

Perception of cattle farmers of the efficacy of east coast fever immunization in Southern Zambia

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Abstract A study using a structured questionnaire was conducted to assess the perception of cattle farmers of the efficacy of East Coast fever (ECF) immunization in southern Zambia. One hundred and seventy-nine farmers from five districts in southern Zambia were interviewed. The majority of farmers (85%) perceived ECF immunization as being very effective and about half of them (51.4%) preferred immunization to other ECF control strategies. The study showed that the number of calves immunized was strongly associated with the farmer's perception of the benefits of immunization. There was no association between the number of calves immunized and the number of veterinary assistants in a given district or their transport situation. Overall mortality in ECF-immunized calves from various causes stood at 4.2%. Based on farmers' reports, the majority of these deaths seemed to have been caused by anaplasmosis, another tick-borne disease, and might have resulted from relaxation of tick

control after ECF immunization. The reasons identified by farmers for not immunizing their animals included failure by immunizing teams to reach certain areas, not having calves of immunization age, and lack of money. These findings provide valuable information on how livestock farmers perceive and adopt new animal disease control strategies and the information could be useful in their planning and implementation.

Keywords East Coast Fever · Farmers' perception · Immunization · Zambia

Abbreviations

ECF East Coast fever
FMD foot-and-mouth disease; VA, Veterinary Assistant

Introduction

Southern Zambia covers a total surface area of 85 283 km² and is the most important cattle rearing area of the country. The province accounts for the largest proportion (24.4%) of cattle-raising households in Zambia (Central Statistical Office, 2000), holding 742 524 head of cattle (28.3% of the country's total cattle population) (NALEIC, Zambia, 2002). However, cattle productivity in the area is threatened by important cattle diseases such as East Coast fever (ECF), foot-and-mouth disease (FMD) and anthrax. East Coast fever, a tick-borne disease, is the most economically important

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problem in Southern Province. It is caused by the protozoan *Theileria parva*, and transmitted by the brown ear tick (*Rhipicephalus appendiculatus* and *Rhipicephalus zambeziensis*). The disease poses a threat to cattle upon which most local people depend for draught power and income. High cattle mortalities due to this disease have continued to be reported, especially in the poorly managed traditional herds.

Previously, the Veterinary Department in Zambia attempted to control this disease by enforcing a compulsory dipping programme (Berkvens, 1991; Mulumba *et al.*, 2000). However, a number of problems were encountered, such as the high cost of sustaining the programme, infrastructural problems, and unwillingness of farmers to bring their animals regularly for dipping (Berkvens, 1991). A more cost-effective and appropriate method of control was therefore required.

In 1993, the Assistance to the Veterinary Services of Zambia Project (ASVEZA), funded by the Belgian government, was initiated to develop a better control strategy for ECF in southern Zambia. This involved identifying a local *T. parva* strain that could be used for field immunization. *Theileria parva* Chitongo was identified and it was demonstrated that immunization with this strain protected calves against most *T. parva* strains in the province. Since 1999, immunization of cattle against ECF using the treatment and infection method has been implemented as one of the most important control methods in southern Zambia. However, no study has been conducted to assess farmers' perception of these ECF immunizations in the province. How cattle farmers perceive a given intervention is critical to its adoption and hence the success of its implementation. Tatchell (1981) pointed out that when people understand a control option and its benefits, they are likely to respond positively.

The present study was therefore designed to record cattle farmers' perception of the impact of ECF immunizations in ECF-endemic areas of southern Zambia and to determine the major factors influencing that perception.

Materials and methods

A survey based on a face-to-face interview was designed to collect data on the perception of traditional cattle farmers in five districts (Choma, Kalomo, Mazabuka, Monze and Namwala) of southern Zambia. The

study was conducted in June and July 2003. This period coincided with immunization campaigns in the area.

Stratified random sampling was used. Out of the 20–30 immunization points in each of the immunizing districts, 10 were selected. At least 3 farmers with immunized animals were selected randomly at each immunization point, giving 30–40 farmers per district. A total of 179 farmers were interviewed.

Veterinary Assistants (VAs) from the ASVEZA Project speaking the local Tonga language were trained to interview the farmers on the basis of a questionnaire. This questionnaire included information on personal details, number of animals kept, knowledge of ECF and ECF immunization, reasons for using ECF immunization, control strategy preferred, affordability of ECF immunization and the perception of the efficacy of ECF immunization method. The questions were in English, but were later translated into the local Tonga language, and all responses were recorded on the questionnaire in English.

In addition, information on the incidence of ECF from 1998 to 2002 and other relevant data were collected from official veterinary reports in these five districts. This was done to compare farmers' reports on disease occurrence with those in government reports.

Statistical analysis

Data analysis was carried out using STATA SE/8.0 (StataCorp., 2003). A logistic regression model was fitted to compare the districts with respect to whether farmers had reported ECF cases in their herds before. To investigate whether the farmer's perception of the effectiveness of ECF immunization influenced the number of immunized animals, a negative binomial regression was fitted with number of immunized animals as response variable and farmer's perception ('very effective' versus 'effective') as independent variable. No respondents stated that immunizations were ineffective. Finally, the relationship between the number of cattle owned by the farmer and the number of immunized calves was also investigated using a negative binomial regression.

Results

A total of 179 farmers from five districts of southern Zambia owning a total of 10 582 cattle were interviewed.

Table 1 Districts, total number of cattle farmers interviewed and cattle owned

District	District area (sq km)	Total cattle kept	Calves	Cattle farmers interviewed (<i>n</i>)
Choma	6 960.26	1 487 (14.1%)	476	38 (21.2%)
Monze	4 648.12	2 629 (24.8%)	786	46 (25.7%)
Mazabuka	6 313.98	1 339 (12.7%)	402	34 (19.0%)
Namwala	21 084.05	3 987 (37.7%)	876	31 (17.3%)
Kalomo	31 524.73	1 140 (10.8%)	319	30 (16.8%)
Total	70 531.14	10 582 (100.0%)	2 859	179 (100.0%)

Table 2 Ranking of cattle farmers by herd size and by district

Herd size	Percentage of farmers	Percentage of farmers					<i>n</i>
		Choma	Kalomo	Monze	Mazabuka	Namwala	
1–10	12	5 (13%)	5 (17%)	3 (7%)	7 (21%)	2 (6%)	22
11–20	21	7 (18%)	7 (23%)	10 (22%)	9 (26%)	4 (13%)	37
21–30	19	8 (21%)	5 (17%)	10 (22%)	6 (18%)	5 (16%)	34
31–40	9	4 (11%)	3 (10%)	0 (0%)	4 (12%)	5 (16%)	16
41–50	6	2 (5%)	2 (7%)	4 (9%)	1 (3%)	1 (3%)	10
51–60	4	4 (11%)	0 (0%)	1 (2%)	0 (0%)	3 (10%)	8
61–70	6	2 (5%)	3 (10%)	4 (9%)	2 (6%)	0 (0%)	11
71–80	4	3 (8%)	0 (0%)	2 (4%)	1 (3%)	1 (3%)	7
81–90	4	0 (0%)	1 (3%)	3 (7%)	1 (3%)	3 (10%)	8
91–100	4	1 (3%)	3 (10%)	2 (4%)	1 (3%)	1 (3%)	8
101–150	5	2 (5%)	1 (3%)	5 (11%)	0 (0%)	1 (3%)	9
>150	5	0 (0%)	0 (0%)	2 (4%)	2 (6%)	5 (16%)	9
Total	100	38	30	46	34	31	179

Table 3 Farmers reporting ECF cases in their herds before immunization programme

District	No	Yes	Total (<i>n</i>)
Choma	0 (0.0%)	38 (100%)	38
Monze	1 (2.2%)	45 (97.8%)	46
Mazabuka	4 (11.8%)	30 (88.2%)	34
Namwala	3 (9.7%)	28 (90.3%)	31
Kalomo	1 (6.5%)	29 (93.5%)	30
Total	9 (5.03%)	170 (94.97%)	179

Sample characteristics and sanitary situation after the start of the ECF immunization

Approximately 38% of the cattle in the questionnaire came from Namwala district (Table 1). The largest proportion of cattle farmers had herds of 11–20 cattle (21%) (Table 2). Mazabuka was represented best in this group (26%). Of the farmers interviewed, only 5% reported not having previously experienced ECF in their herds (Table 3). There was no significant difference between districts in reporting ECF in their herds before the questionnaire ($p = 0.180$).

Most of the cattle farmers interviewed started immunizing their cattle in 2000 (33%), one year after im-

munization campaigns were launched (Table 4). The highest percentage of calf immunization was observed in Namwala (31%) followed by Monze (29%) and the lowest percentage was noted for Kalomo (12%) (Table 5). There was a strong relationship between the number of calves immunized and the total number of cattle owned by farmers ($p < 0.001$). No association was found between the number of calves immunized and the number of VAs or the number of VAs with motorcycles in any of the districts.

Out of the 2042 calves immunized against ECF by farmers interviewed in 2002, 4.2% died from various causes (Table 6). Most of these deaths were reported in Monze (33.7%), with Kalomo reporting the

Table 4 Year in which cattle farmers started immunizing their animals

Year	District					Total
	Choma	Monze	Mazabuka	Namwala	Kalomo	
1999	14	8	11	4	7	44 (25%)
2000	14	19	7	11	9	60 (33%)
2001	3	12	9	7	6	37 (21%)
2002	7	7	7	9	8	38 (21%)
Total	38	46	34	31	30	179 (100%)

Table 5 Calves immunized in 2002 by interviewed farmers, total cattle and number of VAs and their transport facilities in each district

District	Calves immunized	Cattle owned	Total no. of VAs	VAs with motorcycles
Choma	293	1 487	19 (20.9%)	8
Monze	590	2 629	23 (25.3%)	4
Mazabuka	281	1 339	16 (17.6%)	6
Namwala	641	3 987	17 (18.7%)	6
Kalomo	237	1 140	16 (17.6%)	9
Total	2042	10 582	91 (100%)	33 (36.3%)

Table 6 Deaths of calves reported by farmers after the 2002 immunization programme

District	Deaths reported after immunizations	Deaths reported to local VA
Choma	23	12
Monze	29	23
Mazabuka	11	8
Namwala	21	13
Kalomo	2	1
Total	86	57 (66.3%)

Table 7 Causes of death in calves reported by farmers to have died after ECF immunization

Cause of death	Number of deaths	Percentage	Period after immunization
ECF (confirmed)	5	6	2 less than 35 days, 3 (1–12 months)
ECF (suspected)	4	5	1–12 months
Anaplasmosis	30	35	1–12 months
Heartwater (suspected)	4	5	over 12 months
Black quarter	12	14	1–12 months
Babesiosis	2	2	1–12 months
Bloat	3	3	1–12 months
Injuries	1	1	less than 35 days
Diarrhoeal infections	2	2	1–12 months
Unknown	23	27	5 (<10 days), 6 (1–12 months), 11 (10–35 days), 1 (>1 year)
Total	86	100	

lowest (2.3%). Only 66.3% of these deaths were reported to the local VA. Most of the 86 deaths reported by farmers seem to have been due to anaplasmosis (35%), while confirmed ECF deaths accounted

for 6% (Table 7). Most of the unknown deaths were not reported to VAs. In cases reported to the VAs, blood and lymph smears were taken and postmortems were conducted where possible. Information on all

Table 8 Responses given by farmers in each district on how they perceived the efficacy of immunization

District	Response			Total
	Very effective	Effective	Don't know	
Choma	33	5	0	38
Monze	41	5	0	46
Mazabuka	26	6	2	34
Namwala	23	7	1	31
Kalomo	30	0	0	30
Total	153 (85%)	23 (13%)	3 (2%)	179

Table 9 Number and percentage of farmers owning cattle according to herd sizes in relation to preferred ECF control interventions

Herd size	Control intervention preferred by farmers						Total <i>n</i>
	1	2	3	4	5	6	
1–10	0	9 (41%)	1 (5%)	0	11 (50%)	1 (5%)	22
11–20	0	20 (54%)	1 (3%)	0	16 (43%)	0	37
21–30	1 (3%)	21 (62%)	0	0	12 (35%)	0	34
31–40	0	9 (56%)	1 (6%)	0	6 (38%)	0	16
41–50	0	5 (50%)	0	0	5 (50%)	0	10
51–100	0	21 (50%)	0	1 (2%)	19 (45%)	1 (2%)	42
101–150	0	5 (55%)	0	0	4 (44%)	0	9
>150	0	2 (22%)	1 (11%)	0	6 (67%)	0	9
Total	1 (0.6%)	92 (51.4%)	4 (2.2%)	1 (0.6%)	79 (44.1%)	2 (1.1%)	179

Control interventions: 1 = treatment; 2 = immunization; 3 = tick control; 4 = treatment + immunization; 5 = immunization + tick control; 6 = immunization, tick control + movement controls

deaths and VAs' actions was based solely on farmers' reports.

Perception of ECF immunization by cattle farmers

Of farmers interviewed, 85% described ECF immunization as being very effective, while 2% had no idea of the effect of immunization (Table 8). No farmers stated that ECF immunization was ineffective. Significantly more calves were immunized by farmers who judged immunization to be very effective compared to farmers who judged it to be merely effective ($p < 0.001$).

The majority of farmers (51.4%) interviewed preferred immunization as a control strategy for ECF, with those owning 21–30 animals recording the highest of this group (Table 9). Only 2.2% of the respondents preferred tick control. The least-preferred strategies were treatment (0.6%) and treatment plus immunization (0.6%).

Out of the 10 cattle farmers who had failed to immunize their animals in the previous year (2002), three stated that the immunizing team never reached their

area, two stated that they did not have calves to immunize and five said that they had no money to pay for the immunization (Tables 10 and 11).

Official statistics on ECF in southern Zambia

Table 12 shows that reported ECF cases dropped from 8658 in 1998 (before immunization started) to 2963 in 2002 (after 4 years of ECF immunization): a drop in reported cases of 66%.

Table 13 indicates that the number of calves immunized yearly in the five districts increased almost 10-fold from 1999 to 2002.

Discussion and conclusions

All the farmers in the study were traditional cattle farmers, with those owning 11–20 cattle comprising the largest group (21%). In this study, 95% of farmers interviewed indicated that they had previously experienced ECF in their herds, confirming that the disease was endemic in these districts.

Table 10 Reasons given by farmers for the willingness to continue immunizing their calves ($n = 179$)

Reason	Number of cattle farmers (n)	Percentage
Results from first calves immunized were good	22	12.3%
Convinced that immunized calves are protected	135	75.4%
Seen from fellow farmers immunizing regularly that their animals have stopped dying	22	12.3%
Total	179	100.0%

Table 11 Immunization benefits mentioned by cattle farmers

Benefits	Number of cattle farmers (n)	Percentage
Immunized calves do not die from ECF compared to those that are not immunized	146	81.6%
Immunized calves are easily treated and irregular dipping is possible	22	12.3%
Immunization is less expensive than other control strategies	11	6.1%
Total	179	100.0%

Table 12 Reported ECF cases and deaths, 1998 – 2002^a

District	ECF cases 1998	ECF deaths 1998	ECF cases 1999	ECF deaths 1999	ECF cases 2000	ECF deaths 2000	ECF cases 2001	ECF deaths 2001	ECF cases 2002	ECF deaths 2002
Choma	1425	NI ^b	2046	1637	497	NI	825	269	828	249
Monze	2107	NI	1121	325	1019	263	816	325	1005	244
Mazabuka	1837	1252	1346	918	969	537	640	378	232	110
Namwala	390	166	2125	1516	549	268	193	106	558	331
Kalomo	2899	1652	1220	42	1201	508	410	142	340	156
Total	8658	3070	7858	4438	4235	1576	2884	1220	2963	1090

^aSource: Southern Province Veterinary Office Annual Report for the year 2002

^bNI, no information

Table 13 Number of calves immunized against ECF in five districts of southern Zambia from 1999 to 2002^a

District	Immunization period								Total
	May 1999	Sep 1999	May 2000	Sep 2000	May 2001	Oct 2001	May 2002	Oct 2002	
Monze	349	389	1 003	654	2 102	2 336	2 765	2 935	12 533
Choma	389	237	121	702	1 159	1 627	1 820	2 995	9 050
Mazabuka	142	122	106	680	642	1 096	1 190	1 299	5 277
Kalomo	0	205	454	580	532	918	1 405	1 300	5 394
Namwala	0	0	0	988	640	632	912	1 586	4 758
Sub-Total	880	953	1 684	3 604	5 075	6 609	8 092	10 115	
Total/Year		1 833		5 288		11 684		18 207	
Grand total									37 012

^aSource: ASVEZA-south Mazabuka, Annual internal report for the year 2002

It was of interest that, in the period when immunization had been implemented, most cattle farmers (33%) presented their animals for immunizations only in the second year, suggesting that some farmers will adopt a new intervention only after witnessing its benefits

to fellow farmers. In addition, the number of calves immunized was associated only with the number of cattle a farmer had and the farmer's knowledge of the benefits from the immunizations, and not with the number of VAs or their transport facilities in a given

district. Farmers with more cattle are likely to have more draught power and hence increased area under cultivation and increased income from crops that enables them to pay for immunization. The number of VAs with motorcycles (36.3%) in all the districts is probably too low compared to the areas of operation covered to make any meaningful impact on their extension abilities. Woods and Colleagues (2003) pointed out that provision of motorcycles to extension officers increases their interactions with farmers and enhances their importance as sources of information on management practices. This then contributes to improved adoption by farmers of new and recommended interventions. Elyn (2002) reported the lack or inadequacy of transport (both motorized (motorcycles) and non-motorized (pedal bicycles)) as one of the major problems facing veterinary assistants in Zambia.

A number of deaths occurred after animals had been immunized against ECF. However, some of these deaths were not reported to the local VA. Anaplasmosis, a tick-borne disease, seemed to be the main cause of death in cattle on the basis of farmers' reports. This may be because most farmers tended to relax their tick control programmes once animals had been immunized against ECF. The findings of this study are not in agreement with the findings of Berkvens (1991) in Eastern province, where anaplasmosis was not a problem after ECF immunization. A possible explanation for the situation in Eastern province might be the absence of *Boophilus decoloratus*, the main vector of this disease, which is said to have been replaced by *B. microplus* (Berkvens *et al.*, 1998). However, in southern Zambia, *B. decoloratus* was found throughout the area and *B. microplus* was not recorded (Speybroeck *et al.*, 2002). In addition, Jongejan and colleagues (1988) reported that *Bos indicus* cattle have a high resistance to *B. microplus* ticks, thereby reducing the chances of transmitting the parasites. This is probably a contributing factor in that most of the cattle in Eastern province are indigenous Angoni (short-horned Zebu) cattle (Berkvens *et al.*, 1998), which are resistant to anaplasmosis, whereas in southern Zambia most of the animals kept in the study area are crosses with *Bos taurus* breeds (authors' own observations). Farmers thus need to be advised to continue dipping/spraying of their animals (at reduced frequencies) after ECF immunization to reduce tick burdens and control other tick-borne diseases.

Most respondents in the study (85%) perceived ECF immunization as being very effective and only 2% had

no knowledge on the effectiveness of immunization. This has led to most of them (51.4%) preferring immunization to other ECF control strategies. This is confirmed by the increasing numbers of calves immunized each year in all the districts, as seen from the official reports. In addition, the reduction in the number of officially reported ECF cases and deaths may be due partly to increased adoption of ECF immunization in the districts concerned. A combination of immunization and tick control came second (44.1%). Economically, immunization combined with seasonal tick control is the most profitable way of managing a herd under a traditional production system (Minjauw *et al.*, 1999). Farmers need to be advised to adopt these strategies.

A number of farmers identified lack of money and inability of immunizing teams to reach their areas (the most remote areas) as reasons for not having immunized their animals. Woods and colleagues (2003) reported that the distance between a farmer's household and a veterinary facility had a negative influence on the way veterinary services were used. The decision-making process of farmers regarding using recommended animal health practices is also determined by their available income from the sale of crops and other activities and by their priority ranking of other necessities (Elyn, 2002). Financial assistance to farmers and improvement of the mobility of veterinary assistants by providing them with reliable motorized transport might increase the adoption of this important ECF control strategy.

It is evident from this study that information on how livestock owners perceive a new disease control intervention (e.g. ECF immunization) is critical to the success of implementing such a programme. The perception of small-scale farmers of a particular technology affects their decision to adopt it (Adesina and Baidou-Forson, 1995). The current findings may be useful in planning and implementing new animal disease control programmes in the country.

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Perception par les éleveurs de bétail de l'efficacité de l'immunisation contre la fièvre de la côte est dans le Sud de la Zambie

Résumé – Une étude utilisant un questionnaire structuré a été menée pour évaluer la perception par les éleveurs de bétail de

l'efficacité de l'immunisation de la fièvre de la côte est (ECF) dans le sud de la Zambie. Cent soixante dix neuf fermiers provenant de cinq régions du Sud de la Zambie ont été interviewés. La majorité des fermiers (85%) ont perçu l'immunisation de la fièvre de la côte est comme étant efficace et environ la moitié d'entre eux (51.4%) ont préféré l'immunisation à d'autres stratégies de contrôle de l'ECF. L'étude a mis en évidence que le nombre de veaux immunisés était fortement associé à la perception qu'ont les fermiers des bénéfices de l'immunisation. Il n'y a eu aucune association entre le nombre de veaux immunisés et le nombre d'assistants vétérinaires dans une région donnée ou leur situation de transport. La mortalité des veaux immunisés contre l'ECF en raison de diverses causes s'est située globalement à 4.2%. Si l'on se base sur les rapports des fermiers, la majorité de ces décès semblaient avoir été induites par l'anaplasmosis, une autre maladie transportée par les tiques et elle aurait pu être causée par le relâchement du contrôle des tiques après l'immunisation par l'ECF. Les raisons identifiées par les fermiers pour ne pas immuniser leurs animaux ont inclus l'incapacité des équipes d'immunisation à atteindre certaines régions, le fait de ne pas avoir de veaux d'âge immunisable et le manque d'argent. Ces constatations ont fourni des informations précieuses sur la façon dont les éleveurs de bétail perçoivent et adoptent les nouvelles stratégies de contrôle des maladies des animaux et les informations recueillies pourraient être utiles dans leur planification et leur mise en oeuvre de telles stratégies.

Percepción de los granjeros-ganaderos sobre la eficacia de la inmunización de Fiebre de la Costa Oriental en Zambia del sur

Resumen – Se llevó a cabo un estudio utilizando un cuestionario estructurado para evaluar la percepción de los granjeros con ganado sobre la eficacia de la inmunización contra la Fiebre de la Costa Oriental (FCO) en el sur de Zambia. Se entrevistaron ciento setenta y nueve granjeros de cinco distritos distintos del sur de Zambia. La mayoría de los granjeros (85%) percibía la inmunización de FCO como algo muy efectivo y aproximadamente la mitad de ellos (51.4%) prefería la inmunización a otras estrategias de control de la FCO. El estudio puso de manifiesto que el número de becerros inmunizados estaba fuertemente asociado a la percepción del granjero de los beneficios de la inmunización. No hubo asociación entre el número de becerros inmunizados y el número de asistentes veterinarios en un distrito dado o la situación de transporte. La mortalidad total por diferentes causas en becerros inmunizados contra FCO era de 4.2%. Según los informes de los granjeros, la mayoría de estas muertes parecía estar causada por anaplasmosis, otra enfermedad transmitida por garrapatas, y podría haberse debido a la relajación del control de las garrapatas después de la inmunización contra FCO. Las razones que identificaron los granjeros para no inmunizar a sus animales eran: fallo de los equipos de inmunización para llegar a ciertas áreas, no tener becerros en edad de inmunización y falta de dinero. Estos hallazgos proporcionan una valiosa información sobre cómo perciben y adoptan los granjeros ganaderos las nuevas estrategias de control de la enfermedad animal, y la misma podría utilizarse en asuntos de planificación e implementación.