The impact of controlling Newcastle Disease in Thyolo district, Malawi
A baseline study

D.C. van den Ende

Faculty of veterinary medicine

Utrecht University

The Netherlands

Abstract

Chickens play a crucial role in the livelihood of households in rural areas of developing countries. Chickens are an important source of protein for the villagers and can be sold or exchanged to supply basic needs. The main limiting factor for poultry production is Newcastle Disease (ND). The KYEEMA foundation is implementing a one year project to improve the quality of life of local villagers in Malawi, Mozambique and Tanzania by improving the availability of chicken through the vaccination against ND.
This baseline study, done in the Thyolo district of Malawi, shows that ND is well recognized as a major constraint. Half of the population have vaccinated before. Vaccination seems to have a positive effect, but has been done inconsistently. A ND-control program with emphasis on sustainability could increase the number of chickens and thus provide food security and generate more income.

Table of contents

Introduction

Poultry plays a very important role in rural areas of many developing countries (Mgomezulu *et al.,* 2005, Alexander *et al.,* 2004). Chickens provide people in these areas with meat and eggs which can be consumed by the owners of the chickens or sold or bartered for medicine clothes and school supplies / fees (Alders *et al.,* 2005b).
Chickens also provide pest control, manure and needed for many traditional ceremonies and festivals. Chickens in rural areas are held in a low yield, low input way. These chickens come from local breeds which are hardy, are able to scavenge for their own feed, are able to run and fly to escape predators and are capable of reproducing to supply replacement stock for the household flock. These village chickens require a minimal of inputs in terms of housing, disease control, management and supplementary feeding. This makes these chickens very valuable to villagers in developing countries. In these countries approximately 20% of all protein comes from eggs and chicken meat and poultry contributes 70% of the rural production in low-income, food-deficit countries (Branckaert *et al.,* 2000).
One of the main limiting factors to rural poultry production is Newcastle disease (ND) (Alders *et al.,* 2005b, Alexander *et al.,* 2004). In countries where ND is endemic, outbreaks of this disease regularly result in mortalities of 50 to 100%. In developing countries where ND is not endemic, outbreaks may occur less frequently but potential losses due to the disease make vaccination necessary (Alders *et al.,* 2008). In developing countries, the objectives of Newcastle disease control in rural chicken populations are to improve food security and aid in poverty alleviation.
A sustainable ND control programme is composed of five essential components:
– An appropriate vaccine, vaccine technology and vaccine distribution mechanisms.
– Effective extension materials and methodologies that target veterinary and extension staff as well as community vaccinators and farmers.
– Simple evaluation and monitoring systems of both technical and socio-economic indicators.
– Economic sustainability based on the commercialisation of the vaccine and vaccination services and the marketing of surplus chickens and eggs.
– Support and coordination by relevant government agencies for the promotion of vaccination programs (Alders *et al.,* 2008).
It is difficult to motivate every poultry owning household in a village to cooperate and work on Newcastle Disease vaccinations and control. In order to set up a sustainable vaccination program and judge how effective vaccination programs will be in preventing Newcastle disease it is necessary to have an idea how village inhabitants view ND control and what knowledge the village community is about the clinical signs and cause of ND.

There are several conventional vaccines available for control of ND in the commercial poultry sector in Malawi. These have effectively controlled the disease and reduced the incidence in commercial poultry farms (Mgomezulu *et al.,* 2005).
A vaccine that is commonly used in controlling free-range rural scavenging chickens is La Sota. La Sota is a live lentogenic vaccine with poor thermostability (Young *et al.,* 2002). La Sota produces moderate vaccinal reactions, which makes it unsuitable for vaccinating a population including young chicks, as in village situations. This is because the virus spreads and it is not practical to isolate the adults from the chicks (Awuni *et al.,* 2005).
Transport difficulties, high ambient temperatures and lack of refrigeration pose special problems for ND control in rural areas (Mgomezulu *et al.,* 2005). A solution to this problem is the use of vaccine strains of ND virus that have been selected for thermostability like the I2 vaccine.

The I-2 vaccine has several advantages over other vaccines:

- It is cheap and therefore affordable to all farmers.
- It does not require strict cold-chain facilities for transportation.
- It can be produced locally and thus readily available to farmers.
- Its application does not require specialised skills, and farmers can administer the vaccine on their own (Awuni *et al.,* 2005).
- It has the ability to spread between chickens (Tran Dinh, 2001).

The ACIAR (Australian Centre for International Agricultural Research) provides the I-2 ND master seed free of charge (Copland *et al.,* 2005).

Previous studies show that the vaccination with the thermotolerant I-2 ND vaccine resulted in a protective immunity in vaccinated chickens. In almost all study areas, it was observed that all chickens not presented for vaccination succumbed to ND. The results recommend that chickens should be vaccinated every 4 months with I-2 ND vaccine to maintain protective immunity (Mgomezulu *et al.,* 2005).

To assist the governments of Malawi and Tanzania in developing and implementing efficient and equitable ND control programs the KYEEMA Foundation, a non-governmental organisation (NGO) implemented the project: "Strengthening rural livelihoods and food security through improving village poultry production in Malawi, Mozambique, Tanzania and Zambia". This project aims to contribute to poverty reduction and increased food security through a sustainable model for Newcastle disease control (Bagnol, 2009).

In the KYEEMA ND vaccination project in Malawi three campaigns will be carried out per year: in March, July and November. The I-2 thermostable vaccine will be used by means of administering one drop in the eye of the chicken. Community vaccinators will be trained to develop effective and sustainable community participation and ownership of a ND control program.(Bagnol, 2009) The desired effect of this project is to increase poultry flock size and health, to increase the knowledge ND and ND control and here by improving the economic situation and welfare of village inhabitants (KYEEMA, 2009).

To test if these goals have been reached a participatory rural appraisal (PRA) to obtain qualitative data and a questionnaire to obtain quantitative data were carried out in January 2010 as a baseline using the same protocol as in Tanzania and Mozambique. After one year of vaccination, in January 2011 the same questionnaire and a PRA will be carried out again. The results from these two tests will be analysed to obtain an idea if the project goals have been achieved.

Background information on Malawi

Malawi is a small country with 118,5 thousand square kilometre of surface area but holds a population of 14,3 million. (Worldbank 2009) This makes it a very densely populated country where land is scarce. It is one of the poorest countries sub-Saharan Africa, but is has recorded fast improvement in the last few years. The average income per capita is US$250. (Worldbank 2009) In the last 4 years high growth rates averaging 7.5 percent have been registered, compared to below three percent in previous years. The economy grew by 9.7 percent in 2008. Malawi's economy is mainly based on agriculture. Although it contributes to 35 percent of the Gross Domestic Product, the sector contributes to 80 percent of the country's employment and export earnings. Smallholders make up about three quarters of agricultural production. The country's main export products are tobacco, tea, sugar, and coffee. This makes the economy very vulnerable to weather influences.

Figure 1. Map of South Malawi

The district of Thyolo in the South of Malawi was selected by the Ministry of Agriculture to implement the project. Rural chickens have a large contribution to household income in this region, were livestock is scarce as access to land is difficult due to the large tea plantations. To alleviate the lack of land, the government promotes the resettlement of families to districts where more land is available (Bagnol, 2009).

Goals of the baseline study

The goal of this baseline study is to assess the impact that Newcastle disease has in this area and to assess the impact a Newcastle disease vaccination campaign can have in the future. This will be done by taking into consideration:

- The advantages of raising chickens
- The knowledge of Newcastle disease
- Knowledge of vaccination
- Current vaccination state
- Gender sensitive issues

This baseline study will be compared to a baseline study with the same methodology implemented in the Singida region of Tanzania in November 2009, to assess the environmental influences of on implementing a cross country ND-control campaign.
The differences between Malawi and Tanzania will be analysed using the data collected in the baseline PRA and the questionnaire during the KYEEMA ND vaccination project.

Methods and methodology

Five villages in the district of Thyolo were selected by the ministry of Agriculture to set up sustainable Newcastle Disease control. In these five villages a baseline study was done by a conducting a questionnaire for quantitative data and a participatory rural appraisal (PRA) in each village to collect qualitative data.

Before collecting the data 8 enumerators and 4 supervisors were trained in conducting the questionnaire. During this half day training the questionnaire was checked for translation mistakes. Staff from the ministry of agriculture were used as supervisors and extension workers of the selected and surrounding villages as enumerators. To overcome gender related issues while interviewing both male and female enumerators were trained.

The PRA is a focus group discussion with men and women from the village to be able to discus major constraints in the village. The PRA was led by social anthropologist Brigitte Bagnol and one of the extension workers assisted her as a translator.

The questionnaire was a shortened version of the questionnaire produced for the SANDCP project (SANCP, 2005) and was reviewed and translated after its application in Mozambique and Tanzania. The questionnaire includes questions on:

- Poultry production
- Sales consumption and other use of chickens and eggs
- Knowledge about nutrition
- Animal health and mortality
- Vaccination

150 households in five villages were randomly selected to be interviewed using a two stage sampling technique developed by Lawrence Spradbow. In this sampling methodology 15 clusters of households are defined and 10 households per cluster are selected.

It is essential to have a complete list of households from every village. The total number of households in the selected villages was 2836.

2836 dived by 15 clusters is 189. The random number between 0 and 189 selected was 13. Because the villages did not vary a lot size in each village 3 clusters of 10 households were selected as demonstrated in table 1.

Village	No. of H/H	Cumulative No. of H/H	Random Number	Clusters in sample
Beula	533	533	13, 202, 391	3
Chingondo	458	991	580, 769,958	3
Kavunye	653	1644	1147, 1336,1526	3
Maganiza	613	2257	1715, 1904, 2093	3
Ndalama	579	2836	2282, 2471, 2660	3
Total	2836			15

Table 1. random selection of clusters and households

After the number of clusters per village was defined the selection of the household was selected randomly according to the above methodology but now selecting the 10 households in the village. To be able to do this it was necessary to have a complete list of households in each village. In each village 50% males and 50% females were interviewed.

Results

Identity

In five villages 150 households were selected to be interviewed. In 77 households a female was interviewed and in 73 households a male was interviewed. The category of 21 to 40 years contains 44.0 percent of the interviewees and in this group more males than females were interviewed (table 2). The category of ages 41 to 60 contains 30.7 percent and in this group more females than males were interviewed.

		Sex of the interviewee				Total	Column %
		F	row%	M	row%		
Age of the interviewee	1 to 20	4	80.0%	1	20.0%	5	3.3%
	21 to 40	29	43.9%	37	56.1%	66	44.0%
	41 to 60	30	65.2%	16	34.8%	46	30.7%
	61 to 80	13	44.8%	16	55.2%	9	19.3%
	81 to 100	0	-	1	100.0%	1	0.7%
	Missing					3	2.0%
Total		76	51.7%	71	48.3%	150	100%

Table 2. Spread in ages of the interviewees.

Demography

The majority (66.0 percent), of the interviewees in this study live in a household with 1 to 5 people (figure 2). Thirty-three percent of the interviewees lived in a household with 6 to 10 people. Only one interviewee lived in a household with 11 to 15 people.

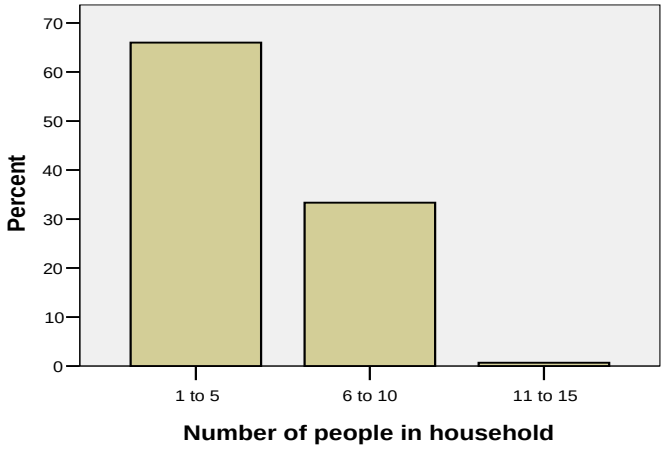

Figure 2. Houshold size

Chickens evidently account for the major part of the livestock owned. Households that raise chickens own an average of 8.8 chickens per household. Few other animals are raised as shown in table 3. Pigs and doves are the most represented animals labelled others. Women own 58.5 % of the chickens and 41.5 % of the chickens are owned by men.

	Number of households	Sum	Mean	Std. Dev.
Cattle	1	1	1.0	.
Goat	37	106	2.9	1.75
Sheep	0	-	-	-
Donkey	0	-	-	-
Chickens	118	1037	8.8	7.05
Others	51	275	5.4	6.26

Table 3. Composition of the livestock

Households where chickens are not reared have the tendency to contain less people than households where chickens are reared. Among the households with chickens; 63.3 percent contain between 1 and 5 people and 36.4 percent contain between 6 and 10 people. Households without chickens tend to be smaller; 75.0 percent of the households contain less than 6 people (table 4). This trend can be seen in the total of all villages and in the separate villages of Beula, Chingondo and Kavunye.

		Households					
		With chickens	%	Without chickens	%	Total	%
How many people do you live with?	1 to 5	24	75,0%	75	63,6%	99	66,0%
	6 to 10	7	21,9%	43	36,4%	50	33,3%
	11 to 15	1	3,1%	0	0,0%	1	0,7%
Total		32	100,0%	118	100,0%	150	100,0%

Table 4. Family size in households with and without chickens.

Poultry

The village of Chingondo has the highest numbers of chickens (table 5). This village has a mean of 8.7 chickens per household and the interviewed households had a total number of 261 chickens. Only 4 of the selected households did not rear chickens and 19 of the 26 that did, owned more chickens than the median. Households in Beula have the lowest numbers of chickens. This village has a mean of 4.6 chickens per household and a sum of 139 chickens. 11 households did not rear chickens at all and 10 of the 19 households that did raise chickens owned only a small flock. There is not a significant difference in the number of people vaccinating in these villages (χ^2, p =0.57).

		Village					
		Beula	Chingondo	Kavunye	Maganiza	Ndalama	Total
Chickens	Mean	4.6	8.7	7.7	7.8	5.8	6.9
	Std. Dev.	6.1	6.9	8.7	7.8	6.0	7.2
	Median	2	9	5	6	5	5
	Total	139	261	231	233	173	1037
Number of households without chickens		11	4	5	5	7	32
Number of households owning less chickens than the median		10	7	11	10	9	47
Number of households owning more chickens than the median		9	19	14	15	14	71

Table 5. Numbers of chickens owned per village and the distribution households with no chickens /small flock / large flock. Total number of households per village is 30.

Households	Village											
	Beula		Chingondo		Kavunye		Maganiza		Ndalama		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Vaccinated	14	46.7%	13	43.3%	17	56.7%	13	43.3%	18	60.0%	75	50.0%
Non-vaccinated	16	53.3%	17	56.7%	13	43.3%	17	56.7%	12	40.0%	75	50.0%

Table 6. Number of households vaccinating per village.

Households that vaccinate rear an average of 8.6 chickens per household. Households that do not vaccinate rear an average of 5.3 chickens per household. The vaccinating households have significantly more adult chickens and growers than non-vaccinating households (table 7).

		Have you ever vaccinated your chickens against Newcastle Disease?		
		No	Yes	Total
Adults (more than 5 months)	Mean	2.0*	3.4*	2.7
	Standard Deviation	2.3	3.7	3.2
	Total	149	258	407
	Total %	36.6%	63.4%	100.0%
Growers (2-5 months)	Mean	1.2*	2.4*	1.8
	Standard Deviation	2.3	3.3	2.9
	Total	93	177	270
	Total %	34.4%	65.6%	100.0%
Chicks (day old – 2 months)	Mean	2.0	2.8	2.4
	Standard Deviation	3.9	4.4	4.1
	Total	152	208	360
	Total %	42.2%	57.8%	100.0%
Total number of chickens	Mean	5.3*	8.6*	6.9
	Standard Deviation	6.1	7.9	7.2
	Total	394	643	1037
	Total %	38.0%	62.0%	100.0%

Note: Means within a row with * are significantly different (P<0,05)

Table 7. Chicken ages in vaccinating and non-vaccinating households.

Sales, consumption and other use of chickens and eggs

Each interviewee was asked to rank the 3 most important reasons for raising chickens. The most important reason was awarded 3 points, the second 2 points and the third 1 point. The percentages in figure 2 account for the percentage of the total number of points given by all the interviewees.
Family consumption and selling are ranked as the most important reasons for raising chickens. There is no significant difference in the number of people ranking selling or family consumption as the most import reason for raising chickens (χ^2, p=0.68).
The "others" category was chosen by 51 interviewees, of which 68.8% specified "others" as manure and 25.5 % as raising chickens for medicine.

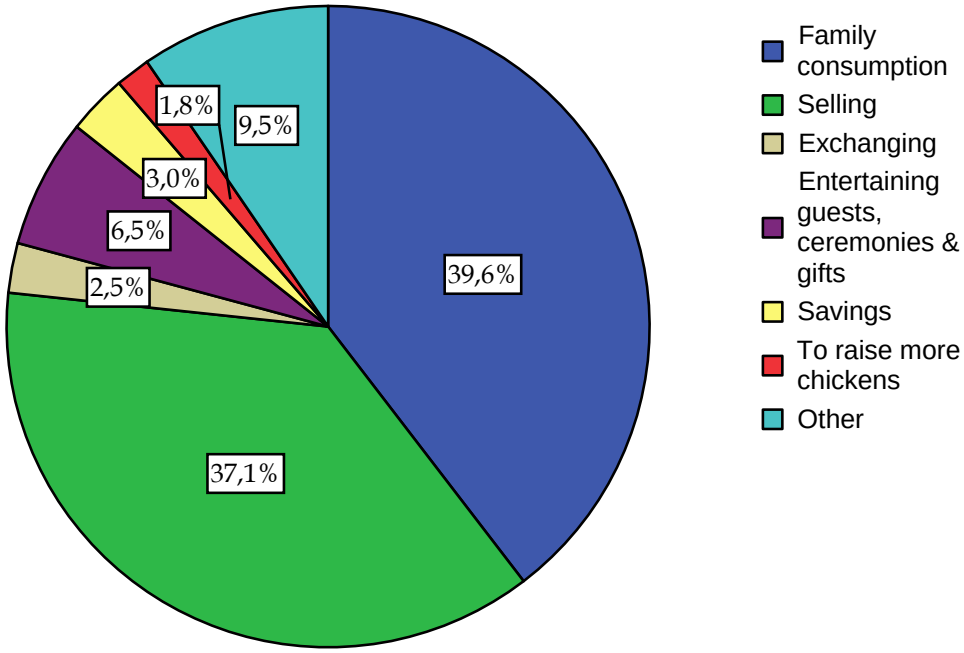

Figure 3. The most important reasons for raising chickens.

Table 8 shows the mean number and sum of chickens and eggs disposed of by the households. An average of 0.5 chickens and 1.8 eggs are eaten per household per month. An average of 0.2 chickens and 0.2 eggs are sold per household every month.

		3 months		6 months	
		Mean	Sum	Mean	Sum
Chickens	Eaten	1,6	245	2,8	420
	Exchanged	0,0	5	0,1	10
	Sold	0,6	96	0,9	142
	Gifts	0,3	44	0,5	70
	Other	0,1	13	0,1	22
Eggs	Eaten	6,0	895	10,5	1569
	Exchanged	-	0	0,0	6
	Sold	0,9	130	1,1	162
	Gifts	0,1	10	0,1	16
	Other	0,0	3	0,0	3

Table 8. Distribution of chicken and eggs in the 3 and 6 months prior to the research done in January.

Villagers were asked in which months of the year they use sell and exchange more chickens, eat chickens and when ND outbreaks are seen. As shown in figure 4; more households use, sell, and exchange more chickens in January and December compared to the rest of the year. In these same months and in July more households eat chicken. Newcastle disease outbreaks start in July and are most seen by villagers in October, but may last until December.

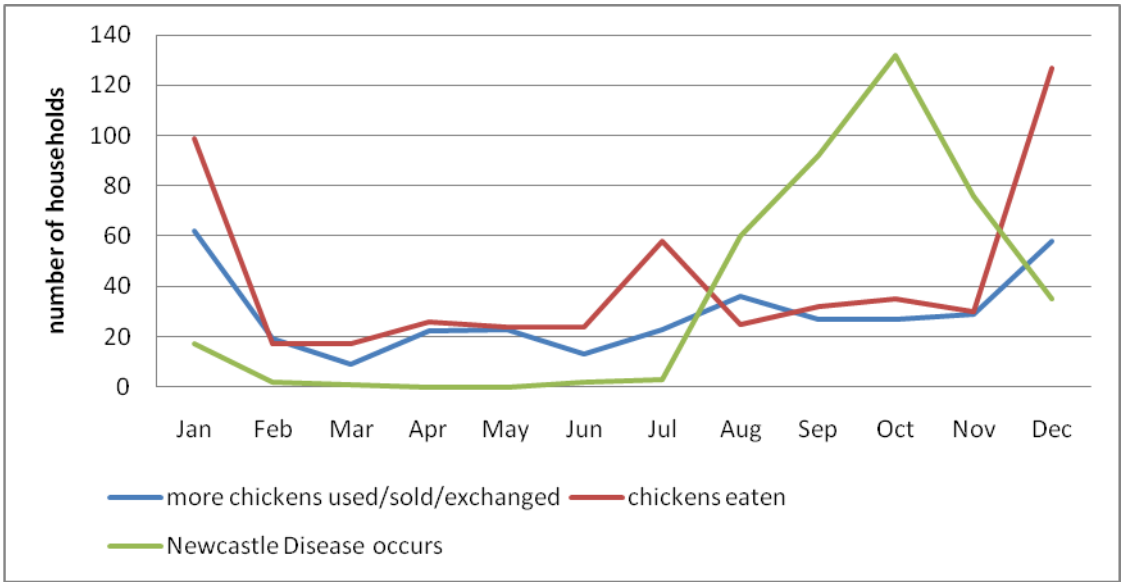

Figure 4. Timeline of when households use/sold/exchange more chickens, chickens are eaten and months of the year ND occurs.

Knowledge about Nutrition

The interviewees were asked if they thought each of the categories was an advantage of eating chickens. The percentages in figure 5 account for the percentage of the total number of advantages stated as important. The most important advantages of eating chickens are a varied diet and that it helps to grow (protein source). Another important advantage is that it helps protect against disease (a source of vitamin A). That chickens are good for the ill, babies and pregnant women is of less importance to the people in Malawi. Significantly more male interviewees thought it was important that chickens help to protect against disease than female interviewees (χ^2, p=0,014).

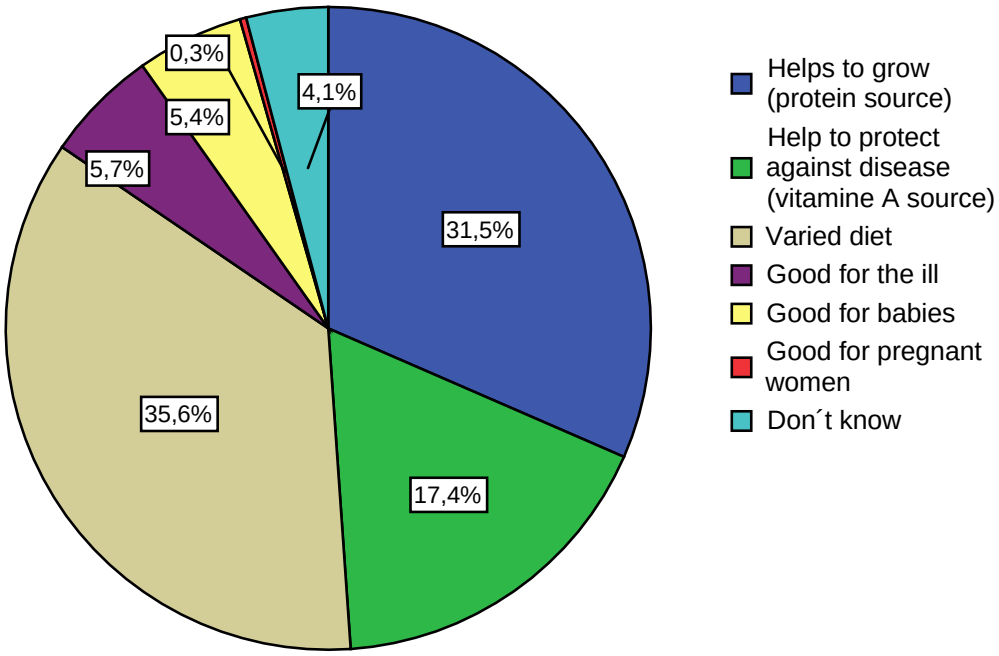

Figure 5. The most important advantages of raising chickens

Animal health and mortality

Each interviewee was asked to rank the 3 most important reasons. The most important reason was awarded 3 points, the second 2 points and the third 1 point. The percentages given per reason in figure 4, account for the percentage of the total number of points given by all the interviewees.
Newcastle Disease is ranked as the most important reason for chicken mortality. Predators and theft are the two other main reasons as shown in figure 6. The 9.5 % which account for "others" includes fleas, small pocks and worms. There is no significant difference between households that do and do not vaccinate in the ranking of reasons for chicken mortality when the means of the number of points are compared (t-test; $p>0.05$).
ND as a reason for chicken mortality was awarded 3 points by 86.6% (n=65) of the vaccinating households and by 92.0% (n=67) households that do not vaccinate.

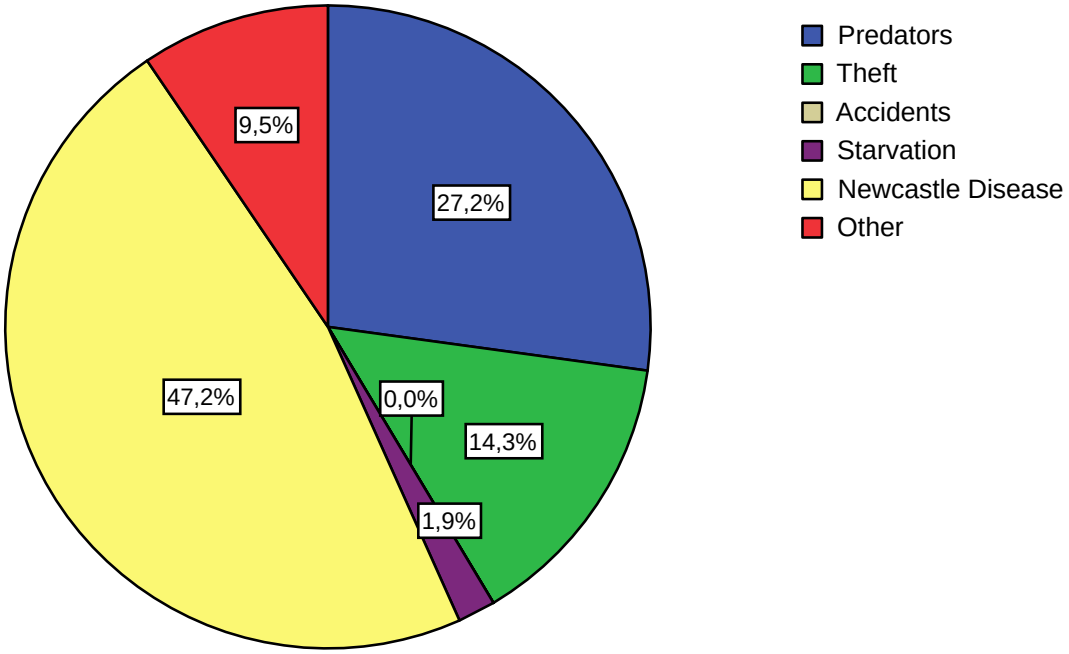

Figure 6. The most important reasons for chicken mortality.

Vaccination

Half of the 150 households have vaccinated their chickens and 75 have not. In the households vaccinating against Newcastle Disease, 58.7 percent of the vaccination resulted in decreased chicken mortality and 16 percent in more deaths of chickens. In 25.3 percent of the households vaccination made no difference in chicken mortality. In 37 households chickens died after a vaccination campaign. In 21 of these households more chickens younger than 5 months died, in the remaining 16 of these households more deaths were recorded in adult chickens.

The first time one of the interviewees vaccinated their chickens was in September 1996 and the last time was in January 2010. The major part of the vaccinating households (74%) vaccinated their chickens for the last time in 2009. Approximately half of the households that vaccinated their chickens against Newcastle Disease only vaccinated their chickens once. It was not documented how regularly the households that vaccinated more than once vaccinated their chickens. There are various reasons why people did not vaccinate. Lack of knowledge, lack of funds, lack of vaccine and negligence were the most given explanations.

When asked if you could vaccinate a sick chicken 70.0 percent of the villagers answered no and 10.7 percent stated that they did not know (figure 7).

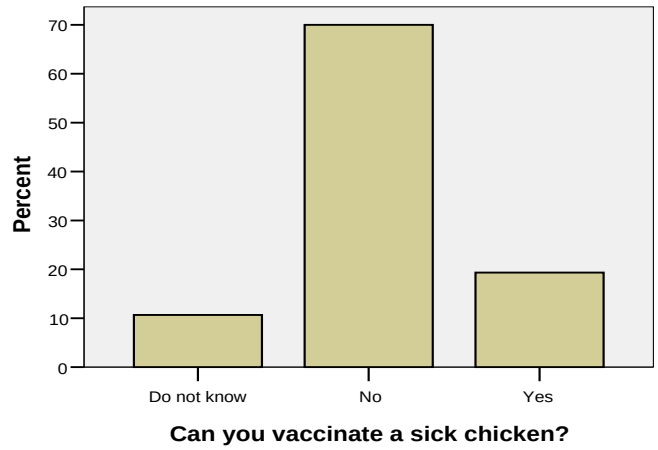

Figure 7. Percentages of answers to the question "Can you vaccinate a sick chicken?"

As can be seen in table 9, households that have vaccinated their chickens have an average of 8.6 chickens and households that have not vaccinated own an average of 5.3 chickens. In all villages except Ndalama, the average flock size is higher in vaccinating households, than in non-vaccinating households.

Village	Vaccinated	Mean	Std. Dev	N
Beula	No	3.1	4.7	14
	Yes	5.9	7.0	16
	Total	4.6	6.1	30
Chingondo	No	6.4	6.3	13
	Yes	10.5	7.0	17
	Total	8.7	6.9	30
Kavunye	No	4.4*	4.7	17
	Yes	12.1*	10.8	13
	Total	7.7	8.7	30
Maganiza	No	6.5	8.3	13
	Yes	8.7	7.5	17
	Total	7.8	7.8	30
Ndalama	No	6.0	6.4	18
	Yes	5.4	5.6	12
	Total	5.8	6.0	30
Total	No	5.3*	6.1	75
	Yes	8.6*	7.9	75
	Total	6.9	7.2	150

Note: Means within a column * are significantly different (P<0,05)

Table 9. Mean, standard deviation and total number of chickens per village.

When the interviewee was asked how many times you should vaccinate your chickens 35.8 percent answered the question with "I don't know", 11.5 percent said once, 20.3 percent said

twice, 27.0 percent said three times and 5.4 percent said four times. This is demonstrated in figure 8.

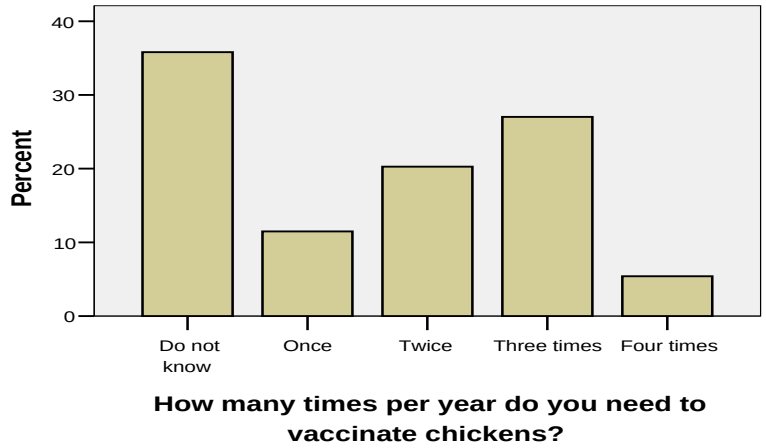

Figure 8. Percentage of answers given to the question: "How many times per year do you need to vaccinate chickens?

Figure 9 shows the person in the household that decided to vaccinate the chickens. In 48.0% of the households a female (a female owner 34.7% or an adult female 13.3%) made the decision to vaccinate. In 50.6 % of the households a male (a male owner 21.3% or an adult male 29.3%) made the decision to vaccinate. In 1.3 percent of the households vaccinating, vaccination was a family decision.
Most interviewees, 78.7 percent, have never participated in an interview about Newcastle disease, 20.7 percent of the interviewees have been interviewed about Newcastle disease during other campaigns.

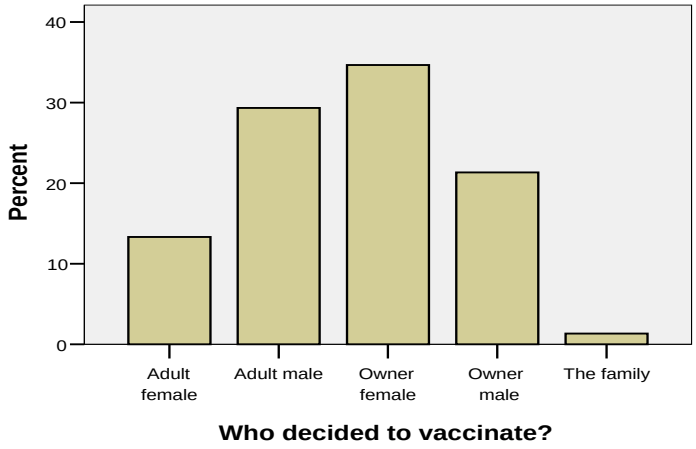

Figure 9. Person who decided to vaccinate the chickens against ND.

Summary of Participatory Rural Appraisal

A PRA was held in the same villages as the questionnaire during the conduction of the interviews. The following is a summary of the data collected by Dr. Brigitte Bagnol (Bagnol, 2009).

Livestock

A lot of the households do not raise any kind of animals at all and some raise very few animals. They own few pigs, goats and chickens. Manure is the main reason for keeping animals. Selling of chickens is preferred to eating. Animals are very often under the control of men and women although pigs and chickens are mainly taken care of by women. These women also control the benefits resulting from selling the animal.
Poultry are kept free range and are not additionally fed. Very few households have a chicken house. The animals are often kept inside the house where the family sleeps.
The size of the flock varies during the year. Flock size increases during harvest, when the chickens reproduce more. Flock size decreases in August because of the death of chickens and because farmers sell their chickens out of fear of losing them to ND. Most families eat at least one chicken to celebrate Christmas and New Year. In January to March the granaries are empty and chickens are sold to buy food. The average amount of chickens owned per household in January when flock size is low is 4 and 16 during the harvest period.

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ND								XXXX	XXXX	XXXX	XXXX	XXXX
Rainy season	XXXX	XXXX	XXXX	XXXX							XXXX	XXXX
Dry season						XXXX	XXXX	XXXX	XXXX	XXXX		
Seedling	XXXX	XXXX	XXXX									XXXX
Hunger	XXXX	XXXX	XXXX									
Harvest					XXXX	XXXX	XXXX	XXXX				
High nº of chickens/ eggs						XXXX	XXXX	XXXX				
Less chickens									XXXX	XXXX	XXXX	XXXX
More chickens				XXXX	XXXX	XXXX	XXXX	XXXX				
Sell a lot of chickens					XXXX	XXXX	XXXX	XXXX				XXXX
High price					XXXX	XXXX	XXXX	XXXX	XXXX			
Low price									XXXX	XXXX	XXXX	

Figure 10. Calendar of seasonal effects on flock size.

Newcastle Disease

The farmers do not have a lot of knowledge on ND and often refer to symptoms that are not related to ND such as swelling of the eyes. In this area of Malawi the disease is called '*Chitopa*'. It is widely believed that ND is a natural disease that comes with the wind. It usually occurs from August to October but can continue into November and December. ND is ranked as the main problem for their livestock by men and women. Predators, mainly dogs are also named as a threat to chickens.

Vaccination

Most people know about the existence of the La Sota vaccine which is available at the veterinary office in Thyolo. Some of the farmers have vaccinated their chickens, but have been very inconsistent. Organized campaigns have not been implemented in the area. The vaccine can be bought by organizations, individuals or extension workers who vaccinate as a private business. The price these private businesses charge varies greatly.

Discussion

Raising free range chickens does not require a lot of land and this contributes to why they account for the major part of the livestock in Malawi. The high population density makes it difficult to rear larger livestock (goats and cattle) as farmers do in rural villages in Tanzania (Kamps, 2010). The absence of other animal species and the relatively small family size make households more dependent on their chickens. Increased chicken numbers provide food security and generate an income. Chickens are more likely to be consumed or sold to resolve immediate family needs such as medicines or school fees, when compared to ruminant species, (Alders *et al.,* 2001). One chicken can be sold for 200 – 700 MK (1.32- 4.60 USD) depending on the season (Bagnol, 2009).

Family consumption and selling are ranked as the main reasons for raising chickens in the questionnaire. During the PRA conducted in the same villages as the questionnaire, selling was ranked more important than family consumption and it was explained that chickens are rather kept in case of necessity than eaten. Manure is also noted as one of the main reasons for keeping animals. The government is implementing a subsidized distribution of fertilizer in Malawi and it seems that due to this, the awareness about the importance of manure is higher than in other countries (Bagnol, 2009). Chickens are widely used in rural areas for celebrating special occasions (Bagnol, 2001). In December chickens are eaten for Christmas and in January for celebrating the New Year. The 6th of July is Independence Day in Malawi and chickens are also used for celebrating this. These months show a peak in use and eating in figure 4. In December until February the stocks of the past harvest are used and new plants are still growing during the rain season. This is the period of hunger and chickens are sold to buy maize or rice.

The impact of Newcastle disease

During the onset of Newcastle Disease more chickens are sold and consumed out of fear of losing chickens to ND. Previous studies show that forced sale and consumption out of fear of ND can be decreased significantly after successful implementation of a ND-control campaign (Harun, *et al.,* 2005). Newcastle Disease outbreaks start in august when the dry season starts and peaks in October, but may last until December.
Newcastle disease is recognized as the most important reason for chicken mortality. Households that do not rear chickens, still rank ND as a major problem. This demonstrates that they know the impact ND can have on a flock. However, during the PRA when villagers were asked to describe the symptoms of ND they described various symptoms that are not related to ND. The villagers lack knowledge about the disease and relate all unknown symptoms to 'Chitopa'.

Vaccination

The La Sota vaccine against Newcastle disease is available from the veterinary office in Thyolo and most of the villagers have heard of this vaccine, but organized vaccination campaigns have not been implemented in the area (Bagnol, 2009). Half of the households interviewed in this study have vaccinated their chickens at least once. This shows that they recognize ND as a major problem and are willing to invest in preventing it. In the households that have vaccinated their chickens, vaccinations show a positive effect; households that have vaccinated have significantly more chickens than households that have never vaccinated. Though vaccination has been done inconsistently, this positive effect can be due to almost three quarters of the households vaccinating their chickens for the last time in the previous year. If chickens were only vaccinated once with the La Sota vaccine

before the seasonal outbreak, this could have had a positive effect. The La Sota vaccine provides 5 months of protection (Dieleman, 2001). Households that vaccinate have significantly more adult and growers, but not significantly more chicks (table 7). This could indicate that households with more chickens are more likely to vaccinate. It could also indicate that vaccination has a positive effect on flock size. Because it was not documented when the households vaccinated, it is not possible to know which relation is correct. This information could be gathered in the PRA. In half of the households chickens died after a vaccination campaign. More deaths were recorded in young chickens. This could be due to the use of the La Sota vaccine. As the La Sota vaccine is lentogenic, it produces moderate vaccine reactions and is not suitable for vaccinating young chicks. (Awuni, *et al.,* 2005).

In 58.7 percent of the households that vaccinated, vaccination led to fewer deaths of chickens. Unfortunately only half of the households that vaccinated their chickens vaccinated more than once. An inconsistent vaccination program will not give the required results (Alders, 2001). In areas where ND control has been effectively implemented, chicken numbers increase (Cambaza, *et al*.,2005).The farmers consider chickens as the first step in animal-rearing activities. Surplus chickens provide farmers with the funds to buy goats (Cambaza, *et al.,2005).* The sustainability of a vaccination campaign depends on the extension services provided, the awareness of the population, the availability of the vaccine and on the financial means of the population (Dieleman, 2001).
In this study the reasons for not vaccinating chickens at all are various and can mostly be contributed to a lack of knowledge about vaccination. When the interviewees were asked how many times you should vaccinate a chicken per year, 35.8 percent answered with "I don't know". This states that a great part of the population has no knowledge on the correct way to vaccinate chickens against ND. Twenty-seven percent answered the question with 3 times which is consistent with how often the I-2 vaccine needs to be administered to chickens to maintain protective immunity in the flock. (Alders *et al.,* 2001a)

Gender sensitive issues
Larger animals are usually under the control of men and the smaller animals under the control of women (Bagnol, 2001). In Malawi only few large animals are kept and men play a bigger part in chicken raising activities. This could explain why no significant differences between males and females in knowledge about ND were found. The knowledge about the nutritional value of chickens was also almost the same in males and females. Only the advantage of chickens helping to protect against disease was named more by males than females. This in contrast to other baseline studies on ND in Tanzania in 2003, where women were found to be less exposed to extension messages and therefore lack in knowledge on ND (SANDCP, 2005). More than half of the chickens are owned by females. During the PRA it was stated that both men and women take care of the animals, but that chickens and pigs are mostly the responsibility of women. In previous literature women were found to have more decision power of chickens and to enjoy most of the benefits from selling chickens (Alders, 2005a). In this study the decision to vaccinate the chickens was made by almost equal amounts of males and females. It seems that in this area of Malawi men are more in control of the livestock. This could be due to the composition of the livestock.
The households to be interviewed were selected randomly, without taking in consideration if the head of the household was a male or a female. Instead to be able to attain a 50:50 ratio male : female, any male or female above 18 from that household was interviewed. None of the questions in the questionnaire indicates if the head of the household was male or female and the relationship with the interviewee. Female headed households are often poorer and smaller in size than male headed households. An explanation for the small size of the households in this district could be an increased number of female headed households

because young men move out of the district to find work in the city. This conclusion can not be drawn if the sex of the head of the household is not known.

Comparison with Singida district, Tanzania

Both regions were selected because of the large dependency of chickens.
In Malawi the households are smaller than in Tanzania. In Tanzania 32.2 % have a family size less than 6 people compared tot 66.0% in Malawi. In Tanzania it is seen that larger households own more chickens. When flock size increases excess chickens can be sold to buy goats and eventually cattle, opening up more resources (Copland, *et al.,* 2005).
In Malawi villagers own an average of 6.9 chickens per household, in Tanzania they own an average of 16.1 chickens per household. Due to this greater source of income other animals can be bought that are not available to households with less income as cattle, goats and sheep (Alders, 2004) In Tanzania, households owning more chickens also owned more other animals.
In both regions family consumption and selling are ranked as the main reasons for raising chickens. Because of the larger amount of chickens raised per household in Tanzania the amount of chickens eaten per month is much higher. In Tanzania an average of 1 chicken and 8 eggs are eaten per household each month. In Malawi this is less than 1 chicken and 2 eggs per month. This difference is even more apparent in the amount of chickens and eggs sold in both countries: In Malawi an average of 0,2 chickens and 0,2 eggs are sold per household per month. In Tanzania more than 1 chicken and 3 eggs are sold per month.

Newcastle disease is markedly ranked as the most important reason for chicken mortality in both regions. Theft was a more important reason for losing chickens to the villagers in Malawi than to the villagers in Tanzania.
In Tanzania ND peaks in August and September. In Malawi the major peak of ND occurs in October.
In all villages households that have ever vaccinated have more chickens than households that have never vaccinated their chickens. In both countries vaccination shows a positive effect with a decrease in deaths of chickens. If after vaccination chickens died in both countries more deaths occurred in chicks compared to chickens older than 5 months.

In Tanzania (70%) and in Malawi (50%?) of the households that vaccinated their chickens only vaccinated once. The knowledge about vaccination is low in both countries, in both approximately half of the interviewers did not know how often to vaccinate their chickens. In contrast to Malawi none of the interviewees in Tanzania had even participated in an interview about ND before. In Malawi 20.7 percent has participated.

Conclusions and recommendations

Households of rural villages in the Thyolo district are very dependent on their chickens due to small family size and few other livestock. Increasing chicken numbers would provide food security and generate more income. Newcastle disease is described as the main reason for chicken mortality. Although organised campaigns have never been implemented in this area, part of the villagers has participated in a study on ND before and knowledge levels about ND were higher than expected.

Half of the households in this area have vaccinated their chickens before, but it was not documented which vaccine and how often they vaccinated.
The main reasons for not vaccinating could be tackled by informing the villagers. The villagers need to be informed on the symptoms of Newcastle Disease and symptoms of other diseases to prevent thinking the vaccination was not successful when chickens die due to other diseases. A structured cost-benefits analysis must be shown to the villagers to convince them to invest in vaccinating their chickens.

Newcastle disease has a huge impact on the villages in both Malawi and Tanzania. In Tanzania a larger amount of chickens are raised, opening up more resources than in Malawi. Knowledge on vaccination is low in both areas and although many households have vaccinated they have vaccinated in a very inconsistent way. Setting up a sustainable Newcastle Disease control program, would benefit both regions greatly.

References

- ALDERS, R.G., (2001). Sustainable Control of Newcastle Disease in Rural Areas, *In 'SADC Planning Workshop on Newcastle Disease Control in Village Chickens' ed. By R.G. Alders & P.B. Spradbrow, ACIAR Proceedings No. 113, page 80-87*

- ALDERS, R.G.(2005a), The AusAID Southern Africa Newcastle Disease, Control Project: Its history, approach and lessons learnt, *In 'Village chickens, poverty alleviation and the sustainable control of Newcastle disease', ed. by R.G. Alders, P.B. Spradbrow and M.P. Young. ACIAR Proceedings No. 131, page 63*

- ALDERS, R.G., BAGNOL, B., HARUN, M., MSAMI, H., SPROWLES, L.J., and YOUNG, M.P. (2005b). The impact of Newcastle disease control in village chickens using I-2 thermotolerant vaccine in rural areas of Dodoma and Mtwara Regions, Tanzania. *Paper presented at the DfID Livestock Production Programme International Workshop on Improving the Wellbeing of Resource-poor Communities – the contribution of small livestock. 12-15 September 2005. Howick, South Africa.*

- ALDERS, R.G., FRINGE, R., MATA, B.V.(2001a). Characteristics of the I-2 Live Thermostable Newcastle Disease Vaccine Produced at INIVE, *In 'SADC Planning Workshop on Newcastle Disease Control in Village Chickens' ed. by R.G. Alders & P.B. Spradbrow, ACIAR Proceedings No. 103*

- ALDERS, R.G. and SPRADBROW, P.B. (2001b) Controlling Newcastle Disease in Village Chickens: a field manual. Canberra. *Australian Centre for International Agricultural Research. Monograph 82. 112pp.*

- ALDERS, R.G. and PYM, R.A.E. (2008). Village poultry: Still important to millions eight thousand years after domestication. *Paper, XXIII World Poultry Congress, Brisbane, Australia, 30 June - 4 July 2008.*

- ALEXANDER, D.J., BELL, J.G. AND ALDERS, R.G. (2004). Technology Review: Newcastle disease with special emphasis on its effect on village chickens. *FAO Animal Production and Health Paper No.* 161.

- AWUNI, J.A., COLEMAN, T.K., SEDOR, V.B.(2005), Comparative advantage of the use of a thermotolerant vaccine in the protection of rural chickens against Newcastle disease in Ghana, *In 'Village chickens, poverty alleviation and the sustainable control of Newcastle disease', ed. by R.G. Alders, P.B. Spradbrow and M.P. Young. ACIAR Proceedings No. 131, page135-140.*

- BAGNOl, B., (2001). The Social Impact of Newcastle Disease Control, *In 'SADC Planning Workshop on Newcastle Disease Control in Village Chickens' ed. by R.G. Alders & P.B. Spradbrow, ACIAR Proceedings 103, page 69-75*

- BAGNOL, B. (2005). Improving village chicken production by employing effective gender-sensitive methodologies, *In 'Village chickens, poverty alleviation and the sustainable control of Newcastle disease', ed. by R.G. Alders, P.B. Spradbrow and M.P. Young. ACIAR Proceedings 131, page 35-42.*

- BAGNOL, B., (2009). Strengthening rural livelihoods and food security through improving village poultry production in Malawi, Mozambique, Tanzania and Zambia

- BRANCKAERT, R.D.S., GAVIRIA, L., JALLADE, J. and SEIDERS, R.W. (2000). Transfer of technology in poultry production of developing countries. *Paper, XXI World Poultry Congress, Montreal, Canada, 20-24 August, 2000*

- CAMBAZA, A.B., ALDERS, R.G., HARUN, M. (2001). Newcastle disease control using I-2 vaccine in Mozambique. *In 'Village chickens, poverty alleviation and the sustainable control of Newcastle disease', ed. by R.G. Alders, P.B. Spradbrow and M.P.Young. ACIAR Proceedings 131, page74-83.*

- COPLAND, J.W. and ALDERS, R.G. (2005). The Australian village poultry development programme in Asia and Africa. *World's Poultry Science Journal, Vol. 61*

- DIELEMAN, E.F. (2001). VETAID Field Experiences with Newcastle Disease Vaccinations in Mozambique. *In 'SADC Planning Workshop on Newcastle Disease Control in Village Chickens' ed. by R.G. Alders & P.B. Spradbrow, ACIAR Proceedings 103, page 104-109.*

- HARUN, M., ALDERS, R.G., SPROWLES, L., BAGNOL, B., CAMBAZA, A.B., MSAMI, H., MGOMEZULU, R. (2005). Southern Africa Newcastle Disease Control Project impact studies: baseline and participatory rural appraisal results. *In 'Village chickens, poverty alleviation and the sustainable control of Newcastle disease', ed. by R.G. Alders, P.B. Spradbrow and M.P.Young. ACIAR Proceedings 131, page 96-101.*

- KAMPS, T. (2010) Newcastle disease control in Singida, Tanzania. A baseline study. *Thesis written for the faculty of veterinary medicine, Utrecht University, The Netherlands.*

- KITALYI, A.J. (1998). Village chicken production systems in rural Africa: Household food security and gender issues. *Animal Production and Health Paper No. 142. Food and Agriculture Organisation of the United Nations, Rome, Italy.*

- MGOMEZULU, R.A., ALDERS, R.G., CHIKUNGWA, M.P., YOUNG, M.P., LIPITA, W.G., WANDA, G.W. (2005) Trials with a thermotolerant I-2 Newcastle disease vaccine in confined Australorp chickens and scavenging village chickens in Malawi. *In 'Village chickens, poverty alleviation and the sustainable control of Newcastle disease', ed. by R.G. Alders, P. B. Spradbrow and M. P. Young. ACIAR Proceedings No. 131, page 84–95.*

- SANDCP Completion Report (2005). Southern Africa Newcastle Disease Control Project July 2002 – October 2005, *Completion Report Project August 2005.*

- SPRADBROW, P.B. (2005). Thermostable vaccines in the control of Newcastle disease in village chickens: a history. *Paper presented at the Village chickens, poverty alleviation and the sustainable control of Newcastle disease international conference. 5–7 October 2005. Dar es Salaam, Tanzania.*

- TRAN DINH, T. (2001). Village Chicken Production in Vietnam and Newcastle Disease Control with Thermostable Vaccine, *In 'Agriculture: New directions for a new nation East Timor (Timor-Leste), ed. by Helder da Costa, Colin Piggin, Cesar J. da Cruz and James J. Fox, ACIAR proceedings No. 113, page 110-114*

- Worldbank (2009) In 'International development association country assistance strategy progress report for the republic of Malawi', *Worldbank report, 17 December 2009*

- YOUNG, M., ALDERS, R.G., GRIMES, S., SPRADBOW, P., DIAS, P., DA SILVA, A., LOBO, Q., (2002) Controlling Newcastle disease in village chickens, *A field manual 2002 ACIAR monograph No. 87*

Annex 1 Sampling technique

First stage sampling

Step 1
Made a table:
1st column: name of the village
2nd column: the number of households in each village.
3rd column: the cumulative number of households, e.g. Village 1 + Village 2. (Village 1 + Village 2) + Village 3, etc.

Village	No. of H/H	Cumulative No. of H/H	Random Number	Clusters in sample
Beula	533	533	13, 202, 391	3
Chingondo	458	991	580, 769,958	3
Kavunye	653	1644	1147, 1336,1526	3
Maganiza	613	2257	1715, 1904, 2093	3
Ndalama	579	2836	2282, 2471, 2660	3
Total	2836			15

Step 2
Divided the total number of households by total number of clusters to obtain the interval:
2836 / 15 = 189

Step 3
Selected a random number between 1 and 189
- Random number selected = 13

Step 4
Completed 4th column of the table:

- Entered random number 13 in row 1 as 13 is between 0 and 533
- Added interval to random number: 13 + 189 = 202. This number lies between 0 and 533. Entered into row 1.
- Added interval to random number + interval: 202 +189 = 391. This number lies between 0 and 533. Entered into row 1.
- Added interval to previous number: 391 +189 = 580. This number lies between 533 and 991. Entered into row 2.
- Continued adding the interval and for each number obtained entered into the relevant row as shown in the table.

In each village 3 clusters of 10 households were selected.

Second Stage Sampling

After the number of clusters per village was defined the selection of the household was selected randomly according to the above methodology but now selecting the 10 households in the village. To be able to do this it was necessary to have a complete list of households in each village. In each village 50% males and 50% females were interviewed. If in a household the no one of the correct sex and above was available to be interviewed, the household was substituted with the household directly right or left to the one selected to be interviewed.

Village	No. of H/H	Total number selected households	Interval	Random Number
Beula	533	30	18	7
Chingondo	458	30	15	10
Kavunye	653	30	22	1
Maganiza	613	30	20	16
Ndalama	579	30	19	3
Total	2836			

Annex 2 Questionnaire

1 IDENTITY

Date: _____/_____/_____ _____

Name of the Interviewer: _____ Questionnaire #: _____

District: _____ Ward _____ Village: _____

Name of the Interviewee: _____

1.1 Sex of the interviewee: Female ☐ Male ☐

1.2 Age of the interviewee: _____

2 DEMOGRAPHY

2.1. How many people do you live with, including yourself? *(Read the options and tick a box)*

1	1 to 5		2	6 t o 10		3	11 to 15		4	16 and more		

2.2. Which of the following animal species do you have? *(Tick the box)*

Cattle	Goat	Sheep		Donkey		Poultry		Others	

2.3. How many animals per species do you have *(Read the options and tick the box. write the number in the box*
More than one box can be ticked) filled up

Catte	Goat	Sheep	Donkey	Poultry	Others

3 POULTRY PRODUCTION

If you have poultry, please answer the following questions. If you don´t have poultry, please go to question 3.5. *(Read the list and write the number in the boxes.)*

3.1. How many chickens does your family currently have?

3.1.1. Adults (more than 5 months) ☐

3.1.2. Growers (2 - 5 months) ☐

3.1.3. Chicks (day old - 2n months) ☐

3.1.4. Total number of chickens ☐

3.2. How many people in the house own chickens? ☐

3.3. How many chickens does each member of your family own?
(Write a number in each box. The total of the question is 3.1.4)

Person	Gender (M/F)	Age	No. of chickens

3.4. What are the 3 most important reasons your family is raising chickens?
(Rank the three most important by writing the numbers 1 to 3 in the relevant boxes)

3.4.1. Family consumption ☐

3.4.2. Selling ☐

3.4.3. Exchanging (for goods, food and services) ☐ ☐

3.4.4. Entertaining guests (gifts, ceremonies) ☐ ☐

3.4.5. Savings ☐

3.4.6. To raise more chickens ☐

3.4.7. Other ☐ Specify: _____

3.5. *(Only for farmers without chickens).* When was the last time you had chickens?

4 SALES, CONSUMPTION & OTHER USE OF CHICKEN AND EGGS

4.1. How many chickens and eggs did your household dispose of in the last 3 and 6 months?
(Enter numbers in each box. If "other", please state the purpose)

Activity	**No of chickens**			**No of eggs**	
	3 months		6 months	6 months	3 months
Family eating					
Exchanged for goods					
Sold					
Guests, ceremonies,					

and gifts				
Other 1 -				
Other 2 -				

4.2. In which months of the year do you sell or exchange more chickens?
(Read the months and tick boxes. More than one box can be ticked)

4.2.1	4.2.2	4.2.3	4.2.4	4.2.5	4.2.6	4.2.7	4.2.8	4.2.9	4.2.10	4.2.11	4.2.12
January	February	March	April	May	June	July	August	Sept	Octob	Nov	Dec

4.3 In which months of the year do you eat chicken? *(Tick the boxes. More boxes can be ticked)*

4.3.1	4.3.2	4.3.3	4.3.4	4.3.5	4.3.6	4.3.7	4.3.8	4.3.9	4.3.10	4.3.11	4.3.12
January	February	March	April	May	June	July	August	Sept	Octob	Nov	Dec

5 KNOWLEDGE ABOUT NUTRITION

5.1. What is the advantage of eating chicken? *(Tick the boxes. More than one box can be ticked)*

5.1.1 Help to grow (source of protein) ☐

5.1.2 Help to protect against diesease (source of Vitamin A) ☐

5.1.3 Varied diet ☐

5.1.4 Good for sick people ☐

5.1.5 Good for babies ☐

5.1.6 Good for pregnant women ☐

5.1.7 Don't know ☐

6 ANIMAL HEALTH AND MORTALITY

6.1. In your opinion what are the three main reasons for the death of your chickens?
(Rank the three most important by writing the numbers 1 to 3 in the relevant boxes)

6.1.1 Predators ☐

6.1.2 Theft ☐

6.1.3 Accidents ☐

6.1.4 Lack of food ☐

6.1.5 Newcastle diesease ☐

(Green watery feaces, drooping wings, twisted neck, many deaths)

6.1.6 Other disease ☐

6.2. In which months of the year is Newcastle disease more likely to occur?

(More than one month can be ticked)

6.2.1	6.2.2	6.2.3	6.2.4	6.2.5	6.2.6	6.2.7	6.2.8	6.2.9	6.2.10	6.2.11	6.2.12
January	February	March	April	May	June	July	August	Sept	October	Nov	Dec

7 VACCINATION

7.1. Have you ever vaccinated your chickens against Newcastle disease?

7.1.1 Yes ☐ 7.1.2 No ☐

If the interviewee has never vaccinated his/her chickens, go to question 7.8

7.2. When was the first time you vaccinated your chickens?

7.2.1 Month ☐ 7.2.2 Year ☐

7.3. When was the last time they were vaccinated?

7.3.1 Month ☐ 7.3.2 Year ☐

7.4. In which vaccination campaigns did you participate since 2009?

(Tick the boxes. More than one box can be ticked)

Vaccination campaign	**2009**	**2010**
January / March		
May / July		
September / November		

7.5. Who decided that the chickens should be vaccinated?

More than one answer can be given

7.5.1 Owner/male ☐

7.5.2 Owner/female ☐

7.5.3 The family ☐

7.5.4 Adult female ☐

7.5.5 Adult male ☐

7.6. What was the result of the last vaccination ?

7.6.1 No difference ☐

7.6.2 Less deaths ☐

7.6.3 More deaths ☐

7.7. If chickens died after a vaccination campaign, where there more deaths in adult chickens or young birds?

7.7.1 Adult chicken (more than 5 months) ☐

7.7.2 Chicks (less than 5 months) ☐

7.8. If you have never vaccinated your chickens, please explain why? _____

_____

8 KNOWLEDGE OF VACCINATIONS

(Read each statement ony by one and tick ONLY one box)

8.1 How many times per year do you need to vaccinate your chickens against Newcastle disease?

8.1.1 Once ☐

8.1.2 Twice ☐

8.1.3 Three times ☐

8.1.4 Four times ☐

8.1.5 Do not know ☐

8.2. Should the vaccine be given to sick chickens?

Yes ☐ No ☐ Don't know ☐

9 Have you ever participated in an interview about Newcastle disease control in village poultry like this one?

Yes ☐ No ☐

Annex 3 Recommendations for repetition of the baseline study

Questionnaire:

- If a household is female or male headed is important information when comparing the data to previous studies.
- Knowing the relationship of the interviewee to the head of the household will be interesting to take in account with questions that asses knowledge.
- The use of categories, for example household size groups, causes a valuable loss of information. Actual numbers are preferred when analyzing the data.
- If a household has vaccinated, we would like to know with which vaccine. The number of times per year chickens should be vaccinated differs between vaccines. Some vaccines have adverse effects that could explain why households did not continue to vaccinate their chickens.
- When only asking the first and last time people have vaccinated their chickens, valuable information on the consistency of vaccination is lost. We would like to know in which years and months vaccination has been done.
- If chickens died after a vaccination campaign, it is more valuable to know the amount of chicks/adult chickens that died.

PRA:

- If villagers did not continue to vaccinate their chickens, we would like to know why. Knowing the reasons for discontinuing vaccination could help prevent it.
- In this study vaccinating households owned significantly more chickens than households that did not vaccinate. This could be due to more chickens surviving because of the vaccination or because households with more chickens are more likely to vaccinate. The correct relation can be discussed in a PRA.