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Eliciting preferences for attributes of Newcastle disease vaccination programmes for village poultry in Ethiopia

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ABSTRACT

Newcastle disease (NCD) is an important disease of poultry, directly affecting the livelihoods of poor farmers across developing countries. Research has identified promising innovations in NCD vaccine development and field trials among village poultry have been promising. However, NCD vaccination is not currently part of village poultry extension programmes in many developing countries. Understanding the preferences for, and relative importance of, different attributes of potential vaccination programmes to prevent NCD will be crucial in designing acceptable and sustainable prevention programmes. This research employed the discrete choice experiment approach to elicit farmers' preference for attributes of NCD vaccination programmes for village poultry in rural Ethiopia. The choice experiment survey was conducted on 450 smallholder farmers. The relative importance of attributes of NCD vaccines to farmers was estimated using a random parameter logit regression model. The preferred NCD vaccine programme had greater bird-level protection (i.e. greater capacity to reduce mortality should NCD occur in a flock), was delivered by animal health development agents, and could be administered via drinking water. Results from simulations on changes in attribute levels revealed that bird-level protection capacity and delivery of vaccine by animal heath extension affect farmers' preferences more than other attributes. These findings suggest that it is important to ensure NCD vaccine programmes offer reasonable capacity to protect against mortality. It also suggests the need to understand farmers' preferred vaccine delivery mechanisms and route of vaccine administration for a wider acceptance of vaccine.

1. Introduction

Livelihoods in rural Ethiopia typically depend on a complex array of small on-farm and off-farm enterprises. By virtue of the requirement for low start-up capital and relatively undemanding management skill, poultry[1] production is the most widespread livestock enterprise in rural Ethiopia. Village poultry production has the potential to provide food and income and is an important component of food security for the rural poor. However, infectious and parasitic diseases affecting poultry among many other things, remain important constraints to poultry production, and to the realization of poultry's potential for food security in many developing countries.

Disease and poor management have been emphasised as the major limitations to chicken production (Henning et al., 2009). In particular, Newcastle disease (NCD) is considered as one of the most important poultry disease (FAO, 2014). In rural Ethiopia, NCD is widespread (Dessie and Ogle, 2001; Zeleke et al., 2005) and believed to cause high mortalities. Where successful, control of NCD through routine vaccination has greatly reduced the impact of this disease in village poultry (FAO, 2014). However, implementation of NCD vaccine programmes to village chickens in developing countries, particularly in sub-Sahara African countries, is limited. One of few examples of implementation of an effective NCD control programme in African countries is that of Mozambique, which, in combination with improved management strategies resulted in increased chicken stocks, improved households' food security and access to nutritious food and empowered women (Bagnol, 2001; Woolcock et al., 2004).

The potential benefits of village poultry to food security will remain unrealised whilst poultry die in vast numbers annually, from preventable diseases such as NCD. This is especially the case when village poultry producers remain disengaged from national animal health services (Alders, 2014). Hence, while introduction of improved genetic

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[1] Poultry production in Ethiopia almost solely involves chickens.

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material will play an important role in transforming the traditional village poultry production in Ethiopia (as well as in other developing countries), such gains may be greatly limited by disease like NCD. Therefore, access to efficient and acceptable poultry health services, incorporating effective preventive measures, become essential.

The challenges of Newcastle disease control in endemic areas are very different in village, compared to in the intensive, production systems. In the intensive poultry industry, prevention is achieved by repeated applications of suitable vaccines. Such control methods which are relatively expensive and require appropriate vaccine storage conditions are neither feasible nor affordable in rural areas (Ideris et al., 1990). Under village poultry settings, an effective NCD control programme must be applicable in the absence of a viable cold chain (Alders, 2014), and vaccine must be deliverable in small quantities (Bensink and Spradbrow, 1999).

Some existing poultry vaccines can be used under these less than optimal field conditions, and they offer the means for farmers to protect their flocks (McLeod and Rushton, 2007). Thermostable NCD vaccines, developed over the past few decades have been used effectively in village settings. Implementation of the heat tolerant V4 vaccine (Spradbrow et al., 1988) has provided promising results in some African countries (Alders and Spradbrow, 2001). The I-2 NCD vaccines, produced in freeze-dried form, maintain its activity for eight weeks when stored below 30 °C (Alders, 2003). Studies on the application of these vaccines, usually under trial conditions, in village poultry across developing countries have demonstrated that it is possible to effectively control NCD in these settings (Wambura et al., 2000; Copland and Alders, 2005; Msoffe et al., 2010). More recently Lal et al. (2014) reported the development of low-dose, fast-dissolving tablet vaccines, each containing up to 50 doses of vaccine, that could maintain virus stability for more than six months at 4 °C. This allows for compact and better packaging and hence it could provide a promising option to control NCD in village poultry across developing countries.

Despite the development of thermostable NCD vaccines for village poultry and the need to control NCD in village chickens, it has proved difficult to achieve a sustainable control programme. Implementation of a successful and sustainable NCD control programme should incorporate economic sustainability, based on the commercialisation of the vaccine and vaccination services, and delivery of effective extension materials including methodologies among others (Alders et al., 2010).

We contend that it is imperative for Ethiopia, a country where egg and chicken are predominantly supplied from village poultry, to have a well-designed policy for NCD control in rural areas. There exists, within Ethiopia, the capacity to produce millions of doses of NCD vaccines (Anebo et al., 2014) and NCD vaccines have routinely been provided to commercial poultry producers. However, currently there is no comprehensive policy to control NCD in village poultry. The sustainability of effective NCD vaccination programmes will depend on prevailing production systems, poultry keepers' preference for vaccine technology and alternative approach to deliver the vaccine. However, there is currently no information available regarding poultry keeper's preference for vaccine programmes. This study, therefore, aimed to evaluate farmers' preference for attributes of possible NCD vaccine programmes.

2. Materials and methods

2.1. Study area

This study was conducted in the Horro district of Central Western Ethiopia. Poultry is consumed during festive periods and has significant social importance in the community. Nonetheless, farmers in this area keep poultry primarily for sell of chicken and egg (Terfa, 2015). The district was, therefore, selected because of the high potential for poultry to contribute to the livelihoods of rural households in this region. Furthermore, previous work with farmers in the area has identified infectious disease, including NCD, as major impediments to poultry production (Dessie and Ogle, 2001). The mainstay of life in the district is rain-fed mixed crop-livestock farming system. The district receives average annual rainfall of 1685 mm (ranging from 1300 to 1800 mm) and annual temperature of 19 °C (ranging from 14 to 24 °C) (Desta et al., 2013). Major livestock species kept by farmers in this area include cattle, sheep, poultry, and goat, while the main crops grown include wheat, *teff*, maize, barley, and beans.

2.2. Discrete choice experiment designing and survey

Preferences for village poultry NCD vaccination programme were elicited by using a Discrete Choice Experiment (DCE) approach. The discrete choice experiment survey reported here involved several design phases. The process began with the collection of expert opinion on the attributes and attribute levels of potential NCD vaccination programmes. Initial findings were explored through discussion with experts in poultry health and examination of research literature to validate the identified attributes and attribute levels. Subsequently, two focus-group discussions were conducted in the study area, involving farmers and livestock development and marketing agency workers, to gauge the practicality of communicating the identified attributes and attribute levels to farmers. This process identified five attributes and their levels for the choice experiment. From the focus group discussions, it was learnt that farmers understood the risk of bird's death due to NCD to be a two-part process; a risk that disease occurs in the flock and the risk, when it does, of one or more birds dying. This lead to the decision to include two attributes related to NCD protection; 'flock-level protection' (that is, the ability of vaccination to prevent outbreaks within the flock) and 'bird-level protection' (that is, the ability of the vaccine to prevent bird deaths should a flock be affected by NCD). The other attributes were 'route of vaccine administration', 'delivery mechanism', and price. As the vaccine was available in 50 dose vials, which was more than sufficient to vaccinate even large village flocks, cost was calculated based on 1 vial per flock per administration and was expressed per flock per year, regardless of the number of birds in the flock. In addition, findings of previous study on willingness to pay for vaccine service, conducted in the same setting, (Terfa et al., 2015) was also used as reference to determine possible cost of vaccine. A summary of attributes and attribute levels used in the final designing process is presented in Table 1.

For analysis of data, cost of NCD vaccination, three times in a year, was included in the model as a continuous variable with their actual levels. All other attributes of the designed NCD vaccine programme were treated as discrete variables. For each discrete attribute in the DCE with levels L, we created $L-1$ discrete variables. Following suggestion by Hensher et al. (2005), effects coding was used to measure nonlinear effects in the trait levels and to avoid confounding effects of reference

Table 1
Attributes and attribute levels in the choice experiment.

No.	Vaccine Attribute	Attribute level	Reference level
1	Flock-level protection	1 30 % 2 50 % 3 70 %	50 percent
2	Delivery mechanism	By vet. technician 1 By trained farmers	By trained farmer
3	Route of administration	1 in water 2 in feed 3 Aerosol Spray	Aerosol spray
4	Bird-level protection	1 20 % 2 40 % 3 60 %	40 percent
5	Price of vaccine	1 ETB 60.00 2 ETB 80.00 3 ETB 100.00	Used as continuous