FACTORS INFLUENCING PASTORAL HOUSEHOLD LIVESTOCK-DEPENDENT INCOMES IN SELECTED AREAS OF TURKANA AND WEST POKOT COUNTIES OF KENYA.

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Abstract

This study was designed to determine factors influencing pastoral household livestock-dependent incomes in selected areas of Turkana and West Pokot counties in Kenya, and to find out if the choice of veterinary delivery systems is one of the factors. The main goal of the study was to shed more light on the strategies to adopt in order to increase pastoral household livestock-dependent incomes in the two counties. The purpose of this paper, is therefore, to provide baseline data to facilitate the tracking of progress made towards the improvement of pastoral household livestock-dependent incomes in the two counties since the devolution of government functions, following the adoption of a new national Constitution that was promulgated in March 2013. The study analyzed the social and economic factors that influence pastoral household livestock-dependent incomes in the selected areas. The hypothesis tested was that animal health service delivery in the arid and semi-arid lands (ASALs) is not adequate to improve pastoral incomes and livelihoods

Field surveys for the collection of information were conducted using questionnaires, while socio-economic data were used to draw up a 'check list' for a number of variables to determine factors affecting household income in the two counties. Descriptive and regression analyses were carried out for data collected from a total of 160 respondents (80 from Turkana county and 80 from West Pokot county), which included household income and expenditure, herd size, cost of delivery of veterinary services, household size, age of household head, level of education of household age, gender of household age, availability of credit to herders, availability and acceptability/satisfaction of veterinary services, and service demand. Semi-structured interviews were used to elicit specific information regarding the monthly animal health expenditure for a period of one year for the households involved and the mode of service delivery was obtained by identifying the most used animal health delivery systems in each area. The delivery systems considered included veterinarians (public or private), self-treatment using modern medicines, self-treatment using traditional medicines, or the use of community based animal health workers (CAHWs).

The results indicated that in Turkana county, the level of education, acceptability/satisfaction with available services and distance to the nearest veterinary clinic showed positive and significant ($p \leq 0.05$) influences on pastoral household livestock derived incomes. Household size showed a positive and marginally significant ($p \leq 0.10$) influence whereas accessibility showed a negative and marginal ($p \leq 0.10$) influence on pastoral household livestock incomes. The other variables (age of household head, cost of service delivery, and mode of service delivery) had positive but insignificant effects on household incomes, except for satisfaction with the available services, which had a negative but insignificant influence on household income.

In west Pokot county, the level of education of the household head also showed a positive and significant ($p \leq 0.05$) influence on pastoral household livestock incomes. The cost of service delivery showed a positive but marginal ($p \leq 0.10$) influence on pastoral household livestock incomes. Household size, age of household head, and mode of service delivery had positive but significant effects on household incomes whereas accessibility, availability, and acceptability of services had negative but insignificant influences on

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household incomes.

From the results, it was concluded that the delivery of animal health services in the target areas at the time of the study, was neither effective nor sustainable and thus, it was not able to positively influence pastoral incomes and livelihoods. It is recommended that the government of Kenya, in collaboration with stakeholders in the livestock sub-sector takes measures to streamline research and extension on socio-economic factors that affect livestock production and marketing and improve the delivery of animal health services in the two counties in order to significantly impact on pastoral household livestock derived incomes and livelihoods. It is further recommended that the Government and other stakeholders should explore an alternative animal health care delivery model for the Arid and Semi-Arid Lands (ASALs) other than CAHWs that is effective and acceptable within the current policy and legal frameworks.

Key words: pastoral household livestock incomes, extension services, service demand, animal health care service providers, access to credit.

Introduction

It has been observed that since the 1980s, the funding for the livestock sub-sector, and the agricultural sector in general, has been declining in Kenya. Whereas the total agricultural sector used to receive 10% of the total government budget in the 1960s, the funding level decreased to 7.5% in the 1980s and to a dismal 3% in the 1990s. During the financial year 2005/2006, the entire agricultural sector received about 5-7% of the total budgetary allocation. Indeed, since the financial year 2002/2003, the total agricultural sector budgetary allocation has been about 3% of the total government budget, with the livestock budget accounting for only 1% of this proportion, which is equivalent to about 0.25% of the national Gross Domestic Product (GDP) (Kenya fiscal year budgets 2002/2003; 2003/2004; 2004/2005; 2005/2006). This is as opposed to the contribution of the livestock sub-sector to the national GDP that is currently estimated at about 10%. In the financial year 2008/2009, the agricultural sector received 4.5% of the national budget against 7% in 2007/2008. In the financial year 2008/2009, the livestock sub-sector received Kenya shillings (KSh) 4.56 billion (0.6% of the national budget) against a requirement of KSh 10 billion (1.3%) of the budget (Ministry of Livestock Development, 2009). This included KSh 800 million for control of Rift Valley Fever (RVF), KSh. 420 million, for the control of Pestes des Petits Ruminants (PPR) and KSh. 700 million for drought response. The budget

for emergency interventions was KSh 557 million. As a result of inadequate funding for disease control, the vaccination coverage for diseases including foot and mouth (FMD), and Contagious Bovine Pleural Pneumonia (CBPP) in the Arid and Semi-Arid Lands (ASALs) of Kenya has been extremely low and irregular resulting in the current status of frequent outbreaks and spread of these diseases.

This study was therefore designed to determine factors influencing pastoral household livestock-dependent incomes in selected areas of Turkana and West Pokot counties in Kenya, and to find out if the choice of veterinary delivery systems is one of the factors, the main goal of the study being to shed more light on the strategies to adopt in order to increase pastoral household livestock-dependent incomes in the two counties. The study analyzed the social and economic factors that influence pastoral household livestock-dependent incomes in selected areas of Turkana and West Pokot districts of Kenya. The hypothesis tested was that animal health service delivery in the arid and semi-arid lands (ASALs) is not adequate to improve pastoral incomes and livelihoods

The purpose of this paper, is therefore, to provide baseline data to facilitate the tracking of progress made towards the improvement of pastoral household livestock-dependent incomes in the two counties since the devolution of government functions, following the adoption of a new national Constitution that was promulgated in March 2013.

Materials and Methods

Study area

The study was conducted in 2010 in West Pokot and Turkana counties in the Rift Valley region of Kenya. Following the promulgation of a new national constitution in August 2010 and the subsequent adoption of a devolved system of government from March 2013, the Rift Valley Province was dissolved and apportioned into devolved Counties. As a result, West Pokot and Turkana districts became Counties. Most Government functions were devolved and the delivery of animal health services became the responsibility of County governments. West Pokot and Turkana Counties which border Uganda, South Sudan and Ethiopia, are occupied by pastoral, agro-pastoral and sedentary Pokot and Turkana communities. The area has a harsh climate with unreliable rainfall that renders the areas very low in arable agricultural potential. They are only suitable for extensive rearing of indigenous livestock. Livestock production is the main economic activity in the two areas and accounts for 93.2% of most household incomes and 95% of most households' employment.

Sources and collection of data

Primary (raw) data were collected through questionnaire interviews, focus group discussions (FGDs) and other participatory methods. A questionnaire for the herders was developed, pre-tested on selected households in the study areas and adjusted as appropriate. In each of the two areas, a total of 80 households were selected. Data were collected on household size and characteristics, number of livestock owned, sources of income, access to markets and roads, access to water, access to veterinary and extension services, and affordability of the services. Identification and training of enumerators from the local communities was carried out before the actual fieldwork was undertaken. The rapporteurs were trained to ensure that they did not deviate from the required protocol, thereby reducing bias in the sample data collected.

Selection of study units and sampling

A stratified random sampling procedure was used to collect the socio-economic data. (Mugenda and Mugenda,1999). A list of all divisions in each of the counties was obtained from the provincial administration. Then two divisions in each county that had the highest cattle population were purposively selected to form the primary sampling units (PSUs). Selection of these PSUs was followed by the selection of households and finally the determination of the individuals within the households to be included in the study. A list of households in each selected division was obtained from which a sample frame was drawn. Random sampling was done using random numbers generated using a computer that enabled a deliberate unbiased sampling process, so that each sampling unit in a group had an equal probability of being selected (Levy and Lameshow, 1996). A sample size of 40 households per division was considered making a total of 80 households per county, a sufficiently large and acceptable sample size for social studies (Freund and Benjamin, 2006).

Data collection

Each household was visited individually and data collected on selected variables namely, size of house hold, the age of the herder, level of education of the household head, gender of the household head, satisfaction with veterinary services available, distance to the nearest veterinary clinic or animal health service deliverer, actions taken whenever ones animals got sick, availability and accessibility of veterinary services, availability of extension services, cost of veterinary services, herd size, availability of credit to herders, household income and expenditure, service demand and response time.

Data analysis and analytical models

Both descriptive and regression analysis was done, with descriptive statics being analyzed for all the selected variables.

Descriptive analysis

Data collected was analyzed mainly for descriptive statistics. Descriptive statistics were used to provide summaries about the sample measures that included means, ranges, mode and variation (Sternsten, 1996). Descriptive statistics were used to analyse household incomes and expenditure, herd sizes, costs of delivery of animal health services, household sizes, ages of household heads, levels of education of household heads, gender of household heads, monthly incomes, availability of credit, acceptability of veterinary services and service demand.

Regression Analysis

Model specification

Regression models were constructed for continuous dependent variables. Linear regression models were used to analyze both quantitative and qualitative responses. Other regression formulations involving the choice of animal health service delivery as a binary choice dependent variable were tried and these were the logit, Probit and linear probability model (LPM) regressions. These approaches are used to estimate models involving dichotomous response variables. This was done because the model that fits the data set better could not be determined a priori. Unfortunately, none of the binary choice models fitted the available data. Thus ordinary least squares (OLS) models were found to fit some of the data better. However, the OLS regression results depicted the presence of heteroscedasticity with respect to herd size. Herd size was therefore used to weight the data so as to obtain weighted least squares (WLS) model (Madalla, 2001). As a result, the R2, t and F values increased significantly.

The following general equation represents the base model used for the analysis.

$$Y_i = \alpha + \beta X_i + \mu_i \quad i = 1,2,3,\ldots,N$$

Where Yi is the continuous dependent variable for household i, α is the intercept term Xi is the explanatory variable for household I, β is the parameter, and µi is the error term, µi~ $(0,\sigma2)$ of the unknown effects on the dependent variable. The specific expanded OLS model including more explanatory variables for estimation can then be written as in Equation (1):

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_n X_{ni} + \mu_i \,)$$

Where:
Y_i = Income from livestock for HH$_i$
α = Constant
X_{1i} = Cost of delivery for HH$_i$
X_{2i} = Acceptability by HH$_i$
X_{3i} = Herd size for HH$_i$
X_{4i} = Accessibility to services by HH$_i$
X_{5i} = Availability of services to HH$_i$
X_{6i} = Education of the herder HHi
X_{7i} = Extension services to HH$_i$
X_{8i} = Availability of credit to HH$_i$
X_{9i} = Gender of HH$_i$
X_{10i} = Household size HH$_i$
X_{11i} = Income level HH$_i$
X_{12i} = Age of herder HH$_i$
X_{13i} = Service demand HH$_i$
X_{14i} = Mode of animal health service delivery for HH$_i$
X_{15i} = response time
HH stands for Household

The degree of responsiveness of pastoral household livestock-dependent incomes to changes in the factors included in the model were quantified and the policy implications interpreted. It was hoped that the study would hed more light into strategies to adopt to increase pastoral household livestock-dependent incomes, one of the strategies being improving the quality of veterinary service delivery.

Results and Discussion

Descriptive statistics

The results of the variables tested are as follows:

Age of the herder: According to the survey, the majority of the respondent herders' ages

in both counties were in the age class of >46 years. There were more elderly herders (average age of the household age was greater than 46 years of age) than younger ones. Contrary to the findings of this study, it was expected that the average age of the herder was changing with more young people taking full charge of households and providing herd management. While Shiferaw and Holden (1998) underscored the positive correlation between age and perception of problems in a farming system, Bellon and Taylor (1993) argued that older persons are less likely to engage in productive farming practices.

Household size: The results indicated that by the time of the study, the average household size was 9.89 in West Pokot county whereas that of Turkana county was 7 adult equivalents. Since the number of people living in a household is a determinant of the household's availability for labor, it was expected that the bigger the size of the household, the higher the productivity and hence the household income. The results concurred with the findings of Henry (1990) who reported that the human population in the arid and semi-arid lands (ASALs) particularly the more drought prone arid areas has various patterns of concentration.

Level of education of household head: Of the herders interviewed in both counties, the majority were illiterate. Households headed by educated individuals are less likely to be poor compared to those of uneducated heads. This is because educated heads of households have higher income earning potential and more alternative income earning opportunities, and are therefore better able to improve the quality of their respective households' welfare

(Krishna *et al.*, 2004; Mango, *et al*, 2004). Muyanga (2004) pointed out that education provides an opportunity for pastoral households to diversify their livelihood portfolios especially through employment as a source of wages and remittances.

Gender of household age: All (100%) of the 160 households sampled in the two counties were male headed. Because of cultural and religious norms, women are deprived of property ownership rights and given lower status in all of the pastoral communities. They are also denied participation in traditional leadership and control of key assets and are given marginal benefits from divorce and inheritances of common properties (Marinda and Heidhues, 2004).

Satisfaction with the available veterinary services: Veterinary services in the two counties were provided by Veterinarians, Animal Health Auxillaries, Livestock Officers and Community Animal Health workers (Lewa, Mbithi, Nyariki, Muchina and Wabacha; 2020). The results from the study indicate that relatively more herders in Turkana county were satisfied with the animal health care services available (mainly CAHWS) than those in west Pokot county. Herders in West Pokot county may have been more exposed and more aware of quality veterinary services and would not accept services by CAHWs, since by the time of the study, in West Pokot county, there was a private veterinarian who was distributing quality veterinary drugs through Animal Health Auxiliaries (AHAs) to herders.

Table 1 shows the findings on satisfaction with veterinary services available in West Pokot and Turkana counties.

Table 1: Satisfaction with veterinary services available

Response	County			
	West Pokot District		**Turkana District**	
	Number of Households	**Percentage of households**	**Number of households**	**Percentage of households**
Very satisfied	6	7.5	38	47.5
Just satisfied	29	36.3	32	40
Not at all satisfied	45	56.3	10	12.5
Total	**80**	**100**	**80**	**100**

Distance to nearest Veterinary Clinic or Animal Health Service Deliverer: The majority of herders in Turkana county covered shorter distances (<5 Km) to the nearest animal health service deliverer. On the contrary, in West Pokot county, the majority of the herders covered longer distances (6-10 KM) to the nearest animal health service deliverer. This difference in distances may have been attributed to the presence of a private veterinary practice in West Pokot county (in Kapenguria division) and herders may have preferred walking longer distances to access quality veterinary drugs from the veterinarian whereas in Turkana county, herders walked shorter distances to CAHWs who lived amongst them in the communities. Table 2 shows the average distances covered to the nearest veterinary clinic or to the nearest AHSD.

Table 2: Average distances covered by herders to the nearest veterinary clinic and animal health service in west Pokot and Turkana counties

	West Pokot District		**Turkana District**	
	Number of Households	**Percentage of households**	**Number of households**	**Percentage of households**
<5	13	16.3	62.0	77.5
6-10	41	51.3	0.0	0.0
11-15	18	22.5	2.0	2.5
>15	8	10.0	16.0	20.0
Total	**80**	**100**	**80**	**100**

Response time: In both study areas, animal health service providers, took on average, longer than expected to respond to a herder's call leaving the herders with no other option but to treat their own animals.

Table 3 shows average time taken by the animal health service providers to respond to herders' calls in West Pokot and Turkana counties.

Action taken by herders whenever their animals were sick: The results of the study indicated that the majority of herders in west Pokot County treated their own animals whereas the majority of herders in Turkana county called an animal health service provider. In West Pokot County, herders accessed quality drugs from the private veterinarian located in Kapenguria, whereas in Turkana county, most herders sought veterinary services from Community Animal Health Workers (CAHWs) who lived with them in the communities and hence the difference.

Table 4 shows actions taken by interviewees whenever their animals were sick

Table 3: Average time taken by the animal health service deliverer to respond to a herders call in West Pokot and Turkana counties.

Time	County			
	West Pokot District		**Turkana District**	
	Number of Households	**Percentage of households**	**Number of households**	**Percentage of households**
Hours	33	41.3	24	30
Days	27	33.8	23	28.8
Week	9	11.3	11	13
>Week	11	13.8	22	28.2
Total	**80**	**100**	**80**	**100**

Table 4: Actions taken by interviewees whenever their animals were sick

Action taken	County			
	West Pokot District		**Turkana District**	
	Number of Households	**Percentage of households**	**Number of households**	**Percentage of households**
Treated Own Animals	47	58.8	33	41.25
Called an AHSD	29	36.3	42	52.8
Slaughtered	4	5	5	6.25
Total	**80**	**100**	**80**	**100**

Extension services: Only 18/80 (22.5%) of the herders interviewed in West Pokot county accessed extension services, and none of the herders interviewed in Turkana county accessed the services. From a market economic perspective, customers of animal health services have limited knowledge and information on the available treatment/preventive options (Leonard 1993; 2000). This information asymmetry may result in adverse selection of a veterinary service.

Table 5 shows a summary of explanatory variables affecting household income in West Pokot and Turkana counties.

Table 5: Summary of explanatory variables affecting household income in West Pokot and Turkana counties

Variable	Unit definition	Average recorded	
		West Pokot	Turkana
Herd size	TLUs	39.34	90.3
Household size	Adult equivalents	9.89	7
Age of household head	Scale	>46	>46
	1-4: The larger the older	(mode = 4)	(mode = 4)
Level of education of household head	Scale	Illiterate	Illiterate
	1-4: The larger the higher	(mode = 1)	(mode = 1)

Variable	Unit definition	Average recorded	
Acceptability of service (satisfaction with service)	Scale	Not satisfied by available service	Very satisfied with service
	1-3		
	The lower the better	(mode = 3)	(mode=1)
Accessibility to service (Distance to the nearest veterinary service	Scale	6-10 KM	6-10 KM
	1-4	(mode = 2)	(mode = 2)
	The lower the fewer the kilometers		
Availability of veterinary services (Hours taken by AHSD to respond to herder's call)	Scale	Hours	Hours
	1-4		(mode = 1)
	The higher the more	(mode = 1)	
Availability of extension services	Binary	80 herders do not access extension services	80 do not herders access extension services
	1 for yes		
	2 for No		
Service demand (action taken when animals are sick)	Scale	5	
	1-6	Self-treatment	

TLUS:Total Livestock Units

Results of regression analysis

Two models involving multiple regression analysis were applied using the base Equation (1). These were the ordinary least squares (OLS) and the weighted least squares (WLS). The exact regression procedures involved in the estimations of the models are as shown below:

1. *OLS:* This involved the direct application of the base equation, where all the classical linear regression assumptions on the error term were assumed to hold.
2. *WLS:* When OLS regression analysis was done, the factors were examined at a 5% significance level in both counties. In West Pokot, none of the factors was significant at this level, but in Turkana county, only two factors were significant, namely acceptability/satisfaction with available veterinary services (Community Animal Health Workers), and the response time (time taken by an animal health service provider to respond to a herder's call). When the level of significance was raised to 10%, only response time became marginally significant in West Pokot county, whereas the mode of service delivery became marginally significant in Turkana county.

Because of the low R2 (Coefficient of determination) in the OLS and the evidence of heteroscedasticity, brought about by herd size, a form of weighting was applied to the data before running an OLS regression to obtain WLS parameters. An OLS was then run to

obtain WLS and the factors were examined again at 5% and 10% levels of significance. The level of education of the household heads in both counties was significant at 5%. In Turkana county, also significant at 5% were acceptability of available animal health services and distance to the veterinary clinic. When the significance level was raised to 10%, in Turkana county, accessibility, response time and household size became marginally significant, whereas in West Pokot county, the cost of service delivery per month became marginally significant. Tables 6 and 7 report the OLS and the WLS results for Turkana county.

Table 6: Factors influencing pastoral household livestock incomes: Ordinary Least Squares (OLS) Regression Coefficientsa for Turkana county using household incomes as the regressand.

Factor	β	t	Sig.
Level of education of household head	.024	.192	.848
Age of household head	.129	1.236	.221
Cost of service delivery per month	-.147	-1.449	.152
Accessibility	-.039	-.392	.696
Satisfaction	.042	.419	.676
Acceptability	.287	2.209**	.031
Distance to vet clinic	.123	.960	.340
Mode of delivery	.201	1.895*	.062
Response time	.318	2.696**	.009
Herd size (TLUs)	.162	1.535	.129

aDependent variable: Monthly income level of herder (month)
**Significant at 5%; *Significant at 10%; R2 = 0.376;Adj R2 = 0.276;
F = 3.731**

Table 7: Factors influencing pastoral household livestock incomes: Weighted Least Squares (WLS) Regression Coefficientsa,b for Turkana county using household income as the regressand and herd size as the weighting variable.

	β	T	Sig.
Level of education of household head	.334	3.816**	.000
Age of household head	.099	.900	.371
Cost of service delivery per month	.143	1.613	.112
Accessibility	-.159	-1.837*	.071
Satisfaction	-.110	-1.272	.208
Acceptability	.184	2.015**	.048
Distance to vet clinic	.431	3.620**	.001
Mode of delivery	.133	1.194	.237
Response time	.171	1.903*	.061
Household size	.181	1.689*	.096

aDependent variable: Monthly income level of herder (month)
bWeighted by herd size (TLUs)
**Significant at 5%; *Significant at 10%; R2 = 0.543;Adj R2 = 0.475;
F = 7.963**

Table 8: Factors influencing pastoral household livestock incomes: Ordinary Least Squares (OLS) Regression Coefficients a for West Pokot county Using household income as the regressand

	β	t	Sig.
mode of delivery	.117	.991	.325
Household size	-.029	-.246	.807
Level of education of household head	.173	1.511	.135
Age of household head	.104	.879	.382
Cost of service delivery per month	.119	1.039	.303
Availability of extension services	-.139	-1.214	.229
Accessibility to service (Distance to the nearest road/ markets)	-.184	-1.592	.116
Acceptability of service (satisfaction with service)	-.196	-1.686*	.096
Herd size (TLUs)	-.006	-.047	.962

ªDependent variable: Monthly income level of herder (month)
*Significant at 10)%; R2=0.167; Adj R2=0.060; F=1.557

Table 9: Factors influencing pastoral household livestock incomes: WLS Regression coefficientsa for west Pokot countyusing household incomes as the regressand and herd size as the weighting variable.

	β	t	Sig.
Household size	.184	1.540	.129
Level of education of household head	.283	2.431**	.018
Age of household head	.167	1.446	.153
Cost of service delivery per month	.210	1.742*	.087
Accessibility to service (Distance to the nearest road/ markets)	-.173	-1.428	.158
Availability of extension services	-.055	-.469	.641
Acceptability of service (satisfaction with service)	-.124	-1.072	.288
mode of delivery	.041	.352	.726

ªDependent Variable: Monthly Income level of herder (month)
ᵇWeighted Least Squares Regression - Weighted by Herd size (TLUs)**Significant at 5%; *Significant at 10)%; R2=0.246; Adj R2=0.147; F=2.492*

Hypothesis Testing

Focusing on the WLS model which explains more than the OLS model by virtue of its R2 value and F statistics, the results indicated that in Turkana county, levels of education of the household heads, acceptability, and distance to the nearest veterinary clinic showed positive and significant (p≤0.05) influences on pastoral household livestock incomes. Household size showed positive and marginal significance (p≤0.10) influence whereas accessibility showed negative and marginal (p≤0.10) influence on pastoral household livestock income. The rest of the variables including the age of household head, cost of service delivery, and mode of service delivery had positive but insignificant effects on household income, except for satisfaction with available services, which had a negative but insignificant influence on household income. In West Pokot county, the level of education of the household head also showed positive and significant (p≤0.05) influence on pastoral household livestock incomes. The cost of service delivery showed positive but marginal (p≤0.10) influence on pastoral household livestock income. Household size, age of

household head, and mode of service delivery had positive but significant effects on household incomes whereas accessibility, availability and acceptability of services had negative but insignificant influences on household incomes.

The significant variables are described below: Education level of the household head: In both counties, this factor was significant at a 5% level of significance. The education level of the household head influenced the monthly income of a household positively. The result supported the set hypothesis, which was positive. This may have been due to the reason that learned household heads made more informed decisions with regards to the choice of animal health service deliverers. The results were consistent with the findings of Peter *et al.*, (2006) which showed that that with increased diversification into desirable assets and livelihoods (including education) households can remain active in the pastoral economy.

Household size: Household size was marginally significant in Turkana county (at a 10% level) and was not at all significant in West Pokot County. In Turkana county, it had a positive coefficient, indicating that larger households had more income. Larger pastoral families are expected to be secure in terms of labor provision, and therefore can afford to maintain larger herds resulting in bigger incomes, compared to smaller households (Dahl and Hjort, 1979).It has been argued that the availability of child herding labor influences diversification of pastoral livelihoods since households with a larger family labor force would be more willing to devote labor to another income generating activity in addition to pastoralism (Farah, Nyariki, Ngugi, and Musimba, 2003).

Acceptability of available services: In Turkana county, this factor was significant at a 5% level, whereas in West Pokot county, it was not at all significant. In Turkana county, CAHWs were more accepted than in West Pokot county, since they were the only services available in most of the study area and this led to more utilization of the services which impacted

positively on household livelihoods. In West Pokot county, herders did not utilize a lot of services offered by CAHWs, and most of them could also not afford quality services provided by the only private veterinarian available. A study by Riviere-Cinnamond and Eregae (2003), demonstrated that community's acceptance of CAHWs led to higher production and income. This finding is in agreement with findings by Van *et al.*, (2004) who reported that acceptability is affected by the attitude of the herders towards the animal health service provider and their evaluation of the costs of interventions.

Distance to the nearest veterinary clinic: In Turkana county, distance to the nearest veterinary clinic was significant (5% level of significance) whereas in West Pokot county, this factor was not at all significant. The reason for this observation was because in Turkana county, CAHWs lived in the community and were easily accessible. Their utilization led to positive impact on livelihoods. Availability of animal health service providers is often affected by the physical distance between him/her and the herder (Woods 2000). This in turn affects productivity and household income. Leonard (2004), also reports that the most prominent transaction in animal health service provision particularly in developing countries is distance. In Uganda, Koma (2000), and Woods (2000) found that greater distance to animal health providers noticeably reduced demand for their services.

Accessibility of animal health care: As hypothesized, accessibility to animal health care was expected to increase household incomes through increase in productivity (Heffernan, 2001; Dawit, 2003). Accessibility in Turkana county was marginally significant (At a 10% level of significance) whereas the factor was not at all significant in West Pokot county. However, in Turkana county, accessibility to animal health care influenced household incomes negatively. This could be explained by the fact that the herders could not differentiate between self-treatments and alternative animal health services that they could have opted for.

Response time: In Turkana county, the response time was marginally significant (at a 5% level of significance). Response time had a positive coefficient indicating that herders were most likely to use animal health services which were offered on time, therefore increasing productivity and income as well. This finding was consistent with the findings of Kathiravan et. al., (2009), who reported that the herder whose dependency on livestock for livelihood (as is the case in our study area) loses faith in animal health service providers who are not easily available. Increase in response time decreased the utilization of the services

Other Parameters Tested

Other parameters tested included the following:
(i)   *Cost of service delivery*
         The cost of delivery was marginally significant in West Pokot county, but not at all significant in Turkana county. As hypothesized, the cost of animal health service delivery was expected to lower household income through decrease in productivity, since high cost of delivery was expected to reduce demand. In the contrast, the cost of service delivery influenced household incomes positively. This finding is in agreement with the results of previous study done by Ahuja *et al.*, (2002), which indicated that price is not an important determinant of the decision to use veterinary services.

(ii)   *Affordability of animal healthcare services*
         The affordability parameter was not tested for significance since it did not vary amongst the interviewees in both counties. This parameter evaluated the minimum necessary level of preventive and curative animal health care in each county.

(iii)   Access to credit
         At the time of the study, none of the interviewees had access to formal financial arrangements, and as a result, this parameter was not included in the model for analysis since it was not a variable.

Conclusion

After weighing, amongst other factors affecting household incomes in Turkana county, it was concluded that the level of education of household head, accessibility to and acceptability of animal health services, distance to veterinary services, time taken by the animal health service deliverer to respond to a herder's call and household size significantly influenced household incomes. The effects of cost of animal health services delivery, satisfaction with the animal health services offered and the mode of animal health service were so weak as to lack significance in the sample chosen.

In as far as the cost of animal health services delivery was concerned, the clients were observed to seek for quality of care dictated by their particular conditions and gave only secondary consideration to the price. This study further concluded that the delivery of animal health services in the target counties is neither effective nor sustainable and thus, in its current state, shall not improve pastoral incomes and livelihoods.

Recommendations

The study recommends the following:
• *Research:* It was observed that some key socio-economic factors, which also influence livestock production such as level of education of herders, cost of service delivery, accessibility of the services and acceptability of animal health services, have not been given sufficient attention in the past. It is recommended that the government of Kenya in collaboration with stakeholders in the livestock sub-sector also takes measures to streamline research and extension on socio-economic factors that affect livestock production and marketing.
• It is also recommended that the county governments should increase investments in the livestock sector, through prioritization of livestock in the development planning processes in the County governments;
• Animal Health Service Delivery should

be improved in the two Counties in order for it to significantly impact on pastoral incomes and livelihoods. This could be achieved through exploration of an alternative animal health care delivery model for the Arid and Semi-Arid Lands (ASALs) other than CAHWs that is effective and acceptable within the current policy and legal frameworks.

• Other recommended interventions that need to be put in place to increase the efficiency of the delivery of animal health services in ASALs include recruitment of sufficient veterinarians and animal health technicians specifically for the ASALs to increase accessibility to professional/government animal health services, and also reduce distances to veterinary clinics, services and other inputs into the livestock value chain; Prioritization of livestock in the development planning process at the county governments; focus on enhancing level of education of pastoralists; an integrated approach to livestock development at the county governments; development of county policies that enhance economic viability of pastoralism; extension of the county extension programs to pastoral areas; and promotion of alternative livelihoods to pastoralists

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