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Economic impact of foot and mouth disease outbreaks on smallholder farmers in Ethiopia

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ABSTRACT

Foot and mouth disease is endemic in Ethiopia with occurrences of several outbreaks every year. Quantitative information about the impact of the disease on smallholder farming systems in the country is, however, scarce. This study presents a quantitative assessment of the clinical and direct economic impacts of foot and mouth disease outbreaks on household level in smallholder livestock farming systems. Impacts were assessed based on data obtained from case outbreaks in cattle in crop–livestock mixed and pastoral smallholder farming systems that occurred in 2012 and 2013. Data were collected by using questionnaires administered to 512 smallholder farmers in six districts within two administrate zones that represent the two smallholder farming systems. Foot and mouth disease morbidity rates of 85.2% and 94.9% at herd level; and 74.3% and 60.8% at animal level in the affected herds were determined for crop–livestock mixed system and pastoral system, respectively. The overall and calf specific mortality rates were 2.4% and 9.7% for the crop–livestock mixed system, and 0.7% and 2.6% for the pastoral system, respectively. Herd level morbidity rate was statistically significantly higher in the pastoral system than in the crop–livestock mixed system ($P < 0.001$). The economic losses of foot and mouth disease outbreak due to milk loss, draft power loss and mortality were on average USD 76 per affected herd and USD 9.8 per head of cattle in the affected herds in crop–livestock mixed system; and USD 174 per affected herd and USD 5.3 per head of cattle in the affected herds in the pastoral system. The herd level economic losses were statistically significantly higher for the pastoral system than for the crop–livestock mixed system ($P < 0.001$). The major loss due to the disease occurred as a result of milk losses and draft power losses whereas mortality losses were relatively low. Although the presented estimates on the economic losses accounted only for the visible direct impacts of the disease on herd level, these conservative estimates signify a potential socioeconomic gain from a control intervention.

1. Introduction

Livestock production has a significant role to the Ethiopian economy by contributing up to 45% of the agricultural GDP, 19% of total GDP and one fifth of the country's export (Behnke, 2011). Within the livestock population of the country, cattle represent about 71% of the total

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42.2 million tropical livestock units (livestock biomass) (MoARD, 2007). Cattle production in Ethiopia occurs mainly in subsistence oriented small holder farming systems. Within these systems, cattle play an essential role at household level by providing milk and meat for food, draft power, manure for soil fertilizer and cooking, cash income, and other economic and social functions like financial security and matrimonial dowry. Crop–livestock mixed (CLM) farming is the dominant farming system in which about 80–85% of the national cattle population is kept. The primary purpose of cattle in this system is to provide draft power for crop production. In Ethiopia 80% of the required traction power for crop agriculture is provided by oxen (MoARD, 2007). Pastoral farming is the second most important farming system, which represents about 15–20% of the national cattle population. Cattle in this system are mainly kept for milk production for household consumption. The third is market oriented farming system, which mainly consists of dairy and fattening, and represents only a small proportion of the national cattle population.

Foot and mouth disease (FMD) is one of the endemic diseases in Ethiopia that occurs recurrently, causing several outbreaks every year (Ayelet et al., 2012). Serological surveys reported a sero-prevalence that ranges from 5% to 25% at the animal level and up to 60% at the herd level in different parts of the country (Rufael et al., 2008; Megersa et al., 2009; Bayissa et al., 2011).

Foot and mouth disease is considered as the most important livestock disease in the world in terms of its economic impact (James and Rushton, 2002). The annual economic impact of FMD in terms of visible production losses and vaccination costs in endemic regions of the world is estimated between US$6.5 and 21 billion, while outbreaks in FMD free countries and zones cause losses of more than US$1.5 billion a year (Knight-Jones and Rushton, 2013). The economic impact of FMD in endemic areas can be separated into two components: direct and indirect losses (Rushton, 2009; Knight-Jones and Rushton, 2013). The direct losses of the disease consist of loss of milk production, loss of draft power, retardation of growth, abortion and delayed breeding, and mortality especially in young animals. The indirect losses are related to market restrictions, use of suboptimal production technologies and costs of control.

Foot and mouth disease is commonly considered as mild in indigenous animals in the traditional productions systems (James and Rushton, 2002; Vosloo et al., 2002; Thomson and Bastos, 2005), implying a limited economic significance of the disease for smallholder subsistence farmers who keep indigenous animals and do not participate in the international trade. However, the importance of the disease for the smallholder farmers has been controversial. For example, Perry et al. (2003) claimed a pro-poor impact of foot and mouth disease control in the southern African region through a national economic growth that would create a suitable base for poverty reduction. Scoones and Wolmer (2006), however, commented that although this study clearly showed that the investment in FMD control primarily benefits the commercial sector, the researchers inappropriately concluded that the poor would benefit indirectly from the national economic growth. In a subsequent paper, Perry and Rich (2007) indicated that FMD has diverse impacts across different farming systems and that its control would constitute a pro-poor investment in many developing countries. Meanwhile, several case outbreak studies that were conducted in different parts of the world reported a significant impact of FMD in the smallholder settings (Barasa et al., 2008; Rast et al., 2010; Shankar et al., 2012; Young et al., 2013).

Quantitative information on the impact of FMD is essential in order to make sound decisions about its control. Although it can be conjectured that losses from FMD in Ethiopia could be significant due to the multiple functions of cattle in the smallholder farming systems, empirical estimates about such losses are scarce. This study presents an empirical case study of the clinical and direct economic impact of FMD outbreaks on household level in the smallholder livestock farming systems in Ethiopia.

2. Materials and methods

2.1. Study areas

The study was conducted in the administrative zones of North Wollo and Borena (Fig. 1). These zones were selected for their representation of the two main smallholder farming systems in Ethiopia and their recent FMD outbreak experience.

North Wollo is located in northeast Ethiopia. The agro-ecological landscape within North Wollo ranges from drier lowlands at about 1000 m above sea level, through fertile midlands, to cold highlands as high as 3700 m above sea level (Edge and Adal, 2000). The main livelihood within this zone is crop–livestock mixed (CLM) farming. Cattle are primarily kept on smallholdings where they provide draft power for crop production, manure for soil fertility and fuel, family diet, and cash income. The study within the North Wollo zone was concentrated on the districts of Kobo, Guba Lafto and Habru as these three districts were recently affected by an FMD outbreak that occurred from June to November 2012.

Borena zone is located in southern part of the country. Except for a central mountain range and scattered volcanic cones and craters, the zone's landscape is gently undulating across an elevation of 1000–1600 m (Coppock, 1994). The zone is dominated by a semi-arid climate and most parts of the zone are less endowed with moisture for reliable crop based livelihoods. The main livelihood in this arid and semi-arid region is pastoralism. Three representative districts namely Dugda Dawa, Yabello and Dire were used for the study. These pastoral districts were selected based on their recent history of experiencing an FMD outbreak that occurred from December 2012 to February 2013 and on their accessibility for investigation.

2.2. Sampling and data collection

The necessary sample size was determined for each zone (production system) independently. Based on the expectation of a high herd level morbidity rate (80%), a 95% confidence level and a 5% desired absolute precision, a sample size 246 small holder farmers was determined for