Preventive Veterinary Medicine xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed

Estimation of impact of contagious bovine pleuropneumonia on pastoralists in Kenya

J.O. Onono*,[1], B. Wieland[2], J. Rushton

Department of Production and Population Health, Veterinary Epidemiology and Public Health Group, Royal Veterinary College, Hawkshead Lane, AL97TA Hatfield, United Kingdom

ARTICLE INFO

Article history:
Received 12 June 2013
Received in revised form 18 March 2014
Accepted 22 March 2014

Keywords:
Cost of disease
Impact assessment
Pastoral production system

ABSTRACT

Contagious bovine pleuropneumonia (CBPP) is an infectious disease which impacts cattle production in sub-Saharan Africa. To adequately allocate resources for its control, there is a need to assess its impact on cattle producers. The present study estimated the impact of CBPP on pastoralists through analysis of various strategies employed for its control in cattle herds including: preventive vaccination, antimicrobial treatment, slaughter of clinical cases and other combinations of these control strategies. The assessment was based on a loss-expenditure frontier framework to identify a control strategy with minimum cost from both expenditures on control strategies and output losses due to mortalities, reduced milk yield, reduced weight gain and reduced fertility rate. The analysis was undertaken in a stochastic spreadsheet model. The control strategy with minimum cost per herd was preventive vaccination with an estimated cost of US$ 193 (90% CI; 170–215) per 100 cows per year, while slaughter of clinical cases had an estimated cost of US$ 912 (90% CI; 775–1055) per 100 cows per year. The impact of CBPP to the nation was estimated at US$ 7.6 (90% CI; 6.5–8.7) million per year. Yet, if all pastoralists whose cattle are at high risk of infection adopted preventive vaccination, the aggregate national impact would be US$ 3.3 (90% CI; 2.9–3.7) million per year, with savings amounting to US$ 4.3 million through reallocation of control expenditures. The analysis predicted that control of CBPP in Kenya is profitable through preventive vaccination. However, further research is recommended for the technical and financial feasibility of implementing a vaccine delivery system in pastoral areas where CBPP is endemic.

1. Introduction

Approximately 70% of the cattle population in Kenya are raised in the arid and semi-arid lands, and these areas constitute over 80% of the total surface area of the county's land mass (Nyariki et al., 2009; MoLD, 2010b). The cattle population is currently estimated at 17.5 million head, out of which 3.4 million head are dairy breeds kept in a highland production system and 12.2 million head are kept in a pastoral system in areas that are arid and semi-arid (Behnke and Muthami, 2011). The remainder are dual-purpose breeds found in the mixed crop-livestock system in humid and sub-humid areas (KARI/ODA, 1996; MoLD, 2007; KNBS, 2010). The average herd sizes within pastoral areas are 100 head of cattle per herd (Roderick et al., 1998; Onono et al., 2013c). While in the smallholder dairy

* Corresponding author. Tel.: +254 705934013
E-mail address: jonono@rvc.ac.uk (J.O. Onono).

[1] Currently at Department of Public Health, Pharmacology and Toxicology, College of Agriculture and Veterinary Sciences, University of Nairobi, P.O. Box 29053-00625, Nairobi, Kenya.

[2] Currently at Swiss Agency for Development and Cooperation SDC, Mongolia.

http://dx.doi.org/10.1016/j.prevetmed.2014.03.022
0167-5877/

system, the average herd size is 4 head of cattle (Bebe et al., 2003; Onono et al., 2013c), with an approximate number of 838,850 smallholder dairy herds (Kiptarus, 2005).

CBPP is reported to be a constraint to cattle production in the arid and semi-arid pastoral areas (Kairu-Wanyoike et al., 2013), therefore affecting livelihoods of over a hundred thousand households. However, other cattle systems have remained free from CBPP. Its persistence in pastoral areas has been attributed to the nomadic lifestyle of pastoralists which allow for uncontrolled movement of cattle with continuous mixing at grazing fields, watering points and difficulty accessing vaccination services (Amanfu, 2009). Therefore public sector effort directed towards the control of CBPP in Kenya needs to focus on what should be done in pastoral areas.

The presence of CBPP in a herd results in direct losses due to its impact on cattle production, through increased mortalities, reduced milk yield, reduced weight gain and reduced fertility rate, and therefore it compromises both household and national food security due to loss of protein and draught power (Twinamasiko, 2002; Tambi et al., 2006). CBPP also causes indirect losses through additional cost of treatment, preventive vaccination, field diagnostic testing, slaughter of clinical cases, surveillance activities, disruption of trade and the limitation of investment opportunities due to reluctance in adoption of improved breeds (Rushton et al., 1999).

The disease is caused by a bacterium *Mycoplasma mycoides* subspecies *mycoides* biotype Small Colony, which is a member of *Mycoplasma* cluster group (Nicholas and Bashiruddin, 1995). The organism causes disease in cattle and water buffaloes, but studies have reported experimental infection in sheep (Sahu and Yedloutschnig, 1994; Gonçalves et al., 2002).

1.1. Public initiatives to control CBPP

The policy for control of CBPP in most countries relies on mass vaccination of susceptible cattle and enforcement of movement control (Windsor, 2006; Kairu-Wanyoike, 2009). Additionally, research on antimicrobial agents for use in treatment of CBPP was recently proposed (FAO, 2007). The only antibiotics which are effective against the causative agent, based on in vitro experiments are oxytetracycline and tilmicosin (Ayling et al., 2005). Further field experiments have also shown that use of oxytetracycline and danofloxacin to treat infected cattle has a potential to reduce spread of CBPP to susceptible cattle (Niang et al., 2007, 2010; Nicholas et al., 2007).

The implementation of test and slaughter as a control policy is unattractive to cattle producers in sub-Saharan Africa, but the strategy was instrumental for CBPP eradication from Australia (Newton and Norris, 2000). Likewise, the policy was recently applied in Botswana during an outbreak in Ngamiland district in 1996, although its application resulted in food security challenges to children under 5 years of age who suffered malnutrition (Boonstra et al., 2001).

Preventive vaccination of susceptible cattle is recommended as the most appropriate control measure in many countries where CBPP is endemic (Amanfu, 2009; OIE, 2011).

The FAO/OIE/AU-IBAR consultative group had also proposed creation of three distinct epidemiological zones for CBPP control in Africa (FAO, 1998). These include: disease free areas (where surveillance activities and emergency preparedness are planned), CBPP infected areas (where intense control by stamping out or vaccination and quarantine are instituted), and cordon sanitaire (where a defined buffer zone between disease free areas and infected areas is maintained). Other proposals included construction of abattoirs in CBPP infected areas to reduce the risk of its spread through movement of cattle (FAO, 2007).

In Kenya, various CBPP control zones have been described (Kairu-Wanyoike et al., 2013). These include infected, buffer, surveillance and disease free zones. Control policies in the infected zone are movement restriction and preventive vaccination. In other control zones, the policies are test and slaughter of infected cattle and ring vaccination around outbreak foci. Other preventive measures involve disease surveillance activities which are intensified around livestock markets and abattoirs (MoLD, 2010a). Despite having these policies in place, their implementation has not been well coordinated due to limited resources which are allocated for animal health activities.

1.2. Private initiatives to manage CBPP

A study amongst Maasai pastoralists in Kenya had revealed that they employ different strategies (antimicrobial treatment, home slaughter, preventive vaccination and other combined strategies) to manage CBPP within-herds (Onono, 2013). Effectiveness of these strategies in the control of CBPP was predicted through mathematical modelling. Further modelling work for CBPP control in pastoral areas of east Africa has been described by Mariner et al. (2006a).

Lesnoff et al. (2004) also reported private response to CBPP presence in Ethiopia. Within this smallholder community, the common practices against disease occurrence were separation of sick cattle and injection of sick cattle with 10% oxytetracycline. Another example of private sector involvement in CBPP control was partnership with the public sector in Zambia (Muuka et al., 2013a). The participation of the private sector was through a memorandum of understanding signed between the government and a local company which operated meat selling points across the country. The company bought meat of the CBPP infected and culled cows, and this was sold through their outlets. Through this arrangement, the prevalence of CBPP is reported to have dropped from 15.4% in 2006 to only 0.05% by end of 2009 (Muuka et al., 2013b).

The aim of this study was to estimate the impact of CBPP on pastoralists based on the cost of alternative control strategies. Results of this analysis will provide a basis for policy change on national budgetary allocation for CBPP control.

Please cite this article in press as: Onono, J.O., et al., Estimation of impact of contagious bovine pleuropneumonia on pastoralists in Kenya. PREVET (2014), http://dx.doi.org/10.1016/j.prevetmed.2014.03.022