Economic Impact Of Foot And Mouth Disease (Fmd): A Review

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Abstract: Foot and mouth disease is considered as the most important livestock disease in the world in terms of its economic impact. It is endemic in many African countries including Ethiopia. The economic impact of the disease in endemic country is that it leads the loss of milk production; loss of draft power; retardation of growth; abortion and delayed breeding and mortality especially in young animals. It also leads market restrictions, use of suboptimal production technologies and costs of control. The severity of the impact varies country to country based on their disease control strategy.

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1. Introduction

FMD affects all the major non-avian livestock species causing high morbidity and low mortality, although high mortality of young stock can occur [1, 2, 3, 4]. Foot and mouth disease (FMD) is one of the endemic diseases in Ethiopia that occurs recurrently, causing several outbreaks every year [5]. 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 [6, 7, and 8].

Foot and mouth disease is considered as the most important livestock disease in the world in terms of its economic impact [9]. 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 [10]. The economic impact of FMD in endemic areas can be separated into two components: direct and indirect losses [11, 10]. 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. This review was done with the objective of identifying the different economic impacts of FMD.

2. Types Of Economic Impacts Of Fmd

The impact of FMD is not equal across all countries and livestock populations due to differences in the genetics of the livestock; the management of the livestock and the prevailing prices for the livestock systems inputs and outputs [12].

FMD outbreak has the potential to cause enormous economic losses to not only livestock producers, but also to auction markets, slaughterhouses, food processors and related industries, as well as consumers. The economic consequences also include trade disruptions and decreased tourism. The size of the outbreak can determine the range and magnitude of the impact [12]. Fig. 1 shows the different impacts of FMD [11].

2.1. Direct impacts

2.1.1. Visible losses

Visible production losses are most prominent in pig and cattle in intensive production systems and dairy cattle. These two systems are key sources of animal protein in different countries and their importance continues to grow [13]. Visible losses from FMD include the production losses and loss due to death.

Production losses: Direct production losses would result from lost animals in depopulated premises and industries linked to the livestock sector, such as slaughterhouses or processors. Because infected premises cannot return to full production for at least 60 days after cleaning and disinfection, additional losses would be linked to limited production after an outbreak.

Production losses due directly to FMD include reduced milk production [8], affecting both the humans and calves that depend on it. This can account for 33% of losses in endemic settings [14]. Not only crucial to commercial dairy operations, milk is an important source of nutrition for many pastoralists, particularly for children [15]. Although FMD typically has a short-term effect on an animal's health, chronic FMD typically reduces milk yields by 80% [8, 15]. Livestock growth rates are also suppressed and mortality amongst young stock is typically 2–3% [6]

although occasionally much higher [15]. Loss of traction power where draught animals are used is particularly damaging if it occurs during harvest [16, 1].

2.1.2. Invisible losses

FMD causes problems with fertility, due to abortion losses and a reduced probability of conception. These both translate into the need to have a greater proportion of breeding animals in a population implying that for every kilo of meat or milk produced there is an additional fixed cost to maintain more breeding stock [11]. The cost due to abortion is high as the farmer will have to pay to keep the cow without it producing anything for another year or more, or cull the animal. FMD also leads delay in development/growth that prolongs the time when the animal reaches sale weight and this leads extra costs.

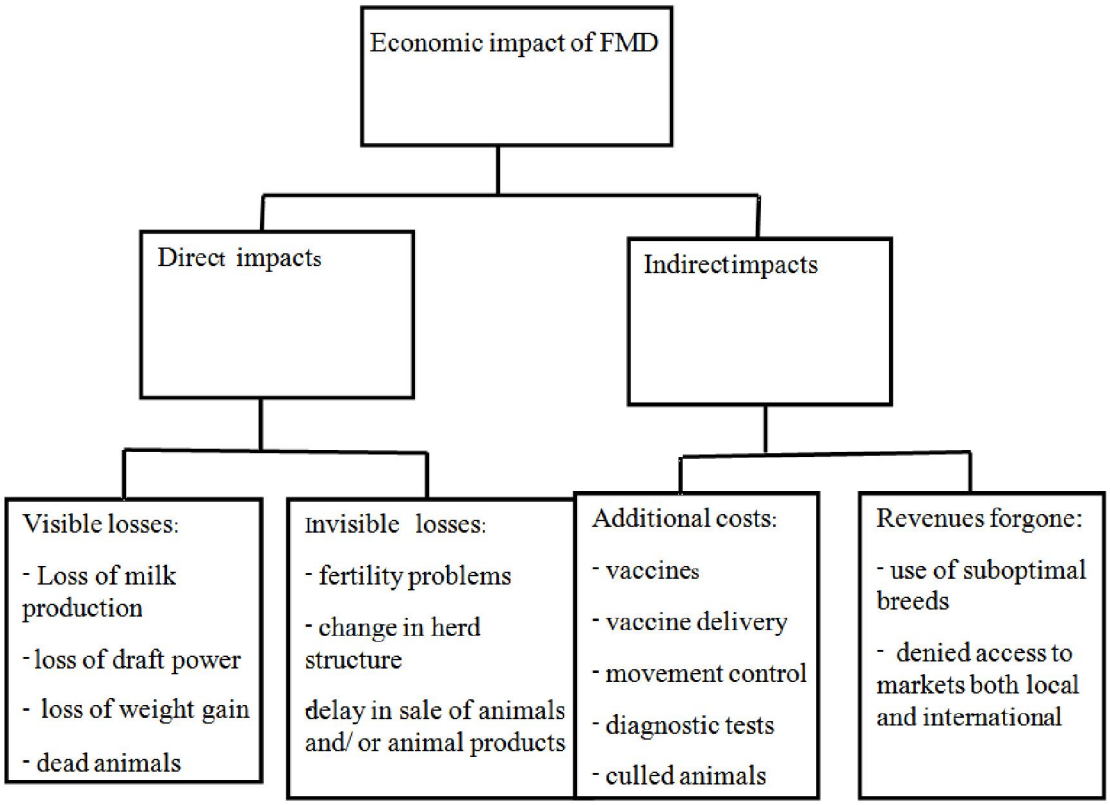

Fig. 1. diagrames showing different impacts of FMD

2.2. Indirect impacts

2.2.1. Additional costs

Disease control and eradication costs: The cost of control and eradication carried out by the state veterinary services includes costs for quarantine enforcement, euthanizing and disposing of infected animals, vaccination, outbreak control, culling, compensating producers for destroyed animals and cleaning and disinfecting affected premises. These costs are enormous with an estimated 2.35 billion doses of FMD vaccine administered in the world every year [17] at a cost of $0.4–3 or occasionally $9 per dose including delivery and application [18,15,19]. Due to the short duration of immunity induced by FMD vaccines, ongoing control programs vaccinate cattle one to three times a year and sheep and goats once a year; limiting resources available to combat other diseases. Treatment costs depended on the length of sickness and the number of visits by a veterinarian.

Even if a country is FMD free there are ongoing costs due to efforts to prevent disease introduction, including import controls and sometimes vaccination. In addition, maintaining FMD early detection and control capability, including vaccine banks, is costly. Other costs include FMD related research and permanent restrictions on the livestock sector (such as post-movement standstills and bans on feeding swill). The cost of surveillance are significant, including proving disease freedom after an outbreak; for example greater than three million serum samples were tested after the UK 2001 outbreak [20] in addition to approximately 3.5 million sera tested during the outbreak.

Control measures can affect other industries, a worst case example being the UK 2001 outbreak which caused US$4–5 billion lost in tourism revenue [21]. Culling based control measures can have wider impacts including public outrage, depression and suicides amongst farmers [22], pollution from carcasses and animal welfare issues. Movement restrictions disrupt the normal flows of animals between different units and enterprises at different stages of their life and can result in welfare problems if access to housing and grazing is prevented; in the UK 2001 outbreak welfare reasons accounted for one third of animals culled [23].

2.2.2. Revenue foregone

Market access loss: Countries infected with FMD cannot trade live animals with FMD free countries. Typically the countries with the best meat prices are FMD free (i.e. EU, USA and Japan) [9] where prices are typically 50% higher [24].

The trade of livestock products is also restricted. If regular outbreaks occur only processed, tinned products can be exported to free countries; if FMD is effectively controlled with vaccination by a competent veterinary service able to detect outbreaks then deboned meat can be exported. Also, trade of fruit and vegetables can be affected by FMD status. Even if a country is FMD free, if it trades with FMD infected countries it will experience trade restrictions [9].

Lack of access to lucrative markets has further consequences; it restricts the development of commercial farming. Restrictions limit the supply of livestock and livestock products to free countries with trade limited to certain types of meat (e.g., processed meat); although this is good for domestic producers it leads to increased market prices for consumers. If FMD free status is lost livestock are dumped on the domestic market, reducing prices for consumers at the cost of producers. Even within an endemic country livestock trade is limited; those affected by FMD receive lower prices for their stock and those wishing to purchase animals from FMD free herds face a restricted supply [9].

Externalities: FMD is highly contagious, affects many species and is not easily contained within one farm or one population. The presence of FMD creates problems to all livestock owners who are connected to populations where FMD is present. This connection may be geographical or via market chains. Therefore, FMD creates what economists call externalities. If an outbreak occurs because one farmer did not protect his animals others may suffer. Conversely when a livestock owner protects their animals from FMD infection they will generate a positive externality as they are less likely to become infected and transmit the pathogen to other farms [1].

The positive and negative impacts of FMD on different players in a dynamic market are complex; when FMD outbreaks create increased demand for vaccines, pharmaceutical companies benefit. When a free country experiences an outbreak poultry prices may increase due to public reluctance to consume products from FMD susceptible species, particularly if through ignorance there is a reluctance to eat products from FMD vaccinated animals.

Where externalities exist there is a need for public investment as one farmer's actions create costs and benefits for others. These externalities are not equally shared amongst different livestock sectors with production losses being particularly severe for commercial dairy farms. Even when individuals reap positive returns from successful FMD control there is less of an incentive to undertake such a programme if there is a high risk of reinfection from those that do not attempt FMD control [1].

Effective control of infectious diseases with vaccination often requires high levels of vaccine coverage to develop herd immunity; with a sufficient proportion of immune animals outbreaks will tend to die out due to a lack of susceptible hosts. If left in the hands of individual farmers a lack of action by those less visibly affected by FMD will result in pockets where control is poor, undermining the entire control programme. Impacts on the livestock producer have ripple effects along the entire market chain, impacting on other players, such as markets, abattoirs and dairies to mention a few [25] FMD control can be both an externality, with benefits not captured by the market, and a regional or global public good, as the reduction in risk of FMD is also experienced by countries other than ones controlling the disease; external funding and cooperation is therefore required [19].

Use of sub-optimal technologies/breed of animals: High productive breeds are typically more susceptible to FMD. The risk of FMD therefore restricts the use of these breeds and prevents the development of more intensive production systems based on these breeds.

3. Fmd Impact In Different Countries

The impact of the FMD is not equal across all countries and livestock populations due to differences in not only FMD status, incidence and risk of incursion but also (a) the genetics of the national herd; (b) prevailing livestock management practices; (c) prevailing prices of livestock production inputs and outputs and (d) their ability to supply livestock for export markets. This is easier to appreciate when one considers specific countries which differ in these characteristics [11]. The impacts of the disease in different countries were indicated as follows:

(i). The impact of FMD in a country with export potential but where FMD is present in the wider region:- In this setting the main impacts are through the cost of on-going control, particularly vaccination, and loss of export markets and further control measures when outbreaks occur [26].

(ii). The impact of FMD in a disease free country with significant livestock exports and relatively low risk of incursion: - In this setting the major impact is through maintaining preparedness due to the dire economic consequences of an FMD incursion.

(iii). The impact of FMD in a disease free country which imports livestock products:- In this setting the major impact is due to the high price paid for importing meat from FMD free countries only. Other ongoing control costs may also exist.

(iv). The impact of FMD in an endemic country with limited export potential looking to increase national productivity and reduce risk to neighboring countries:- In this situation the main impacts are disease-induced production losses, ongoing vaccination costs, premium prices paid for FMD free imports and the risk the country poses to neighboring free countries [27].

(v). The impact of FMD in an endemic country with the potential to export:- In a country like this the control costs required to attain and maintain free status are sizeable and the risk of subsequent outbreaks in free zones may be high. If FMD free trade can be established the benefits are significant, however, other barriers to market access may exist. For example in Ethiopia due to the presence of FMD the export of live cattle and their products to FMD free countries is an unlikely prospect [28]. This raises the case for investment in veterinary service infrastructure to improve the control of all trade limiting diseases for international market access.

References

1. Perry B.D. and Randolph T.F., 2003. The economics of foot-and-mouth disease, its control and its eradication. In: Dodet B., Vicari M., editors. Foot-and-Mouth Disease: Control Strategies. Éditions scientifiques et médicales, *Elsevier, SAS*; pp. 23–41.
2. Perry B.D. and Rich K.M., 2007. Viewpoint Poverty impacts of foot-and-mouth disease and the poverty reduction implications of its controland its control. *Vet. Record.* 160:238–241.
3. Perry B.D. and Sones K.R., 2007. Global Roadmap for Improving the Tools to Control Foot-and-Mouth Disease in Endemic Settings; Report of a workshop held at Agra, India 29 Novemebr–1 December 2006, and subsequent Roadmap outputs; Nairobi: *ILRI* (International Livestock Research Institute).
4. Perry B. and Grace D., 2009. The impacts of livestock diseases and their control on growth and development processes that are pro-poor. Phil. *Trans. Roy. Soc. Lond. Ser. B Biol. Sci*. 364: 2643–2655.
5. Ayelet, G., Gelaye, E., Negussie, H. and Asmare, K., 2012. Study on the epidemiology of foot and mouth disease in Ethiopia. *Rev. Sci. Tech*. 31: 789–798.
6. Rufael T., Catley A., Bogale A., Sahle M. and Shiferaw Y., 2008. Foot and mouth disease in the Borana pastoral system, southern Ethiopia and implications for livelihoods and international trade. *Trop. Anim. Health Prod.* 40: 29–38.
7. Megersa, B., Beyene, B., Abunna, F., Regassa, A., Amenu, K., Rufael, T., 2009. Risk factors for foot and mouth disease seroprevalence in indigenous cattle in Southern Ethiopia: the effect of production system. *Trop. Anim. Health Prod*. 41, 891–898.
8. Bayissa B., Ayelet G., Kyule M., Jibril Y. and Gelaye E., 2011. Study on seroprevalence, risk factors, and economic impact of foot-and-mouth disease in Borena pastoral and agro-pastoral system, southern Ethiopia. *Trop. Anim. Health Prod*. 43: 759–766.
9. James A.D. and Rushton J., 2002. The economics of foot and mouth disease. *Revue scientifique et technique* (OIE). 21: 637–644.
10. Knight-Jones, T.D.J., Rushton, J., 2013. The economic impacts of foot and mouth disease – what are they, how big are they and where do they occur? Prev. Vet. Med. 112, 161–173.
11. Rushton J. CAB International; Oxfordshire & Massachusetts: 2009. The Economics of Animal Health and Production; pp. 193–197.
12. http://www.footandmouthdiseaseinfo.org/factsheetindustryeconomics.aspx accssessed on 12/06/2017.
13. Delgado C., Rosegrant M., Steinfeld H., Ehui S.m and Courbois C., 1999. IFPRI; Washington, DC, USA: Livestock to 2020. The Next Food Revolution. Food, Agriculture and the Environment Discussion Paper 28; p. 72.
14. Ellis P.R., Putt S.N.H., 2008. Pan Livestock Services; Reading, UK. The Epidemiological and Economic Implications of the Foot and Mouth Disease Vaccination Programme in Kenya.
15. Barasa M., Catley A., Machuchu D., Laqua H., Puot E., Tap Kot D. and Ikiror D., 2008. Foot-and-mouth disease vaccination in South Sudan: benefit–cost analysis and livelihoods impact. *Transbound. Emerg. Dis.* 55:339–351.
16. Perry B.D., Kalpravidh W., Coleman P.G., Horst H.S., McDermott J.J., Randolph T.F., and Gleeson L.J., 1999. The economic impact of foot

and mouth disease and its control in South-East Asia: a preliminary assessment with special reference to Thailand. *Revue scientifique et technique (OIE)*. 18: 478–497.
17. Hamond J., 2011. An event organised by NFUS, Moredun and Scottish Government, 15 March 2011; FMD Vaccine: Practical Applications from an International Perspective-FMDV Vaccine to Live.
18. Sutmoller P., Barteling S.S., Olascoaga R.C. and Sumption K.J.,2003. Control and eradication of foot-and-mouth disease. *Virus Res*. 91: 101–144.
19. Forman S., Le Gall F., Belton D., Evans B., François J.L., Murray G., Sheesley D., Vandersmissen A. and Yoshimura S., 2009. Moving towards the global control of foot and mouth disease: an opportunity for donors. *Revue scientifique et. technique (OIE)*. 28: 883–896.
20. Paton D. J., de Clercq K., Greiner M., Dekker A., Brocchi E., Bergmann I., Sammin D.J., Gubbins S. and Parida S.,2006. Application of non-structural protein antibody tests in substantiating freedom from foot-and-mouth disease virus infection after emergency vaccination of cattle. Vaccine. 24:6503–6512.
21. Thompson D., Muriel P., Russell D., Osborne P., Bromley A., Rowland M., Creigh-Tyte S. and Brown C.,2002. Economic costs of the foot and mouth disease outbreak in the United Kingdom in 2001. *Revue scientifique et technique (OIE)*. 21: 675–687.
22. Mort M., Convery I., Baxter J. and Bailey C.,2005. Psychosocial effects of the 2001 UK foot and mouth disease epidemic in a rural population: qualitative diary based study. *BMJ (Clinical research ed.)*; 331:1234. 1234.
23. Mansley L.M., Donaldson A.I., Thrusfield M.V. and Honhold N., 2011. Destructive tension: mathematics versus experience – the progress and control of the 2001 foot and mouth disease epidemic. *Revue scientifique et technique* (OIE); 30: 483–498.
24. Jarvis L.S., Cancino J.P. and Bervejillo J.E., 2005. The Effect of Foot and Mouth Disease on Trade and Prices in International Beef Markets; American Agricultural Economics Association Annual Meeting, Providence, Rhode Island, 24–27 July 2005.
25. Le Gall F. and Leboucq N., 2004. The Role of Animal Disease Control in Poverty Reduction, Food Safety, Market Access and Food Security in Africa; Recueil des thèmes techniques présentés au Comité international ouaux Commissions régionales Vol. 2003, 87–106 et 107–126, Paris, France.
26. Otte M.J., Nuggent R. and McLoed A. 2004. FAO; Rome, Italy. Transboundary Animal Diseases: Assessment of Socio-economic Impacts and Institutional Responses, Livestock policy discussion paper No 9.
27. Sumption K., 2009. Foot and Mouth Disease Situation and Control Strategies in Europe – the Current Situation; OIE/FAO Global Conference on Foot-and-Mouth Disease – The Way Towards Global Control, 24–26 June 2009, Asuncion, Paraguay.
28. Rich K.M., Perry D. and Kaitibie S., 2009. Commodity-based trade and market access for developing country livestock products: the case of beef exports from Ethiopia. *Int. Food Agribus. Manag. Rev*. 12:1–22.

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