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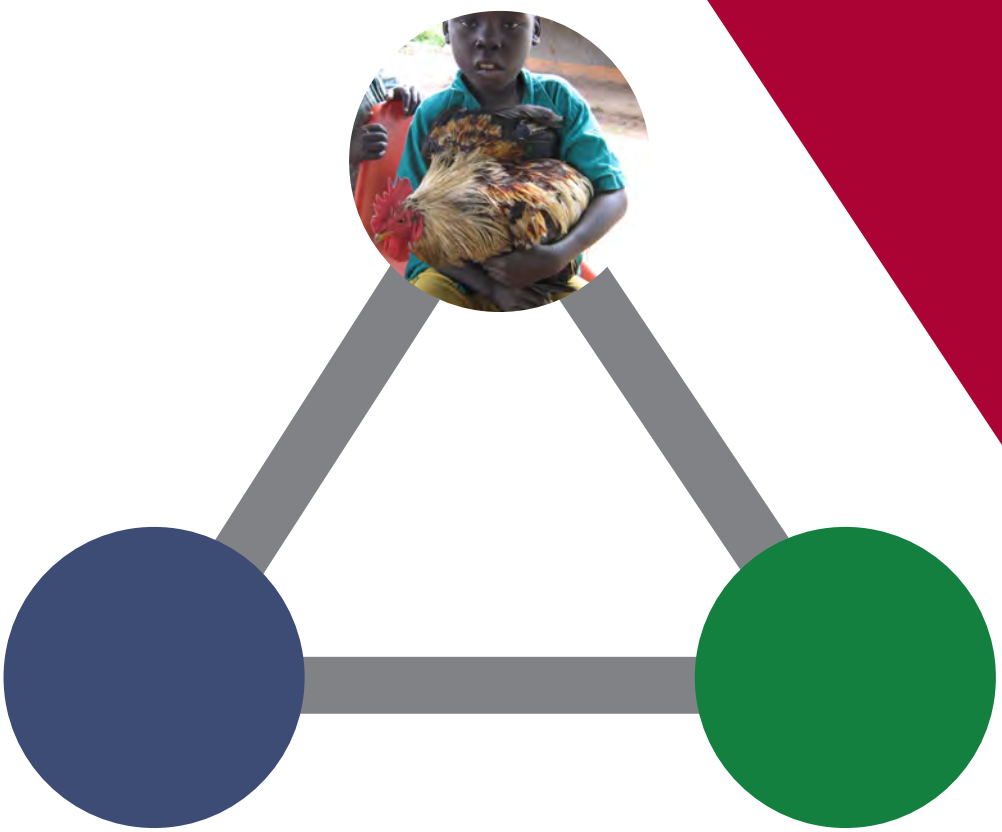

AHBL • Promoting strategies for prevention and control of HPAI

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Acronyms

AHBL	Animal Health Breed and Livelihood
CAO	Chief Administrative Officer
CBO	community-based organization
CBR	Community-Based Rehabilitation
CHOGM	Commonwealth Heads of Government Meeting
DRC	Democratic Republic of the Congo
DVO	district veterinary officer
FGD	focus group discussion
FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
HPAI	highly pathogenic avian influenza
KII	key informant interview
LGDP	Local Government Development Programme
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
NAADS	National Agricultural Advisory Services
NCD	Newcastle disease
NGO	non-governmental organization
PAF	Poverty Alleviation Fund
PMA	Plan for Modernization of Agriculture
PRA	participatory rural appraisal

Summary

This study was conducted to review the poultry disease control strategies currently used in smallholder poultry production systems and local poultry populations in Uganda. The study has three main objectives:

- to gain a better understanding of the role that vaccination can play in controlling highly pathogenic avian influenza (HPAI);
- to identify effective and sustainable strategies for disease control that can deal with changing demands for animal health services and service delivery;
- to identify key areas for change in disease risk management and improved production, and practical ways of achieving these.

Five districts, each in a different region of Uganda, were selected for the study: Tororo in the east, Jinja in the southeast, Lira in the north, Arua in the northwest and Kanungu in the southwest. The main selection criterion was large numbers of poultry kept at the household level.

Quantitative and qualitative data collection methods were used, and respondents/participants were men and women poultry farmers. Quantitative data were captured from a household questionnaire and key informant interviews, while qualitative methods included focus group discussions using participatory rural appraisal techniques, and key informant interviews. Participatory rural appraisal techniques included community systems analysis, a solution matrix, gender analysis, poultry disease risk factor analysis, a poultry marketing and disease risk factor matrix, ranking of the relative burdens of diseases, and discussions.

Various methods were used to collect data on households' socio-demographic characteristics, poultry species, flock sizes, flock compositions, types of housing, types of feeding, sources of feed, provision of water, management systems, sharing of housing with other species, main sources of labour, and sources of poultry. Other data were collected on the poultry disease prevention measures used, mortality rates, vaccinations, constraints to vaccination, general poultry disease management and strategies for sustainable disease control, and extension service delivery.

Results from this study show that there are low literacy levels among smallholder poultry producers. The majority of respondents were educated only to primary levels (56.8 percent), and the proportion with no education at all ranged from 1.5 percent in Jinja to 34.6 percent in Tororo. There were no significant differences between genders.

Across all districts, chickens are the main domestic poultry, and are kept principally for income and food.

The findings of this study show that households keep their chickens and other poultry mainly in their own kitchens (35.5 percent), which are regularly cleaned by women and children; in chicken houses (28.9 percent); or in their own houses (16.1 percent). There were no significant differences among districts.

About 52 percent of households applied some disease prevention measures, especially cleaning of poultry housing (43.7 percent) and vaccination (35.7 percent). Other biosecurity and disease prevention measures such as use of disinfectants, isolation of sick birds and restriction of entry to poultry houses were lacking or insignificantly practised. Poultry diseases were reported in 91.4 percent of households interviewed, and only 28.2 percent had vaccinated their poultry against Newcastle disease (NCD), with significant variations among districts: Jinja had the highest coverage (48.7 percent), and Arua the lowest (14.6 percent). Main sources of vaccines were the government (62 percent), private companies (36 percent)

and civil societies such as non-governmental organizations (NGOs) (2 percent). Vaccinations were carried out by government staff (50 percent), family members (27 percent), neighbours (17 percent) and others such as NGOs (6 percent).

The study revealed that 86 percent of farmers perceived gaps in the delivery of poultry health care services, and 90 percent of respondents suggested that health care for poultry receives less attention than that for other livestock species.

Respondents listed some of the major challenges and constraints to achieving an effective and sustainable poultry disease control strategy in smallholder poultry production systems. These included scarce or lacking extension service providers (mentioned by 20 percent of respondents), inadequate availability of drugs and vaccines (20 percent), ignorance (10 percent), keeping birds in free-range systems (8 percent), lack of cooperation among poultry farmers (7 percent), unavailability of vaccines (6 percent), and corruption (2 percent).

This study confirms the predominance of the free-range poultry management system (93.9 percent of respondents). This system exposes poultry to diseases and other production risks, such as predators and thieves, as birds roam around the village without restriction.

The housing of chickens in households' kitchens, the types of chicken house constructed and their vicinity to human houses increase contacts between household members and poultry and poultry wastes, thereby increasing the risks of infection spreading between poultry and humans.

Poultry diseases are the leading challenge to the poultry industry in all districts. Farmers normally attempt to treat diseases themselves, using traditional medicines or modern drugs, and only consult animal health care workers if their poultry fails to recover. This results in high mortality to diseases.

NCD is the main disease, creating a major constraint to poultry production in rural areas. Vaccination coverage is generally low in all study districts. Only Jinja reported fair coverage because of a NCD vaccination project. Private veterinary practitioners support the vaccination of poultry in the districts by supplying and delivering vaccines, but there are technical constraints to sustaining effective district vaccination programmes, especially: unreliable power supply for maintaining a cold chain; unreliable supply of vaccines; inadequate extension services.

A multidimensional approach should be taken to address these challenges, including through the promotion and development of farmers' groups and poultry associations. Existing groups should be empowered and community structures that are built on team work and cooperation should be supported and used. Educating schoolchildren on poultry management practices would be a feasible strategy.

There is need to develop a national vaccination strategy and to strengthen the priority that the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) gives to NCD vaccination. Vaccines should be made more affordable through appropriate packaging of 100 to 500 doses rather than 1 000. Sources of alternative power, such as solar energy and kerosene for fridges, could be provided at the sub-county level to protect vaccines, which are often not thermostable, and the use of thermostable vaccines (which do not need a cold chain) in situations where power supplies are unstable should be promoted. The facilities developed and lessons learnt from NCD control will be useful in the event of a highly pathogenic avian influenza (HPAI) outbreak.

There is need to develop a policy that enables easy access to credit services for smallholder poultry producers. This will stimulate productivity at the household level and help address challenges and constraints in the poultry sector.

In all districts, the shortage of labour and the inadequacy of extension service providers were reported as major challenges to smallholder poultry producers. There is therefore need to review the recruitment and deployment strategies of animal health extension personnel in

rural areas that are difficult to reach, and to base the number of available extension staff on the number of households rather than the number of animals. Extension services should target households, as they cannot change the animals without changing the owners.

Disease challenges are dynamic and complex and it is essential that research on smallholder poultry be supported to provide valid and reliable information with which to plan interventions.

Introduction

Uganda's agriculture sector employs 80 percent of the country's labour force and provides potential for improving the living standards of most Ugandans. Through the Plan for Modernization of Agriculture (PMA), the Government of Uganda has initiated programmes to boost agricultural production and marketing and the processing of agricultural goods. All these programmes aim to alleviate poverty through transforming subsistence agriculture into commercial agriculture. Within the agriculture sector, livestock contributes 17 percent of agricultural gross domestic product (GDP), representing about 7.5 percent of total GDP. Poultry is an important and integral part of most Ugandan households because it plays a key role in poverty alleviation, even though its economic contribution to GDP is low.

Chicken production is the main type of poultry farming, although other species documented include turkeys, ducks, guinea fowls, pigeons, geese and ostriches (Byarugaba, 2007). Uganda has an estimated poultry population of 27 million birds (UBOS, 2008), more than 87 percent of which are local chickens managed under the free-range system in rural areas. In 2000, the chicken population was estimated at 30 million, of which 80 percent were indigenous breeds (MAAIF Report, 2001). Exotic commercial birds were introduced into Uganda in the 1960s, and over the past decade the number of intensive commercial poultry units (for broilers and layers) has increased considerably, especially around urban areas. Indigenous chickens remain the predominant poultry species in rural areas. These birds, which are commonly referred to as "village chickens" in the literature, contribute to basic socio-economic welfare in rural families and play various cultural roles in communities in the study districts. They are important in the lives of rural people, including as a cheap source of protein. In local poultry markets, indigenous village chickens are preferred to exotic breeds because of their feather colouring, the taste of their meat, their leanness and their suitability for special dishes (Ssewanyana et al., 2001). Village chickens are raised mainly in free-range, backyard or semi-intensive systems (Mukiibi-Muka, 1992). They obtain most of their feed and water by scavenging in the natural environment, and may or may not be given shelter. The semi-intensive poultry management system is characterized by permanent housing with access to a yard or the surrounding environment. Under this system, birds are given supplementary feed and water in the houses, and stocking densities are up to 500 birds per acre (about 1 200 per hectare). The semi-intensive management system therefore leaves birds to get as much as they can from the environment, with the farmer complementing these inputs and protecting the birds from natural hazards by providing housing and disease prevention and control.

The development of smallholder poultry production systems in Uganda, particularly village chicken production, could help to meet the nutritional, income, employment and gender needs of rural people (Kusina and Kusina, 1999). Almost every household in rural areas of Uganda keeps village poultry, but the smallholder poultry production sector continues to be hampered by low productivity, poor management, poultry diseases, predation, poor reproductive performance, poor growth rates, and lack of organized markets. These constraints result from the use of low-performance poultry breeds; various biological, cultural, social and economic factors that influence healthy flock management in villages; and shortage of feed resources (Kusina and Kusina, 1999).

BACKGROUND TO THE STUDY

Emerging transboundary animal zoonotic diseases are a growing problem, which affects the small-scale poultry producers and rural societies in developing countries in particular, and which is endangering poultry genetic resources. Appropriate veterinary policies and strategies against such diseases are essential. Currently, there are outbreaks of highly pathogenic avian influenza (HPAI) in countries of Asia and other parts of the world, including Africa, and these are having very bad effects on small-scale poultry producers in the countries concerned. This situation calls for national, regional and international disease prevention and control strategies that are sensitive to the needs of smallholder poultry producers. In July 2006, the Food and Agriculture Organization of the United Nations (FAO) and the Government of Germany signed an agreement for the Animal Health, Breed and Livelihood (AHBL) project: Promoting Strategies for Prevention and Control of Highly Pathogenic Avian Influenza (HPAI) that Focus on Smallholder Livelihoods and Biodiversity. As a starting point for developing appropriate policies and strategies, a good understanding of poultry management and production systems is required, including the opportunities and constraints and the types of chicken (local breeds, exotic) involved. HPAI control is particularly difficult when there is only limited understanding of how animal health services are delivered. A good entry point is an assessment of completed and ongoing vaccination programmes against Newcastle disease (NCD) carried out by the government, the private sector or civil society, such as non-governmental organizations (NGOs).For many years, rural households in Uganda – as in other parts of Africa – have kept poultry as scavengers. Each household keeps a flock of about six to 20 chickens, but numbers vary during the year owing to the occurrence of diseases such as NCD, which can wipe out 60 to 100 percent of chicken populations. Poultry farmers sell many birds prior to the season for such diseases, to avoid losses, but this practice encourages the rapid spread of disease from one focus to another. It is estimated that NCD can kill entire village poultry flocks more rapidly than any other disease. Poultry disease outbreaks and sales due to disease cause differences in flock structures and dynamics throughout the year (Byarugaba, 2007). In addition, village birds are in uncontrolled contact with birds from different households and with recently introduced birds from markets, gifts and other sources. Birds from markets and wild birds may be a source of infection.

The mortality of indigenous poultry under scavenging conditions is estimated at 70 percent, and is higher for chicks of up to eight weeks of age (Kirunda and Mukiibi-Muka, 2003).

SCOPE OF THE STUDY

Across the globe, emerging transboundary epidemic and zoonotic diseases are causing heavy losses of life and money. Many rural areas in developing regions, including Africa, are constrained by poultry diseases. NCD and endoparasites have major negative economical impacts on poultry production (Musiime, 1992, FAO, 1998). This is owing to the favourable epidemiological factors in free-range poultry management systems (Yongolo, 1996; Permin and Hansen 1998). The recent outbreak of HPAI raises particular concerns. Uganda has not yet been affected by this epidemic, but a National Task Force against HPAI has been established to prepare for a possible outbreak.

Among other agencies, FAO is supporting the design of effective strategies for HPAI prevention and control. Its approach to this is to provide policy-makers with baseline information on current poultry disease prevention practices and the roles that vaccination could play in an HPAI outbreak, using NCD vaccination as a model. Detailed terms of reference (Annex 1) were laid out through a Letter of Agreement with the Faculty of Veterinary Medicine (FVM) at Makerere University, Uganda.

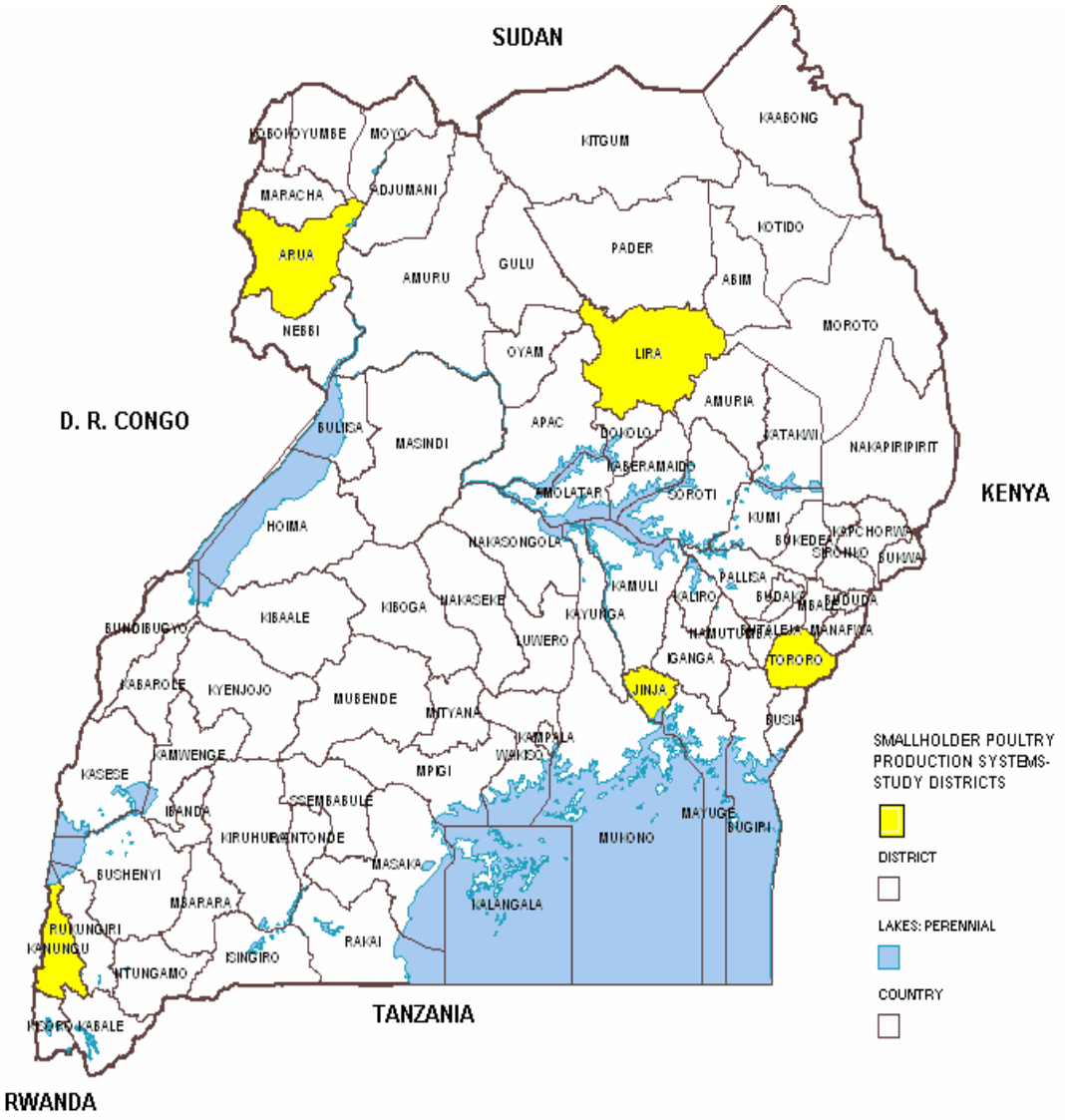
Methodology

This section provides profiles of the selected study areas, the sampling protocol and the data collection process. Both quantitative and qualitative participatory rural appraisal (PRA) methods were used to capture the data.

Study areas

The survey was carried out in five districts selected as representative of Uganda's major regions: Arua (west Nile), Lira (north), Kanungu (southwest), Jinja (southeast) and Tororo (east).

Figure 1 The study districts



Arua district

Arua district is situated in the far northwest corner of Uganda. It covers an area of 5 476 km2 and has an estimated population of 491 500 (UBOS, 2008); Arua town is about 500 km from Kampala. The district boarders Southern Sudan in the northwest, Yumbe district in the northeast, the Democratic Republic of the Congo (DRC) in the west, Nebbi district in the south, and Gulu district in the east. The terrain is undulating, dropping eastwards to the Nile plain. The human population is densest in the western part around Arua town, where crop cultivation is the main source of food and income. Goods and services are traded across the boarders with DRC and Southern Sudan, including poultry and poultry products. The district is well endowed with cattle, goat and poultry production, and has an overall sparse human population.

Lira district

Lira is in the north of Uganda, and covers 4 337 km2. Its population is estimated at 626 500, and Lira town is 337 km from Kampala. Lira borders nine other districts: Pader in the north; Abim, Moroto and Amuria in the east; Kaberamido and Dokolo in the south; Apac in the west; and Oyam and Gulu in the northwest.

Lira's continental climate is modified by the swamp area surrounding the district's southern part. Rainfall is bimodal, with peaks in April to May and August to October. Average annual rainfall varies from 1 200 to 1 600 mm, decreasing towards the north; rainfall is mainly convectional and normally comes in the afternoons and evenings. Average minimum and maximum temperatures are 22.5 °C and 25.5 °C, respectively. Absolute maximum temperature rarely goes beyond 36 °C, and absolute minimum rarely falls below 13 °C. The equatorial trough and the south-easterly winds both pass over Lira, bringing rainfall. Land and sea breezes are common. Wind speed is low (at 1 to 4m/second) during the rainy season and moderate (at 4 to 8m/second) during the dry season.

Lira's tradition of keeping local chickens was disrupted by the long civil war, when people were forced to abandon their livelihoods and move to camps for internally displaced people. Efforts are under way to resettle people back in their homes, and chicken keeping might be pivotal in restoring livelihoods. Lira district is in Lango region of northern Uganda. The majority ethnic group is the Langi

Kanungu district

Kanungu district comprises one county, with nine sub-counties and one town council, 50 parishes, four wards in the town council, and 415 villages. It is a new district, having been created by Parliament in July 2001. The district is located in south-western Uganda, bordering Rukungiri district in the north, Kabale district in the southeast, Kisoro district in the south, and DRC in the west. Kanungu covers 1 228.28 km2; its northern area is in the Rift Valley, characterized by undulating plains. The district's population is estimated at 231 600 (UBOS, 2008). Its administrative headquarters are in Kanungu town, about 450 km from Kampala. Agriculture provides the livelihoods of most Kanungu residents; major staple food crops are bananas, sweet and Irish potatoes, rice, sorghum, beans and millet. The district also produces cash crops, including tobacco and tea. Livestock farming is one of the main activities, including cattle farming, goat production and smallholder poultry production.

Jinja district

Jinja is in eastern Uganda, 87 km northeast of Kampala. It covers 722.7 km2 and has an estimated population of 451 000 (UBOS, 2008). It is bordered by the districts of Iganga to the east, Kamuli to the north, and Mukono to the west. Agriculture thrives on fertile soils, abundant water sources and reliable rainfall. Other industries are metal processing, leather

and paper processing, grain milling, sugar, organic fruit and coffee growing for export, and brewing for local sale. There is local and export fishing on Lake Victoria. The biggest local employer is the Kakira sugar works, which runs on sugar alcohol, as there are frequent power cuts in Jinja's electricity supply.

Jinja contains 11 sub-counties. It is relatively flat, with high ridges, isolated hills and undulating lowlands. The hills are linear, with convex slopes of between 2 and 8 percent; valleys are almost flat, with slopes of less than 2 percent. The lowest point, at 1 200m above sea level, is in the south along Lake Victoria, and the highest point, at 1 500m above sea level, is in the north.

Tororo District

Formerly known as Bukedi, Tororo district already existed at independence in 1962. It borders Pallisa district in the north, Mbale district in the northeast, Iganga district in the west, Bugiri district in the south, and Kenya in the east. Tororo covers 1 849.3 km2 and has an estimated population of 440 000 (UBOS, 2008).

The district has diverse languages, including Japadhola, Lusamia-Lugwe, Ateso, Lugwere and Lunyoli. Agriculture focuses on food crops such as millet, cassava, cowpeas, potatoes, beans, simsim and sunflower. The livestock sector includes cattle, goats and smallholder poultry production.

Sampling of households

A total of 526 households were selected using a multi-stage sampling strategy from the five districts: 101 households from Jinja, 96 from Tororo, 116 from Lira, 103 from Kanungu, and 110 from Arua. The primary sampling units were sub-counties, secondary sampling units were parishes, and tertiary sampling units were villages, where households were randomly selected. Lists of households in urban centres and rural areas were provided by local community leaders, and households randomly selected from these lists were surveyed using questionnaires (Annex 6).

Data collection

The survey was conducted between September and October 2008.

Quantitative data

Quantitative data were collected by a trained interviewer using structured questionnaires (Annex 2). The data collected included household information, poultry species, flock size and composition, poultry management system, type of housing and feeding, sources of feed and water, extent to which housing is shared with other species, and main sources of poultry. The questionnaires also captured poultry disease prevention measures, poultry disease prevalence and causes, poultry vaccination programmes and their effectiveness, general poultry disease management and strategies for sustainable disease control, and extension service delivery.

Qualitative data

Qualitative data were collected through focus group discussions (FGDs) using PRA methods that included community systems analysis, a solution matrix, gender analysis, poultry disease risk factor analysis, a poultry marketing and disease risk factor matrix, ranking of the relative burdens of diseases, and discussions. Key informant interviews (KIIs) with selected officials were also held (Annex 3).

Focus group discussions

Discussion groups were composed of smallholder poultry producers, both women and men, drawn from two sub-counties from each of the five districts selected. Each group had six to 12 poultry farmer participants. In most sub-counties, two discussions were held, one for women and one for men. However, in both the Kanungu sub-counties, one sub-county in Lira and one in Arua, it was not possible to mobilize separate groups of men and women, so discussions were held with mixed groups. A total of 16 FGDs were held; the poultry farmers who participated were not included in the household questionnaire survey, which was carried out in each community the day before the group discussions (Annex 4).

Key informant interviews

KIIs were held with the district administrative personnel and district technical teams involved in poultry production and health services. The technical teams included district production officers, district veterinary officers (DVO), district National Agricultural Advisory Services (NAADS) coordinators and chairpersons of sub-county farmers' associations. Administrative personnel included chief administrative officers, assistant chief administrative officers in charge of production, and chairpersons of district farmers' associations. They were selected because of their roles and their knowledge about the resources allocated to the poultry industry. A total of 15 KIIs were conducted (Annex 5).

Data analysis

Quantitative data were entered in Microsoft Office Excel program. They were cleaned and analysed using Statistical Analysis Software (SAS) and STATA statistical packages. Descriptive analysis using tabulation and graphical approaches, and correlation and contingency table analysis were also carried out, to assess associations among the variables.

Qualitative data were coded and grouped according to study themes. Labels were developed and all the data with the same code were listed together under the respective label. Analysis was conducted using a master sheet following the study's main themes. Key concepts per theme were synthesized, the numbers of respondents reporting each concept were noted, and majority responses were identified. Deductions were made from the synthesized data, and verbatim key quotations from participants and respondents were incorporated to enrich the analysis and subsequent discussions.

Results and discussion

POULTRY PRODUCERS AND PRODUCTION SYSTEMS

Characteristics of producers

Table 1 lists some of the characteristics of the households involved in the study. Household heads were predominantly male (81.7 percent). Low literacy levels can be seen among smallholder poultry producers; the majority of household heads were educated only to primary level (56.8 percent), and the proportion with no education at all ranged from 1.5 percent in Jinja, to 34.6 percent in Tororo. Twenty three percent of respondents had secondary education, and about 6 percent had tertiary.

Table 1 Characteristics of households and respondents

Variable	Frequency	Percentage
Sex of household head		
Female	94	18.3
Male	421	81.7
Education level of household head		
None	73	14.2
Primary	292	56.8
Secondary	120	23.3
Tertiary	29	5.6
Relationship of respondent to household head		
Head	166	47.4
Wife	137	39.1
Child	38	10.9
Brother	3	0.9
Other	3	0.9
Aunt	2	0.6
Grandmother	1	0.3
Gender of respondent		
Female	227	49.3
Male	233	50.7

Poultry management in the household

Study results revealed that smallholder poultry producers in Uganda still keep their chickens under the free-range system (93.9 percent of respondents), with only 3.9 percent using the semi-intensive system. Most farmers did not isolate their poultry (90.2 percent), and left it to intermingle freely with other poultry in the neighbourhood (93.2 percent).

Table 2 shows that the main types of housing for poultry were households' kitchens (for 35.5 percent of respondents), chicken houses (28.9 percent), main houses (16.1 percent), and trees (4.2 percent). Chickens were housed only at night in 89.5 percent of households. There were no restrictions on entry to poultry houses in 89 percent of households. Almost 40 percent of households housed their chickens with other poultry, animals and/or humans. In Arua district, some poultry houses are built very close to the household's dwelling, to avoid the theft of birds.

Table 2 Types of housing for poultry

	No. of households	Percentage
Kitchen	189	35.5
Chicken house	154	28.9
Main house	85	16.1
Trees	22	4.2
Kitchen and trees	21	4.0
Kitchen and chicken house	11	2.1
Chicken house and trees	6	1.1
Other	5	0.9
Main house and trees	3	0.6
Kitchen and main house	2	0.4
Kitchen, chicken house and trees	1	0.2

FGDs revealed that poultry was mainly cared for by women in all districts, principally because poultry management costs are relatively low. Decisions about the sale of poultry were usually made by men, although some flexibility was observed in a sub-county in Arua, where some men decided with women but did not allow women to sell without informing them. Most of the money from sales of poultry is controlled by men.

Poultry management activities such as feeding and watering, treatment with herbs and cleaning poultry houses are mainly carried out by women and children. Men are mostly responsible for vaccination, treatment with drugs, building poultry houses and marketing poultry. However, in Kanungu district, women did most of the poultry marketing. This was unique.

Photo 1 Women poultry farmers discussing gender issues in poultry keeping, Lira district

The study revealed that 98 percent of respondents provided supplementary poultry feeding during the harvesting season. Supplementary feeds were mainly whole grains such as maize, simsim and millet, and rice in Kanungu district. In addition, mill by-products were used for supplementation with maize bran, sometimes mixed with silver fish and cotton seed cake. Kitchen wastes, home-mixed rations and commercial feeds were also used for supplementation, especially in urban centres. The main sources of water were boreholes (49.3 percent of respondents) and wells (35.5 percent).

Importance of livestock production in the study districts

From KIIs and FGDs, it emerged that livestock is a source of income for many households, and also a source of food, fertilizers and pride; poultry also fulfils cultural functions. Cultural values include paying chickens (or goats or cows) to the bride's family prior to marriage, and using them for funeral ceremonies, when a lot of livestock is normally slaughtered. Livestock production has created jobs, and provides overall security in households. All these values were evident in all the study districts.

Changing demand for livestock services

Key informants reported a recent increase in demand for the provision of services for improved livestock breeds. People are changing from traditional to improved systems of rearing. In the past, few poultry farmers kept exotic poultry, but now more are taking up improved breeds. Others are increasing the numbers of local poultry they keep, from two or three to 30. The trend is similar for other animals such as cattle. Farmers are beginning to look at livestock as a business, and this change in attitude has engendered a change in the demand for services. Growing demand has been observed for livestock treatments, advice on housing, feeding and vaccination, control of NCD in poultry, and training. These changes have been particularly evident since the introduction of NAADS.

> "We need to plan more on sensitizations and trainings which farmers demand a lot. Farmers also want to visit other farmers and learn from them" (key informant, Kanungu).

Despite the increased demand, all the key informants emphasized that traditional mentalities linger on. It was also reported that both the extension and clinical animal services have sometimes tended to be theoretical rather than real. Under NAADS, people are contracted to train farmers, but soon leave, discouraged by farmers' infrequent attendance at training sessions. For the clinical aspect, farmers usually first try to treat their livestock themselves, and consult veterinary staff only when these methods fail. Few farmers seek clinical services, because they are too costly for the majority.

The role of vaccination in controlling poultry diseases

Vaccination of poultry

The study found that only 34.7 percent of 496 households reported having vaccinated their birds (Table 3). Only 28.2 percent of households vaccinated against NCD.

Table 3 Vaccinations of poultry

Variable	Frequency	Percentage
Poultry vaccination		
Yes	172	34.7
No	324	65.3
Vaccination against NCD		
Yes	126	28.2
No	321	71.8
Vaccination by		
Government	82	49.7
NGO	5	3.0
Neighbour	28	17.0
Family member	44	26.7
Government and family member	1	0.6
Neighbour and family member	5	3.0
Supplier of vaccine		
Government	97	61.8
NGO	3	1.9
Private sector	56	35.7
Reliability and accessibility of vaccine		
Very easy	30	19.6
Easy	58	37.9
Difficult	59	38.6
Unreliable	6	3.9

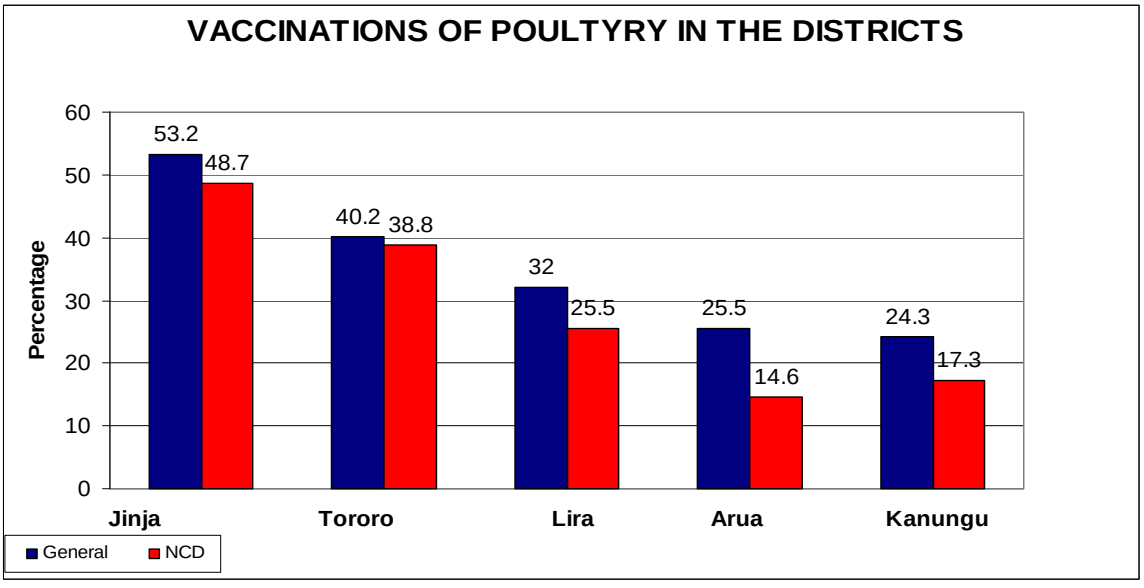
Figure 2 shows vaccination coverage in the study districts. Jinja had the highest coverage (reported by 53 percent of respondents) and Kanungu the lowest (24 percent). Jinja also had the highest coverage of NCD vaccination, and Arua the lowest. The general trend for vaccinations across study districts was statistically significant. The same is true of NCD vaccination. About 78 percent of the vaccinations reported by respondents were against NCD. Other vaccinations were against gumboro, fowl typhoid and fowl pox. Among those who vaccinated, about 62 percent felt that vaccination against NCD is effective.

The main sources of vaccines were the government (for 62 percent of respondents) and the private sector (36 percent); civil societies such as NGOs accounted for only 2 percent. District veterinary offices and veterinary drug shops in towns and trading centres were the main avenues of supply. In Kisoko sub-county, Tororo, focus groups mentioned that the district veterinary office supplies farmers with poultry vaccines every Saturday. Farmers arrive with flasks to collect the vaccine, and are instructed on how to administer it. They pay approximately USh 100 for three birds, and are advised to administer the vaccine within no more than two hours. This strategy is expected to be expanded to other sub-counties with the introduction of rural electrification, which will allow the storage of vaccines at sub-county headquarters.

Photo 2 A beneficiary of the Saturday vaccinations feeding his poultry, Tororo district

In all the study districts, most vaccinations were carried out by government (49.7 percent of respondents). Others involved in vaccinating poultry were family members (26.7 percent), neighbours (17.0 percent) and NGOs (3 percent).

Figure 2 Vaccinations in the five study districts



According to FGDs, the majority of households do not take the initiative in vaccinating their chickens, and use mainly herbs. FGDs revealed that there is extensive ignorance about the difference between treating poultry with drugs and vaccination. Most FGDs could not tell which diseases their poultry were vaccinated against.

Sub-counties that are distant from the district centres were particularly likely to report that they had never heard that poultry could be vaccinated. Vaccination campaigns do not reach them. Extension workers seem more interested in helping those with large poultry farms. Apart from the vaccination arrangements reported in Tororo and Lira, the communities, NGOs and districts have done very little or nothing to improve poultry vaccination.

Participants' experience of vaccination programmes

When asked about the accessibility and reliability of vaccines, about 58 percent of respondents reported that they were easily accessible and reliable (Table 4).

Table 4 Accessibility and reliability of vaccines

Very easy	19.6
Easy	37.9
Hard	38.6
Not reliable	3.9

During FGDs, many participants complained about losing poultry soon after vaccination; this has greatly discouraged farmers from embracing the exercise.

"I vaccinated the birds which were already sick and 30 of them died. I had bought the vaccine from a veterinary shop in Jinja town". "I gave the old chicken and chicks a drug I had bought from a veterinary shop. The old chicken recovered but all the chicks died". (FGD, Jinja) "Last year in June we vaccinated but all our poultry died" (FGD, Arua).

"My grandfather would first keep the vaccine until the next time the vaccine is brought and then releases the previous"
(H. Tororo).

Some poultry keepers believed that whether they vaccinated or not, the birds would die. Some farmers in Tororo believed that poultry that has been vaccinated does not taste good, and others felt there was no point in vaccinating – they used herbs. Other farmers reported that even when poultry dies, they do not lose much, and instead get meat and soup from the dead birds.

Other farmers acknowledged that those who follow proper vaccination procedures rarely lose their poultry. These procedures included vaccinating when poultry is not sick; vaccinating within two hours of receiving the vaccine; and attending training sessions.

Poultry keepers were dissatisfied with district veterinary personnel, who call farmers for vaccination only when there is an epidemic. In Arua, there were complaints that vaccinations took place during the rainy season, but disease outbreaks are more common in the dry season.

Overall, it was observed that the few farmers who had vaccinated regularly through the private sector registered increased poultry production, while the majority, who waited for epidemics before vaccinating, had lost many birds.

A farmer in a village in Jinja district, reported that she had vaccinated her own poultry and sold the surplus vaccine to neighbours for a small fee.

In the Adekwokok sub-county, Lira district, FGDs reported an arrangement in which the poultry farmers in a village contributed money for the vaccine, gathered their poultry in one household and sent someone to buy the vaccine, which was then administered to the birds. In another village in the same sub-county, farmers contributed money and sent someone to buy the vaccine, which was administered to birds at individual households. In both villages, poultry belonging to the few households that could not raise any money was also vaccinated, because if it became diseased, all the poultry in the village would be affected.

The vaccinations were reported to take place every three months. However, in Ogur sub-county in the same district, farmers reported they had never heard about poultry vaccinations, and had never treated poultry with drugs from shops.

Farmers in Jinja district were disgruntled that vaccinations are provided only to farmers' groups and farmers with large flocks, usually of at least 100 birds. These same farmers also receive training on poultry feeding and disease control and prevention. A similar situation was found in the other districts. Veterinary offices in Lira, Arua and Kanungu districts were reported to have carried out mass vaccinations only once in the previous year or two, when there were disease outbreaks. Jinja registered the highest vaccination coverage of the five districts.

NAADS does not provide direct poultry health services in any of the districts; instead, it provides training on poultry disease control and prevention, but not all the farmers reported having benefited from this training, which takes place at centres once a month. Some sub-counties are distant from NAADS services, so few farmers benefit from them, and those who do are usually members of farmers' groups or have large poultry farms, of between 500 and 3 000 birds.

The NGO Environmental Alert, in Tororo district, was reported to have once provided treatment for typhoid and coccidiosis in poultry, but other NGOs limit their activities to supplying poultry and providing training services to farmers.

Photo 3 Poultry farmers who do not belong to a farmers' group and have not benefited from NAADS, Arua district

Key informants' experiences of veterinary and vaccination services

Key informants confirmed that NAADS provides advisory services on disease control in all districts, but vaccinates only when it is introducing new stock into a community. Some informants pointed out that this gap in poultry health management should be filled. NAADS should provide poultry health services because diseases remain a leading constraint to poultry production.

Veterinary offices supply vaccines for individuals and during mass vaccinations. Mass vaccinations are scheduled by local governments, especially when there is an outbreak of NCD.

Constraints to vaccinations

Participants and respondents perceived that the constraints to vaccination were inaccessible or unavailable vaccines, high costs of vaccination, unreliable supply, lack of extension staff or qualified personnel to provide services, lack of sensitization, low literacy levels among households, poverty, deaths of birds after vaccinations, corruption, use of expired vaccines, free-range management systems, and a poor cold chain system.

All 16 FGDs reported poultry deaths after either drugs or vaccines had been administered. This has caused farmers to doubt the effectiveness of vaccines, and led the majority to treat diseases with herbs. Reports of farmers administering over- or underdoses were attributed to the farmers' failure to attend training.

"The situation is like having a medical officer in a clinic without a nurse" (key informat, Jinja).

In all districts, there were concerns about inadequate personnel for providing poultry production and health services. Key informants confirmed that the veterinary office is supposed to be responsible for the poultry health sector, but is understaffed.

In all the districts, failure to maintain the cold chain was reported as a major constraint. This is exacerbated when farmers do not vaccinate immediately after receiving the vaccines. Farmers are supplied with already reconstituted vaccines, but then take hours to return to their farms, going to market, greeting friends, etc. on the way, and do not understand the importance of maintaining the cold chain. There is also a lot of wastage of vaccine because some farmers vaccinate more than the prescribed two drops into every bird.

Power shortages are another major problem in all districts. Key informants reported that in Tororo, sub-counties without electricity have secured paraffin refrigerators. The vaccine is stored in bulk at the district level, and sub-counties procure what they need for their programmes. Sub-counties have procured ice boxes, as the district does not have enough vaccine carriers and cannot provide vaccine carriers/flasks for every farmer. Farmers without vaccine carriers bring their own flasks and are given ice to keep the vaccine cold. They are advised that the vaccine is not supposed to last more than two hours.

Kanungu district used to rely on Kambuga referral hospital for storing vaccines, but the hospital restricted this because of space limitations and the inconvenience it caused. District staff were also concerned that the vaccines would loose their viability during transportation from the hospital to the communities. To guard against this, the veterinary department now removes vaccines from the hospital only for mass vaccinations, when only one or a few large batches are removed for transportation; this reduces the inconvenience for the hospital. Lira district used to stock its vaccines in the fridges used for human medicines, but stopped doing so for fear of medical personnel accidentally administering the poultry vaccine to humans. The district now has two fridges in the veterinary department for storing vaccines.

Lessons learned

Vaccination coverage is still very low and is constrained by a number of factors (described in the previous sections), which are similar in all five districts. Efforts are being made in the districts, but these are not yielding the expected outputs. However, the experiences gained and the lessons learned from these efforts can be built on.

Vaccination in the districts is supported by private veterinary practitioners, but these private services tend to be too expensive for all but the larger commercial poultry producers. Jinja is the only district to report more than 50 percent vaccination coverage. This high coverage can be attributed to a NCD vaccination project in the area, along with the prevalence

of semi-commercial, peri-urban poultry keeping, which is an incentive for providing health care, and better access to poultry health services.

Sustainable vaccination of village poultry against NCD should be a priority, and efforts should be made to improve NCD vaccinations, such as through public-private partnerships, with increased private-sector involvement in the supply of vaccine. Given the current limited workforce in veterinary departments, it will require a lot of time and resources to reach all the birds to be vaccinated. Costs will also depend on the numbers of poultry at each location, and the accessibility of farmers to veterinary personnel. A cost recovery programme should therefore be put in place, similar to the one in Lira, to make vaccination sustainable for farmers. Farmers are also unlikely to cooperate if, for example, vaccinated birds continue to die. Solar fridges could be used to protect vaccines and ensure their quality in remote areas, where it is difficult to maintain a cold chain.

Another solution would be to promote the use of thermostable vaccines, which do not need the cold chain system. These vaccines would be particularly useful in the situations of unstable power supply that characterize much of rural Uganda. Thermostable NCD vaccines are being tested in many areas, with promising results. These vaccines can be administered to poultry on certain feedstuffs, when necessary, and experience in many countries demonstrates that they can produce substantial immunity under village conditions. Recently developed thermostable vaccines should be adapted and adopted, including those that have shown to be effective such as strains V4 and 12 (Spradbrow, 1992; 1999), or the locally developed ND I-2, which has proved also effective in combined application to drinking-water for vaccinating chickens against both NCD and endoparasites in rural poultry management conditions (Illango et al., 2008; 2005).

So far, poultry disease control strategies have not been sustainable, because they have not been demand-driven. Very few smallholder farmers request training and take it seriously, even where outbreaks of NCD occur every year, with many birds dying. This could indicate that farmers do not see any cost-recovery benefits in vaccinating, and so do not see its importance. Farmers still regard the supply of drugs and vaccines as the veterinary department's responsibility, and believe that services should be provided free of charge. The switch to more demand-driven strategies therefore needs to be carefully planned, and should encompass changes of attitude at the community level, and district-based institutionalization of poultry production and health programmes. The scaling-up of community vaccination initiatives, such as those reported from Lira and Tororo, would protect poultry from disease.

Limiting the provision of vaccinations and treatment to poultry farmers who belong to farmers' groups or who farm on a larger scale, as reported in Jinja, is disastrous to disease control strategies, as smallholders remain potential sources of diseases. The strategy should therefore identify and address the factors that prevent farmers from joining groups, and provide special treatment and vaccination arrangements for those who own only a few birds. Experiences in Lira and Tororo districts (highlighted in previous sections) provide a model for this.

DISEASE CONTROL STRATEGIES

Poultry disease prevention measures

Results indicate that 52 percent of surveyed households applied some disease prevention measures, mainly cleaning (43.7 percent), vaccination (35.3 percent), quarantine (3 percent), and disinfection (0.8 percent). Poultry disease prevention measures were not statistically different among districts.

Poultry diseases

Diseases ranked highest as the main cause of poultry losses. Some 65.7 percent of households experienced high mortality (of more than 50 percent) in their flocks, mainly due to diseases and predators.

Diseases were reported to occur in more than 91 percent of households, with almost 31 percent reporting diseases in the last month. Most diseases affected all age groups (66.1 percent of respondents), followed by diseases affecting chicks only (25.6 percent). The most affected poultry species were chickens, ducks and turkey, and normally all age groups were affected (Table 5). All FGDs noted that ducks do not normally show signs of sickness, and high mortality is observed only among young ducks.

The most common disease mentioned was NCD. Others mentioned were fowl typhoid, coccidiosis, gumboro, fowl pox and ectoparasites. Very few respondents knew the names of specific diseases, so described a disease by its clinical symptoms. Respondents and FGD participants mentioned the common signs of diseases they had observed: diarrhoea (whitish, greenish or blood-stained), coughing, ruffled feathers, neck twisting, depression, rale, rattling, swelling of combs, swelling of eyes, nasal discharge, drooping feathers, and death.

Table 5 Poultry disease occurrence in households

Variable	Frequency	Percentage
Poultry diseases in household		
Yes	445	91.4
No	40	8.2
Diseases last seen in flock		
1 month ago	137	30.8
2 months ago	69	15.5
3–6 months ago	110	24.7
6 months to 1year ago	66	14.8
More than 1 year ago	69	15.5
Most affected age		
All	294	66.1
Chicks	114	25.6
Growers	47	10.6
Adults	31	7.0
Most affected species		
Chickens	400	89.9
Ducks	29	6.5
Turkeys	17	3.8
Guinea fowls	2	0.4
Pigeons	3	0.7
All	1	0.2

FGDs also confirmed that most treatment methods used for poultry were traditional, and the few farmers who bought drugs from veterinary shops were those who either lived close to towns or kept poultry in relatively large numbers. Only 10 percent of households had ever obtained supplies of drugs, mainly from government sources.

No clear indication emerged as to which was the more effective type of treatment: sometimes both drugs and herbs worked, and at other times one or both did not.

Photo 4 A participant showing some of the herbs used to treat poultry, Arua district

Effective and sustainable disease control strategies for changing demands in the poultry sector

The study revealed that 86 percent of farmers perceived that there are gaps in poultry health service delivery. This was confirmed by ranking, in which smallholder poultry producers listed the gaps they experienced, as shown in Table 6.

Table 6 Gaps in poultry health service delivery mentioned by smallholder poultry producers

Gap	Mentions (% of respondent farmers)
Too few extension service providers	45
High cost of poultry drugs, feeds and vaccines	43
Lack of sensitization/training and inadequate attention to poultry	22

Smallholder poultry farmers suggested practical measures for addressing these gaps, and expressed their opinions about how to establish an effective and sustainable strategy for poultry disease control in their communities. Among these recommendations was the need for both government and the private sector to recruit more veterinary extension service providers. It was also emphasized that training in various poultry issues would help farmers and alleviate the situation. Reductions in the costs of drugs, feeds and vaccines would be a significant contribution. Some respondents suggested that there is need for a well designed sustainable vaccination programme. Regarding health care for poultry compared with that for other livestock, 90 percent of respondents felt that poultry receives less attention than other

livestock. FGD participants reported that farmers themselves pay less attention to training in poultry than to training in other livestock.

The study revealed that challenges are constraining the achievement of an effective and sustainable poultry disease control strategy (Table 7), especially the limited number of extension service providers (20 percent), the inadequate availability of drugs and vaccines (16 percent), costs (13 percent), ignorance (10 percent), use of the free-range management system (8 percent),lack of cooperation among poultry farmers (7 percent), unavailable and ineffective vaccines (6 percent), poor cooperation between farmers and some veterinary officials (3 percent), and corruption (2 percent).

Table 7 Participants' perceived challenges to achieving a sustainable disease control strategy

Challenge	Frequency	Percentage
Few extension workers/animal health workers/vets/veterinary services	67	19.5
Inadequate availability of drugs	55	16.0
Costly/no finances	45	13.1
Ignorance	35	10.2
Free-range system	27	7.9
Lack of corporation among farmers	24	7.0
Vaccines not effective/not available	20	5.8
No government support/poor communication between veterinary officials and farmers	9	2.6
Corruption	7	2.0

Respondents' suggestions for how to design an effective and sustainable poultry disease control strategy for smallholder poultry production communities included continued sensitization/training, regular vaccination programmes, and the motivation of extension workers and veterinary services to ensure their availability and accessibility.

There is need for government intervention to provide small loans or credit schemes for small poultry producers. This would promote the design and construction of appropriate housing, better access to quality feeds, affordable basic poultry health care, and the purchase of improved breeds, thereby improving productivity sustainable.

District-level poultry production improvement programmes

The importance of poultry in the survey districts is linked to the speed with which poultry production realizes outcomes: it does not take long to start obtaining eggs. Poultry is easy to look after, especially local breeds, and easy to manage; marketing is not a problem, as traders come to households to purchase eggs and hens. Even the very poor can afford to keep poultry, which is generally a good source of livelihood. In light of this, key informants underlined the need for improved poultry production programmes in the districts. These programmes should be designed in ways that encourage farmers to attend training courses, as farmers' current demand for training was reported to be low.

The extension and animal husbandry workers recruited by districts tend to move on quickly to other jobs, because of low pay and poor service conditions. In Kanungu and Tororo districts, farmers who are interested in poultry production receive some additional support, but normally only very little. For example, under PMA, NAADS supplies farmers with day-old chicks and start-up feed, and has constructed poultry housing on demonstration farms, with wire mesh, drinkers and troughs. Farmers can request turkeys or local chickens, and are also provided with knowledge and skills in poultry management, for example, on treating birds, mixing feeds, keeping records, balancing profits and losses in poultry enterprises, and good hygiene. Under PMA, farmers in Tororo district have been supplied with cocks.

Service providers confirm what the FGDs reported. Private entrepreneurs and NGOs reported in Jinja included the Uganda National Farmers' Federation, which trains farmers on poultry rearing, and the Children's Christian Fund and Jinja Diocese Catholic Organization, which handle poultry production. Registered drug stores supply drugs to farmers, and the feed companies NOVITA and UGACHICK have suppliers in some towns, such as Tororo. In Kanungu, the community-based organization (CBO) Kazinga Work for Development, with support from Heifer International, has been raising and brooding day-old chicks for distribution to farmers in Kihiihi sub-county. Kinkizi diocese and Caritas have been supplying cocks to farmers to upgrade their birds. However, these services reach only the few farmers who have expressed interest in improved poultry production.

"We put announcements on radio and whether they listen to them is another issue. We call like 200 farmers and only about 50 or less turn up. Then the rest claim they have never had sensitizations". (Key informant, Jinja).

"Farmers still want free-range poultry, even when we advise them to have improved birds. They have also not come up to join poultry associations. "We still have a long way to go with poultry production". (Key informant, Kanungu).

" "Farmers still want free-range poultry, even when we advise them to have improved birds. They have also not come up to join poultry associations. We still have a long way to go with poultry production" (Key informant, Kanungu).

District-level programmes for the improvement of poultry health services

As already reported, NAADS provides advisory services on disease control in all the districts. However, NAADS vaccinates only when it is introducing new stock into a community, and some key informants pointed out that by limiting itself to advisory services only, NAADS leaves a gap in poultry health management. District veterinary offices sensitize farmers, and provide advisory services on housing, disease control and marketing. They also supply vaccines to individuals and during mass vaccinations. Special arrangements for vaccinations were reported in Tororo and Lira. A key informant in Tororo explained that farmers who rear poultry on a commercial scale can obtain services at any time, and the district veterinary office is always open for anybody seeking vaccines. However, very few farmers come to the offices – sometimes only two or three a month. These findings seem to contradict information gathered from FGDs, which reported a lack of vaccines in the veterinary department.

In Lira, poultry diseases have not been effectively controlled and are normally ignored, because poultry keepers have learned to live with them. They rarely seek treatment, and when they do, tend to do so when it is too late. Poultry is kept by smallholder farmers who are not well informed, and poultry's economic value is not stressed. The situation is similar in other districts, and should be resolved, especially given the public health consequences of poultry diseases such as HPAI.

In Tororo, mention was made of surveillance teams that monitor disease outbreaks at all levels. Before birds are supplied to farmers, the district verifies their sources and determines whether they are disease-free or not, after which it recommends the prices suppliers should charge for the birds. The birds' health is verified by the DVO or a specialist working on the DVO's behalf.

Personnel for poultry production and health services

Government extension workers, neighbours, parents and farmers' groups (Table 8) were the main sources of information on poultry production and health, but a large proportion of respondents have never received such information. The majority (74.1 percent) claim that they have no access to extension services (Table 9).

Table 8 Sources of information on poultry production and health

Source of information (n=354)	Frequency	Percentage
Nowhere	168	47.46
Extension worker/animal health worker/Gvt e.g. Radio	95	26.84
Neighbours	29	8.19
Inherited/parents	19	5.37
Farmer groups	13	3.67
NGO	7	1.98
Neighbours & inherited/parents	6	1.69
Extension worker/animal health worker/Gvt e.g. Radio & Neighbours	5	1.41
Seminars	4	1.13
Extension worker/animal health worker/Gvt e.g. Radio&NGO	2	0.56
Extension worker/animal health worker/Gvt e.g. Radio & Inherited/parents	1	0.28
Extension worker/animal health worker/Gvt e.g. Radio & farmer groups	1	0.28
NGO & Neighbours	1	0.28
NGO & Inherited/parents	1	0.28
NGO & Farmer groups	1	0.28
Extension worker/animal health worker/Gvt e.g. Radio & NGO & inherited/parents	1	0.28

In all districts, there were concerns about inadequate personnel to provide poultry production and health services. The veterinary offices responsible for the poultry health sector are understaffed, with too few staff members for the sub-counties. One staff member may be responsible for two or three sub-counties, which leads farmers to contact NAADS staff instead of the veterinary office for assistance. Production depends on good management; if poultry is poorly managed, its health will be affected and it will not be productive. The lack of district personnel for production services therefore creates a need for more poultry health personnel. This problem is attributed to the government policy of phasing out field assistants and reducing the numbers of animal husbandry officers.

Table 9 Access to and provision of extension services

Variable	Frequency	Percentage
Access to animal extension services (n = 482)		
Yes	125	25.9
No	357	74.1
Provision of animal health extension services (n = 128)		
Government	93	72.7
Private	12	9.4
NGO	9	7.0
Neighbours and family	8	6.3
Government and private	3	2.3
Government and NGO	1	0.8
Government and neighbours/family	1	0.8
NGO and private	1	0.8

Jinja district reported a different arrangement in which veterinary personnel go to

parishes to sensitize farmers and ask them to identify people who could help them to treat their poultry. Local council chairpersons are usually identified, and receive practical training in how to use vaccines. Each chairperson is then responsible for about ten households. Six months after a vaccination campaign, veterinary staffs return to the parishes to evaluate the impact of the vaccines. This leads other farmers to start demanding the vaccine, or to buy it from drug shops, which have requested and obtained approval from the National Drug Authority. However, as already mentioned, few farmers benefit from these arrangements, as the veterinary department works only with farmers' groups, and not individual farmers, and most smallholders are not members of groups.

NAADS has enough staff in the districts, and trains about three community-based facilitators to assist farmers in each parish. However, NAADS operates in only a few sub-counties in each district, and its operations depend on what farmers select. Poultry keeping is a selected topic in some areas, while other areas select goat or cattle keeping or crop farming.

Budgetary allocations and constraints for the poultry sector

Key informants in all districts reported that budgetary allocations for the poultry sector are very limited. When funds are sent to the district, the bulk go to the sub-counties, and the remaining 35 percent or so is divided among the different sections of the Department of Production.1

The poultry sector is funded through the Department of Production, not specifically through the veterinary section. Budget allocations for poultry have to fund drugs and vaccines, and sometimes the budget allocated may differ from that originally planned for. PMA, the Poverty Alleviation Fund (PAF) and the Local Government Development Programme (LGDP) have been the main funders. (See Annex 7 for examples of budgetary allocations for livestock.)

The biggest constraint is that there is never enough money for the poultry sector. As a result, farmers' birds die because there is not enough vaccine and staff lack the fridges for keeping it. In Tororo, as already described, the district's Saturday vaccination initiative asked farmers to pay a small fee for vaccines, to help improve the sustainability of vaccination programmes in the face of very limited public funding. This has proved successful.

The government sometimes issues directives for districts to use all the money allocated to buy seeds, especially during famines. Budgets may also be cut as a result of other government programmes, such as occurred with the Commonwealth Heads of Government Meeting, when a lot of budget items were cut. A major constraint is that districts depend on donor funding, which may not meet farmers' demands, especially for vaccines and drugs. In addition, funds allocated to sub-counties are supposed to be spent on the priorities decided by the people, making it difficult to obtain budgets for livestock as most people's priorities are health and education. In Kanungu, for example, poultry is not a priority for farmers, whose main interest is cattle, followed by goats and then chickens.

"When we started with the LGDP programme, we had contracted advisors. We would put aspects of disease control in the budget, poultry inclusive, and they would tell us that control of diseases in poultry through vaccination was not an investment. They would instead go for infrastructure and all other diseases in animals were not an investment" (key informant, Lira).

[1] Departments of Production at the district level comprise sections for veterinary, agriculture, fisheries and entomology.

Credit services available to smallholder poultry production systems

Tororo, Kanungu and Lira districts described a NAADS revolving fund that gives credit to farmers, including for poultry activities. A Savings and Credit Cooperative Services (SACCOS) scheme provides farmers in Kanungu district with access to loans for their poultry projects. The grace period is three months. Other farmers have their own credit and savings groups, where they deposit money as savings, disbursing it to members as required.

Effectiveness and sustainability of current strategies for disease control

The survey findings indicate that diseases are rampant in poultry populations in Uganda and that there is an urgent need to develop sustainable control strategies as a contribution to poverty alleviation, and in preparation for a possible outbreak of HPAI. Poultry producers describe diseases by symptoms, and there is a need for proper diagnosis by trained personnel supported by diagnostic services. Unfortunately these are lacking in most parts of Uganda.

Farmers are willing to do everything possible to treat their poultry, and there was no mention of poultry being left to die without any attempts to treat it. Herbal medicine is cheap, accessible and often effective, so it is used extensively. Strategies for disease control should therefore focus on three factors: affordability, accessibility and efficacy of the drugs and vaccines. Increased use of drugs and vaccines does not mean that farmers will discard their traditional treatments completely, but they should be encouraged to understand the important role that vaccination, in particular, plays in controlling most common poultry diseases. In addition, the roles of men, women and children in the vaccination and treatment of poultry with drugs and herbs, the disinfecting of poultry houses, and the marketing of poultry should be identified and promoted. This could be achieved through the training of smallholder poultry keepers to help them understand and appreciate their responsibilities to seek health care for their poultry and to keep their poultry houses free from diseases using cheap, local methods. Farmers will then become increasingly involved in activities aimed at improving poultry production and disease control.

The current limited public support to the poultry sector needs to be improved. Findings from FGDs and KIIs revealed that farmers are sensitized about HPAI only when there is a rumour of an outbreak, such as the one in the Sudan, and vaccinations are carried out only when there is an epidemic. This situation is risky, as diseases could easily run out of control. Sensitization about the need for disease prevention should be continuous, and could be channelled through other fora, such as awareness campaigns for other animal diseases or general agricultural training for farmers. Findings also show that farmers' knowledge about HPAI seems very limited, as they continue to engage in risky practices such as sleeping with poultry in their family houses, and failing to report strange disease outbreaks.

Low levels of literacy are likely to affect the pace at which poultry management practices can be adapted to cope with emerging production and sustainability challenges. The predominance of the free-range production system implies that controlling the spread of disease will remain a major challenge for smallholder producers. If diseases are to be controlled and productivity increased, management systems must start to change, through a step-by-step approach leading to a semi-intensive system in which the movement of poultry is controlled and contacts among the birds of different households are minimized.

Disease risk management

Poultry disease risk factors

Sources of poultry

The study revealed that the main sources of poultry were markets (75 percent of respondents), gifts (16 percent) and hatcheries (9 percent). FGDs and KIIs mentioned other sources, such as private service providers and NGOs, although these provide poultry only to the members of farmers' groups and to large-scale poultry owners, who are a minority.

Tororo district registered a higher number of farmers receiving poultry from NGOs than the other districts. NGOs such as Plan International, Environmental Alert and Community-Based Rehabilitation (CBR) were reported to have supplied free poultry to farmers' groups, with each group receiving one cock. CBR also supplied poultry to the disabled.

In Lira district, commercial poultry farmers obtained their birds from private providers and NGOs, such as Caritas and Samaritan's Purse. In Kanungu district, a private provider, who was a Member of Parliament, distributed poultry (exotic cocks) to individual farmers in two sub-counties, but most of these birds died.

In all districts, NAADS and PMA extension workers supply poultry only to demonstration farms and farmers' group members. These farms are used for training farmers on poultry feeding and housing, and the control and prevention of disease.

Sharing of poultry housing

Table 10 shows that most local chickens kept under the smallholder production system were housed in families' kitchens (35.5 percent of respondents). Chickens were found to share housing with other poultry, animals and humans (Table 10).

Table 10 Chickens' sharing of housing

Variable	Frequency	Percentage
Share housing with other poultry		
Yes	187	39.8
No	283	60.2
Share housing with:		
Humans	126	72
Birds	20	11.4
Birds and humans	14	8.0
Other animals	10	5.7
Other animals and humans	3	1.7
Other animals, birds and humans	1	0.6
Birds and other animals	1	0.6

Some 72 percent of households shared their own housing with poultry. This represents a high hazard in the case of an HPAI outbreak, as it provides opportunities for the spread of zoonotic diseases, especially when there is no regular cleaning and disinfection. Efforts should be made to construct simple and affordable chicken houses, as these provide the opportunity to confine birds, especially while they are awaiting vaccinations or other treatment. Unfortunately, however, birds in poultry houses are also more exposed to theft, and houses increase the risk of disease transmittal from free-range scavenging birds.

Different poultry species hatched and kept together

The practice of giving guinea fowl and turkey eggs to chickens for hatching, and vice versa – as reported by FGDs in Tororo – has implications for poultry production and disease management, because all the species will share the same housing, and receive the same feeding and treatment practices. This promotes inter-species transmission of diseases, and complicates efforts to identify the pattern and trends of disease transmission. On the other hand, the practice also ensures that the different species live together harmoniously. The benefits and risks need to be explored further.

The mixing of poultry of different species and from different sources poses risks, and the survey also found no measures for restricting the mixing of poultry from different households or with wild birds. It was noticed that wild guinea fowls led domestic guinea fowls while scavenging, and the turkeys of farmers living near swamps usually mixed with wild birds. Some farmers had been sensitized about the risk of diseases from wild birds infecting poultry, but it is difficult to control both the wild birds and the scavenging chickens.

Marketing poultry

Markets are the main source of poultry in rural Uganda. The study revealed that 75 percent of poultry kept in households came from markets. Poultry markets in the study districts share many management features. FGDs revealed that poultry was generally sold at weekly or daily markets, most of which were rural and also sold other animals and commodities. Each sub-county has at least two or three markets, held in open spaces. Each market has designated places for sales of poultry and other livestock. Markets are cleaned at the end of each market day, but no disinfection is carried out.

Chickens and turkeys are the most frequently sold poultry products in these markets. Eggs are rarely sold – they are either raised at home, or bought from supermarkets, urban shops and trading centres.

Dressed chickens are not sold in markets; they are sold in supermarkets and are also roasted and sold from street stalls in major towns, especially in the evenings. Cooked chicken is served at the restaurants that operate on market days.

Poultry that is not sold is taken back home and brought back for the next market day. There is no monitoring of the birds brought to the markets, which makes it easy for farmers to sell sick birds, as revealed by FGD participants. These sick birds are then taken to either their buyers' homes or other markets for resale. Buyers come from neighbouring countries such as Kenya, the Sudan and DRC. In contrast, cattle are checked as they enter and leave most markets. Cattle sellers and buyers have to obtain clearance from the local authorities and the market authorities, respectively.

The only market carrying out disinfection was located in the suburbs of Lira town and engaged in the sale of chickens only. It is owned by a poultry vendors' association, which disinfects with a locally available insecticide (Doom) once a week. The costs are met by members of the association.

Photo 5 Poultry in a market owned by a poultry vendors' association, where weekly disinfection is carried out, Lira district

Birds from unknown origins, sick birds, and the mixing of different species in market places with no official inspection and control all represent major challenges to disease control.

The tools and equipment used for poultry

Farmers were unable to report on the health risks associated with cleaning poultry houses, failing to use protective wear, and allowing visitors to come into contact with birds. This demonstrates the farmers' lack of knowledge about disease risks in poultry production.

A cultural practice reported in Jinja district, where elderly women treat the knives they have used to cut chicken, proved to be an unintentional disease prevention practice. For cultural reasons, most of the elderly women in Jinja have not eaten chicken meat since childhood, and still perceive it as wrong to reuse a knife that has cut chicken without first treating it, by washing it thoroughly with soap and then burning it in fire to remove all traces of chicken. This practice contributes significantly to preventing the spread of poultry diseases, and should be encouraged for all the equipment used for poultry and other meat, at all stages of production, including dressing.

Consumption of wild birds

Wild birds are extensively consumed in the districts of Tororo and Lira, and had been eaten during the few days before the survey discussions. A few wild birds were consumed in Kanungu, particularly in Kihiihi sub-county, which is adjacent to DRC and a game reserve. There were no reports of wild bird consumption in Jinja, and women in Lira and Arua do not eat wild birds. Arua district revealed a unique practice of selling the roasted dry meat of wild birds in markets, particularly during the months of December to March, when there are large numbers of wild birds. There were no reported risks associated with eating wild birds, as long as they are handled properly. The cultural practices of roasting and cooking wild birds protect those who eat them from contracting diseases from the birds.

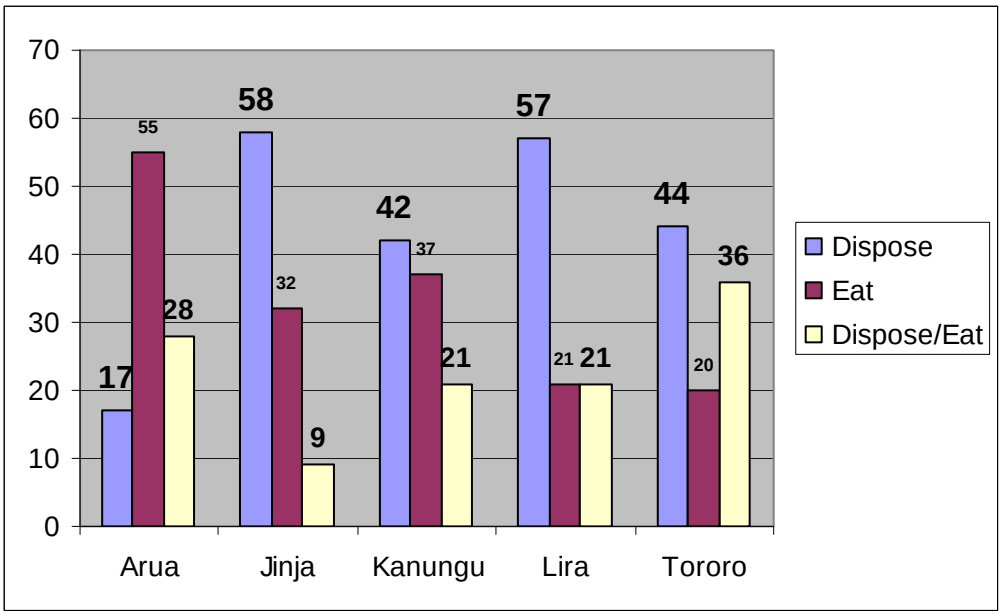
"The wild birds are trapped using a thorny branch, dressed, roasted and dried so that they become oily and appetizing, after which they are taken to the market". (FGD, Arua).

"Our conscience is clear and we do not see any problem in eating wild birds. It is very good source of food". (FGDs, Arua, Lira, Tororo).

Disposal of dead birds

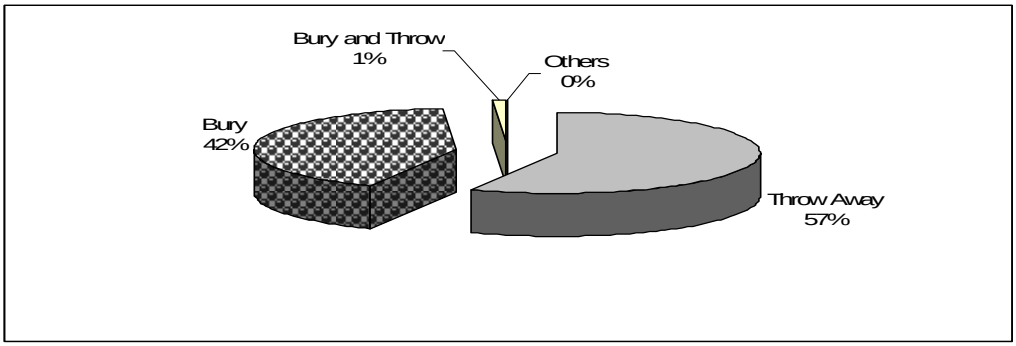
The survey revealed that most households disposed of dead birds (Figure 3), although a significant proportion ate them. The trend was similar in all districts except Arua, where about 55 percent of households ate dead birds. Depending on the cause of death and the condition of the carcass, some households sometimes ate and sometimes disposed of the dead birds.

Figure 3 Disposal of dead poultry across the districts



Methods of disposal were mainly throwing away (57 percent of respondents), burying (42 percent), or both (1 percent), depending on the circumstances (Figure 4).

Figure 4 Methods for disposing of dead birds



FGDs in Jinja and Lira revealed that poultry that had died from disease was buried, burned or thrown into latrines; in Tororo, Arua and Kanungu, it was eaten. In Lira, children and elderly people may eat diseased birds, while in Jinja heavy drinkers do. In Kanungu, survey

participants mentioned that families collected dead diseased chickens from the few families that did not eat them, and ate the birds to overcome hunger. Participants in Tororo stated that sometimes when a man had instructed his wife to throw the dead poultry away, she would instead prepare and share it with her children while he was out.

FGD participants clarified that turkeys that had died from disease were normally not eaten because their meat turns dark, slippery and bitter.

"Whatever goes in the stomach is not poisonous, but what goes out may be dangerous. The stomach has enough acids to kill the germs" (FGD Molo sub-county, Tororo district).

Dead birds are first roasted with salt and dried for up to a week; when cooking, the first soup is discarded and the bird is boiled again for longer than usual. This helps to kill bacteria and was reported by all six FGDs in Tororo and Arua districts. One FGD in Kihiihi sub-county, Kanugu reported that no special cooking treatment was given to such chickens. Another FGD reported that the birds were first roasted and then fried, as chicken treated in this way rarely has fat.

One FGD in Molo sub-county, Tororo, revealed that even chickens that had been bitten by a snake were eaten. One participant acknowledged having eaten a chicken after finding it dead next to a snake. Seven out of the eight FGDs that reported eating dead chickens stated that they were confident they would not get any disease. Participants in only one FGD in Arua acknowledged that some of the diseases they had suffered from could be the result of eating chickens that had died from disease.

Photo 6 Participants laugh about eating chickens that have been bitten by a snake, Tororo district

Table 11 Participants' perceptions of disease risk factors

Activity/practice	Answers	Associated disease and other risk factors as ranked by participants
1. Species of birds kept and where they are bought	- Chickens, ducks, pigeons, guinea fowls, turkeys - Mainly from markets, others from neighbours, some given by relatives	1. Chickens from markets have diseases that infect other poultry within a few days 2. Some unknowingly buy old birds that cannot produce 3. Others buy birds with vices such as eating/pecking eggs
2. Type of housing for poultry	- Chickens, guinea fowls and turkeys sleep together in family's kitchen, a poultry house, family's house, and/or trees. In Tororo and Lira, most sleep in trees - Chickens hatch guinea fowl and turkey eggs, and vice versa, so that the three species live harmoniously - Sometimes turkeys are aggressive and have a separate house - Ducks usually sleep on verandas or in separate houses - Pigeons sleep on roofs or small nests - In Tororo, unmarried men have cocks sleeping in their houses, to wake them up	1. Chickens sleeping in the family's house bring ectoparasites that attack humans 2. Irritating smell of droppings, even after cleaning, but no disease associated with it 3. Transmission of diseases among species. Ducks rarely manifest clinical signs of many diseases
3. Mixing of poultry from different households and with wild birds	- Poultry mix with neighbours' birds and sometimes with wild birds - Wild birds that mix with poultry: cattle egrets, wild guinea fowls, Enkwali (obufunzi), Ebikoona, crested cranes, quails and Marabou stocks in Tororo; compound birds, wild doves, and kanyamunyu in Arua - Chickens normally chase away the wild birds	1. Poultry reported diseased owing to mixing with neighbours' poultry 2. Wild birds are potential sources of diseases for domestic birds.
4. Human visitors coming into contact with birds	- People visit only large-scale poultry farming	1. Infections can easily be introduced to poultry
5. Use of protective wear in poultry management	- No protective wear used	1. Infections can easily be transmitted between humans and birds
6. Cleaning of poultry house, use of disinfectants, poultry management equipment	- Ash widely used to clean poultry houses in all districts, but its local use as a disinfectant is not known, making it an unintended disease prevention practice - Use of disinfectants - Only equipment used are knives, which are also used for peeling - Old women in Jinja district treat knives used on chicken by thoroughly washing with soap and then burning in fire (another unintended disease prevention practice)	1. Major risks in cleaning poultry houses reported only in Arua: fears of contracting poultry disease through the hands 2. Equipment can transport diseases if not regularly cleaned and disinfected
7. Disposal of dead birds	Refer to section on disposal of dead birds	1. If not disposed of in latrine or by burning, other poultry will feed on them and become diseased, and the environment will be contaminated
8. Slaughter and consumption of wild birds	- Wild birds widely consumed in all districts except Jinja	No risks reported

Note: Associated disease and other risk factors are listed according to their ranking by FGD participants, with 1 being the highest-ranked.

Implications of findings for disease risk management

The study confirms findings from earlier reports (Byarugaba, 2007; Kyomugisha, 2008) that poultry diseases are still a major constraint for smallholder poultry production and that poultry production practices are quite risky. Biosafety and biosecurity measures are either non-existent or below acceptable standards. Producers should be sensitized and made aware of the dangers associated with buying poultry from markets. Poultry buyers can be advised to quarantine new birds before introducing them into their flocks – a practice that was found to be done only with cattle.

Mechanisms for instituting and enforcing safety measures, precautions, rules and regulations to govern the operations of all markets should be put in place otherwise it will be difficult to control diseases in poultry. This should be coupled with sensitization of farmers and poultry keepers about best farming practices, including those for the purchase of breeding birds, and routine management practices such as the use of disinfectants. There are high risks of disease spreading among households as there is no inspection of the birds sold in markets, no disinfection and no checking of birds slaughtered for cooking at markets. Clear hygiene and safety guidelines for the management of live bird markets must therefore be put in place.

Appropriate and suitable housing for different poultry species should be constructed with locally available materials, to minimize the sharing of houses among bird populations. Regular cleaning and disinfection of poultry houses, tools and equipment should be emphasized, and poultry workers should be encouraged to use personal protection wear.

The eating of birds that have died of disease should be discouraged, and dead birds should be burned or buried appropriately.

A number of known and unknown diseases continue to ravage poultry populations in households. Apart from vaccination, disease prevention measures are difficult to implement in free-range systems. Although disease is the greatest constraint to poultry production, addressing disease problems alone will not help to improve the situation; attention must also be given to the other constraints.

Conclusions and recommendations

Conclusions

The characteristics of smallholder poultry producers and production systems in Uganda are similar to those reported in previous studies in other developing countries. Literacy levels are low, and poultry is kept mainly in free-range (scavenging) systems. Diseases remain the leading challenge to poultry production in all districts, but most diseases are not reported. Diseases are identified mainly in terms of their symptoms, and little confirmatory diagnosis is made, partly because diagnostic support is rarely available. The study found that farmers first attempt to treat their sick poultry, using traditional medicines or modern drugs, before seeking health services from animal health care workers. Poultry health care is inadequate, as veterinary services – where they are accessible – pay more attention to other livestock. The study confirmed that there are few extension and animal health service providers in Uganda. Enormous challenges are faced in achieving an effective and sustainable poultry disease control strategy for smallholder enterprises in Uganda.

Poultry production practices are largely risky, especially in the wake of emerging zoonotic diseases. The main risk factors for disease are poultry markets, inadequate preventive measures at the household level, the free-range management system, poultry's sharing of housing with humans, and improper disposal of dead chickens. Vaccination coverage is inadequate across all districts, although it is slightly better in Jinja than elsewhere, perhaps

owing to greater access to the city centre and the impact of a previous NCD vaccination project.

Experiences and lessons learned from this project can be used to improve disease control through vaccination.

Avenues for improving smallholder poultry production include establishing village and/or poultry producers' groups, training village vaccinators, promoting and supporting farmer field schools for a largely illiterate population, improving marketing infrastructure, providing access to credit, using both private and public animal health service providers, and ensuring the active involvement of national research and education institutions.

The key issues to emerge from this study are the deficiencies that exist at the household/community and institutional levels. At the household level, smallholder poultry production is largely informal with low to no inputs. Most poultry owners are comfortable with this situation, and only a minority seek advisory, extension and health services. At the institutional level, local (district) staffing levels are generally low, and poultry is rarely a priority, so scarce resources go to other activities (other livestock, or crop farming). Infrastructure is generally poor, with no cold chain and no reliable availability of vaccines/drugs.

The positive community initiatives noted included providing basic services, such as vaccination campaigns and organized marketing. These initiatives could be a starting point for education measures. In addition, although they sometimes engage in risky practices, most poultry owners have basic knowledge about disease prevention, through cleaning poultry houses and disposing of dead birds. Farmers' awareness that diseased poultry should be treated before it is eaten indicates the existence of good indigenous knowledge, which should not be ignored. However, it also highlights two diverging scenarios: 1) some farmers' readiness to avoid the human health risks associated with sick poultry could imply that that they will embrace strategies for preventing the spread of HPAI; but 2) other farmers' may be tempted to treat and eat HPAI-infected dead birds.

Recommendations

There are four main factors at the household/community level:

- the limited accessibility of vaccines and health care;
- attitudes and beliefs;
- ignorance; and
- poverty.

Institutional factors depend on existing guidelines, national budgets, the level of innovation, and the extent of collaboration with the private sector and NGOs.

Institutional factors include problems in the cold chain for transporting and storing vaccines, such as lacking or unreliable power supply, limited budgets for poultry vaccinations and health care, and limited human resources, especially extension staff.

In addition, there is a lack of innovative measures for cost recovery from vaccination use, and collaboration with the private sector and NGOs is limited. The sustainability of vaccination programmes can be improved by addressing these institutional and household-level factors.

Community beliefs and attitudes must also be tackled, so that institutional interventions can be implemented effectively. Membership of farmers' groups and poultry associations can significantly change farmers' attitudes and beliefs about poultry disease management. Improvements can best be achieved through educating schoolchildren and demonstrating better poultry management practices for farmers, at markets or in church gardens.

This will change farmers' attitudes, helping them to emerge from the chains of ignorance and poverty through participation in training to improve their poultry production and increase their use of and access to poultry health services. It will also provide an entry point for easy service delivery by district veterinary staff and other stakeholders.

Existing district guidelines for allocating funds to the poultry sector may need to be revisited, to ensure that farmers' increased interest in vaccinations is not frustrated by a lack of available vaccines. Close collaboration between districts and the private sector and NGOs would bring poultry health services closer to farmers, especially in areas where extension services are understaffed.

Innovative ways of recovering the costs of vaccinations are important in helping farmers and districts to feel a sense of ownership of programmes. Best practices in this area were observed in Tororo and Lira, and should be use as examples for other districts, offering great opportunities for sustainable poultry disease control and safer production.

Household-/community-based strategies

There is need to develop farmers' institutions through encouraging the formation of farmers' groups and poultry associations, empowering existing groups, and using community structures built on team work and cooperation, such as educating schoolchildren and providing public demonstrations of good poultry management practices.

Community-based mechanisms for reporting diseases need to be enforced in villages. Mechanisms should include recording all the poultry deaths to disease or following vaccination or drug use, to provide data for monitoring poultry diseases and the effectiveness of vaccinations and treatments. This could be achieved with support from extension workers, DVOs and community-based animal health workers. As there are so few extension workers, village volunteers could also help.

Farming communities need the support of appropriate legislation, policies, rules and regulations. These should provide measures and guidelines for reducing the disease risks associated with markets and poultry husbandry, such as providing poultry housing, cleaning poultry houses, using protective wear, and limiting human contacts with birds. Clear communication channels and an awareness raising programme using village, parish, sub-county and district councils should be put in place.

The different roles of men and women in poultry production should be recognized to give them a sense of responsibility for and ownership of their birds. This would encourage smallholder farmers to participate in activities for improving poultry production and disease control.

Poultry producers should be sensitized and educated on disease risk management and safer poultry production.

District-/institutional-based strategies

Vaccination is an important tool for poultry disease control. Strategies should be developed to address the identified constraints to vaccinations and to improve vaccination coverage. Vaccination campaigns against poultry disease should be an integral part of animal disease control activities, and poultry vaccination programmes should be guided by a national policy on vaccinations. One of the important constraints to vaccination is maintenance of the cold chain;

The use of thermostable vaccines should be promoted in situations of no or unstable power supply; solar and kerosene fridges would also protect commonly used vaccines that are not thermostable, and should be provided at the sub-county level. Vaccines should be packed in affordable quantities, of up to 500 doses rather than the current 1 000. Vaccine centres should be located centrally in each region, so vaccines can be properly stored and collected quickly, instead of being obtained from Kampala, which is distant from many upcountry

districts. The centres should be staffed by trained personnel from MAAIF, to ensure easy access and quality. A national policy on poultry vaccination should be enforced. Vaccination of birds against major diseases that affect livelihoods, such as NCD, should be treated as a public good and should receive greater financial support from public resources, complemented by the private sector. Vaccination against NCD should be a high priority and an integral part of production and health extension packages. This will provide a disease control network in case of an outbreak of HPAI.

A policy that enables easy access to credit for small-scale poultry producers should be put in place. This will stimulate increased productivity, as households and small-scale producers will be able to use credit to acquire feed resources, better health care, improved breeds, and better access to market opportunities. Such credit and micro-finance schemes can help transform poultry production from traditional to commercial management.

Given the emergence of new poultry diseases, such as HPAI, and their impacts on livelihoods (income and food security) and public health, there is need to sensitize poultry owners about the health risks associated with poultry production. Extension service provision for smallholders and rural areas that are difficult to reach should be reviewed. These resource-poor segments of the population produce more than 80 percent of Uganda's poultry, making an enormous contribution to the nation's economy and nutrition. They need a lot of support from public extension services, which currently do not provide adequate back-up to smallholder poultry producers and village chicken owners. Extension staff should be distributed according to the number of households, rather than the number of animals.

Live bird markets should be controlled and regulated through rules and regulations, such as for routine disinfection. There is need to formulate a structure for controlling the animals entering or leaving markets, and permits should be required for moving birds to and from large-scale production units.

More support to research on village poultry is needed, so that the information required for interventions is valid and reliable. Emphasis should be put on epidemiological studies of poultry diseases and challenges, using both conventional and participatory epidemiological tools. This will require strengthening of the linkages among national and international institutions and educational and research institutions.

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Annexes

Annex 1 Terms of Reference

Under the overall supervision of Prof. David Kabasa, the Dean, Faculty of Veterinary Medicine of Makerere University, and the direct supervision of Dr Odoch Terence and Dr Clovice Kankya, the Faculty of Veterinary Medicine will undertake the prescribed study.

The overall objective of this study is to provide comprehensive information to policy-makers about the current poultry disease control strategies in smallholder poultry production systems and local poultry populations in Uganda, for informed decision-making regarding future policies related to disease control

Specific objectives

To gain a better understanding of the importance of disease prevention in poultry, and of the role vaccination can play within HPAI control, by assessing the NCD control project in Jinja and assessing the vaccination campaigns in Lira, Tororo, Arua and Kanungu (vaccine type, delivery, involvement of private sector, etc.).

Identify strategies for disease control that are sustainable and effective, including for the changing demands on animal health services and service delivery (extension, supplies, drugs, vaccines, the roles of the private and public sectors, etc.) for the poultry sector, concentrating on smallholder farm households.

Identify key areas for change in disease risk management and improved safer production, as well as practical ways of achieving them.

Annex 2 Quantitative instrument – household questionnaire

Review of current poultry disease control strategies in smallholder poultry production systems and local poultry populations in Uganda

General information

The study intends to give a better understanding of what small-scale producers are prepared to invest, including vaccinations, in the health of their animals, and to assess the most suitable disease control tools for highly pathogenic avian influenza (HPAI) in smallholder poultry production systems. The study will give a better understanding of what poultry owners are doing to prevent and control diseases, and what they are looking for to ensure improved and safer poultry production.

The study will also assess the ongoing Newcastle disease (NCD) vaccination campaigns, and the past NCD control project in Jinja. Makerere University Kampala, Faculty of Veterinary Medicine will record this information, analyse it and prepare it for use.

The intention is therefore to achieve veterinary policies and strategies against HPAI that are sensitive to the needs of smallholder producers and biodiversity. We therefore request you to give as much information as possible using this questionnaire. The group from Makerere University is working with a local team from the district and the community. The information provided will be strictly confidential and for the purposes of the study only. Please feel free to ask any questions. Thank you very much.

QUESTIONNAIRE

Identification number:

A. Respondent household information:

A.1. Name of household head:

A.2. Tribe of household head:

A.3. Location of household: GPS position:

A.3.1. Village (LC 1): A.3.2. Parish:

A.3.3. Sub-county: A.3.4. District:

A.3.5 Region:

A.4. Sex of household head ☐ M ☐ F

A.5. Education level of household head:

(1) None (2) Primary (3) Secondary (4) Tertiary

A.6 Relationship of respondent to/within the household

A.7 Gender of respondent: (1) Male (2) Female

A.8 Age (in years)

A. 9 Education level of respondent

(1) None (2) Primary (3) Secondary (4) Tertiary

A.10 How many people live in this household?

A.11 Occupation of respondent:

B. Poultry management in the household (tick more than one choice where necessary)

B.1. Do you keep any domestic birds in this household? (1) Yes (2) No

B.2 What are the birds/poultry species kept in this household?

B.3. Species of poultry

Poultry species	Number chicks	Number growers	Number adults
Chickens			
Ducks			
Turkeys			
Guinea fowls			
Pigeons			
Others			

B.4. What is the main purpose for which each selected breed is kept?

Poultry species	Main purpose
Chickens	
Ducks	
Turkeys	
Guinea fowls	
Pigeons	
Others	

B.5 What is the main source of poultry in your household?

Poultry species	Gift	Market	Hatchery	Other
Chickens				
Ducks				
Turkeys				
Guinea fowls				
Pigeons				
Others				

B.6 What type of poultry management do you apply?

(1) Free-range (2) Semi-intensive (3) Intensive (4) Others (Specify)

B.7. If management is intensive or semi-intensive, who takes care of the poultry?

(1) Husband (2) Wife (3) Children (4) Relative (5) Employee

B.8. What is the type of housing for your poultry?

(1) Kitchen (2) Main house (3) Trees (4) Chicken house (5) Others (specify)

B.9. When is this poultry housing utilized?

(1) Both day and night

(2) Night only

B.10. Do your poultry share housing with other birds, animals or humans? (1) Yes (2) No

B.11. If yes, which species?

B.12. Are your poultry isolated from other birds (belonging to neighbours, other farmers)? (1) Yes (2) No

B.13. If yes, how are they isolated

B.14 Do your poultry intermingle freely with neighbours' poultry?

(1) Isolated (2) Mixed with neighbours' (3) Others (specify)

B.15. Do you have restrictions for entering the poultry house? (1) Yes (2) No

B.16. If yes, what type of restrictions?

B.17. Do you feed your birds? (1) Yes (2) No

B.18. If yes, what type of feeding?

(1) Supplementary feeding (2) Complete rations

B 19. Source of your feeds:

(1) Commercial feeds (2) Home mixed rations (3) Kitchen wastes

(4) Mill by-products (bran, etc.) (5) Whole grains (maize, millet, sorghum, etc.)

(6) Others (specify)

B 20. What do you do during scarcity of feed for your poultry?

B 21. Do you provide water to your birds? (1) Yes (2) No

B 22. If yes, what is your water source?

C. Poultry disease prevention measures

C.1.Do you apply measures to prevent diseases in your poultry? (1)Yes, (2) No

If yes, please specify (quarantine, cleaning, disinfection, vaccination)

C.2 If you use disinfectants in your poultry house, when do you disinfect your poultry house?

Please list the disinfectants that you use

Do you see any result from using the disinfectant?

(1) Yes (2) No

If yes, please specify.

C.3. Have the poultry in your area ever been vaccinated?

(1) Yes (2) No

If yes, who does the vaccination?

(1) Government (2) NGO (3) Neighbour (4) Family member

What is the source/supplier of the vaccines?

(1) Government (2) NGO (3) Private sector

How reliable and accessible is the vaccine?

What diseases have your poultry been vaccinated against?

How frequently are the birds vaccinated and against which diseases?

What is the cost of vaccination, per bird per year?

Disease – vaccine used	Cost (U Sh)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

C.4. What are the constraints/ problems related to vaccination of poultry in your area?

C.5. Are there any benefits acquired from the vaccination of poultry in your area (specify these and rank them)?

C.6. Is there or has ever been a Newcastle disease (NCD) vaccination programme in your area?

Yes (2) No

If yes, how effective is or was it?

What are/were the challenges and or lessons learned during the NCD vaccination?

Suggest ways of addressing these challenges

D. Poultry disease management and effective and sustainable disease control strategies

D.1. Do you have problems with poultry keeping? (1) Yes (2) No

If yes, list and rank them

D.2. Are you aware of poultry diseases in general?

(1) Yes (2) No

D.3. Do you have poultry diseases in your household or in this area?

(1) Yes (2) No

If yes,

What kind of disease have your poultry had?

When was disease last seen in your poultry flock?

(1) < a month ago (2) Two months ago (3) Three to six months ago

(4) Seven months to a year ago (5) Over a year ago

Which was the most affected age?

(1) Chicks (2) Growers/pullets (3) Adults (4) All age groups

Which species were most affected?

What signs were seen?

D.4. What do you do when birds get sick?

(1) Eat them (2) Sell them (3) Isolate them from healthy birds (4) Seek diagnosis/ treatment

D.5. If you treat your poultry,

Who does/did the treatment?

(1) Self (2) Neighbour (3) Veterinarian/animal health worker (4) Others (specify)

What type(s) of treatment is/was given to your poultry?

(1) Herbs (specify) (2) Drugs (specify) (3) Others (specify)

What is/was the outcome of this treatment?

(1) Recovered (2) Died (3) Still sick (4) Others (specify)

How much money did you spend per bird on this treatment (once off or over a period)?

USh

D.6. Have you ever obtained drugs supplies?

(1) Yes (2) No

If yes, what was the source of these supplies?

(1) Government (2) NGO (3) Private sector (4) Village or town

Drugs used in poultry	Sources	Personnel administering the drug	Route (means) of administration	Cost of drugs per bird per year	Constraints	Remarks

D.7. What is the extent of losses/deaths over one year?

(1) None (2) Moderate (less than 50 percent) (3) Severe (more than 50 percent)

D.8. What was the major cause of bird deaths/losses?

(1) Disease (2) Predators (3) Theft (4) Others (specify)

D.9. What do you do when birds die?

(1) Dispose off them (2) Eat them (3) Others (specify)

D.10. How do you dispose of dead/sick birds?

D.11. Do you notice any diseases that are associated with certain events?

(e.g., addition of new birds, change of feeding practices, season)

(1) Yes (2) No

If yes, please specify

E. Extension service delivery and animal health services

E.1. Where do you get information about poultry keeping?

EE.2. Do you have access to animal health extension services?

(1) Yes (2) No

If yes, who provides them?

(1) Government (2) NGO (3) Neighbours/family (4) Private

Who pays for this service?

(1) Government (2) NGO 3) Self

E.3. Whom do you talk/report to in case of a disease outbreak?

(1) Neighbour (2) Animal health worker/veterinarian (3) Traditional healer

(4) Others (specify) (5) No-one

E.4. What other forms of support do you obtain or have you obtained?

F. Other information

F.1. Are there gaps in poultry health care service delivery?

(1) Yes (2) No

If yes,

List and rank the gaps

What should be done in your area to fill these gaps?

F.2. How do you compare the health care given to poultry with that given to other livestock?

F.3. Do you have any suggestions on how to improve the animal health service?

F.4. In your opinion, what should be done to establish an effective and sustainable strategy for controlling poultry disease in your area?

F.5. What are the challenges or constraints associated with achieving an effective and sustainable poultry disease control strategy in your community?

F.6. Suggest practical ways of applying the strategy in your household or community

Annex 3: Qualitative instruments

Key informant interview guide category 1: district administrative personnel

Chief administrative officer, chairperson of district farmers' forum, chairperson of district farmers' association.

Introductory questions

1. How important is poultry production in the district?
2. What provisions are made for animal health care at the district level?
3. For poultry production, what are the main issues considered?

Theme 1 Poultry disease management and support to the poultry sector

1. What is the district's role in the prevention and control of poultry diseases?
2. Are any private sector bodies or NGOs involved in poultry disease prevention and control?
3. What plans does the district have for establishing an effective and sustainable strategy for poultry disease control?
4. What challenges has your district met in improving the poultry sector?
5. What do you think should be done to address these challenges?

Theme 2 Poultry industry in the district and its allocation of financial resources

1. Are there funded programme activities focusing on poultry sector development in your district? (Probe for their roles and services provided)
2. What is the involvement of the private sector and NGOs in the provision of poultry production and health services? (Probe for their roles and services provided)

3. How does your veterinary department rank the poultry sector's contribution to improving rural livelihoods in your district?
4. What are the sources of funding for all the animal industry in your district?
5. What direct financial allocations are made to the poultry sector in your district?
6. How are funds utilized to implement poultry development programmes?
7. What budgetary constraints do you face in funding poultry sector development programmes in your district? (Probe for poultry health and production programmes)
8. How have you overcome these constraints?
9. How is accountability handled during poultry programme implementation?

Theme 3 Poultry marketing

1. How are live poultry markets managed in the district? (Probe for cleaning and use of disinfectants)
2. How are markets for meat and eggs handled? ((Probe for cleaning and use of disinfectants)
3. What common species of poultry are sold in live bird markets? (Probe for what happens to poultry that is not sold and whether sick birds are marketed)

Theme 4 Allocation of human resources to the poultry sector

1. Is there adequate human resources capacity to implement poultry sector programmes activities in your district? Explain
2. Are the human resources adequate for handling the monitoring and evaluation of poultry development activities in the district?
3. What performance appraisal programmes do you have for the personnel involved in providing animal health sector services, particularly poultry development?

Key informant interview guide category 2 district technical team

District veterinary officer, production officer, NAADS coordinator, NGO forum field officer, chairperson of the sub-county farmers' association

Introductory question

1. Have there been any changes in the demand for services for livestock? (Probe for changes in demand for services for cows, goats and poultry)

Theme 1 Poultry production and health services

1. What programmes in your district/sub-county are aimed at improving poultry health and production? Explain
2. Are there adequate personnel to provide poultry health and production services in your area? Explain
3. What level of support does the district give to the poultry sector in your directorate/department?
4. What is the involvement of the private sector and NGOs in providing poultry production and health services? (Probe for services provided)
5. Are responsibilities in poultry production shared between the public and private sectors?
6. How do you compare the budgetary allocations for poultry health with those for other sectors at the department?
7. Are credit services or direct financial support provided to smallholder poultry production systems in your district? Explain
8. What are the constraints experienced in the funding of poultry health and production programmes in your department?

9. What are your suggestions for overcoming those constraints?

Theme 2 Poultry marketing

1. How are live poultry markets managed in the district? (Probe for cleaning and use of disinfectants)
2. How are markets for meat and eggs managed? ((Probe for cleaning and use of disinfectants)
3. What common species of poultry are sold in live bird markets? (Probe for what happens to poultry that is not sold and whether sick birds are marketed)

Theme 3 Poultry disease vaccinations and sustainability

1. What programme activities in your area focus on poultry disease prevention and control?
2. Is any vaccination of poultry carried out in your area? (Probe for diseases vaccinated against, who pays vaccination, presence of adequate trained personnel for vaccination, support given to farmers)
3. Has vaccination been beneficial to poultry farmers? Explain
4. What private sector bodies and NGOs participate in poultry vaccinations?
5. Do you have a budget for poultry vaccinations? (Probe for sources of funds for vaccines and vaccinations)
6. Can you comment on the release, utilization and accountability of your district's vaccination funds?
7. Are any limitations experienced in the power supply for sustaining the cold chain? (Probe for other limitations, e.g., insufficient facilities for vaccine storage and handling, other infrastructure required)
8. What cost are the cost implications of sustaining vaccinations of poultry? (Probe whether they depend on bird species, whether farmers can afford cost of vaccines)
9. What measures do you think the district should put in place to minimize failures and maximize success of vaccinations?
10. What contributions do you expect from farmers for disease prevention and control?
11. What are your suggestions for effective and sustainable strategies for controlling poultry diseases in your area? (Probe for strategies for disease risk management, workforce supply, storage, power supply, etc)

Focus group discussion (FGD) guide

Theme 1 Poultry production and health services

Methods: A community systems analysis, matrix ranking and a solution matrix were used.

- Participants drew a diagram showing linkages on their own poultry farms and in community poultry projects: sources of poultry, sources of drugs, sources of credit, sources of finance, and use of extension services.
- Constraints experienced were analysed through a matrix ranking.
- A solution matrix generated possible solutions to the problems

Key questions

1. Who provides poultry for your household/community projects? (Probe for extension workers, household heads, other household members and farmers' groups)
2. Who pays for the services? Explain.
3. Who provides poultry health services for your household/community poultry projects? (Probe for extension workers, household heads and farmers' groups)
4. Who pays for these services? Explain

5. Are any other services given to poultry farmers by farmers' groups? (Probe for financial services, credit services, health services)
6. What constraints are experienced in the provision of poultry production and health services?
7. What do you suggest can be done to overcome these constraints?

Theme 2 Poultry management

Methods: Gender analysis of ownership of, access to and control of resources, and activity profile.

- The gender analysis tool provided an in-depth analysis of the roles of women, men, girls and boys in poultry production in households and the community.
- The activity profile provided information on the various poultry activities performed by women, men, boys and girls, with a special focus on disease management.

Key questions

1. Who owns, has access to and controls poultry resources in households? (Probe for women. men, boys and girls)
2. Who performs the different activities in poultry management? (Probe for feeding, watering, treating with drugs, responsible for vaccinations, disposing of poultry dead from disease, decisions about eating poultry dead from disease, cleaning poultry housing, disinfecting poultry housing, marketing poultry)
3. What are the main sources of water for birds?
5. What are the feeding strategies for poultry (Probe for type of feeds, supplements, sources)
6. What challenges do you face in poultry management activities? (Probe for each activity above)
7. What challenges do you face in ownership of, access to and control of poultry resources?

Theme 3 Poultry disease risk factors

Methods: Poultry disease and risk factors matrix.

The matrix helped discussions of a range of risk factors associated with poultry disease, such as bird species, poultry housing, mixing of poultry, human contact with poultry, use and types of equipment for poultry management, use and types of disinfectant, cleaning of poultry houses, disposal of dead birds, and consumption of wild birds.

Key questions

1. What species of birds do you keep in your households? (Probe for source of each species, whether kept together or separately)
2. What types of housing are available for poultry? (Probe for sleeping in family house, poultry house, trees, nests or outside)
3. Does poultry from different households mix? (Probe for mixing with wild birds, and any related problems).
4. Do people from other households or visitors come into contact with your birds?
5. What protective wear is worn in the households?
6. How often are poultry houses cleaned, disinfectants used, and different types of equipment used in poultry management? (Probe for use of protective wear during cleaning, types of disinfectants used and types of equipment used)
7. How are dead birds disposed of?
8. Are wild birds routinely slaughtered and consumed?, If so which type?

Theme 4 Marketing poultry and disease risk factors

Method: Poultry marketing and disease risk factor matrix.

The matrix identified a range of disease risk factors associated with the marketing of poultry, such as distances to markets, number of live bird markets available, procedures for marketing poultry and poultry products, management of poultry markets, cleaning and disinfecting of poultry markets, and species of birds sold in markets.

Different markets were handled separately in the matrix, as market A, market B, market C, etc.

Key questions

1. What are the shortest and the longest distances from your households to the poultry market? (Probe for number of live bird markets in the area and how the birds are marketed)
2. How are live poultry markets managed? (Probe for cleaning and use of disinfectants)
3. How are markets for meat and eggs managed? ((Probe for cleaning and use of disinfectants)
4. What common species of poultry are sold in live bird markets? (Probe for what happens to poultry that is not sold and whether sick birds are marketed)

Theme 5 Poultry diseases and control

Method: Ranking of diseases and their relative burdens, rating diseases according to number of deaths.

The ranking of diseases helped identify the most and least common poultry diseases in the study areas. Participants were then asked how poultry diseases affect their production systems, and this provided the criterion for judging the relative burden of diseases. Participants were then asked to rank the impacts of each disease in order of importance, from very important (9) to only slightly important (1).

An indications of the relative burden of disease is useful for planning and prioritizing disease control strategies.

Key questions

1. What are the common diseases affecting your poultry? (Probe for clinical signs, species of birds commonly affected and why, breeds of birds affected, age groups commonly affected and why and whether disease affects one chicken or spreads to others)
2. Which months or seasons are the diseases commonly observed in poultry? (Probe for the last time chickens were seen with this disease)
3. What do you do to handle disease outbreaks in poultry? (Probe for traditional and contemporary methods of treatment)
4. What happens if the disease is not treated (Probe to find out whether some birds die, how dead birds are disposed off).
5. How would you rate the death rates per disease: very high, high, moderate, low, very low?
6. Do people in your community have knowledge about the control of avian Influenza?
7. What district, community, NGO or private initiatives are there for controlling disease in your area? (Probe for what each does)
8. What do you suggest can be done to control poultry diseases?

Theme 6 Poultry vaccinations

Method: Discussion.

Key questions

1. Is any vaccination of poultry carried out in this area? (Probe for diseases vaccinated against, names of vaccines)
2. Who pays for the vaccinations?
3. What district, community, NGO or private initiatives handle vaccinations in your area? (Probe for what each does)
4. Do you feel vaccinations have been of any help? Explain.
5. Are there any factors that affect the use of poultry vaccines in your district? (Probe for human resources, socio-cultural factors, economic factors, attitudes, etc.)
5. What measures can be put in place to improve vaccinations of poultry? (Probe for communication strategies, service delivery strategies/human resources, and advocacy strategies, etc.)

Annex 4 Sub-counties, Parishes and Villages covered During FGDs

District	Sub-counties	Parishes	Villages	No. of FGDs	No. of participants
Tororo (Eastern Region)	Kisoko	Kisoko, Gwaragara, Pepei	Koi, Morwa, Bendo, Dida, Lulowo, Kisoko central, Pepei, Alobai	1 with men 1 with women	7 men 8 women
	- Molo	Molo, Tuba, Kipangoli, Kidoko	Kamarinyang, Abwar, Karwok, Nyemyem A, Molu B, Abwar, Papakol West, Maga II, Karino Molo, Apuruket, Station, Akisim, Tuba	1 with men 1 with women	11 men 6 women
Jinja (Eastern Region)	- Walukuba	Masese	Buzaama	1 with women	8 women
	- Budondo	Buwagi	Ibungu LC 1	1 with women	10 women
	- Budondo	Buwagi	Buwagi Central	1 with men	10 men
	- Budondo	Buwagi	Namizzi West	1 with men	8 men
Lira (Northern Region)	Adekokwok	Adekokwok	Boke Agali, Ogengo	1 with women 1 with men	12 women 10 men
	- Ogur	Abara, Orit, Angolochomin	Lakamor, Widama, Abungengen, Baroji, Winkot, Amabiri	1 with men and women	4 women and 4 men
Arua (North-western Region)	- Vurra	Nyio	Ejupasi, Ariconi	1 with women 1 with men	10 women 10 men
	- Oluko	Wandi, Ombokoro, Nyio, Ongivu, Turou, Ambeko, Bunyu	Mbaraka, Eliava, Adravu, Ongivuwa-riku, Asawoto, Bunyu, Zikiva, Nyio, Pangawa, Awiraka, Central-Ambeko, Kumara	1 with men and women	4 men and 8 women
Kanungu (South-western Region)	Kihiihi	Nyanga, Nyakatunguru	Burambi, Nyakashozi, Bugongo	1 with men and women	6 men and 6 women
	Kambuga	Ruhandagazi, Nyarugunda, Nyarutoogo	Kayanga cell, Kashuri, Rweere	1 with men and women	4 men and 4 women
Total				16	150 participants

Annex 5 Key Informants interviewed per district

District	Categories of key informants interviewed	No. interviewed
Tororo	- District Production Officer (1) - Ass. CAO in charge of production (1) - Chairperson, District Farmers' Forum (1) - Chairperson, Sub-County Farmers' Association (1) - NAADS Coordinator, Kisoko Sub-County (1)	5
Jinja	- Ass. CAO in charge of production (1) - District Production Officer (1) - Chairperson District Farmers' Association (1)	3
Lira	- District Production Officer (1) - District NAADS Coordinator (1) - District Veterinary Officer (1)	3
Arua	- Coordinator, District Farmers' Association (1)	1
Kanungu	- District Veterinary Officer (1) - District Production Officer (1) - District NAADS Coordinator (1)	3
Total		15

Table 6 Households covered during quantitative interviews

District	Sub-county	Parish	Village	No. of households
Jinja	Budondo	Namizzi	Buyala C	15
			Namizzi W	13
	Butagaya	Nakakulwa	Lumuli	15
		Nawapanda	Buwala	12
			Bubugo C	15
	Walukuba	Danida	Danida	14
		Walukuba	Masese	17
Tororo	Kisoko	Kisoko	Olobai	6
		Gwaragwara	Kisoko C	6
			Bendo	3
			Rolowo	3
			Gwaragwara	5
			Abongongit	9
			Rutengo	4
			Awaya	3
		Tuba	Tuba C	11
			Agogonit	10
		Molo	Molo 1	20
			Moru A	16
Lira	Adekookwok	Bororboro	Te Obwolo	17
			Bar Opuu	21
		Akia	Amo Olel	20
			Okwor okwor	11
	Ogur	Orit	Nanga Abir	11
		Abala	Agweng	11
			Aringo Omele	25
Kanungu	Kihihi	Nyanga	Bukorwe	15
			Burambi	19
		Nyakatunguru	Bugongo	19
	Kambuga	Bugonzi	Ihembe	12
		Katete	Kakinga	14
			Kanyamisinga	24
Arua	Oluko	Yabiavoko	Okalia	14
			Turupa	11
	Adumo	Nyiovuza	Andruvu	15
			Elukoa	16
	Okollo	Ajibu	Oyibo	21
			Zabu	4
	Vurra	Nyiovuza	Ejupasi	11
			Esevu	18

Annex 7 Production Sector, Jinja: Veterinary Department Work plan and Budget: 2007/2008

Objective	Activities	Target	Budget for 1st quarter (U Sh)	Budget for 2nd quarter (U Sh)	Budget for 3rd quarter (U Sh)	Budget for 4th quarter (U Sh)	Total	Funding source
To increase milk production and hence household incomes	Promotion of dairy husbandry and supplementary feeding through training and demonstrations	5 workshops and demonstrationsfor 250 dairy farmers in 5 sub-counties	3 000 000				3 000 000	PAF
*To transfer skills in local poultry production and increase incomes	*Improvement of local bird production though training and demonstrations	5 workshops and demonstrationsfor 250 farmers in 5 sub-counties				2 423 000	2 423 000	PAF
To reduce cases of rabies in pets and human bites from rabid pets	Rabies control through sensitization, vaccinations and killing of stray pets in all sub-counties	1 000 pets vaccinated and 300 pet owners sensitized, 150 stray pets killed		4 000 000			4 000 000	PAF
To increase piggery production and productivity and hence improve household incomes	Piggery production improvement in Budondo, Buwenge, Buyego	4 training courses, 4 demonstration sites, 12 large white piglets distributed	5 000 000				5 000 000	PMA
To reduce production costs for feeding inputs in animal enterprises	Pastures, fodder trees, legumes, garden maintenance, distribution and fencing at Nakabango	3 acres (1.2 ha) of pasture, legumes			3 257 446		3 257 446	PMA
*To reduce NCD cases and transfer skills in local poultry production	*Vaccination of local poultry, deworming and setting up demonstration sites in Buyego sub-county	**20 000 to be vaccinated and dewormed; 1 demonstration site	2 500 000				2 500 000	LGDP
To transfer goat production skills	Improvement of local goat production and productivity through training, production of Boers cross goats and setting up a demonstration unit	1 training course, 50 farmers, 3 goats, 1 demonstration unit in Buyengo sub-county			2 000 000		2 000 000	LGDP