to engage in private practice. This act recognises only veterinarians (trained at the university level) as candidates for private practice and excludes the para-professionals (diploma and certificate holders) and CBAHWs. This legal provision imposes a constraint in the ASAL since very few veterinarians are currently willing to work in these areas. If this remains the case, approximately two-thirds of the country and its animals will be excluded from the benefits of privatisation (Winrock 1992). Cap. 244 is even more stringent: it denies veterinarians the legal right to trade in veterinary drugs except for the purpose of treatment. This legally undercuts the establishment of veterinary drug shops that are the backbone of an effective CBAHW programme. Furthermore, these acts do not provide any mechanism for persons not registered under

Cap. 366 to seek legal redress for payment of any services they might have rendered to their clients.

Despite the restriction imposed by these legal instruments, several organisations have trained CBAHWs in several parts of the country. Some of these organisations include ITDG, Farm-Africa, Oxfam, GTZ, and DANIDA, among others. These organisations have had a difficult task trying to lobby for a change of attitude in the veterinary profession to recognise and accommodate the CBAHW model. These organisations have pursued policy advocacy by engaging in dialogue with key policy formulators in the veterinary field, making field visits to areas with CBAHW programmes, and offering workshops for exchange of ideas and experiences related to CBAHW activities (ITDG 2000b, 2000c). These efforts have resulted in some achievements, including a more attitude toward CBAHWs, to the extent that most are operational despite contravening the law. Unless the law is changed, however, investment in this area is bound to remain constrained.

7. CONCLUSIONS AND POLICY IMPLICATIONS

About 79 percent of livestock keepers interviewed had used the services of CBAHWs within a period of one year preceding the survey. Of these, about 37 percent (29 percent of the total sample) had used CBAHWs exclusively as a source of animal health services. The rest had used CBAHWs in combination with other channels like veterinary personnel and veterinary drug shops. This study argues that CBAHWs are providing animal health services in marginal areas and that their activities should be strengthened as one of the approaches to health service delivery.

7.1 Sustainability of the CBAHW model

CBAHWs' level of record keeping and professional development were the main attributes that determined their level of activity. Here is why: the limited initial training offered to the CBAHWs, it appears that livestock keepers are likely to acquire this knowledge from them and thereafter dispense with their services. Sixty-six percent of the livestock keepers interviewed reported that they had undertaken their own treatment of their livestock within a period of one year preceding the survey. About 40 percent of these livestock keepers revealed that they had acquired this skill from CBAHWs, and 91 percent of them reported that they had obtained the drugs used in treatment from veterinary drug stores. In order to remain financially viable, therefore, CBAHWs must be able to compete with veterinary drug stores for livestock keepers' business. Common sense says that even if the services of CBAHWs include advice and assistance in administration of drugs, livestock keepers will only be willing to pay for drugs priced at levels comparable to those offered by veterinary drug stores. CBAHWs have a competitive advantage over drug stores, however, in that they can lower their drug prices by selling individual doses to livestock keepers. Most drug packaging available from veterinary drug stores is meant to treat several animals, but CBAHWs can sell individual doses by treating several livestock keepers' animals within a few days. The administration of anti-helminthics (for GIT parasites) and trypanocides (for trypanosomiasis) is particularly amenable to this practice.

It seems that CBAHWs, who did not keep records, had difficulty pricing drugs for subsequent sale. Those who kept records made a profit from their activities, whereas those who did not keep records may have been spending more on drugs than they could recoup from sales and therefore were unable to restock their drugs in time to continue offering services.

As far as professional development was concerned, the CBAHWs who regularly enhanced their level of animal health knowledge by attending refresher courses were more active than those who did not. Therefore it is logical to argue that CBAHWs need to remain more knowledgeable than ordinary livestock keepers on livestock health matters. Those who do not enhance their level of knowledge may find their services being demanded less as livestock keepers in their surroundings acquire an equivalent level of knowledge.

Enhancing the record keeping and professional development of CBAHWs will strengthen their capacity in service delivery. Livestock keepers will have easy access to

veterinary inputs. They will be able to obtain treatment when required without having to walk longer distances to local veterinary drug stores. Furthermore, livestock keepers will be able to purchase the exact quantity of drugs required. This will reduce the cost of treatment. Livestock keepers will therefore be more inclined to treat or protect their animals with veterinary inputs. At the same time, more knowledgeable CBAHWs will be able to effectively advise livestock keepers on correct drug dosages, especially in areas where livestock keepers are illiterate and cannot follow instructions on drug packets. In the absence of CBAHWs, livestock keepers will have to rely on their own knowledge or on the advice provided by drug stores. Some studies have shown that some of these veterinary drug stores are manned by persons without any training in animal health (Bett 2001). Under such circumstances, the risks of drug misuse are likely to be greater than when livestock keepers are acting under the advice of CBAHWs. The CBAHWs, although clearly not as well trained as veterinarians or para-veterinarians, appear to provide an improvement over having a few resource-endowed livestock keepers correctly advised by veterinarians or para-veterinarians and the majority of the community receiving no advice at all.

This study has shown that CBAHWs have enhanced the capacity to deliver animal health services in marginal areas. The government can support the CBAHWs through training, and the CBAHWs can in return provide a frontline service in animal health delivery in these areas. There is thus a positive synergy between the government and CBAHWs that the government should consider exploiting.

7.2 Regulation and service delivery enhancement

The current licensing requirements for private veterinary practice exclude important types of animal health service providers. The role of CBAHWs is critical in the provision of animal health services in marginal areas, given the state of events and infrastructure in these areas. CBAHWs wishing to offer services to their communities should be encouraged to do so. Likewise, the CBAHWs currently offering services should be recognised and registered.

Nonetheless, a clear regulatory framework that encourages professional fair play should be enacted. The existing government animal health services structure has a clear and definitive role for veterinarians and para-professionals. Borrowing from this, a new legislative framework to regulate the activities of CBAHWs and give them an official role could be designed. By legitimizing the activities of these service providers, the state will be able to better monitor their performance and control malpractice. The formation of CBAHW associations could enhance training standards and encourage the formation of links with veterinarians. Such associations could also act as a link between CBAHWs and the Kenya Veterinary Board (KVB), whose mandate as a regulatory body should be widened to include a wide range of activities. Membership on the board should be expanded to include farmers or livestock keepers' groups. The three main stakeholders in the livestock industry, namely the government as the public trustee, the livestock producers, and the animal health service providers, would then jointly formulate policies on service delivery. The new board would act as an arbitrator in disputes and ensure maintenance of ethical standards in animal health practice. It is also within this expanded board that the operational framework of all service providers would be designed.

The current animal health services policy in Kenya is outdated because it was enacted before the wave of liberalisation within the African continent. If a review is to be undertaken, a National Veterinary Drug Policy (NVDP) is fundamental and can have a positive impact not only on health delivery, but also on public health and the environment. This policy should include the establishment of an Essential Veterinary Drugs List (EVDL)—that is, a list containing those drugs that have been found to be efficacious and safe for prevention and control of important animal diseases. The EVDL should contain:

- The animal species for which a drug is used;
- Disease condition, usage (treatment or control); and
- Classification—that is, which category of animal health delivery channel should use the drug (qualified veterinarians only, para-veterinarians, CBAHWs, etc).

Such a drug policy could provide the rationale for embracing different components of animal health delivery systems, stimulate pharmaceutical industries to ensure quality control and regular supply, and allow CBAHWs to keep drugs to facilitate their activities. Such a list of drugs should, however, need frequent updating to incorporate advances in scientific knowledge.

7.3 Training and support of CBAHWs

The structure and content of training are vital factors in CBAHW programmes. The technical content and scheduling of training courses should be planned in the context of the local livestock production system. Training could be expanded to include not only the identification, diagnosis, and treatment of common diseases, but also the handling and use of veterinary drugs and the expected role of CBAHWs in relation to veterinary authorities. Furthermore, the training could be expanded to include broader animal husbandry and production techniques and extension skills. These training and supervision activities should offer an opportunity for active involvement of local private and government veterinarians and para-veterinarians. The training package should be developed through close consultation with the livestock-keeping community, using participatory assessment techniques. It may also be preferential to conduct the training in villages rather than in urban centres. Emphasis should be given not only to animal species and health problems present in the area, but also to likely epizootic diseases that could afflict the area. All programmes should emphasize the importance of refresher training and field visits. The activities of CBAHWs should remain community funded, whereas the government should handle the supervisory role.

7.4 Relevance of the findings to other countries

Problems in redesigning the structure of animal health service delivery to livestock keepers in response to the privatisation process are common to most African countries (Holden et. al., 1996). Public sector, budgetary constraints and external pressures mean that livestock keepers must meet larger shares of costs of services increasingly provided by private operators. This study indicates that arid and semi arid lands—where millions of livestock and their owner reside—do not provide conducive environments for high-cost

private veterinary practice. The results point to support for CBAHWs as a low-cost and sustainable strategy. However, supportive institutional and legal frameworks—which are currently lacking in most African countries—must first be developed. Further, CBAHWs require training in new skills and competencies if they are to be viable in the long run.

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Appendix 1: The Logistic Procedure

The logistic procedure fits linear regression models for binary or ordinal response data by the method of maximum likelihood. In this regression, the maximum likelihood estimates (MLEs) of the regression parameters are computed using the iteratively reweighted least squares (IRLS) algorithm. The output includes a table of parameter estimates and tests for the estimates. Using the parameter estimates, the estimated logit of the probability of an event (that is, a CBAHW remaining in active practice) at different level of the exogenous variables can be calculated as:

$$\text{logit}(p) = \pi = \pi_0 + \pi'X' \quad (1)$$

where: π_0 = intercept parameter estimate

π' = vector of slope parameter estimates

X' = vector of exogenous variables

From equation (1) above, the predicted probability of an event at the given levels of exogenous variables can be computed as:

$$P = e^{\pi} / (1 + e^{\pi}) \quad (2)$$

Other outputs of the logistic procedure include “the $-2 \log$ likelihood” ($-2 \log l$) which gives the contribution of the exogenous variables and “the likelihood ratio chi-squared test statistic” for testing the significance of the exogenous variables included in the model. Also of importance is the “odds ratio,” a measure of association which approximates how much more likely it is for the outcome to be among those with $I = 1$ (active CBAHWs) than among those with $I = 0$ (in active CBAHWs) at varying levels of any exogenous variable.