COST ESTIMATATION FOR RIFT VALLEY FEVER FROM 2007 TO 2010

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Abstract

Rift Valley fever (RVF) is transboundary zoonotic disease. Mosquito is the principle vector for RVF. It affects most prominently small ruminants, sheep and goats, and cattle, camels and human can get infected. It occurs following up average heavy rainfalls which render abundance of mosquito vector, and it often occurs every 10 to 15 years associated with ElNio phenomenon. RVF is influenza like illness with fever and muscle ache and back pain, in severe form, it involves retinitis, opthalmitis, encephalitis and hepatic and hemorrhagic form; in addition, it is characterized by storm of abortion in pregnant humans and animals, stillbirth and high mortality rates in young animals. RVF cost has been derived from 2007 to 20010 by using Palisade financial model . Average cost for controlling RVF was estimated by US $ 74,607,069.29, Probability of meeting base case value was 0.00%, total budget required for 95.0% confidence was US $ 78,726,457 and Contingency was US$192,700 with 95.0% confidence. This costing model has significant influence on socioeconomic life of affected communities and potential sequel on national income as well.

Key words: Rift Valley fever, cost estimates, financial model, Sudan

Introduction

Rift Valley fever (RVF) is arthropod–borne zoonotic disease. It is transmitted by mosquitoes to sheep, goats, cattle and humans. RVF is transmitted by infected tissues and raw or undercooked milk. RVF epidemiology was confined to Africa, Madagascar ,but in year 2000, it has erupted to Arabian Peninsula and Yemen, (Madani TA et al 2003). A cross-sectional study has been carried out from 2007 to 2008 to determine risk factors and ecology associated with RVF in Sudan. A total of 698 human cases were reported, and 222 cases were dead (Hassan O et al 2011). Understanding socioeconomic of RVF is required. Therefore, current study is to estimate cost for RVF which has trade and public health importance. Cost effectiveness and countermeasures against RVF using vaccination and insecticides had been evaluated by Gaff H et al (2011). Accordingly, RVF management and control measures are being in practice to decrease its impact in Sudan(OIE, 2016). RVF has negative impact on the livelihood of pastoral community (Davies, 2010), which represent about 80% of population. Economically, livestock sector, international trade in livestock and livestock products were affected. In 2007, Sudan had witnessed a severe RVF outbreak which characterized by high abortion and mortality rates in livestock and humans (Imadeldin E. et al, 2013). In 2008, RVF cases had decreased with a cumulative total of 698 human cases, 222 death reported from Gizera, Kassala, Khartoum, River Nile, Sinnar and White Nile states with overall case fatality rate (CFR) of (31.8%) (WHO, 2016). In 2010, RVF was confined to central Sudan, one hundred human sera samples were tested by RT-PCR and 18 were positive, (18%) percentage positivity (Imadeldin E. et al, 2013). The current study is to understand RVF cost bearing in mind direct loss in livestock and human populations. Consequently, this has broader share in measuring RVF cost as transboundary disease affecting public health, trade and food security in the region. Sudan is one of country in Greater Horn of Africa that participates in market dynamics, especially in livestock and livestock products industry. For example, there is a lot of trade going on in livestock and livestock products between Sudan and Saudi Arabia and Gulf countries. RVF has been identified as risk for trade in the region. Therefore, this paper has put an effort to develop financial model that estimates RVF cost from 2007 to 2010, as well as providing a baseline study and analysis for RVF control measures.

Material &methods

Data and information were collected, managed and analyzed from different resources by using Microsoft Office, Excel windows 7 and @Risk version 7. Financial model was derived by @Risk spread sheet to calculate RVF cost in monetary value for controlling of RVF outbreak. Eventually, Cost estimates for RVF would pertain different parameters like time, RVF mortality, RVF morbidity, Animal weight, Milk production, Fodder, Leather, Land, Labor, Assets, Salaries and Others to realize the losses due RVF. The current financial model has been modified to estimate cost by predicting the optimal cost from the basic values of input elements. Parameters were tested qualitatively, and then cost distribution was simulated. RVF control measures were assessed on Excel spreadsheet from 2007 to 2010.

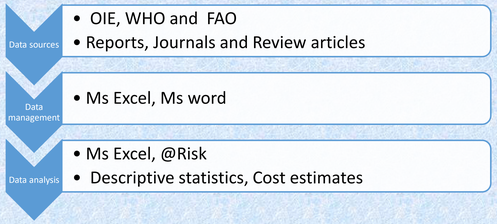

Figure 1: flowchart of data source, management and analysis for RVF control measures from 2007 to 2010

Results

The average cost for RVF control was estimated by US $ 74607069.29, while total budget required with 95% confidence was US $ 78,726,457. Contingency required for 95% confidence was US $192,700 and probability for meeting base case value was 0.00 % (Table 1 :). In statistics of RVF control measures from 2007 to 2010, disease notification had recorded 12.5 %, whereas stamping out and modified stamping out were reported 0.00% respectively. Official vaccination was (0.73%) and control of vector was 11.67% . Beta General distribution of RVF cost with 95% confidence limit ranges from Us $ 61,600000 to US $71,500000 (Figure:2). Cumulative curve for RVF control measure with 90% confidence ranges from US $ 70,510000 to US $ 78,730000. Also, input rank by effect on output mean has began with assets, RVF mortality, land, time, others, animal weight, salaries, labor, fodder and milk production .

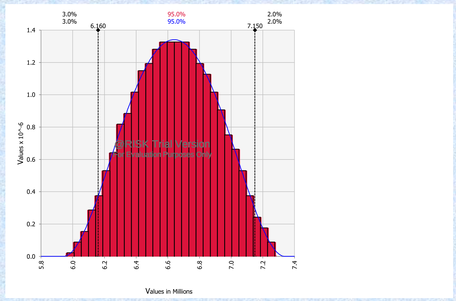

Figure 2:Beta General Distribution for RVF cost

Results (continue)

Table1: cost estimate model for RVF

Input element	Basic value	Minimum	Most likely	Maximum	Minimum	Most likely	Maximum	sample
time	6990084	85%	95%	105%	5941571.4	6640579.8	7339588.2	6640579.8
RVF mortality	233026	85%	95%	105%	198072.1	221374.7	244677.3	221374.7
RVF morbidity	699030.05	85%	95%	105%	594175.543	664078.548	733981.55	664078.5475
Animal weight	23324.25	85%	95%	105%	19825.6125	22158.0375	24490.463	22158.0375
Milk production	69924.655	85%	95%	105%	59435.9567	66428.4222	73420.888	66428.42225
Fodder	2354.075	85%	95%	105%	2000.96375	2236.37125	2471.7788	2236.37125
Leather	7014.1155	85%	95%	105%	5961.99818	6663.40973	7364.8213	6663.409725
land	5500000	85%	95%	105%	4675000	5225000	5775000	5225000
labor	1500	85%	95%	105%	1275	1425	1575	1425
assets	65000000	85%	95%	105%	55250000	61750000	68250000	61750000
salaries	5000	85%	95%	105%	4250	4750	5250	4750
Others	2500	85%	95%	105%	2125	2375	2625	2375
Output								
Total	78533757.1							74607069.29
summary statistics								
Probability of meeting base case value	0.00%							
Total budget required for 95.0% confidence	78,726,457							
Contingency required for 95.0% confidence	192,700							

Discussion

Socio-economics of RVF is significant to evaluate burden and strategies to combat it. RVF has negative impact on livestock industry. Nonetheless, OIE recommendation and regulations allow export in certain conditions from endemic countries that are demonstrating and approved RVF free zones or compartments. OIE and One health initiative are emphasized on safe and effective RVF vaccine. In addition, World Trade Organization (WTO) has Sanitary and Phytosanitary (SPS) agreement which protects both domestic and export countries to have safe and healthy products. Sudan is being an active member in trade and market dynamics in livestock and livestock product industry in Greater Horn of Africa. From 2007 to 2010, Sudan has begun implementing RVF control strategies which brought down the disease to manageable level. Beside, Sudan is still trading with Saudi Arabia and Gulf countries in livestock and livestock products based on OIE and WTO recommendations and the regulations. Although, RVF cost was estimated by US $ 74607069.29, control and emergency preparedness has reduced risk of RVF. The current paper has derived financial model by analyzing essential parameters with its basic values; this provides ranges for distribution of cost in final output. This model has estimated RVF cost derived from population with 95% confidence interval (C.I.) .This had mostly affected the livelihood of rural communities by losing their source of income through death of livestock due to RVF outbreak in 2007 (Hassan O et al, 2011). Official vaccination is the way forward to controlling RVF; however it was being used by (0.73%) from 2007 to 2010, in some scenarios vaccination is prohibited owing to neutralizing of existed antibodies generated by exposure or infection by Rift Valley fever virus (RVFV). Surveillance in study period has demonstrated different control measures at various levels of epidemic depending on epidemiology and spread out of RVF outbreaks. RVF socioeconomic is necessary to be undertaken for control and management of the disease. Risk analysis is essential to estimate cost and risk abreast RVF.

Discussion (continue)

The phylogeny for RVFV had been studied from 2007 to 2010 (Imadeldin E. et al, 2010). In 2007, World Health Organization, Ministry of Health and Ministry of Animal Resources, Fisheries and Range lands investigated RVF outbreak occurred (WHO, 2007). A benefit –cost analysis study and participatory epidemiology was carried out in south Sudan for Foot and Mouth disease by estimating the status of the disease using different parameter like milk production rate and livelihood for duration of time (M. Barasa et al 2008).

Conclusions &recommendations

Estimation of the social and economic values of RVF is necessary to be understood. Risk analysis and geospatial distribution are essential for controlling RVF.

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