MINISTRY OF AGRICULTURE

ANIMAL AND PLANT HEALTH REGULATORY DIRECTORATE

NEWCASTLE DISEASE CONTROL STRATEGY

MARCH 2010

Introduction

Rural poultry production is recognized as an important activity in many parts of Ethiopia. Chickens in traditional village poultry systems provide scarce animal protein in the form of meat and eggs, and are available for sale or barter in societies where cash is not abundant.
They are active in pest control, provide manure, are required for special festivals and to meet social obligations, they are essential for many traditional ceremonies.

Although the output of traditional village chickens in terms of weight gain and number of eggs per hen per year is low, it is obtained with minimum input in terms of housing, disease control, management and feeding.

Any cost-effective strategy that increases the productivity of these birds will assist in poverty alleviation and the improvement of food security. The increased availability of village chickens and eggs should result in an improved intake of protein by the population and increased access to cash and other resources.

II. The current status

The resource:

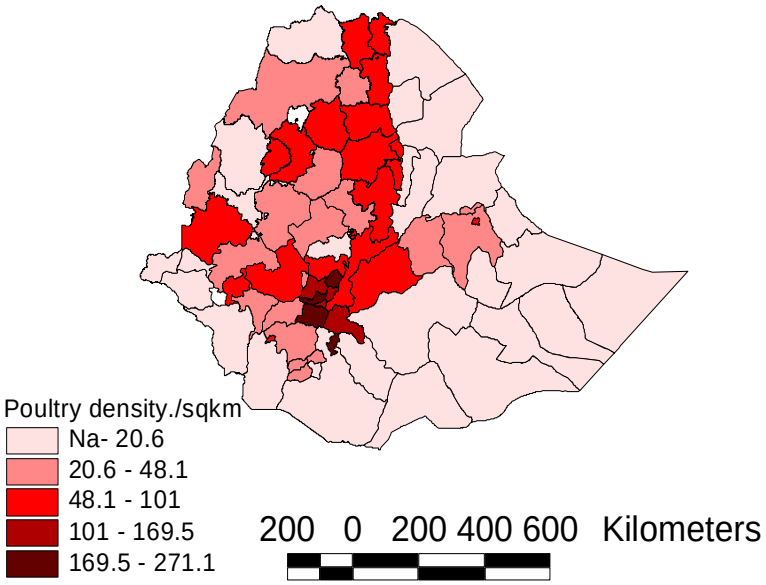
According to the data obtained from the Ethiopian Statistical Agency **agricultural sample survey report 2004-2005, and pastoral areas livestock enumeration in Afar and Somali Regions of Nov. Dec. 2003, the country's has about 31,000,000 poultry population.**

Table 1. Poultry distribution in different regions

Region	**Poultry population**	**% from national total**
TIGRAY	3180235	10.3
AFAR	52149	0.2
AMHARA	8442238	27.3
OROMIA	11637074	37.7
SOMALE	154669	4.9
BENSHANGUL GUMUZ	732273	2.4
ADDIS ABABA	21417	0.3
DIRE DAWA	44736	0.4
GAMBELLA	220430	0.7
SNNP	6586142	21.3
HARARI	31426	0.1
Total	**30882359**	

The seven non pastoral regions and cities (Amhara, Tigray, Oromia, SNNP, Addis Ababa, Dire Dawa and Harari) constitute about 97.4% of the national poultry population.

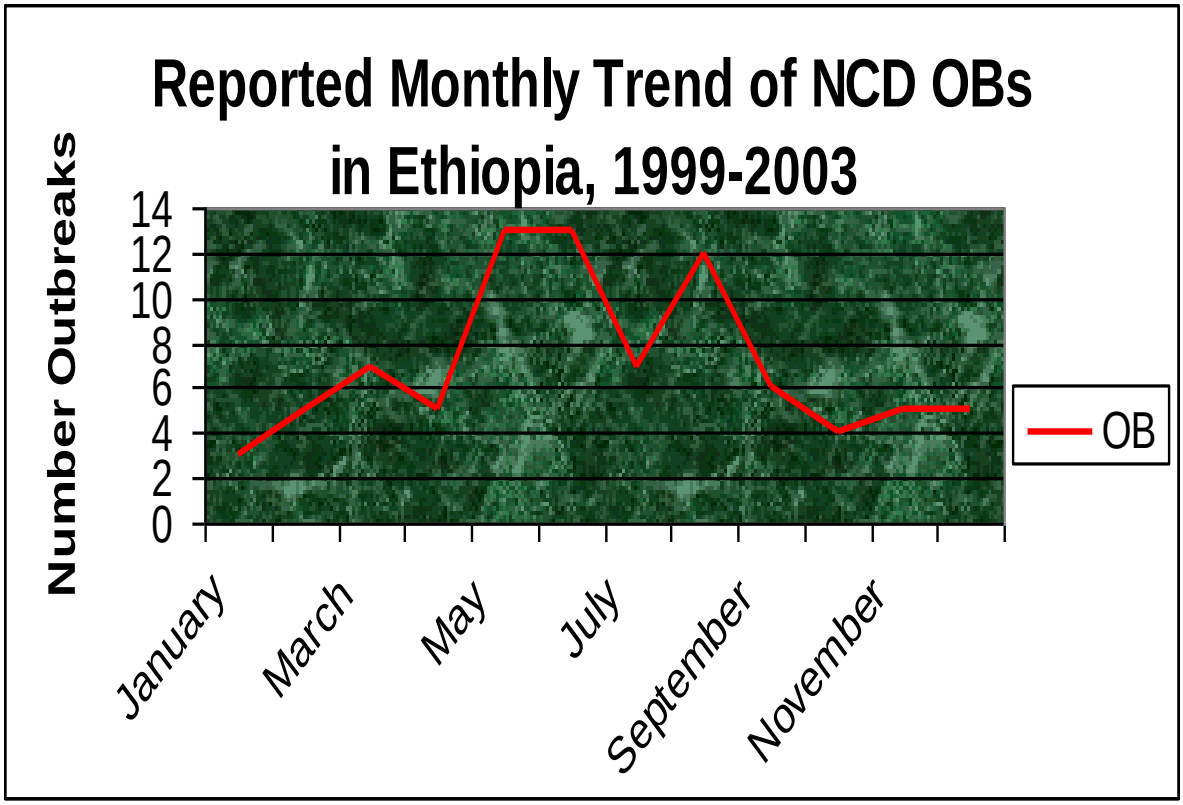
Poultry density per square km area



From the above figure it is indicated that most of the poultry population is found in the highland areas of the country.

The disease:

Newcastle disease is one of the most important poultry diseases found in most parts of the country that affects the poultry population. 0ut of the 359 disease outbreak reports of 8 transboundary diseases received in 2004-2005, NCD constitutes about 33 (9.2%) of the total reported.



The disease seams to occur through out the year with relative high prevalence during the rainy months (May to September).

Out of the **9,957,280 doses of three different poultry vaccines distributed to regions by NVI in** 2004-2005, NCD represent about **8,126,560 doses (81.6%) of the total.**

Table 2: NCD and other poultry vaccines distribution to regions (2004-2005).

Regions	New castle	Fowl Pox	Fowl typhoid	Total	% of NCD from total
Tigray	199300	2400	0	201700	98.8
Afar	0	0	0	0	0
Amhara	996600	126520	19400	1142520	87.2
Oromia	6209320	883200	743700	7836220	79.2

Somalia	0	0	0	0	0
Benshangul Bumuz.	0	0	0	0	0
SNNP	614310	33900	19000	667210	92.1
Dire Dawa	8000	0	0	8000	100
Gambella	0	0	0	0	0
Harari	0	0	0	0	0
Addis Ababa	88030	100	500	88630	99.3
Others	11000	2000	0	13000	84.6
Total	**8126560**	**1048120**	**782600**	**9957280**	**81.6**

III. Strategy

1. Area

The strategy should address poultry population found in the non-pastoral areas of the country since these areas support about 97.4% of the total population.

The strategy will focus in Tigray, Amhara, Oromia, Addis Ababa, SNNP, Dire Dawa and Harari Regions.

2. Community participation

A non-compulsory NCD control program that does not have community participation is unlikely to be sustainable. The community, with particular emphasis to women, will be encouraged to actively participate in the control program through:

- Identifying seasonality of the diseases and arranging vaccination calendar
- Selecting community vaccinators and determine the amount of money to be paid for the service.
- Involve in the monitoring and evaluation of the program

It is also difficult to provide cost-effective routine vaccination services to all local communities, especially those in remote areas through Government veterinary and extension services alone.

Therefore community participation is crucial to the development of a sustainable program to control NCD in village chickens. It is therefore important to complement government veterinary and extension staff at the village level by persons from the local community, the Community Vaccinators.

Manpower:

The manpower resource to be involved in the control program will be:

- Veterinary personnel: through training of community vaccinators and organize and monitor the over all activities
- Development agents : through delivery of extension massages
- Community vaccinators: through vaccination

3. Community vaccinators

Poultry vaccination for NCD is not a complex procedure that require high professional caliber. It is therefore important to utilize this opportunity to conduct vaccination campaigns by use of trained community vaccinators.

The local community will be encouraged to select a man or a woman who should be trained by the veterinary authority to give NCD vaccinations.

She/he must be able to communicate effectively in the language used by farmers, read labels and instructions, and keep appropriate records.

To improve the success rate of the Community vaccinators' sufficient considerations will be given for the following points.

Social factors

- The program will be based on community needs and use existing structures or organizations.
- The community will be involved in all parts and stages of the program.
- There will be an ongoing exchange of information between all stakeholders.

Technical factors

- **Community vaccinators** and their trainers must identify and respect local knowledge and must be able to fulfill their technical responsibilities.
- There will be collaboration with beneficiaries and sources of technical support to ensure that **Community vaccinator** offer appropriate technical advice.

Economic factors

- To ensure economic sustainability, the local community will be made involved in the development of cost-recovery mechanisms for the program.
- Charging of nominal fees for vaccination services to cover the cost of the vaccination and other related activities of the **Community vaccinator** will be put in place to ensure the success and sustainability of the program.

Training:

All manpower to be involved in the control program will be given appropriate training and given field manuals by the veterinary authority beforehand.

In the training program the Community vaccinators must:

- receive appropriate training;
- be assured of a reliable supply of vaccine (and other necessary inputs);
- be answerable to their community;
- be able to monitor their own work;
- be provided with incentive in cash or kind; and
- receive good technical follow-up and support.

The training of Community vaccinators is an important component of the NCD control program. Factors to be considered include:

- who does the training?
- where should the training be conducted?
- who is responsible for post-training supervision?
- who is responsible for monitoring?
- who is responsible for evaluation?

The training program for Community vaccinators involved in control of NCD should include:

- Features of a chicken -simple anatomy
- recognition of healthy and sick chickens
- Handling of a chicken
- Husbandry -housing: ventilation, cleaning, predators
- nutrition: young chicks, use of supplements
- Diseases of chickens -clinical signs, field diagnosis, treatment and controlof:
    - Newcastle disease
    - External parasites
    - Internal parasites (coccidiosis, helminths)

- Fowl cholera, Fowl pox.

- Vaccination techniques -eye drop and drinking water for ND vaccines

Record keeping:

- number of cases
- diagnosis and treatment of cases
- outcome of treatment
- inventory of stock (pharmaceuticals, etc.)
- vaccinations performed
- payment received

In order to perform eye drop vaccination, Community vaccinators must be able to:

- read numbers on a syringe;
- understand the meaning of the lines and intervals between the numbered lines on a syringe;
- read and check the number of doses of NCD vaccine per vial and the expiry date of the vaccine;
- use the syringe to put the appropriate volume of water into a vial and draw vaccine out (if using vaccine that requires dilution);
- check that the vaccine is properly diluted;
- shake vial completely to dissolve all vaccine;
- assemble an eye-dropper;
- hold the eye-dropper vertically to form a drop of the correct size;
- check that the correct number of drops leave the eye-dropper;
- hold a chicken gently and calmly; and
- clean an eye-dropper and syringe correctly.

The NCD vaccination kit for Community vaccinators should contain:

- syringe (10 mL or smaller if appropriate), needle optional;
- calibrated eye-dropper;

- NCD Vaccine
- Cool box and ice pack or damp cloth and basket;
- record book and pencil; and
- chicken marker-leg band, wing tag, colored thread or cord etc.

Indicators of success to be used by Community vaccinators to evaluate their work:

- an increase in the number of chickens per family/household;
- farmers continue to participate in subsequent vaccination campaigns;
- new farmers present their chickens for vaccination at each campaign; and

payment received from farmers for the vaccination of their chickens is sufficient to cover any transport or

Awareness

Extension

Cost recovery

seasonality

Vaccination calendar

Input

Production

Vaccine type

Distribution

Monitoring and evaluation

Annex I: Disease Background

Importance of the disease

In many developing countries such as Ethiopia, Newcastle disease (NCD) is the major constraint to production of village chickens. Circulating strains of NCD virus are capable of causing up to 100 % mortality in unprotected flocks. Outbreaks of NCD are unpredictable and discourage villagers from paying proper attention to the husbandry and welfare of their chickens.

Village chicken farmers are disheartened by the loss of large numbers of their birds to NCD outbreaks that often occur on an annual basis.
In many countries, NCD control through vaccination is generally a very cost-effective intervention and given a high priority by farmers.

Characteristics of Newcastle disease

- Newcastle disease (ND) is caused by a paramyxo-virus which mainly affects poultry.
- Chickens are the most susceptible host
- The incubation period varies with the strain of virus, and is generally ***4 to 5 days (range 2 to 15 days).***
- The virus is readily inactivated by formalin, alcohol, merthiolate, lipid solvents, lysol and ultraviolet light.
- ND virus may persist in ***un dispersed chicken faeces for more than six months*** but under village conditions the virus is unlikely to survive outside a host for ***more than one month***.
- Vaccination is a routine practice for the prevention and control of the disease.

The clinical signs:

- *Clinical signs of NCD vary considerably according to:*
  - *the virulence and tropism of the NCD virus involved,*
  - *the species of bird,*
  - *the age of host,*
  - *The immune status of the host and environmental conditions*. As a result, none may be regarded as a specific sign of NCD.
- Chickens infected with virulent NCD virus strains may die without showing any signs of illness.
- The chicken fluffs its feathers and appears to *'have its coat dragging on the ground'*
- Lethargy and inappetance
- Respiratory signs such as mild rales and snick can be detected by careful observation.
- Severe respiratory distress and gasping.
- Swelling of the head and neck.
- Greenish diarrhoea.
- *Marked decrease in egg production. Sometimes deformed eggs may be produced*.
- Nervous signs of tremor, torticollis, convulsions and paralysis of wings and legs will not be seen until the disease is advanced *(torticollis is generally seen in chickens only when ND is at an advanced stage).*
- Mortality may be very high, often reaching 50 to 100 % ***(When mortality of 50 to 100 % is observed in a flock of chickens, ND virus is almost always the causative agent).***

Post-mortem findings:

- Are characteristic but not definitive
  - NCD can be suspected if the following lesions are encountered, particularly in combination (and when the flock history is also consistent with an NCD outbreak):
    - congestion and mucous exudate in the trachea;
    - congestion of the lungs (heavier than normal; lungs sink in water/formalin);
    - haemorrhages of the mucosa of the proventriculus;
    - haemorrhagic and necrotic ulceration of lymphoid patches of the intestine, caecal tonsils and bursa of Fabricius;
    - congested ovarian follicles in chickens in lay

Virus classification

The NCD virus can be classified into ***five pathotypes*** based on the clinical signs induced in infected chickens:

1. **Viscerotropic velogeni**c: viruses responsible for disease characterized by acute lethal infections, high mortality with intestinal lesions.
2. **Neurotropic velogeni**c: viruses causing disease characterized by high mortality which follows respiratory and neurological disease, but where gut lesions are usually absent.
3. **Mesogeni**c: viruses causing clinical signs consisting of respiratory and neurological signs, with low mortality.
4. **Lentogeni**c: viruses causing mild infections of the respiratory tract.
5. **Asymptomatic enteri**c: viruses causing avirulent infections in which replication appears to be primarily in the gut.

Epidemiology

- NCD virus can infect through:
    - The respiratory tract,
    - The ocular mucous membranes, and
    - The digestive tract, although this usually requires very high doses of virus depending on the virulence of the strain.
  - The virus is shed from the respiratory tract and in the faeces.
  - Most strains of NCD virus are *heat-labile* and do not persist for long periods in the environment.
  - *A few strains are heat-tolerant*, and these are mainly the avirulent strains that seem to favor oral-faecal spread.

NCD in commercial flocks:

- In large commercial poultry units, the virus enters flocks through:
    - Some break in biological security (on food, people, eggs, vehicles),
    - By the introduction of infected birds in multi-age farms, or
    - By aerosol (in the air) from an adjoining property.
- Once a few birds are infected, spread within the flock will be mainly by aerosol.
- Large flocks will produce copious quantities of aerosol virus, which can spread with movements of air to other flocks.
- Vaccines contaminated with virulent NCD virus can also initiate outbreaks within flocks.
- The virus is *not transmitted through eggs* (vertical transmission); the exception may be the apathogenic strains as they do not cause the death of embryos.

In village flocks:

Epizootic NCD

- The usual source of virus is an ***infected chicken***, and spread is usually attributed to the ***movement of chickens through chicken markets and traders.***
- A chicken incubating ND can introduce the virus to an isolated, fully susceptible flock, ***resulting in up to 100 % mortality***.

Endemic NCD

- An endemic form of NCD which causes only ***occasional deaths*** is recognized in village chickens.
- *The number of deaths is relatively low and does not attract official attention*.
- The affected flocks usually result from breeding birds that have survived an outbreak.
- Many birds are immune and the virus passes from susceptible bird to susceptible bird.
- ***This endemic form will often contribute to mortalities among young birds.*** Eventually there are enough susceptible birds to sustain an explosive spread of virus with numerous deaths.
- *Studies indicate that a population of 1,000 birds is sufficient to maintain endemic virus. Such a population could be a large village, or several adjoining small villages.*

Seasonality of NCD outbreaks

Human activity influences the occurrence of NCD:

- In Asia, when seed rice is required for the seed beds in paddy rice fields, chickens are sold to raise the funds to purchase seed.

- Increased turnover in the chicken markets leads to outbreaks of NCD that have in the past been ***attributed to seasonal weather conditions.***
- ***In Uganda, NCD is reported during the dry season***. This is probably not related to weather, but to the fact that farmers with no immediate tasks visit relatives and take chickens as gifts.
- In many areas the villagers recognize the season when NCD will occur, or they recognize the early cases, and they dispose of their chickens by sale, thus initiating or sustaining outbreaks.
- *For each rural area it will be necessary to establish the seasonal pattern of NCD, and if possible to deduce the reasons for these patterns.*

Impact of vaccination

- Vaccines will alter the epidemiology of NCD to some extent since they will ***prevent disease, but not infection***.
- ***Vaccinated birds exposed to virulent virus will develop no clinical signs.*** However, some replication of the infecting virus will occur and birds will excrete virulent NCD virus. This will probably not be excreted in quantities as large as those excreted by susceptible birds, but there will be sufficient virus to infect other chickens.

Control of Newcastle disease

- *Vaccination is the only effective way of controlling NCD*.
- However, vaccines currently in use are mainly of benefit to commercial poultry producers whose chickens are kept in large, single-age, confined flocks. In contrast, village chickens are raised in small, multi-age, free-range flocks and large multi-dose vials of vaccine are inappropriate.

- The cold chain is difficult to maintain under village conditions.

Vaccination

- NCD vaccines currently in use in Ethiopia include:
  - La Sota (live vaccine, thermolabile); and Hitchner B1 (live vaccine, thermolabile), of 5 million dose/year
  - Thermostable vaccine of 2 million dose /year
  - Inactivated vaccine of 1 million dose/year
- The live, thermolabile vaccines:
  - Must be kept in the refrigerator between 4 and 8$^{o}_{C}$ and never frozen.
  - Vaccines should not be used after the expiry date.
  - Once a vial has been opened it should be used immediately and not stored for use the following day.
  - During vaccination campaigns, vaccine should be stored in a cool box or wrapped in a damp cloth, and not exposed to sunlight.
- Even for thermostable vaccine, it is still important to keep them away from sunlight and as cool as possible ensuring that their activity outside the cold chain is as long as possible.
- The vaccines HB1, La Sota, can be administered ***via eye drop or drinking water.***
- The thermostable vaccine can be administered orally after mixing with certain foods (care must be taken to ensure that the chosen food does not contain agents that can inactivate the vaccine virus).

Table 3: Comparison of Newcastle disease vaccines

	Live	Inactivated
	• Contain a small amount of living virus which replicates; • cheaper	• Must contain a large amount of inactivated virus; • more expensive
Routes of vaccine administration	Can be administered by many routes: eye drop, intranasal, spray, drinking water, oral, injection	Must be injected
	Stimulate all forms of immunity	Stimulate only antibody-based immunity
Eye drop administration	*Duration of immunity varies according to route of administration, usually not more than 4 months*	*Duration of immunity approximately 6 months*
	Difficult to store (except thermostable live vaccines	Less difficult to store
	Not dangerous to vaccinator	Dangerous to vaccinator on accidental injection

- Correct dilution of the vaccine is critical.
- If eye-droppers are being used, they should be calibrated beforehand.

- In the absence of suitable eye-droppers, it is also possible to use the tip of a feather or a syringe to administer the drop.
- However, these two options should be seen as last resorts as they are inaccurate and cause considerable wastage of vaccine.
- Most live NCD vaccines require ***re-vaccination at 3 to 4 monthly intervals.***
- Eye drop administration provides good protection because after administration, the vaccine passes to the ***Harderian gland*** just behind the eye. The ***Harderian gland*** in chickens is a key organ in the development of the immune response.

Via drinking water:

- Is easier, but provokes a lower level of immunity than eye drop administration and ***requires more frequent application***.
- ***The vaccine should be given twice, two to three weeks apart initially, with re-vaccination occurring at least every three months***.

It is important to:

- Remove drinking water from the chickens for one to two hours before the administration of the vaccine;
- Mix the vaccine with a volume of water that the chickens will be able to drink during one hour, usually ***5 to 7 mL of water per bird***; and
- Always use ***fresh and clean water***.
- In rural areas, it is best to give the drinking water in the morning just as the chickens are released from their chicken house.

- In areas with abundant surface water, chickens find their own source of drinking water and vaccination via water is not appropriate.

Note that:

- **Do NOT** use metal water receptacles,
- **Do NOT** use disinfectants to clean water receptacles as they will inactivate the vaccine virus,
- **Do NOT** use treated tap water, (If you only have access to treated tap water, it is advisable to:
  - *let the treated tap water stand over night allowing the chlorine to dissipate*, or
  - add one teaspoon of powdered milk per 10 liters of water to neutralize the effects of the chlorine.
- **Do NOT** place water receptacles containing vaccine directly in sunlight or in hot areas,
- **Do NOT** allow other animals access to the vaccine. It should be restricted to chickens.

Via feed:

- Oral vaccination of chickens with thermo-stable vaccines has been successful in some countries.
- ***Good veterinary services***, ***local availability of suitable grains and recovery of virus from the grain are important considerations for successful oral vaccination.***
- One problem with food based NCD vaccination is the ***low recovery of virus from some grains (especially maize)***, a consequence of either binding or inactivation. Therefore, the food used in any vaccination campaign should be recommended by the Veterinary Services Department.

- ***Seven to ten grams of food per bird*** should be well mixed with the corresponding number of doses of appropriately diluted vaccine. With most grains, ***1 mL of fluid will efficiently moisten 10 grams of grain***. The treated food is best given in the morning as the birds are leaving the roost.
- The vaccine should be given twice: ***3 weeks apart initially, with re-vaccination occurring at least every 3 months***.

Via injection:

- ***Inactivated NCD vaccines*** are administered only by intramuscular or subcutaneous injection (in the breast or the leg).
- ***The vaccine should be allowed to reach ambient temperature (approximately 28°C) and the contents well shaken prior to use***.
- If stored in a cool, dark location, this vaccine may retain its activity for **one to two weeks** outside a refrigerator.
- Inactivated vaccines are more effective in chickens that have previously received a living vaccine.
- ***Re-vaccination is usually done every 6 months.***
- Accidental injection of this vaccine into the vaccinator can cause a serious localized reaction. Expert medical advice should be sought at once.

Timing of vaccinations:

- After administration ***one to two weeks is required for the full immune response to occur***.
- *Chickens should be* vaccinated at least one month before an outbreak is likely to occur.

- Immunity will diminish if chickens are not revaccinated.
- ***With the eye drop method of administration, chickens are best vaccinated at least three times a year.***
- ***If oral routes of administration are used, chickens should be given a booster dose two to four weeks after the primary vaccination, with re-vaccination at three monthly intervals***.
- *Vaccinating village chicken poultry flocks at* ***three to four monthly*** *intervals will also provide protection for newly hatched chicks*.
- Inactivated NCD vaccine is usually administered ***every six months.***
- In areas where outbreaks generally occur once a year, the vaccine may be strategically administered before the normal seasonal outbreaks are due to commence.

Benefit: cost considerations

- When working with village chickens, it is essential that benefit: cost analyses of all interventions be done so that any NCD control strategies are cost-effective.
- The main costs associated with the control of the disease are the purchase of the vaccine (the vaccines are delivered free of charge for backyard poultry producers), transport and handling costs.
- ***The less frequently that chickens have to be vaccinated, the more cost-efficient the strategy. However, long revaccination intervals leave newly hatched chicks susceptible and where endemic NCD is present, chick mortality will increase***.

- ***Make sure that to have an idea of the pattern of NCD outbreaks in each area so that can start vaccinating before an outbreak occurs.***
- Farmers must be informed of the different administration regimes and the frequency of application of the vaccine required ensuring adequate levels of protection with each administration route.
- Eye drop administration promotes higher levels of immunity than oral administration. ***Consequently, with the eye drop method it is not necessary to administer the vaccine as frequently in order to maintain adequate levels of protection***.

The main advantages of the thermostable, live vaccines are:

- Thermostability- they are able to reach sites beyond the cold chain in a viable state;
- Ease of administration--they can be applied by farmers at the village level; and
- ***They will spread from vaccinated to non-vaccinated chickens in close contact***.
- The involvement of community vaccinators or community livestock workers in NCD vaccination programs can greatly reduce costs and increase coverage.

Development of NCD vaccination campaigns

- In most cases, it is critical that the first vaccination campaign is a success to convince most farmers grant a second chance.
- The best way of ensuring good results is to prepare thoroughly before commencing with vaccinations in the field and to have the

will and the resources to ensure that subsequent campaigns will be implemented at the recommended intervals.

Awareness of officials, veterinarians and extension workers

- Is the control of NCD in village chickens seen as a priority by decision makers?
- What information do they need to help them understand the importance of vaccinating regularly against NCD?
- Will existing government policies facilitate the development of a sustainable NCD control program?

Farmer awareness

- Is NCD a priority for farmers in the area where you plan to vaccinate?
- Do they know that a vaccine against NCD exists?

Training requirements

- For good results, make sure that all participants in the vaccination campaign have received appropriate training.
- Training will vary according to the function of the individual:
  - veterinary services staff
  - extension staff
  - community vaccinators

Seasonality of NCD outbreaks

- When are NCD outbreaks most likely to occur?
- If there is thought to be a seasonal pattern to outbreaks, ***ensure that the campaign starts at least one month before the outbreaks are expected.***

Agricultural and climatic calendar

- Plan campaigns to coincide with times of the year when farmers are not very busy in their fields and access to the area is possible.

Gender analysis

- The campaigns will meet with better success if arrangements are made with the person in the family who owns and cares for the chickens.

Inputs

Always make sure that you know where you can get the supplies necessary for the vaccination campaign and that the material is in stock:

- Vaccine, of appropriate quality and quantity;
- Eye-droppers; and etc

Preparatory phase

- **Appropriate extension materials**. Prepare and duplicate the necessary extension material.
- **Training of personnel**. Train personnel well in advance of the campaign. They need time to go back to their respective areas to raise farmer awareness, collect information and make their own preparations.
- **Timing of campaign**.
  - Decide in consultation with staff, community vaccinators and farmers.
  - Consider weather conditions, the farmers' annual work plan and the pattern of NCD outbreaks.
- **Extension activities**. Start at least one month prior to the campaign.
- **Vaccine administration option*s***.
  - Use eye drop administration whenever possible.
  - However, in certain circumstances farmers may opt for oral administration.

- Consider whether the vaccinator is to travel to individual houses or if farmers bring their birds to pre-arranged points.

- **In puts**. Vaccine, eye-droppers and syringes, registration books, cool boxes or baskets and cloth must be procured.

Recommendations

- Commence campaigns at least one month prior to the season when NCD outbreaks are more common.
- ***Postpone the vaccination campaign if is suspected that an outbreak of NCD is in progress.***
- Vaccinate healthy chickens only
- Always inform farmers of the need to revaccinate their birds.
- Campaigns are best held during the weekends or school holidays.
- Never promise protection of 100 % of chickens.
- Emphasize that the vaccine protects against NCD only.

Implementation

On the first day of the vaccination campaign, you will have:

- trained teams;
- vaccine and other inputs available;
- decided, in coordination with farmers, on the site of vaccination:
  - -house-to-house visits; or
  - -central vaccination points;
- participating farmers registered;
- a way of identifying vaccinated chickens;
- a system in place for the vaccinator to register the number of birds vaccinated.

Monitoring and Evaluation

- This is an essential part of a NCD control program.

Timing and frequency

- The timing and frequency of monitoring visits will vary according to the position of the person(s) involved (e.g. community vaccinator or Livestock Officer) and the type of monitoring being undertaken.
- Monitoring of activities should occur ***at regular intervals*** to enable timely adjustments to be made:
    - One week to one month after vaccination, Community vaccinator confirms that birds are healthy following vaccination; and
    - Three months after vaccination is an ideal time to monitor chicken numbers, farmer attitudes and to prepare for the following campaign if vaccination is being done every four months via eye drop.

Participatory processs:

In theory all stakeholders should participate in the monitoring process. Stakeholders may include community representatives (male and female), government officials, project staff and, where relevant, consultants.

Indicators

All stakeholders should have a say in defining the indicators of success.

Possible indicators may be:

- Short-term changes in:

    -household chicken numbers;

-the number and types of people participating in vaccination campaigns;

-the level of community involvement in campaigns;

-the economics of households;

-the number of chickens sold or traded; and

-home consumption of chickens and eggs.

- Long term changes in:

-the number and diversity of livestock species raised;

-the demography of households; and

- whether the control of NCD has assisted in poverty alleviation and improved food security.

Identification of other constraints

Front line extension staff should be encouraged to identify other constraints that limit poultry production in order to work with farmers in a process of continuous improvement.

5.5 Other control strategies

- Avoid the introduction of new birds to flocks during the periods of the year when NCD occurs more frequently.
- Avoid contact with people, cars and animals that have been in contact with the virus and other parts of infected chickens (e.g. eggs, feathers, etc.). Dogs and cats can also transmit the virus if they have access to chickens killed by NCD.
- An elevated chicken house that is well-ventilated allows faeces to fall through to the ground and so minimizes contact with various infectious agents.
- Keep chickens and chicks away from the chicken house where the faeces have accumulated or clean the area regularly.

Control measures during an outbreak

- Isolate all sick chickens.
- Do not transport chickens that are ill or dead to other areas that are free of the disease.
- Bury or burn all dead chickens.
- Do not vaccinate chickens that are showing signs of illness.
- Once an NCD outbreak has commenced in a village, it is best not to vaccinate as it is impossible to identify birds that are incubating the disease but not yet showing signs of illness.
- Advise farmers to wait for at least one month after the last mortality before re-stocking.
- Advise farmers to contact the Veterinary Services Officer, Extension Worker or Community vaccinator in their area when they notice any signs of illness.

Storage and transport conditions for thermostable NCD vaccines

- If users have access to normal cold chain facilities, then by all means these should be used, even when dealing with a thermostable vaccine. Freeze-dried vaccine stored at -8°C will retain high titre for a longer period than that stored at ambient temperature.
- At -8°C, the vaccine should maintain an adequate titre for at least one year.
- When taking the vaccine to the field, place it in a cool box with ice or an ice pack.

- DO NOT FREEZE the vaccine (unless the instructions specifically indicate that the vaccine may be frozen).
- For optimal results once removed from refrigeration:
  - Always keep the vaccine away from sunlight.
  - When transporting the vaccine in the field, wrap it in a damp cloth and carry it in a covered open-weave basket. This allows evaporative cooling which helps to keep the vaccine cool and the cover prevents contact with sunlight.
  - Record the date the vaccine leaves the cold chain, it will remain effective for 3 months only.
  - Store the vaccine in a cool, dark location, for example, near the base of a clay water pot

Administration of thermostable NCD vaccines

Standard dose.

- As with other live NCD vaccines such as La Sota, a minimum of $10^6 EID_{50}$/bird is required to produce an adequate level of protection.
- the vaccine virus replicates and excreted in the faeces and the birds then re-infected by the virus in the environment

Administration route.

- These vaccines can be administered via eye drop, drinking water, certain feeds and injection. Field trials
- Farmers prefer eye drop administration even though it required the capture of birds.
- In their opinion, eye drop administration of the vaccine produced a greater survival rate, had a lower frequency of administration and was easy.

- It is important to confirm that the eye-dropper to be used is made of ***virus-friendly plastic and that it is calibrated to ensure that one drop contains one dose***.
- Calibration of the eye-dropper and administration of the eye drop to the bird is done with the dropper in a vertical position to make sure that drops of a uniform size are produced.

Age of bird - the same dose is given to birds of all ages, from day-old chicks to adults.

Vaccination schedule.

- ***For eye drop administration***, the vaccine should be administered once, with re-vaccination every 4 months.
- ***Via drinking water***, the vaccine should initially be given on two occasions, two to three weeks apart, with re-vaccination occurring at least every three months.

Dilution and use of thermostable NCD vaccines

These vaccines may be diluted using locally available potable water. It is recommended that:

- the water is boiled and left to cool overnight in a non-metallic container before use.
- Chlorinated tap water is unsuitable. If, however, this is the only water available, let the treated tap water stand overnight to allow the chlorine to dissipate.
- Once the freeze-dried vaccine has been diluted, it is advisable to follow this simple rule for eye drop administration:

  * Day 1 □□1 drop per bird (i.e. first day of vaccination campaign)
  * Day 2 □□2 drops per bird
  * Day 3 □□discard

Horizontal spread of thermostable NCD vaccine virus.

- The thermostable live NCD vaccines spread from vaccinated to unvaccinated birds when housed together
- The degree of spread under field conditions is less when birds roost in trees and horizontal transmission should not be seen as a reliable substitute for vaccinating village birds.

Development of an extension program for Newcastle disease vaccination campaigns

- rural people themselves are knowledgeable on the many subjects that touch their lives and that they possess a creativity and analytical capacity which can greatly assist in the development of improved agricultural practices.
- ***Knowledge is not a commodity, for transfer from the informed to the uninformed, but the outcome of a dynamic, collaborative process between co-learners***.
- extension messages are often ill-adapted to the management objectives of small farmers
- farmers whose only livestock is village poultry generally belong to the poorer sections of rural communities, and may not have had regular contact with livestock extension programs which have frequently focused on ruminants;
- extension workers frequently find it easier to work with the better-off farmers who are usually more educated as they have more in common;

- participatory approaches allow extension workers to learn from and with rural people, eliciting and using their criteria and categories, and finding, understanding and appreciating indigenous technical knowledge.

Features of extension for village poultry production

What's different?

- Livestock extension networks have tended to focus on male farmers with cattle and small ruminants.
- Since the care of village poultry is often the responsibility of women and children, extension messages need to be specially designed and transmitted to reach their target.
- Men may or may not be targeted depending on their level of involvement in village chicken production.
- Farmers are often reluctant to invest (time, money, materials) in chickens due to bad experiences in the past (e.g. frequent high mortality due to NCD).
- Many farmers are unaware that it is possible to vaccinate chickens.

What's the same?

- Group work is generally the preferred way of interacting with farmers.
- Strategic planning of extension activities is critical, for example, the timing of NCD vaccination campaigns is of vital importance to ensure that chickens are vaccinated before an outbreak occurs.

- The range of communication methods available to the extension worker is the same; although in many cases, ***non-formal methods of communication*** will be emphasized.

Extension methods

Group methods

There are a number of ways the extension agent can bring farmers together to undertake his/her extension work, for example:

- Working with groups of village poultry farmers is often one of the best ways of carrying out extension activities. When planning activities care must be taken to facilitate the participation of poultry farmers.
- Teaching aids such as flip charts that use visual images to accompany an oral presentation can be very effective.
- Presenting appropriate extension material at local primary and secondary schools can also be a very rewarding exercise.

Demonstrations.

- Farmers like to see how a new idea works.
- Demonstrations are essential when training farmers in vaccination techniques and can also be useful when demonstrating designs for poultry houses, and food and water receptacles.

Field days.

Field days are an excellent way for farmers to share their ideas and to learn from the experiences of other farmers.

These days also provide an opportunity for farmers to meet representatives of the government livestock and extension departments and learn about available services. Topics covered may include: NCD vaccination techniques and vaccine conservation under village conditions; construction of poultry houses; design of feed and

water receptacles; improved nutrition using locally available food; the performance of different types of local birds and local poultry husbandry practices; and
demonstrations on different diseases and how they may be controlled.

Mass methods.

Mass media include media that convey information by sound
(radio, audio cassettes); moving pictures (television, film, video); and print (posters,
newspapers, leaflets). The preparation of printed material in black and white enables the
material to be photocopied long after the project has finished and in areas remote from the
area where it was first produced. These channels of communication expose large numbers
of people to the same information at the same time but do not readily allow an exchange of
information between the farmers and the producers of the extension material. The attraction
of mass media to extension services is the high speed and low cost with which information
can be communicated to people over a wide area (Oakley and Garforth 1985).
Radio can be a very useful medium. Local radio stations frequently broadcast in local
languages, and most villages will have at least one radio. Information can be received where
literacy rates are low, and prepared statements, interviews (suggestions for a question and

answer session may be found in appendix 6), drama and song can be used. Radio can
assist in the coordination of vaccination campaigns. Interviews with local farmers who are
skilled village poultry producers and who are willing to share their ideas will increase greatly
the size of the listening audience. Farmers who are supportive of interventions such as ND
vaccination can make a big impression on their fellow farmers. Conduct some audience
surveys to ensure that your messages are being received clearly and that your target group is
listening to the radio at the time your messages are being broadcast.
Extension material may be provided to the Ministry of Education for inclusion in the
agriculture syllabus in schools..[43]

Conclusion

The control of ND in village chickens is much more than the control of an animal disease.

It can make a vital contribution to the improvement of household food security and poverty alleviation in many developing countries. In some circumstances, it will provide the first contact between small-scale farmers and national veterinary services.

As farmers increase their chicken numbers, some will use surplus birds to invest in small ruminants and eventually large animals.

The control of ND will contribute to improved village poultry production as a whole by assisting the process of data collection and reinforcing cooperative links with farmers. These links will greatly facilitate the ongoing work required to enable village chickens to demonstrate their true genetic potential.

Appendix 3: Calibration and care of Eye-droppers

Eye-droppers

Eye-droppers are made of flexible plastic, preferably low density polyethylene. The ideal eye-dropper has a removeable tip, protected by a screw top cap. A suitable eye-dropper should:

hold a suitable volume of vaccine;

not inactivate (destroy) the vaccine virus; and

deliver drops of an appropriate size.

Volume of drops

Eye-droppers of up to 30 mL capacity can be used. It is not necessary to place a full 30mL of vaccine in these droppers. The volume of

vaccine that is used will depend on the number of chickens to be vaccinated, and the size of the drop delivered by the dropper.

Testing for antiviral activity

Vaccine virus will be killed on exposure to some plastics.

A sample of a new batch of eye-droppers should be tested before use in the field.

This test must be done in a laboratory that is able to measure the infectivity of the vaccine virus.

Vaccine virus should be diluted for use and then divided into two parts. The diluent should contain antibiotics as the laboratory will require vaccine free of contamination when the virus content is measured in eggs.

Place half the vaccine in the eye-dropper and half in a stoppered, sterile glass test tube (or leave it in the vaccine vial).

Store both overnight in a cool, dark location. The two preparations are then tested to confirm that there is little or no difference in virus content between the vaccine

stored in the eye-dropper and that stored in the test tube.

Size of drops

The volume of diluent used to reconstitute freeze-dried vaccine, or to dilute liquid vaccine,

will depend on the size of the drop that is formed by the eye-dropper. It is best to use an

eye-dropper that produces more than 40 drops per mL. If the eye-dropper produces 66

drops per mL (an ideal number) it means that each drop is approximately 15 mL. This

volume is ideal for the small eye of a chicken.

Human eye-droppers are not as convenient for use in chickens. These often produce drops
of 25 mL to 35 mL. Such drops are large compared to the size of a chicken's eye and
splashing of the drop and wastage of the vaccine can occur.
Each new batch of eye-droppers should be calibrated to ensure that chickens receive the
correct dose of vaccine..62

Calibration Method Number 1:

1. Remove the tip of the eye-dropper (Figure 18, step 1), add 1 mL of water to the
dropper (steps 2 to 5) and then replace the tip securely (step 6).
2. Hold the eye-dropper upside down, squeeze the dropper very gently and count the
number of drops that fall from the tip (step 7). Remember that the eye-dropper should
be held in the vertical position (see Figure 6 in Section 5.1.1). It is generally advisable to
repeat this process three times and to use the average number of drops in the calculation
below.
3. Use the following formula to calculate the volume of diluent required to dilute the number
of doses of the vaccine per vial and the eye-dropper in use:

Volume of diluent (mL) = No. of doses of vaccine per vial
No. of drops formed per mL

Example 1: How much diluent should be added to a vial containing 250 doses of ND
vaccine given that 1 mL of water in the eye-dropper yielded 50 drops?

Volume of diluent (mL) = 250 doses per vial

50 drops per mL

= 5 mL per vial

Example 2: How much diluent should be added to a vial containing 100 doses of ND

vaccine given that 1 mL of water in the eye-dropper yielded 37 drops?

Volume of diluent (mL) = 100 doses per vial

37 drops per mL

= 2.7 mL per vial

Figure 18: Calibration method number 1.

Calibration Method Number 2:

This method is easier for people less familiar with syringes and mathematical calculations. It

is better if two people to work together.

1. Check the vaccine label to determine the number of doses per vial.

2. Remove the tip of the eye-dropper (Figure 19, step 1), fill the eye-dropper with water

(step 2) and replace the tip (step 3).

3. Remove the plunger from a 10 mL or 20 mL syringe (step 4) and hold the syringe

vertically with the tip down. The tip should be closed with a finger or a thumb (step 5).

4. Hold the eye-dropper vertically, squeeze the eye-dropper very gently and commence

counting drops into the syringe (step 6). Continue counting until the number of drops

equals the number of doses contained in the vaccine vial. Many people find it easier to.63

count the drops in groups of ten and record the number of groups. For instance, for a

250 dose vial, count 25 groups of 10 drops to give a total of 250 drops. Working in
pairs, people count to 10 and then make a mark on the ground.
5. Hold the syringe vertically and check the level of the water against the marks on the
syringe. This is the volume required to dilute the vaccine.
If it is necessary to use glass eye-droppers with a rubber bulb, this method of calibration can
be used.

Figure 19: Calibration method number 2.

How to care for plastic eye-droppers

To ensure a long life for eye-droppers, they must be cleaned and stored correctly after use.
1. Wash in cool, clean water only. Do not use HOT water.
2. Do not use treated tap water. If you only have access to treated tap water, it is
advisable to let it stand overnight to allow the chlorine to evaporate.
3. Do not use disinfectants as they will inactivate the vaccine virus.
4. Do not clean the tip of the eye-dropper with anything abrasive.
5. Do not force anything into the tip of the eye-dropper that will enlarge the opening.
6. Allow the eye-dropper to dry thoroughly and then wrap in a dry clean cloth.
7. Store away from direct sunlight and sources of heat..64

Reasons for vaccine failure

- Incorrect agent
- Ineffective vaccine
- Unsatisfactory vaccine
- Vaccine administered too late;

- bird already incubating disease
- Biological variation
- Presence of passive immunity
- Immunosuppressed bird
- Failure of bird to mount an immunological response
- Insufficient dose of vaccine
- Death of live vaccine
- Administration not satisfactory
- Vaccine failure

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For NCD vaccines:

- Vaccinating in the face of an outbreak.
- Eye-dropper not correctly calibrated; bird did not drink sufficient water, reduction of vaccine titre because of inadequate storage.
- Improper vaccine conservation – exposed to sunlight; exposed to extremely high temperatures during transport or storage; held outside the cold chain beyond the recommended period. Vaccine mixed with an inappropriate food carrier, e.g. maize.
- A very small percentage of birds will not mount an adequate immune response post vaccination.
- Chicks up to the age of three weeks may have passive immunity to NCD that will interfere with vaccination.
- Malnourished bird; infection with immunosuppressive diseases such as Infectious Bursal Disease; certain parasitic infestations