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Protecting Livestock – Improving Human Lives

Baseline study for the integration of novel treatments, vaccines and diagnostics into Animal African Trypanosomosis control programmes

Burkina Faso Field Study Report

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Foreword

African animal trypanosomosis (AAT) is an important constraint of livestock production and threat to food security in sub-Saharan Africa [1]. Of the 37 sub-Saharan African countries affected by trypanosomosis, 21 are among the world's 25 poorest [2]. Reduced productivity of cattle due to trypanosome infection has been estimated at approximately 10-20% across a range of parameters including mortality, calving rate, meat production, milk production and draft power. It also reduces the area which could potentially be used for livestock production, as cattle density is very low in areas with a high tsetse-trypanosome burden. In these areas farmers are often more reliant on crop farming however trypanosomosis reduces the availability of draft animals to plough fields and manure for fertiliser.

This is one of five country specific sub-Saharan African studies (conducted in Burkina Faso, Cameroon, Ethiopia and Uganda and Zambia) aimed at generating baseline information that could inform the integration of novel treatments, diagnostics and vaccines should they become available. A previous systematic review of recent and on-going Trypanosome & Tsetse control programs has been the basis for the geographic focus of the five studies [3].

This report summarizes the results of the study which was carried out in Burkina Faso. AAT is an important constraint to livestock production in endemic areas (Southwest and West) [4]. Trypanocide resistance has also been cited as a major concern to these farmers [4]. The study results will inform the refinement of existing decision support tools to aid evidence-based decisions on the use of novel drugs, diagnostics and vaccines as part of integrated Trypanosome & Tsetse control programs.

Study Aims and Methodology

1. Introduction

1.1 Aim of the study and approach

The aim of the study was to assess the current perceived impact of AAT in the selected study area and the scope for improving AAT control by introducing or integrating new control measures into future or existing AAT control programs or activities.

The relative extent to which AAT constrains livestock production in the study areas was ascertained by comparing farmers' attitudes regarding AAT frequency and economic impact (mortality, loss of production and cost of treatment) with their attitudes towards general livestock diseases in their herds. Successful control of AAT is dependent on farmers' motivation to control the disease individually, and to cooperate with externally-led control programmes. Data regarding existing control programs and consumer willingness to use and pay for new trypanocides, diagnostic tests and vaccines were collected to inform future control programs and assess the demand for, and likely uptake of novel AAT products.

1.2 Background

The economy of Burkina Faso is heavily reliant on agriculture and livestock; it accounts for 40% of the GDP and provides a livelihood for 80% of the population. Agriculture is mainly extensive with low mechanisation and cattle are often used as draught power.

The study was conducted in South West and West Burkina Faso in the Provinces of Ioba, Sissili, Kénédougou and Léraba (Figure 1). The area has a humid tropical climate; annual rainfall varies between 900mm and 1200mm and the temperature varies between 24 and 37^{o}C. The area is largely flat and the rainy season lasts from June to November. Trypanosomosis has previously been reported as the most important constraint to livestock production [4]. Trypanocide resistance has also been cited as a major concern to livestock producers in the area [4]. *Glossina palpalis gambiensis*, *G. tachinoides* and *G. morsitans submorsitans* are the species of tsetse fly present, although the latter is found less frequently [5]. Cattle are most frequently infected with *Trypanosoma vivax*, followed by *T. congolense* and *T. brucei* [5].

Ioba & Sissili province (Sud-Oest administrative region)

This study area contained the departments of Koper, Niego and Ouessa (Ioba province) and Boura (Sissili province). The area consists of relatively new settlements, cultivated lands, open savanna woodlands and clusters of dry forests. The study site was close to protected and unprotected forests and a national park. The population density of Sissili has increased dramatically in the last 20 years due to immigration from the Northern areas of Burkina Faso; mainly by the sedentary Mossi and the pastoralist

Fulani, which has put pressure on the land and farming systems. Therefore there has been some clearance of savanna zones and forest fallows.

The predominant livelihood activity is rain fed agriculture; this is mainly subsistence and has a low degree of mechanisation. Crops produced include millet and sorghum, maize, cotton and food cash crops (groundnuts, vegetables, chili, cowpea and tuber crops). There is plenty of ground water and other activities include fishing and hunting. There is seasonal migration of households during the dry season; although this is becoming less common. The risk of AAT is reported to be high and there have been high mortalities to cattle. The Pan African Tsetse and Trypanosomosis Eradication Campaign (PATTEC) has existing AAT control programs in the area [3].

Kénédougou (Hauts-Bassins administrative region)

The area contains a mosaic of savannas and dry forest. This is a region where many rivers and streams take their source e.g. Mouhoun, Kou and Houet. Main income activities are agriculture (subsistence and cash crops: rice, maize, cotton etc.); this region produces the most fruit in the country (mango, citrus fruits, bananas, papayas) and vegetables (onions, tomatoes, beans, lettuce and cucumber) are grown. Livestock rearing (extensive) is also common however trypanosomosis is a constraint to livestock production in the area. The disease is endemic and losses to mortality, milk production and oxen performance have been reported. There is thought to be widespread resistance to trypanocides (particularly isometamidium resistant *T. congolense*) and the first reports of trypanocide resistance came from this area [6, 7].

Léraba (Cascades administrative region)

The study was conducted in the North of this region; the soil is well suited to maize, rice and cotton production. Sorghum, millet, corn, sesame and soy are also produced; as well as fruit and vegetables. There are three landscapes present; mountains (average altitude), plateau and large plains. Groundwater is frequent and the floodplains provide fodder for livestock during the dry season. There is dense forest, particularly close to the Leraba river which is a high density tsetse area populated area [9]; prevalence of AAT is high and there are reports of treatment failures [8]. The area is crossed by 32 000 cattle per year from the North of Burkina Faso and Mali en route to markets in Côte d'Ivoire. In addition, during the dry season there is transhumance of cattle into the area due to the availability of water points; some of these farmers settle there permanently, but these cattle may be highly susceptible to AAT.

Figure 1: Map of the study areas in Burkina Faso

[1] The study was selected because it was estimated to be a high risk area for AAT from a systematic review of AAT literature [3].

2. Methods for data collection

2.1 Sampling of the study areas and households

The study was conducted in May 2013 within the selected districts a list of village names was obtained for each study area and these villages were selected for incorporation in the study using random sampling. The sampling unit was a household (or homestead) defined as a group of people who normally cooked, ate and lived together. Households were selected using systematic sampling, a central point and random direction was selected in each village and every fifth household was then studied. If the household selected did not own cattle the next closest household owning cattle was studied instead.

2.2 Data collection

The head of the household was contacted and asked if they would be willing to take part in a study which aimed to collect data on cattle production and livestock disease in the area. If the head of the household was unavailable then another household would be sampled and the house was re-visited once the member had returned. There were no refusals to participate in the study. Once sampling of the village was complete the enumerators would provide information, including public health risks, regarding AAT and other livestock diseases to the community. They would also answer any questions the farmers had regarding livestock production and disease.

Study results

3. Burkina Faso Profile

3.1 Results Summary

An overall summary of the findings from each study area are presented in the Table on the following page. The results are then described in detail in the sections that follow. In Ioba & Sissili the perceived impact and the cost of treating AAT appeared to be the highest. Households' reported that the government is responsible for controlling the disease. Few households insecticide treat cattle, there appeared to be no tsetse traps in the study area and the main form of AAT control was treating cattle with trypanocides prophylactically. This area is a high priority for control. Perhaps increasing farmers' awareness and knowledge of the disease would motivate them to take responsibility for the control of AAT.

In Kénédougou the risk of AAT is high and most farmers' reported that it is present all year round (92%). Although the risk of AAT in this study area appears to be the highest; households have good knowledge of the disease, many insecticide treat cattle and most reported that individuals are responsible for the control of the disease. Léraba appears to have a high risk of AAT; with moderate knowledge and impact.

One school of thought regarding AAT control is that the private sector must take responsibility for control in order for it to be sustainable. In the current study, the impact of AAT was perceived to be lowest in the area where the risk of AAT appeared to be highest but farmers' took responsibility for its control. Although other factors may have been involved in this relationship; for example cattle may be more adapted to tsetse/trypanosome challenge.

Ecological System and District

	Ioba & Sissili	Kénédougou	Léraba
General livestock keeping data			
Primary source of income	Crop farming (80%)	Crop farming (88%)	Crop farming (95%)
Median no. of cattle (lower & upper quartile: Q1 & Q2)	6 (3 & 12)	34 (13 & 63)	11 (5 & 18)
Predominant cattle breed	Zebu (Trypanosensitive) > Métis (Zebu X Boulé: Some trypanotolerance) > Taurine (mainly Boulé: Trypanotoloerant)		
Predominant cattle rearing system	Free-grazing	Free-grazing	Free-grazing
Other species livestock	Poultry (94%), Goats (87%), Sheep (67%), Pigs (57%), Equines (35%)	Poultry (85%), Goats (72%), Sheep (64%), Equines (64%)	Sheep (78%), Poultry (76%), Goats (54%)
Impact of AAT			
Perceived AAT occurrence in herd/ disease ranking	Frequent (60%) Ranked no. 1	Constant (92%) Ranked no. 1	Constant (87%) Ranked no. 1
Perceived AAT impact on income	Severe	Moderate	Low
Main losses in livestock outputs due to AAT	Meat & manure	Meat & manure	Meat & manure
AAT treatment failure/perceived reason for failure	Low (8%)	High (72%)	Moderate (48%)
Current AAT control			
	-	Diminazene aceturate > isometamidium	Diminazene aceturate
Treatment of AAT	Vet (or similar)	Vet (or similar) > AHW	Vet assistant (or similar) > AHW > farmers
Cost per AAT treatment	US $1.3 ($1.3 to $1.6)	US $1.00 ($0.9 to 1.5)	US $0.80 (0.7 to 1.6)
Level of knowledge about AAT prophylactic measures	Moderate (53%)	High (77%)	Moderate (54%)
Point of sale of veterinary products	Vet (or similar) Other village	Vet > pharmacy > travelling salesman Other village > nearby town	Vet > travelling salesman > vet pharmacy Local market
Control programmes for AAT/facilitators	20% / officials	62% / individuals	20% / officials > individuals
Future AAT control			
Awareness of AAT & knowledge of epidemiology	Aware: 90%: Lower knowledge	Aware: 100%: Good knowledge	Aware: 88%: Moderate knowledge
Willingness to use/pay higher price for new AAT drugs	89%/87%	98%/98%	90%/90%
Willingness to use/pay for new AAT diagnostic	94%/93% - median: $1.47	100%/100% - median: $0.84	95%/88% - median: $1.05
Willingness to use/pay for novel AAT vaccine	94%/94% - median: $1.57	100%/100% - median: $1.05	95%/95% - median: $1.42
Problems with AAT treatments	Consumables, preparing drug, genuine drugs, clean/sterile water	Weight estimation	Dosing, weight estimation
Perception of fake AAT drug circulation	High	Low	Moderate
PRIORITY AREA FOR AAT CONTROL (based on farmers' perceptions)	**Moderate-high priority (high risk/higher perceived impact/existing control)**	**Low priority (high risk/moderate impact/existing control/good knowledge)**	**Low-moderate priority (moderate risk/low perceived impact/moderate knowledge)**

3.2 Study population characteristics

A total of 225 households were included in the study. The number of households studied, and general household characteristics, according to study area is presented in Table 2. Households tended to be largest in Léraba. Most households' primary income was crop farming and most of them reported having permanent access to land.

	Ioba and Sissili	Kénédougou	Léraba
Number of households studied	123	61	41
Household members median (Q1 & Q2)	11 (7&14)	14 (11 & 19)	18 (11 & 26)
Primary source of income N (%): Crop farming Livestock farming	 97 (79.5%) 17 (13.9%)	 53 (88.3%) 7 (11.7%)	 38 (95%) 2 (5%)
Land us N (%): Use communal land Own land Rent land	 21 (17.1%) 99 (80.5%) 8 (6.5%)	 4 (6.6%) 55 (90.2%) 1 (1.6%)	 39 (95.1%) 2 (4.9%)

Table 2: Number of households studied and median household size with interquartile range (Q1 & Q2) in each study area (data from 225 households interviewed in Burkina Faso in June 2013).

Household amenities according to study area are presented in Figure 2. Not all households had electricity or water; particularly in Ioba and Sissili (approximately 10%). However, most households had water in the community (>90% for all areas). Most households in the Kénédougou and Léraba study areas had toilets. In general these study areas appeared to have better access to amenities compared to villages in Ioba and Sissili. Median time for households without water to reach the nearest water source was 10 minutes.

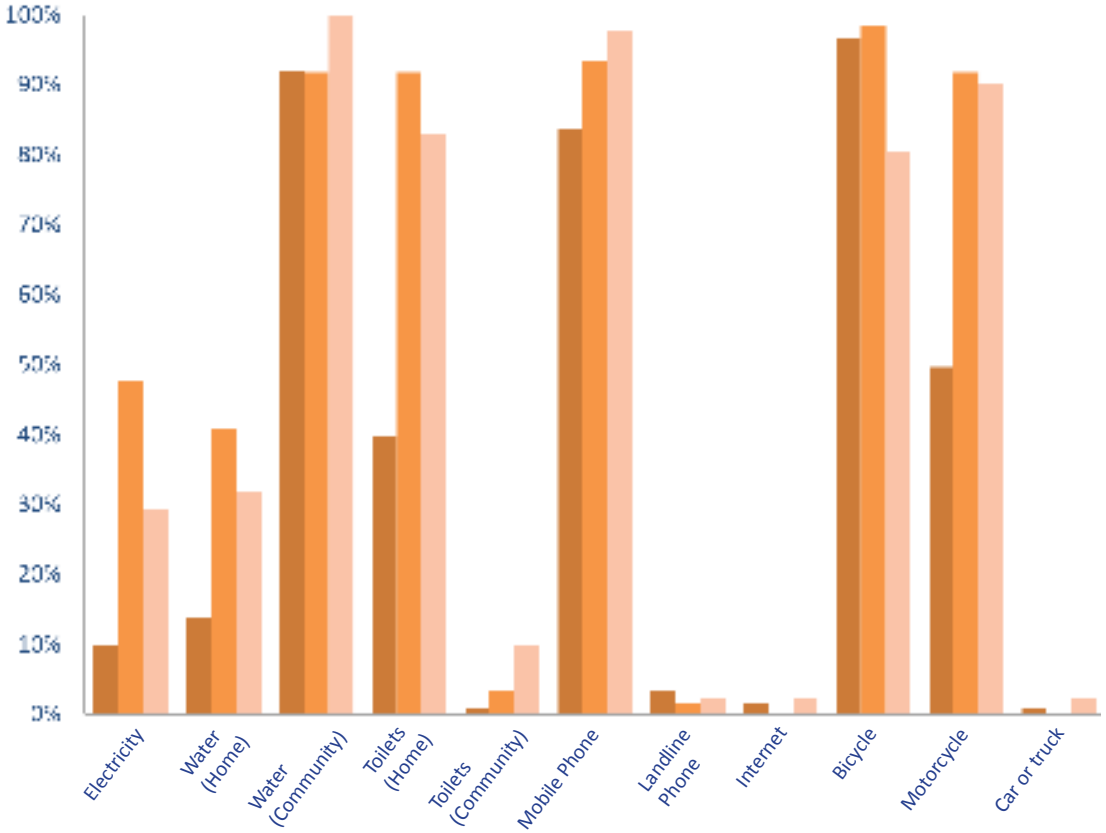


Figure 2: Percentage of household with each amenity, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

Households in all areas had access to healthcare: most households (96%) said they would visit a local medical centre for the first opinion regarding health problems. If this did not solve the problem, they would visit a hospital (64.5%). Some households in Ioba & Sissili (12%) and Kénédougou (6.6%) said they would go to local tribe leader for a second opinion. When asked about the main issues they face, health of livestock was mentioned by 31.8%, 33.7% and 19.6% respectively (Figure 3). Health of crops was mentioned as an issue by 29% and 23.5% of households in Ioba & Sissili, Kenedougou and Léraba respectively. Issues households were facing in each study area are presented in Figure 3. Paying fees was also an issue in Kénédougou, mentioned by 33% of households.

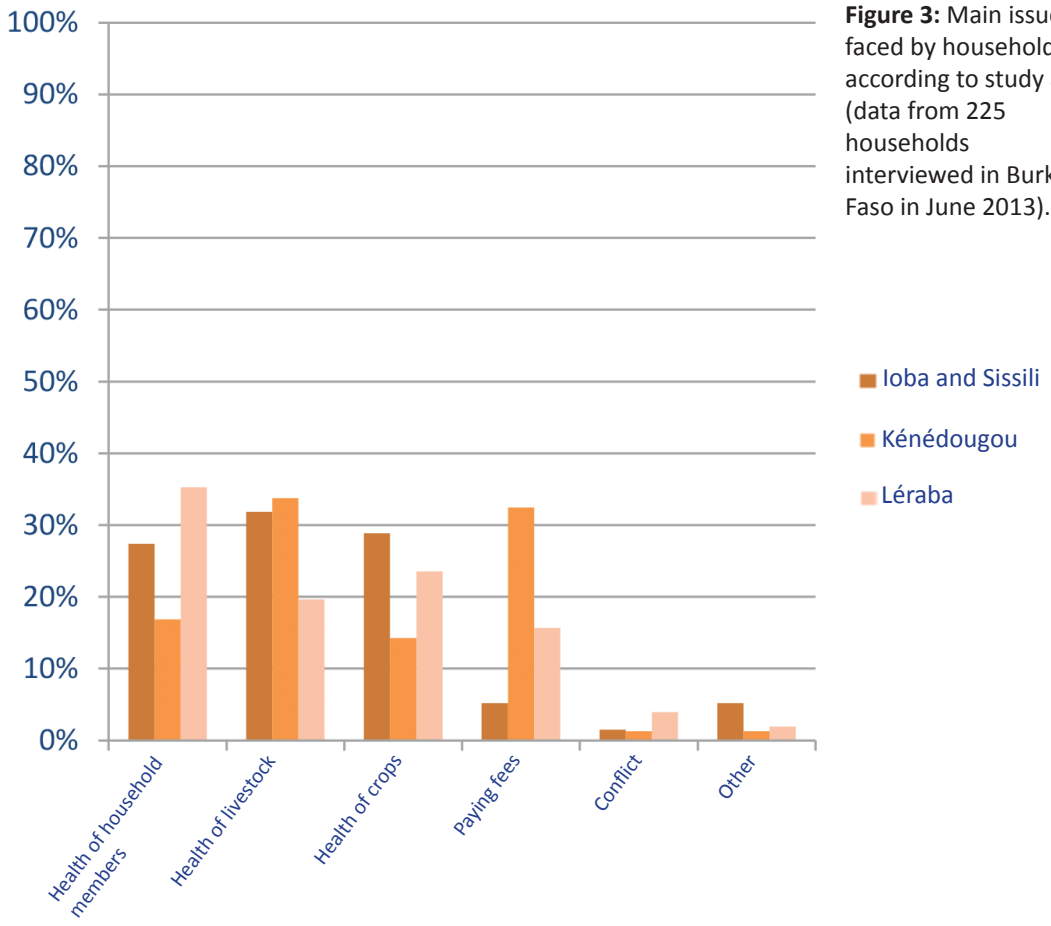


Figure 3: Main issues faced by households, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

3.3 General livestock keeping data

In addition to cattle, the predominant species of livestock owned were sheep, goats, pigs, poultry and equines (Table 4). The number of livestock kept per household according to species is presented in Figure 4. Free grazing was practised in all study areas; a few households from Ioba & Sissili practised other forms of cattle rearing like tethered (3.7%) and penned (1.8%).

	Ioba and Sissili	Kénédougou	Léraba
Total number of cattle: Median (Q1 & Q2)	1494 6 (3.3 & 13)	2589 34 (13 & 63)	1630 21 (10 & 39)
Adult Female cattle: % households owning at least 1 Median (Q1 & Q2)	 69.6% 3 (2 & 6)	 83.6% 18 (7 & 36)	 75.6% 11 (5 & 17.5)
Adult Male cattle: % households owning at least 1 Median (Q1 & Q2)	 96.7% 3 (2 & 4)	 98.3% 6 (4 & 12.3)	 97.5% 5.5 (4 & 10.8)
Calves: % households owning at least 1 Median (Q1 & Q2)	 54% 3 (2 & 4)	 75.4% 8.5 (5 & 14)	 58.5% 7 (3.8 & 13.3)
Cattle rearing system: Free grazing Tethered Penned	 93.6% 4.5% 1.8%	 100% - -	 100% - -
Other species: Sheep % households owning at least 1 Median (Q1 & Q2)	 67.2% 7 (5 & 13)	 63.9% 12 (6 & 22.5)	 78% 15 (6 & 20)
Goats % households owning at least 1 Median (Q1 & Q2)	 87% 8 (5 & 12)	 72.1% 6.5 (3.75 & 10)	 53.6% 4 (3 & 5)
Pigs % households owning at least 1 Median (Q1 & Q2)	 56.5% 4 (2 & 8)	 - -	 12.1% 5 (4 & 8)
Poultry % households owning at least 1 Median (Q1 & Q2)	 94.2% 12 (7 & 20)	 85.2% 13 (7.75 & 23.5)	 75.6% 28 (13 & 36.5)
Equines N (%)	 43 (35.2%)	 39 (63.9%)	 7 (17%)

Table 4: Household herd composition according to cattle type and livestock species (data from 225 households interviewed in Burkina Faso in June 2013).

The main type of cattle kept were Zebus (typanosensitive), Taurine cattle (Boulé) (trypanotolerant) and crossbreeds (Métis: stable cross between Zebu and Boulé which have some level of trypanotolerance). Most households tend to own a mixture of the three breeds and around 80% of households interviewed reported having chosen these breeds for a particular reason. Reasons mentioned were mainly traditional preference, improved traction compliance (especially in Ioba & Sissili) and disease resistance (in particular Léraba) (Figure 4). AAT was the main disease which farmers selected resistant breeds for however some households in Kénédougou mentioned anthrax (10%) and FMD (10%) (Figure 5). In Léraba some households mentioned CBPP (7%) and dermatosis (7%).

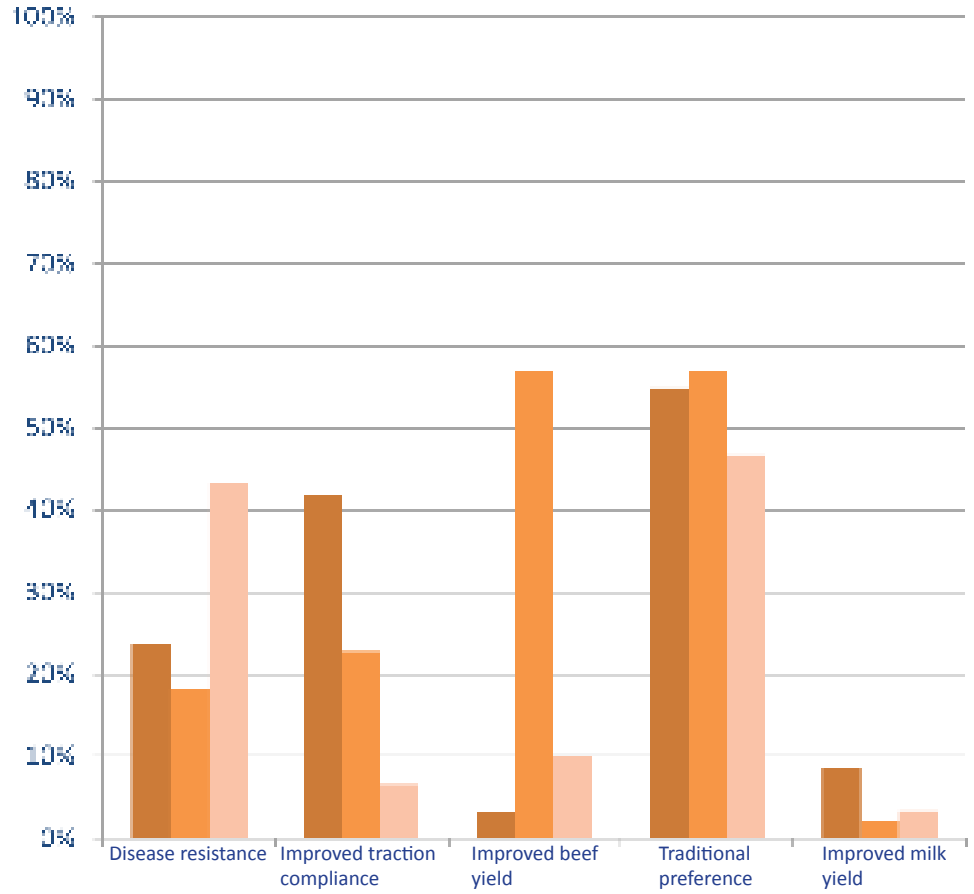


Figure 4: Reasons for choosing a specific breed, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

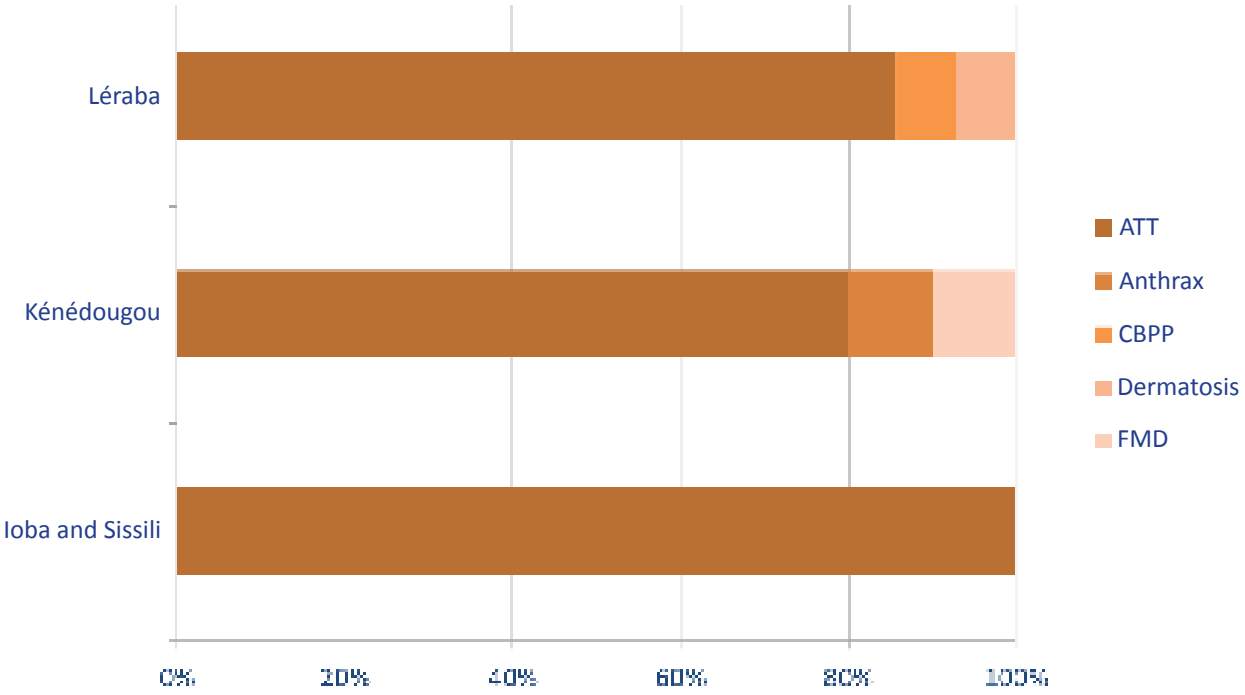


Figure 5: Diseases which households select against (of those which mentioned resistance as a reason for choosing a particular breed) (data from 225 households interviewed in Burkina Faso in June 2013).

4. Veterinary Practises

Around 90% of the households reported consulting a veterinarian or similar when their livestock were sick. Participants were asked to present veterinary products that were currently in the households' possession; they were then asked about any other products they regularly use which were not currently in the household. In Ioba & Sissili only 5% of the household kept any veterinary products and only one household gave details of the drugs kept. Veterinary products kept in other study areas were: trypanocides (77.1% Kénédougou and 53.8% Léraba), anti-helmintics (8.5% Kénédougou and 15.3% Léraba), antibiotics (11.4% Kénédougou and 15.3% Léraba) and insecticides/acaricides (2.8% Kénédougou and 15.3% Léraba). Households in Kénédougou and Léraba kept diminazene aceturate (Berenil ® or Veriben ®) and only some households kept isometamidium (Samorin® or Trypamidium®).

	Ioba and Sissili	Kénédougou	Léraba
Trypanocides	-	77.1%	53.8%
Diminazene aceturate	-	65.7%	46.2%
Isometamidium	-	11.4%	
Insecticides/Acaracides	-	2.8%	15.3%
Not effective against tsetse	-	2.8%	7.7%
Effective against tsetse	-	-	7.7%
Dewormer	-	8.5%	15.3%
Antibiotics	-	11.4%	15.3%
No drugs in households	95.1%	67.2%	80.5%

Table 5: Main livestock drugs kept in the house, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

The main point-of-sale of livestock treatments for each study is presented in Figure 6. Households mainly bought drugs from a veterinarian or similar. They also bought drugs from vet pharmacies and travelling salesman. Most households in Léraba (90%) bought veterinary products from their local market whereas those in Kénédougou (69%) and Ioba & Sissili (80%) bought them from another village.

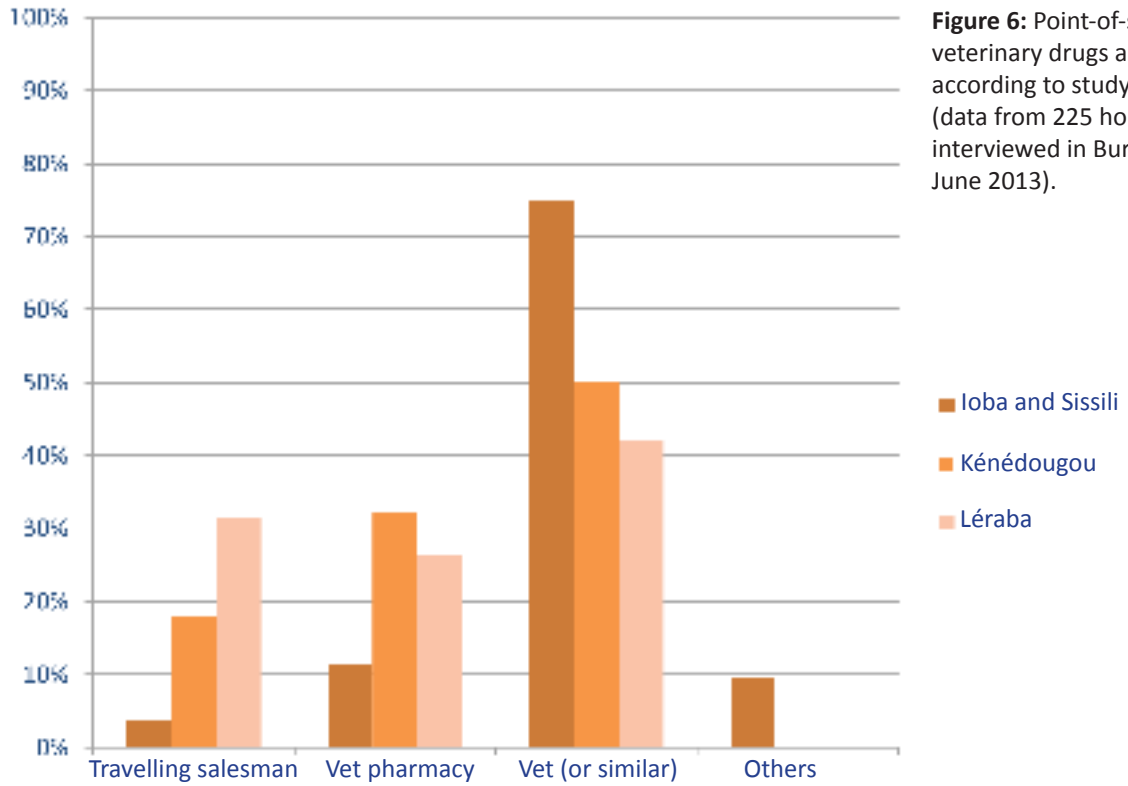


Figure 6: Point-of-sale of veterinary drugs and products, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

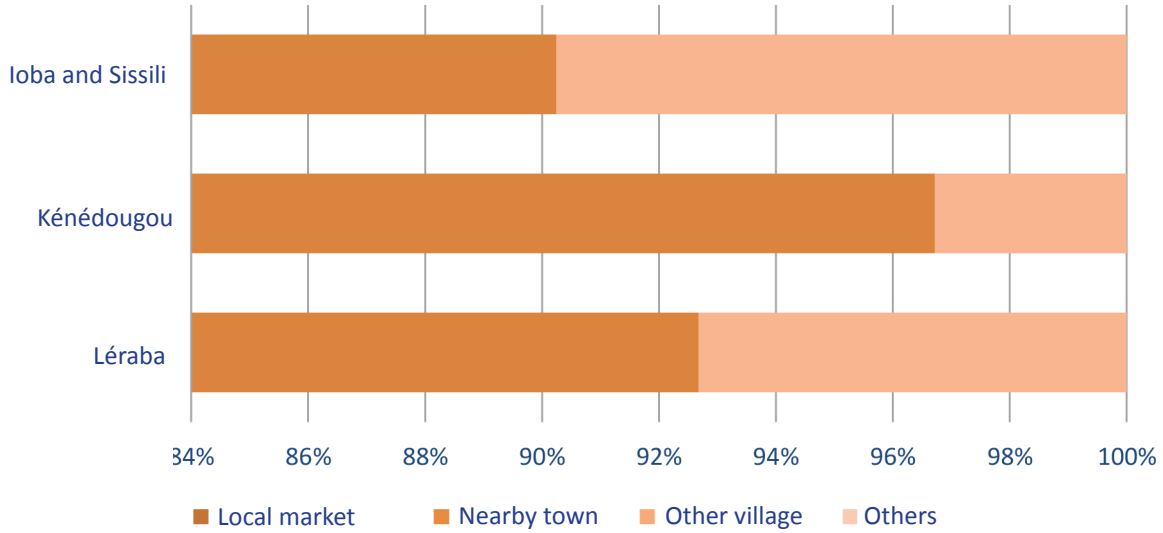


Figure 7: Location of veterinary drug point-of-sale, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

Around 93% of households reported vaccinating their livestock against some diseases. Most of the households vaccinated individually without relying on official programmes. Results according to study area are presented in Figure 8. Households reported vaccinating against CBPP (45.8%), Pasteurellosis (38.7%) and Anthrax (26.2%). Around 54% of households said they vaccinated against AAT despite there being no AAT vaccine currently available. Upon discussion with households and veterinarians this was due to the short-term prophylactic effects of some trypanocides.

In Ioba & Sissili households mostly reported vaccinating against AAT (41%) and CBPP (26%). In Léraba most households vaccinated against AAT and Pasteurellosis (30%). However, in Kénédougou, Pasteurellosis (34%) was the major disease households' vaccinated against and 12% of households reported vaccinating their cattle against AAT, despite their being no vaccine currently available. In Ioba & Sissili 3% of households said they don't know what diseases they vaccinate their animals against.

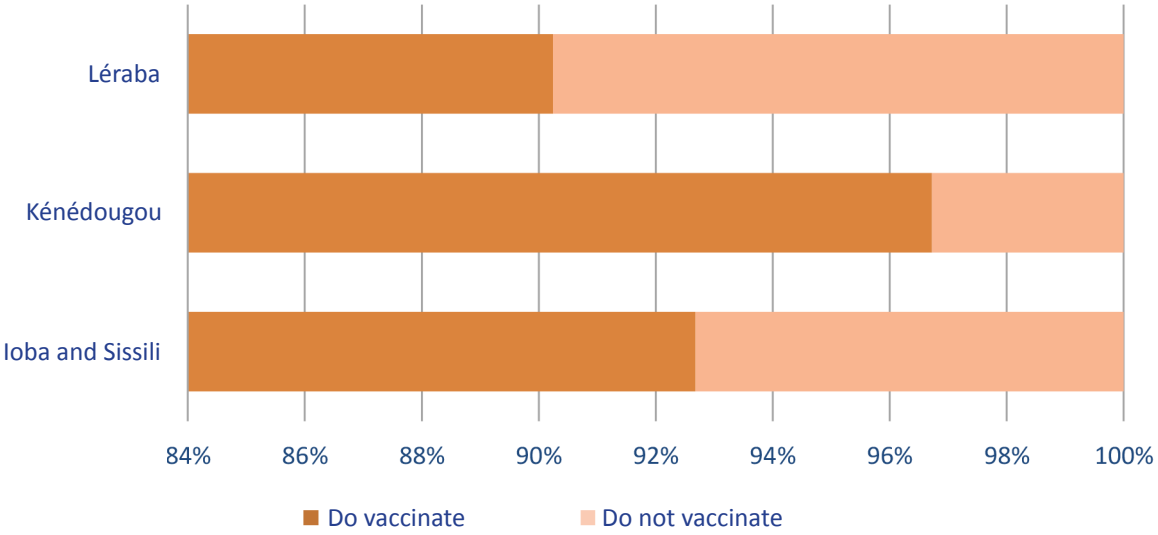


Figure 7: Proportion of people who vaccinate their animals, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

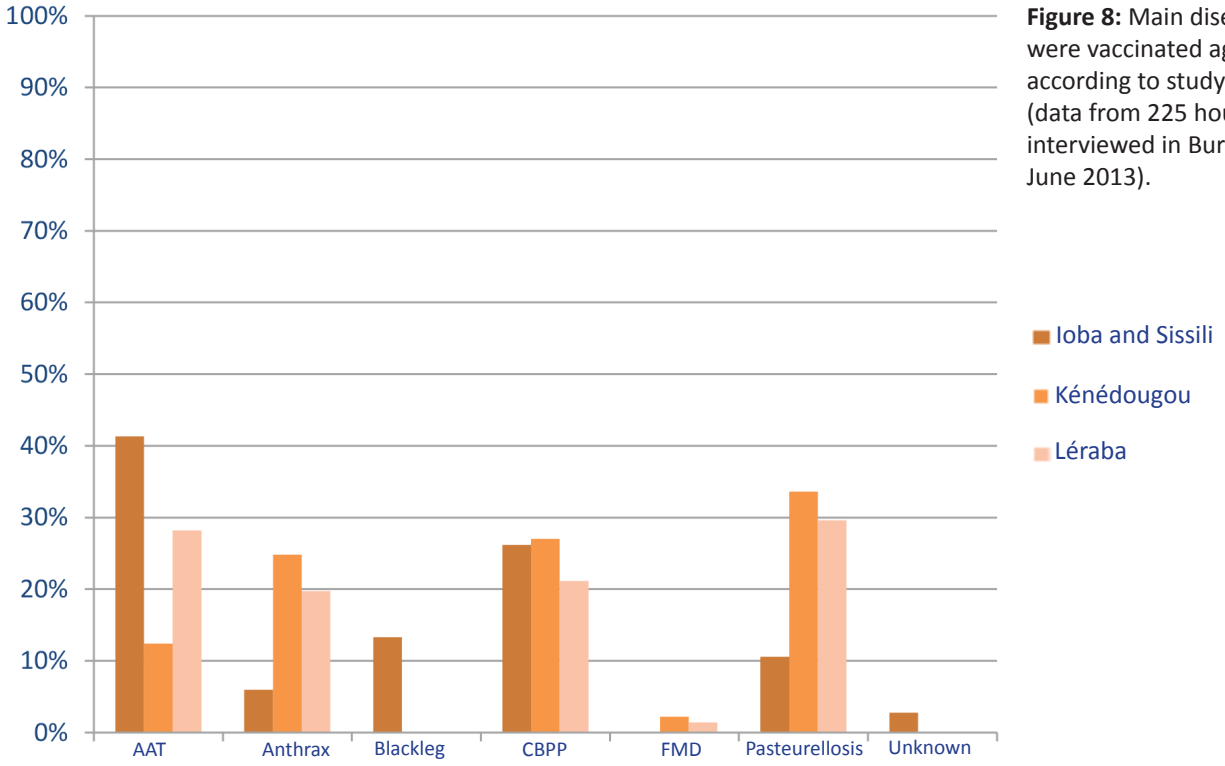


Figure 8: Main diseases cattle were vaccinated against, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

5. Perceived impacts of AAT in study areas

5.1 Perceptions of AAT occurrence

The following results were obtained when interviewees were asked non-specific questions regarding livestock diseases in the area with no mention of AAT. When participants were asked to name the major livestock diseases in terms of monetary loss, the majority mentioned AAT (79.6%). Households also mentioned blackleg, African swine fever, diarrhoea, Newcastle disease and lumpy skin disease (LSD). Results according to study area are presented in Figure 9. AAT (>70%) was mentioned most frequently as an important disease in all study areas (Figure 9).

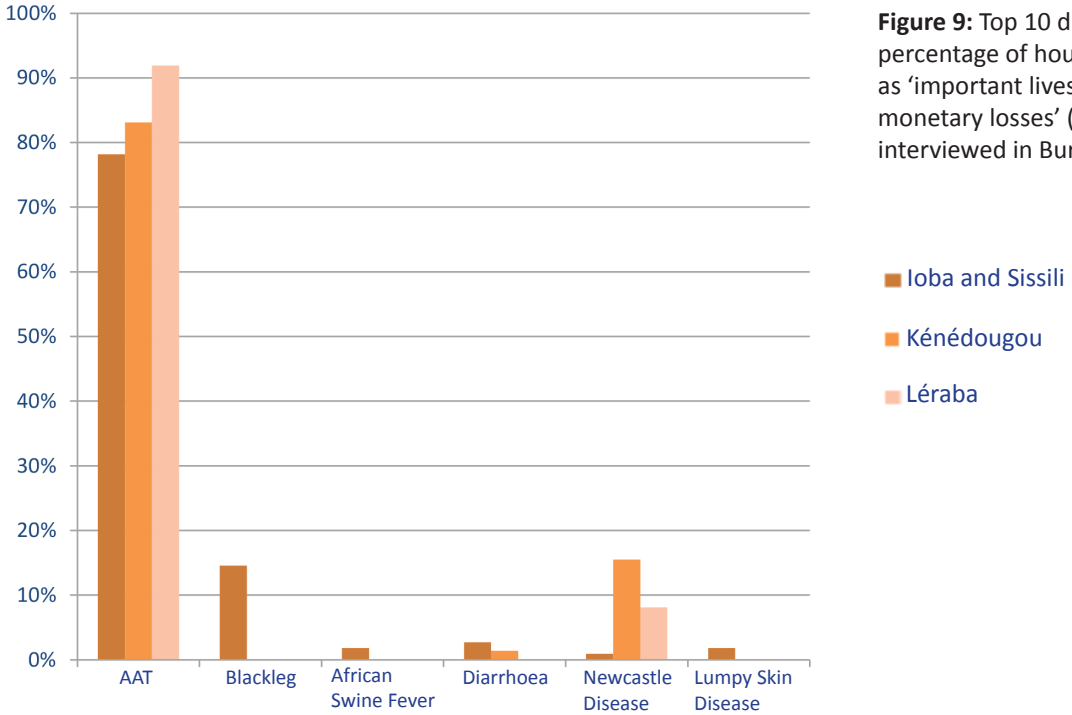


Figure 9: Top 10 diseases, according to the percentage of households mentioning them as 'important livestock diseases in terms of monetary losses' (data from 225 households interviewed in Burkina Faso in June 2013).

Disease	Rankings
AAT	1
Blackleg	2
Newcastle Disease	3
Diarhoea	4
Lumpy Skin Disease	5
African Swine Disease	6

Figure 9 continued: Top 6 diseases, according to the percentage of households mentioning them as 'important livestock diseases in terms of monetary losses' (data from 225 households interviewed in Burkina Faso in June 2013).

Around 21% and 79% of households in Burkina Faso mentioned ticks and tsetse flies as insects causing problems to their animals. Ticks (51%) were the main insects causing problems in Léraba whilst tsetse flies (50%) were more important in Kénédougou (Figure 10).

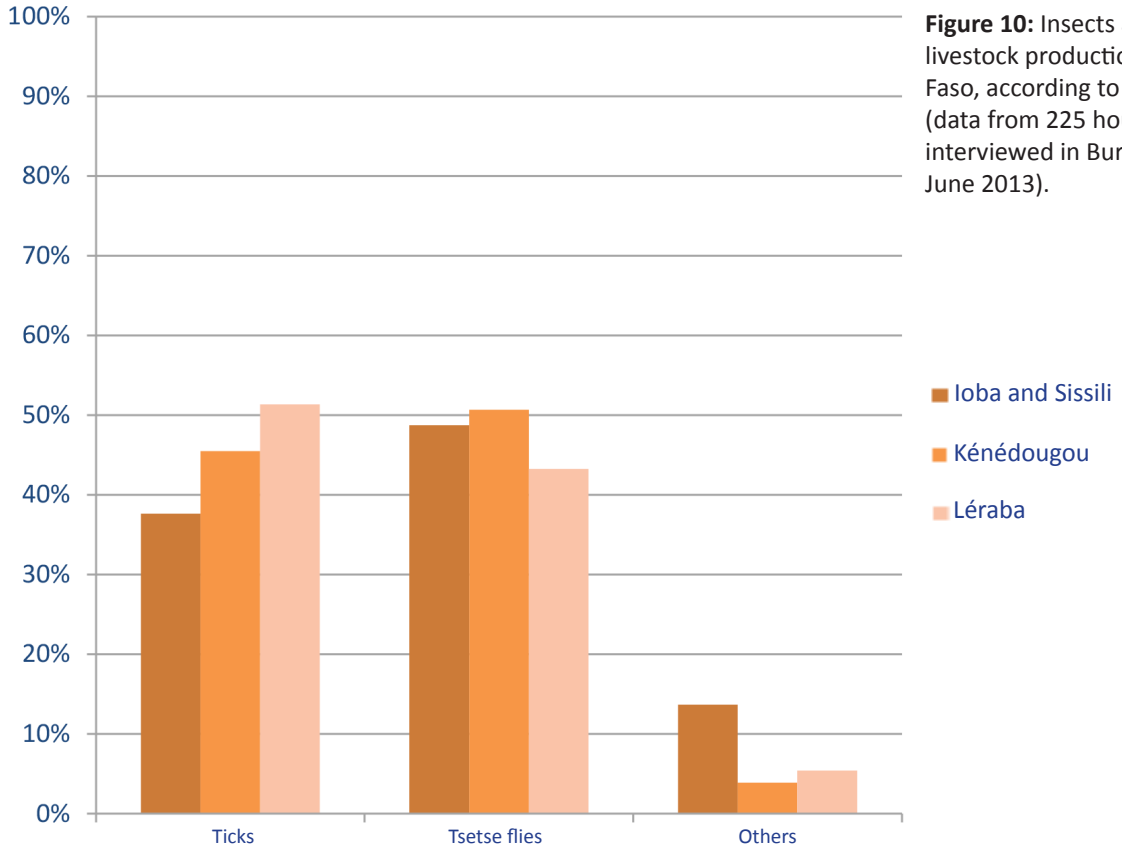


Figure 10: Insects affecting livestock production in Burkina Faso, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

Households were shown a picture of cow suffering from AAT (Image 1), although the clinical signs exhibited by the cow were non-specific. This information was used as an indication of the relative importance of AAT in different areas i.e. in areas where AAT was a major problem a household would be more likely to suggest the cow was suffering from AAT.

Overall almost 78% of the households suggested that the cow was infected with AAT (Table 6). A higher percentage of households in Kénédougou (93%) identified the disease as AAT compared to Ioba and Sissili (91%) and Léraba (81%). The different suggestions for the disease which the cow has are presented in Table 6. Other conditions mentioned were malnutrition, anaemia, and ingestion of plastic bags, parasites and lung infections.

Image 1: AAT infected cow showing typical wasting signs, interviewees were asked to suggest what was wrong with the cow.


Photo credit: R. Selby

Table 6: Disease suggestions when shown a picture of a cow with clinical signs compatible with AAT, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

	Ioba and Sissili	Kénédougou	Léraba
AAT	91.2%	92.6%	81.1%
Malnutrition	-	1.9%	18.9%
Unknown	2.9%	1.9%	-
Other	5.9%	3.7%	-

After non-specific questions were posed to interviewees, the interviewer then asked whether they had heard of AAT. Those that had heard of AAT were then asked a series of specific questions to acquire further information on the relative impact of AAT in the areas. Most interviewees said they knew of it; 91.2%, 98% and 85% in Ioba and Sissili, Kénédougou and Léraba, respectively. The majority of livestock keepers in all the study areas considered AAT a constant problem; however in Ioba & Sissili this was reduced to 60%. Approximately 5% of households in Ioba & Sissili said AAT was never a problem.

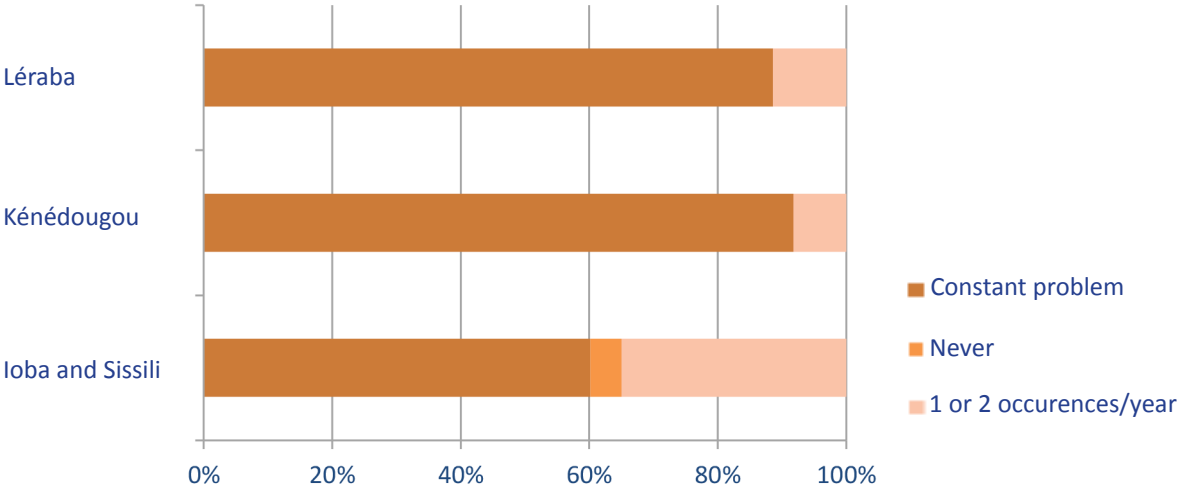


Figure 11: Reported frequency of AAT in livestock, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

Overall, 75% of households reported an influence of season on AAT occurrence; most people said the period of higher AAT occurrence is during rainy season (Figure 12).

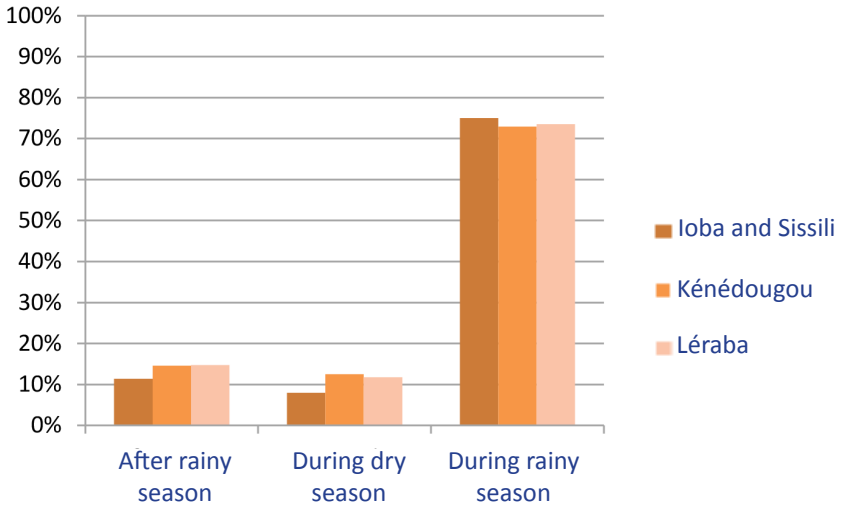


Figure 12: Period of higher AAT occurrence, according to study area
(data from 225 households interviewed in Burkina Faso in June 2013).

5.2 Perceptions of AAT economic impact

The perceived impact of livestock diseases on household income is presented in Figure 13. Most households did not provide an answer for this question but those that did mainly estimated it to be severe (29%) to very severe (54%), particularly in Léraba and in Ioba & Sissili. In terms of losses to production these were mainly meat losses (44% estimated as severe and 17% as very severe), reduced milk output (31% estimated as severe and 15% as very severe) and reduced draught power (30% estimated as severe and 50% as very severe).

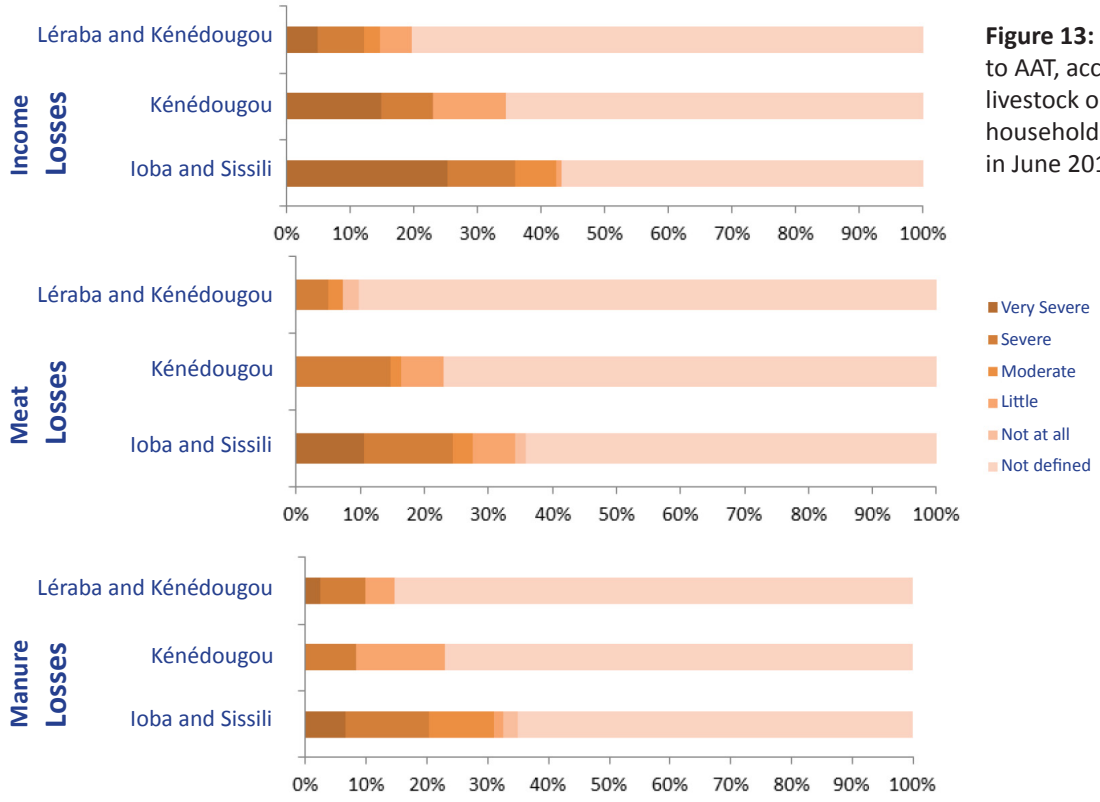


Figure 13: Production losses due to AAT, according to study area and livestock output (data from 225 households studied in Burkina Faso in June 2013).

The cost of AAT and all livestock diseases is presented in Table 7; households in Ioba & Sissili appeared to have incurred the highest costs for AAT treatment. The percentage mortality as a result of AAT and all livestock disease is shown in Table 7. In terms of overall mortality, 50% of the households had lost at least one cow in the last two years, excluding those that were sent to slaughter. When asked about history of AAT in their herds, 27% of households reported that they had lost at least one cow in the

two previous years to AAT. Cattle mortality due to AAT was highest in Ioba & Sissili (31%) compared to Léraba (22%) and Kénédougou (21%). Overall mortality (all causes) was highest in Léraba (63%) compared to the other two study areas where it was 41% and 59 % in Ioba & Sissili and Kénédougou respectively.

In the case of pigs, no deaths were reported from Kénédougou and Léraba. In Ioba & Sissili, 16 (13%) households reported deaths of pigs due to disease, with 4 of these reported deaths due to AAT. One household (Ioba & Sissili) reported the death of one equine due to AAT.

	Ioba and Sissili	Kénédougou	Léraba
Cost per individual AAT treatment (US$): Median (Q1 & Q3)	1.3 (1.3 & 1.6)	1.0 (0.9 & 1.5)	0.8 (0.7 & 1.6)
Total cost (US$) AAT diagnosis & treatment: % households > 0 Median (Q1 & Q3)	65 61.7 (31.2 & 107.3)	34.4 209.8 (83.9 & 281.2)	24.3 210.9 (183.6 & 283.3)
Total cost (US$) disease diagnosis & treatment: % households > 0 Median(Q1 & Q3)	75 72.4 (41 & 168)	95 314.8 (113.3 & 629.5)	66 356.7 (212 & 713.5)
Cattle deaths AAT: % households > 0 Median (Q1 & Q3)	31 2.5 (1 & 7)	21 2 (2 & 10)	22 2 (2 & 5)
Cattle deaths (all disease): % households > 0 Median (Q1 & Q3)	41.4 2 (1 & 3)	59 4 (2 & 6.3)	63.4 4.5 (2 & 7.8)
Small ruminants deaths AAT: % households > 0 Median (Q1 & Q3)	21 3 (2.25 & 6.8)	11.5 5 (3 & 5.5)	5 4.5 (3.8 & 5.3)
Small ruminants deaths AAT: % households > 0 Median (Q1 & Q3)	29.2 4 (3 & 10)	59 3.5(1.75 & 6)	31.7 4(1 & 12)

Table 7: Direct losses from AAT and other livestock diseases in terms of treatment costs in US dollars and mortality (data from 225 households interviewed in Ethiopia in April/May 2013).

5.3 Attitudes and practises towards AAT diagnosis and treatment in cattle

Diagnosing and treating AAT

The majority of people reported consulting a veterinarian or similar if they suspected their animal had AAT (Figure 14). None of the households in Ioba & Sissili said they would deal with the disease themselves and only around 10% of households in Kénédougou and Léraba said this. In addition, all households said they would take some action if they suspected an animal had AAT.

Regarding treatment of AAT; more than 50% of households in all study areas always use veterinarians (or similar) (Ioba and Sissili: 96%, Kénédougou: 75% and Léraba: 56%). Only 7% reported always treating livestock themselves. Those that self-treated their animals reported dosing 'by eye' i.e. they estimate dosage based on visual size which could lead to incorrect dosing and potentially resistance.

When asked the reasons they chose to treat their livestock, most households mentioned minimising economic losses (72%) and minimising the risk other animals become infected (13%). Most trypanocides kept were diminazene aceturate (Diminazene®) or isometamidium chloride (Trypamidium®, Veriben®). Main inconveniences with current AAT treatment are presented in Figure 16. Most households mentioned preparing the drugs, acquiring consumables, and weight estimation. Households in Ioba & Sissili also mentioned buying genuine drugs and acquiring clean water as inconveniences.

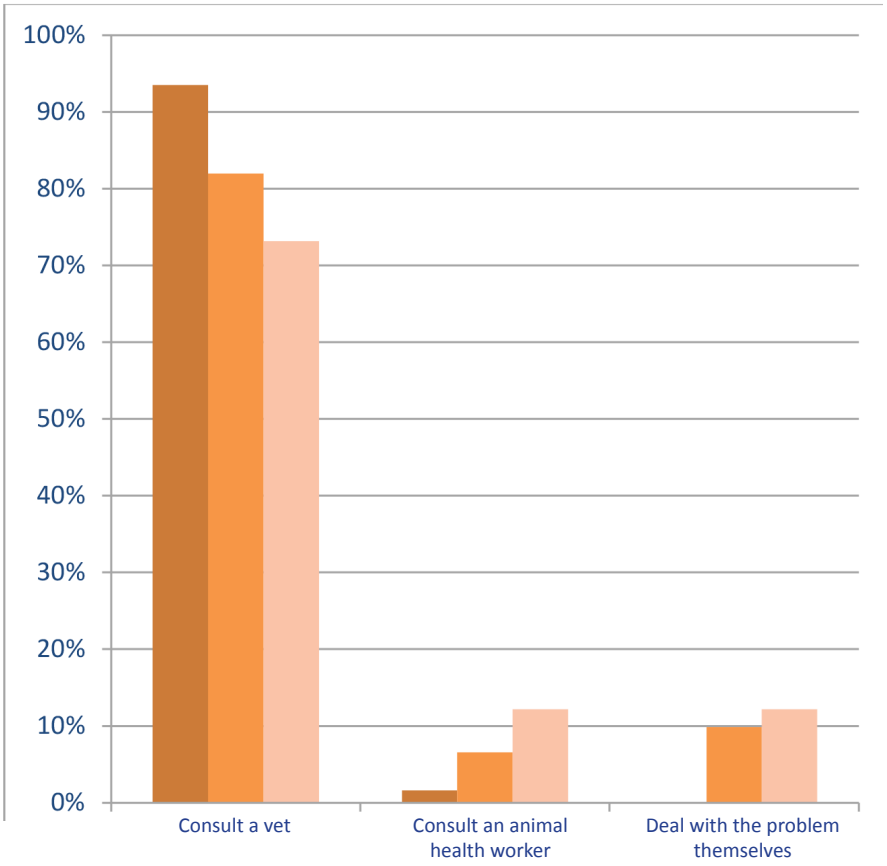


Figure 14: Household action in case of AAT suspicion, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

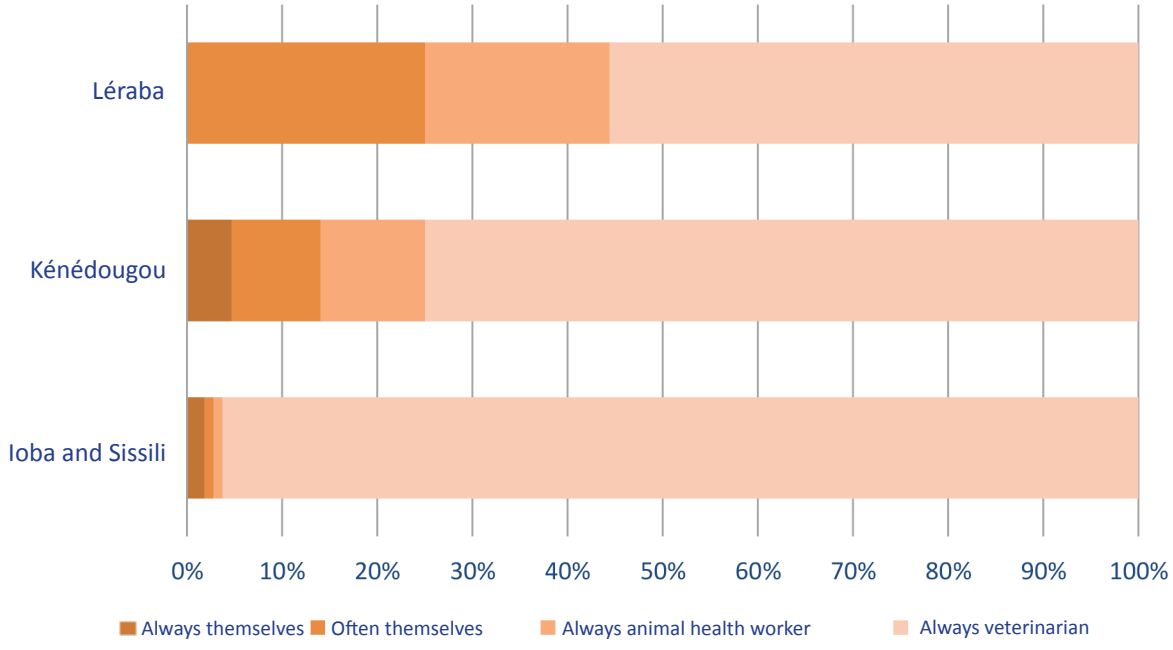


Figure 15: Who treats cattle against AAT, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

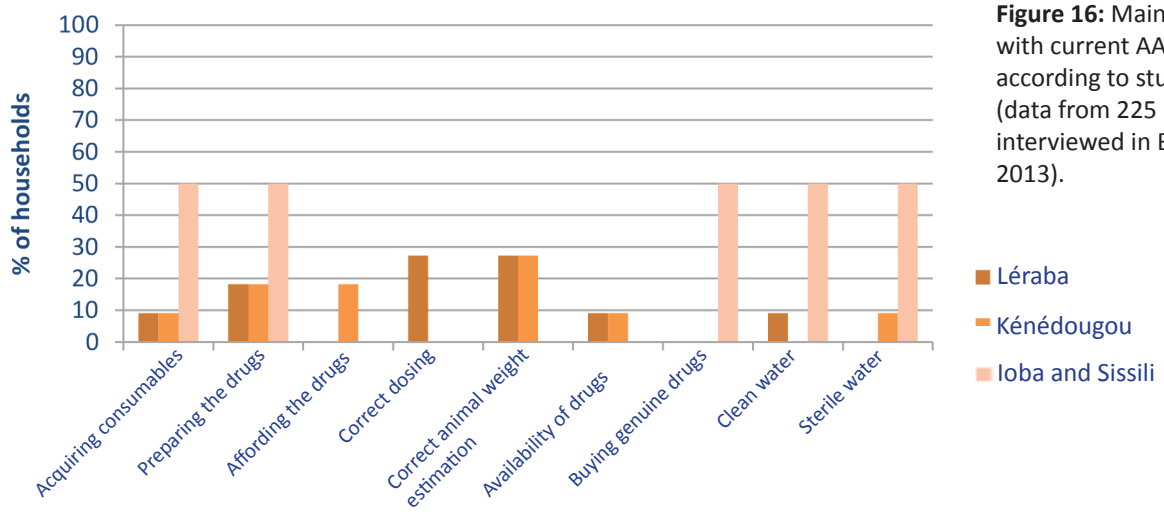


Figure 16: Main inconveniences with current AAT treatment, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

Treatment failure

Around 28% of those interviewed reported AAT treatment failure (Figure 17). Households reporting treatment failure were mainly located in Léraba and Kénédougou. Approximately 92% of households in Ioba and Sissili mentioned there was never AAT treatment failure in their households. Disease resistance was mentioned as a reason for failure, especially in Ioba & Sissili and Kénédougou. Circulation of fake drugs, incorrect diagnosis and improper dosing appear to be an issue in Léraba.

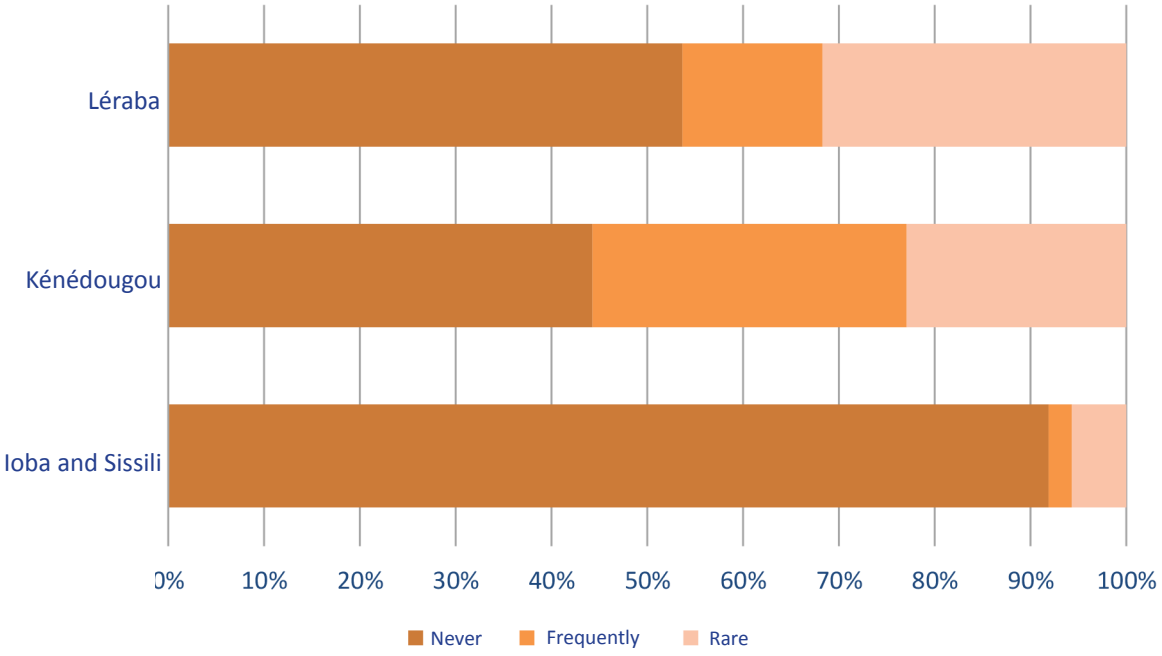


Figure 16: Main inconveniences with current AAT treatment, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

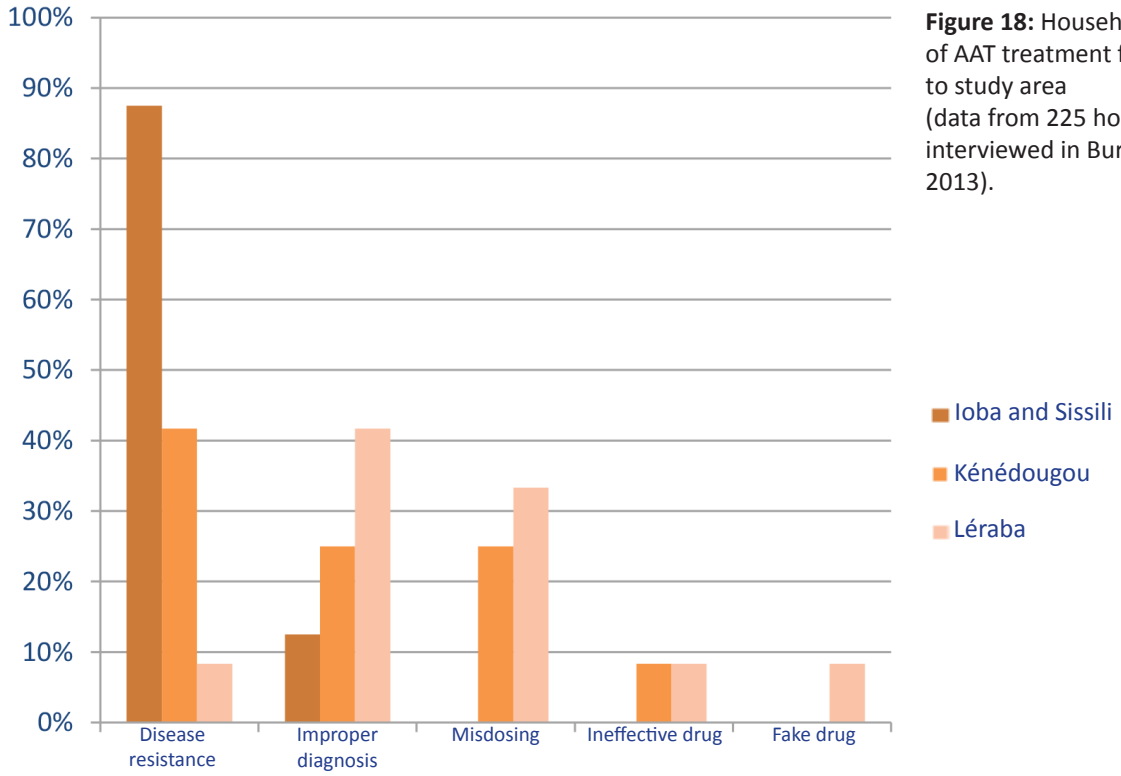


Figure 18: Household perceptions of AAT treatment failure, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

6. Knowledge of AAT

Interviewees identified AAT through classic signs of weight loss, malaise and loss of tail brush. Their knowledge concerning AAT clinical signs and AAT transmission is presented in Table 8. Most households were aware of the disease (especially in Kénédougou). Even though most of the households were aware that AAT is spread by a vector specific knowledge about the vector was low (25%). Households could correctly identify cattle and small ruminants as being susceptible to AAT but this awareness was lower in Léraba.

In Ioba & Sissili and Léraba around 50% of people said they knew how to control the disease and in Kénédougou 77% of households knew how to control AAT. When asked about preventative measures for AAT, less than 20% of households in Léraba mentioned tsetse control and none of the households in Ioba and Sissili mentioned it. Knowledge about insecticide treating cattle was higher in Kénédougou (62%). Only 30% of people in study area could identify a tsetse trap in a picture. In general, awareness of control measures appeared to be lower in Ioba & Sissili.

AAT knowledge	% of households		
Aware of AAT			
Ioba and Sissili	91.2%		
Kénédougou	100%		
Léraba	87.8%		
Mentioned that it is spread by vector			
Ioba and Sissili	82.8%		
Kénédougou	100%		
Léraba	100%		
Mentioned that it is spread by tsetse			
Ioba and Sissili	17.9%		
Kénédougou	39.3%		
Léraba	26.8%		
Mentioned that it is spread by biting flies			
Ioba and Sissili	55.1%		
Kénédougou	81.3%		
Léraba	46.1%		
Mentioned it affects other species	Sheep & Goat	Donkeys	Pigs
Ioba and Sissili	92.1%	11.7%	20.5%
Kénédougou	94.8%	24.1%	0%
Léraba	80%	-	6.7%
Think that AAT is zoonotic			
Ioba and Sissili	69.1%		
Kénédougou	88.5%		
Léraba	41.5%		

Table 8: General knowledge about AAT, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

	Ioba and Sissili	Kénédougou	Léraba
Said they knew how to control AAT: % households	52.9%	77.1%	53.7%
Could identify a picture of tsetse trap: % households	15.5%	50.8%	41.5%
Control measures mentioned (awareness) (% of households)			
Tsetse traps	-	16.4%	19.5%
Insecticide treated cattle	20.3%	62.3%	19.5%
Select resistant breeds	0.8%	-	-
Treat sick cattle	13.0%	3.3%	9.8%
Treat all cattle	42.3%	77.1%	39%
Facilitators of control			
Government bodies	80%	-	54.6%
Communities acting together	1.8%	-	4.5%
Independent individuals	3.6%	93.3%	36.4%
NGO	1.8%	7.7%	4.5%
None mentioned	14.6%	-	-

Table 9: Awareness of AAT control measures, according to study area (data from (data from 225 households interviewed in Burkina Faso in June 2013).

7. Attitudes towards future AAT control

7.1 consumer willingness to use and pay for new treatments

Most households in the study area felt there was a need for new trypanocides and they were ready to pay more than they currently pay for a new AAT treatment if it was more effective (Table 10), particularly in Kénédougou.

	Think there is a need for new AAT treatments	Would be willing to pay for a new treatment
Ioba and Sissili	89.4%	87%
Kénédougou	98.4%	98.4%
Léraba	90.2%	90.2%

Table 10: Proportion of farmers who think there is a need for new AAT drugs and would be ready to pay a higher price for it, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

7.2 Consumer willingness to use and pay for diagnostic tests

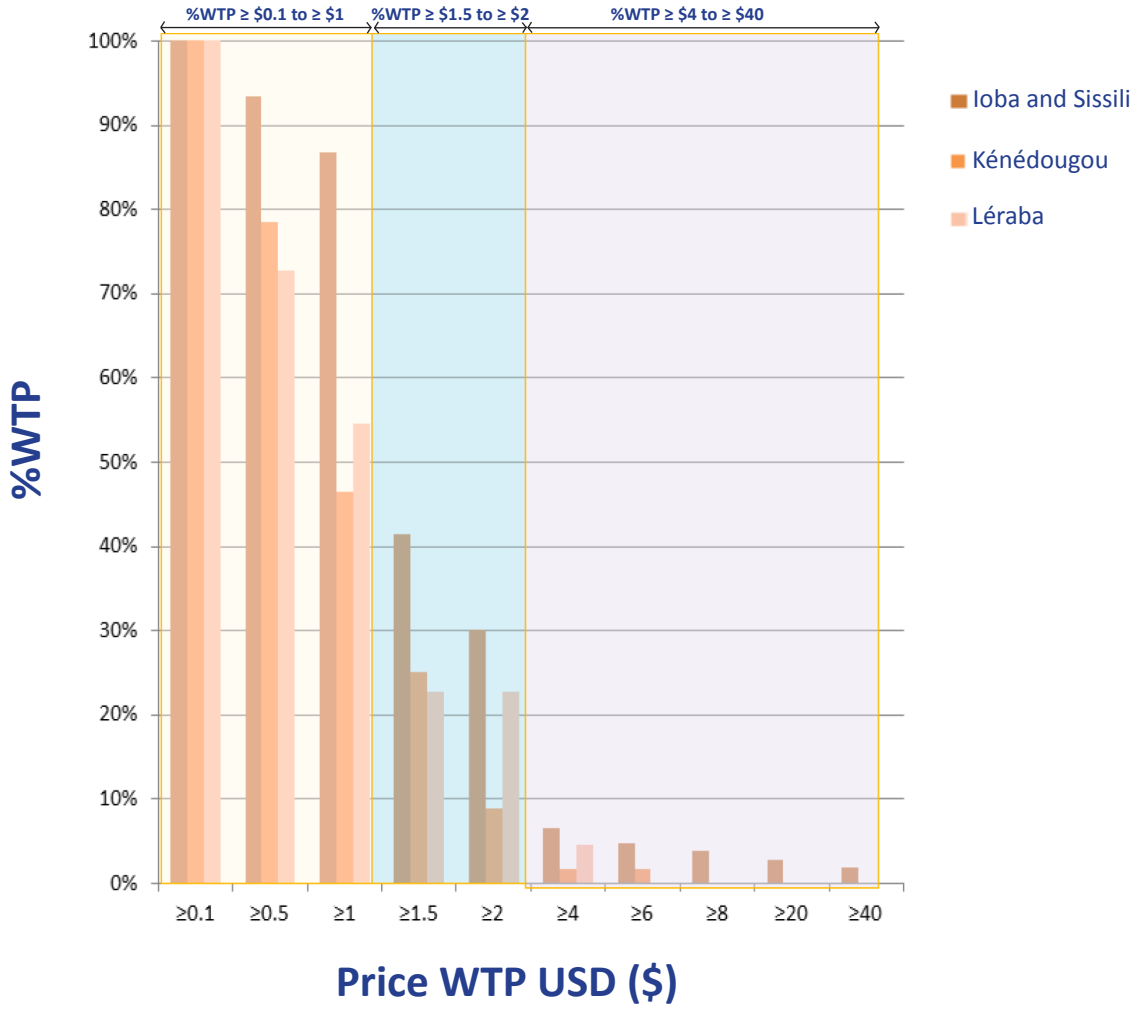
Most households interviewed said they would use a diagnostic test and were willing to pay for it. In Léraba fewer households (88%) were willing to pay for a diagnostic. Data regarding the price they were ready to pay are presented in Table 11 and Figure 19. Households located in Ioba & Sissili were willing to pay highest price.

	Want diagnostic	Willing to pay >0	Median cost (Q1 & Q2) in US$[2]
Ioba and Sissili	93.5%	92.7%	1.47 (1.04 to 2.09)
Kénédougou	100%	100%	0.84 (0.52 to 1.49)
Léraba	95.1%	87.8%	1.05 (0.44 to 1.04)

Table 11: Proportion of households who would use new AAT diagnostics and Cost (in dollars) households would be willing to pay, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

[2] The study was conducted in June 2013 and at this time the exchange rate of the CFA Franc (XOF) to the Unites States Dollar (USD) according to www.xe.com was 476.54 XOF = 1USD.

Figure 19: Cost (in dollars) households would be willing to pay for an individual AAT diagnostic test at each price interval (% of households that said they would pay that price, or a higher price) (data from 225 households interviewed in Burkina Faso in June 2013).



	Ioba and Sissili	Kénédougou	Léraba
≥0.1	100%	100%	100%
≥0.5	93.4%	78.6%	72.7%
≥1	86.8%	46.4%	54.6%
≥1.5	41.5%	25%	22.7%
≥2	30.2%	8.9%	22.7%
≥4	6.6%	1.8%	4.6%
≥6	4.7%	1.8%	-
≥8	3.8%	-	-
≥20	2.8%	-	-
≥40	1.9%	-	-

7.3 Consumer willingness to use and pay for an AAT Vaccine

Most households interviewed would vaccinate their livestock against AAT and were willing to pay if a vaccine became available (Table 12) especially in Kénédougou where all of the households said they would vaccinate. Households would mostly vaccinate cattle, but also mentioned vaccinating goats, sheep, pigs and donkeys, horses and camels. In Ioba & Sissili 33.3% of households said they would vaccinate poultry (even though poultry are not affected by AAT).

	Ioba and Sissili	Kénédougou	Léraba
Would vaccinate	93.5%	100%	95.1%
Willing to pay > 0	94.3%	100%	95.1%
Median cost (Q1 & Q2) in US$	1.57 (1.25 & 2.09)	1.05 (0.84 to 1.67)	1.42 (0.73 to 2.09)
Additional species they would vaccinate:			
Sheep	52.9%	82%	63.4%
Goat	53.7%	65.6%	22%
Pigs	27.6%	1.6%	-
Poultry	33.3%	9.8%	9.8%
Camel	1.6%	-	-
Donkeys	19.5%	14.8%	2.4%
Horses	4.9%	1.6%	-

Table 12: Percentage of farmers who would vaccinate their animal against AAT if a vaccine was available (data from 225 households interviewed in Burkina Faso in June 2013).

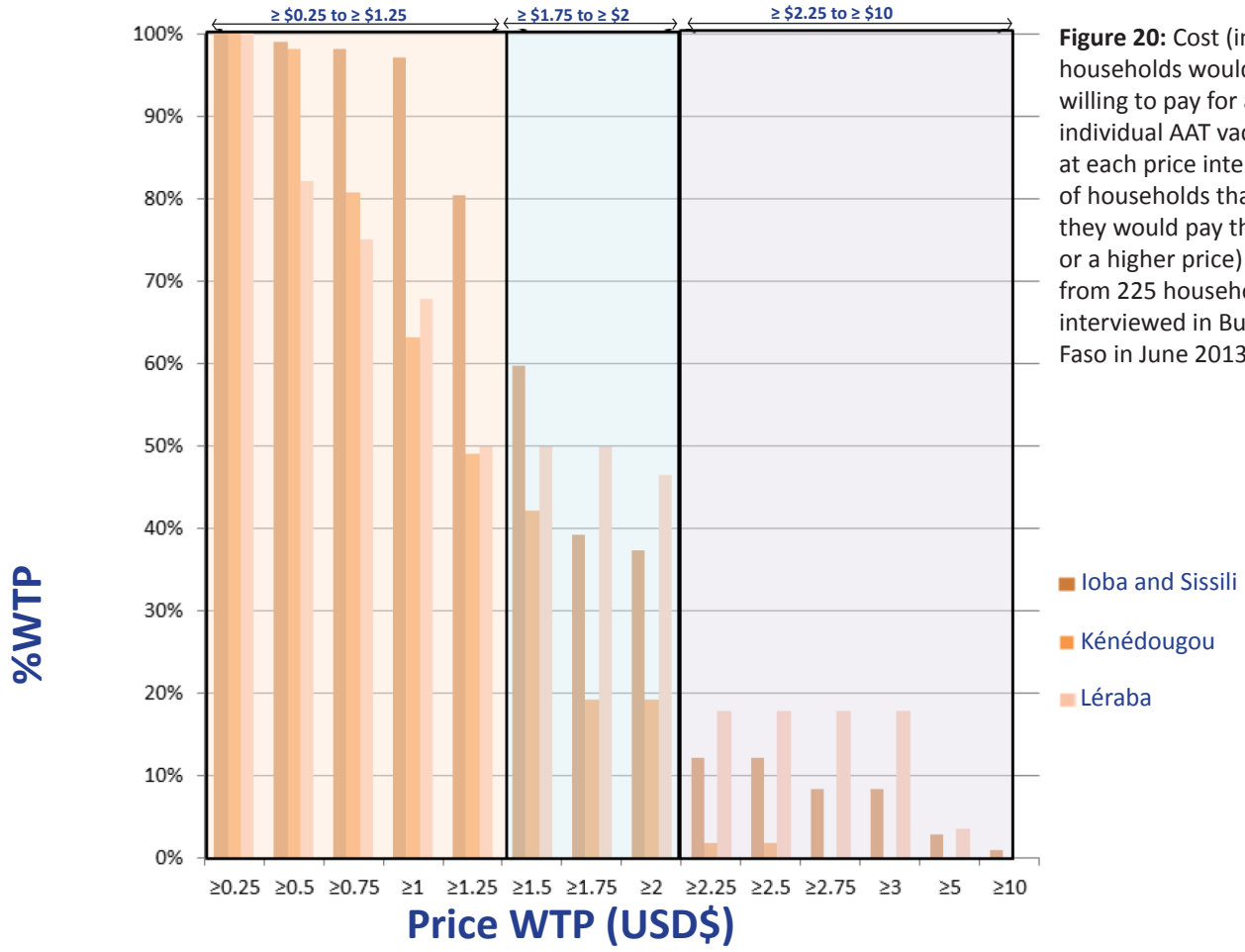


Figure 20: Cost (in dollars) households would be willing to pay for an individual AAT vaccine at each price interval (% of households that said they would pay that price, or a higher price) (data from 225 households interviewed in Burkina Faso in June 2013).

[3] The study was conducted in June 2013 and at this time the exchange rate of the CFA Franc (XOF) to the Unites States Dollar (USD) according to www.xe.com was 476.54 XOF = 1USD.

	Ioba and Sissili	Kénédougou	Léraba
≥0.25	100%	100.%	100%
≥0.5	99.1%	98.3%	82.1%
≥0.75	98.1%	80.7%	75%
≥1	97.2%	63.2%	67.9%
≥1.25	80.4%	49.1%	50%
≥1.5	59.8%	42.1%	50%
≥1.75	39.3%	19.3%	50%
≥2	37.3%	19.3%	46.4%
≥2.25	12.2%	1.8%	17.9%
≥2.5	12.2%	1.8%	17.9%
≥2.75	8.4%	-	17.9%
≥3	8.4%	-	17.9%
≥5	2.8%	-	3.6%

Figure 20: Cost (in dollars) households would be willing to pay for an individual AAT vaccine at each price interval (% of households that said they would pay that price, or a higher price) (data from 225 households interviewed in Burkina Faso in June 2013).

7.4 Important factors to take into account for new drugs development

When discussing factors which farmers take into account when deciding which veterinary products to use the main factors mentioned were that they "know the drug works on disease" i.e. efficacy and that there is no Adverse Drug Reaction (ADR) (Figure 21).

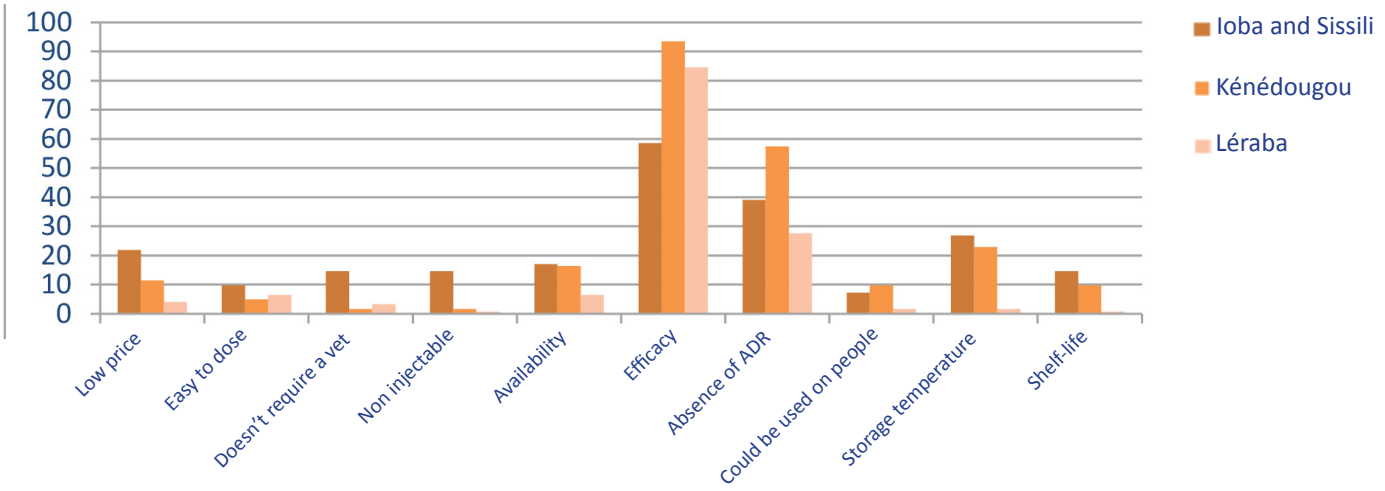


Figure 21: Important aspects for vet medicines, according to study area (data from 225 households interviewed in Burkina Faso in June 2013).

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