

Policy analysis for delivery of contagious bovine pleuropneumonia control strategies in sub-Saharan Africa

J.O. Onono ^{(1)*}, B. Wieland ⁽²⁾, A. Suleiman ⁽³⁾ & J. Rushton ⁽⁴⁾

(1) Department of Public Health Pharmacology and Toxicology, P.O. Box 29053-00625, University of Nairobi, Kenya

(2) International Livestock Research Institute, P.O. Box 5689, Addis Ababa, Ethiopia

(3) Department of Veterinary Public Health and Preventive Medicine, Ahmadu Bello University, Samaru Campus, Zaria, Nigeria

(4) Department of Production and Population Health, Royal Veterinary College, University of London, United Kingdom

*Corresponding author: joshua.orungo@uonbi.ac.ke

Summary

This paper presents a policy analysis for the implementation of contagious bovine pleuropneumonia (CBPP) control strategies in pastoral regions of sub-Saharan Africa, where the disease is endemic. A framework for policy analysis was adapted for this review. The framework has eight principal steps: defining the context of the policy, identifying the problem to be addressed by the policy, searching for evidence of the problem, identifying policy options, projecting policy outcomes, evaluating the potential policy options, weighing their outcomes and making the policy decision.

The data and information used to search for evidence of the problem, options for solving the problem, and the projected outcomes of those options were obtained from both published and grey sources of literature. The policy problem for CBPP control in sub-Saharan Africa was identified as a failure to deliver control services to farmers whose cattle are at high risk of exposure to infection. The authors suggest the adoption of signed contractual agreements between the public and private sectors to support the vaccination of susceptible herds raised in endemic regions. Implementation of this policy will increase vaccination coverage of susceptible cattle herds since current vaccination coverage is low.

Keywords

Contagious bovine pleuropneumonia – Control technology – Policy analysis – Public–private partnership – Sub-Saharan Africa – Vaccination.

Introduction

Contagious bovine pleuropneumonia (CBPP) is an infectious disease of cattle, caused by *Mycoplasma mycoides* subspecies *mycoides* small-colony type. It is widespread in pastoral areas of sub-Saharan Africa, but outbreaks have also been reported in other parts of the world (1). The disease affects cattle productivity through high morbidity and mortality in herds during outbreaks, thus directly affecting the livelihoods of cattle keepers. However, in pastoral areas where it is endemic, the implementation of control policies is hampered by a lack of allocated funds from most governments, which affects the delivery of vaccination services.

Policies for CBPP control in different production systems were outlined by the Food and Agriculture Organization of

the United Nations (FAO) in a concept paper on emergency control of contagious bovine pleuropneumonia in southern and eastern Africa (2). These strategies included annual vaccination, movement control, stamping out and abattoir surveillance.

Different countries have described the role of their Veterinary Services in delivering vaccination services, enforcing movement controls on cattle from endemic zones to disease-free areas, and applying a test-and-slaughter policy in disease-free areas (3, 4). However, implementing these policies has not been free from obstacles, principally the scarce national resources generally allocated for CBPP control. Furthermore, the role of the private sector in the control and management of CBPP is not properly defined. Maasai pastoralists in Kenya have been reported as responding to the occurrence of CBPP in their herds by antibiotic treatment of clinical cases and the slaughter of

cattle that do not respond to treatment (5, 6). This policy gap requires further review, building on those strategies applied by the public sector to control the disease. This will help to identify an effective way of implementing disease control strategies in CBPP-endemic regions.

Policy analysis is the process of identifying and evaluating all possible programmes that are intended to resolve social, economic or physical problems (7). There is a distinction between analysis of the policy process and analysis of policy content. Analysis of the process is policy formulation, while analysis of the content focuses on the technical details of policy options. In general, policy analysis illustrates the need for interventions in addressing important policy issues, to improve their implementation process and therefore gain better outcomes. This review adapted a framework developed for the analysis of health policy by Collins (8), to analyse the content of different policy options for the control of CBPP. The framework has eight principal steps:

- defining the context of the policy
- identifying the problem to be addressed by the policy
- searching for evidence of this problem
- identifying different policy options
- projecting their outcomes
- applying evaluative criteria
- weighing the outcomes, and
- making the decision.

Briefly, these steps can be summarised, as follows.

Defining the context

Defining the policy's context involves providing background information on the country or region affected. It also involves describing the socio-economic and cultural determinants of the policy problem, a process which subsequently forms the basis for policy analysis.

Identifying the problem

A policy problem is a situation or condition that has a current or potential future adverse effect on people's livelihoods. Whether a problem requires further research depends on three conditions: there is a discrepancy between what exists and the ideal or planned conditions; the reasons for the observed discrepancy are unclear; and there is more than one solution to the problem.

Searching for evidence

Searching for evidence involves collecting data and information to define the significant features of the problem under study.

Identifying policy options

This step involves developing alternative courses of action to alleviate the policy problem.

Projecting policy outcomes

This step is concerned with predicting the possible and/or probable results of each of the proposed policy options.

Applying evaluation criteria

In this step, the policy analyst judges the possible or probable outcomes of the proposed policy options against established criteria: relevance, progress, efficiency, effectiveness, and the impact of each alternative.

Weighing outcomes

Weighing outcomes involves deciding on the pros and cons of each potential intervention, and the range of possible outcomes. An intervention with a more favourable outcome is given a heavier weighting. Once this has been thought through, genuine trade-offs between the policy options can be considered.

Making policy

Making the policy decision should only be considered after the potential outcomes of all the alternatives have been carefully weighed. Any decision on which policy alternative should be pursued depends on the policy problem under examination, and its specific context.

Pastoral systems play a vital role in supporting the livelihoods of pastoralist households and providing food security in most countries in sub-Saharan Africa. However, there are a myriad of challenges facing these systems, including outbreaks of infectious disease. With this in mind, the authors present a policy analysis for implementing CBPP control strategies to reduce the impact of this economically important disease on affected households.

Defining context: identifying challenges for contagious bovine pleuropneumonia control

Livestock production systems in sub-Saharan Africa are classified according to the function of the livestock, their management, and herd size and structure. These systems include pastoral, ranching and dairy production systems (9, 10). CBPP is reported to be endemic in most pastoral systems in the region (11, 12). These pastoral systems account for about 77% of the annual beef offtake in most

African countries (9, 13). For example, in Kenya, of the total national cattle population of 17 million head, an estimated 12 million head are raised under pastoral systems (13). Therefore, cattle raised in pastoral systems are an important source of livelihood for households living within pastoral areas, and also contribute to national food security. These pastoral areas are characterised by a great number of challenges, including poor road infrastructure, cattle rustling, frequent drought, scarcity of clean drinking water for both household use and livestock production, livestock diseases, lack of extension services, and poor marketing infrastructure (14, 15, 16).

Public Veterinary Services have the sole mandate to handle vaccines and deliver vaccination services against CBPP in most countries in sub-Saharan Africa (4, 11). However, vaccination coverage has been low, due to limited resources being budgeted for animal health activities. For example, in Kenya, vaccination coverage is estimated at only 20% of susceptible cattle herds (4), while, in Nigeria, coverage varies between 4% and 39% (12, 15, 17). Instead, pastoralists use antibiotics to treat clinical cases, but this is not listed as an official control measure against CBPP (18). Antibiotic therapy may result in the carrier state, which may complicate CBPP control efforts (19). However, pastoralists have attested to antibiotics' usefulness in reducing the severity of clinical disease in cattle. These

antibiotics are readily available to pastoralists through drug stockists found in local marketplaces, and are often sold and given by people who have no or insufficient training in animal health. According to Ole-Miaron *et al.* (20), the lack of enforcement of veterinary legislative controls in Kenya resulted in an invasion of pastoralist market centres by travelling veterinary drug salesmen. The authors reported that these salesmen were exploiting pastoralists and selling injectable antibiotics without specifying their preferred route of administration or correct dosage. But antibiotics remain a popular control option among pastoralists, because culling infected cattle and in-contact herds and restricting movements from infected areas to disease-free areas is reportedly difficult in pastoralist regions where CBPP is endemic (11). The difficulties in implementing restrictions are compounded by cattle rustling and cultural practices that necessitate movement, e.g. loaning cattle to other pastoralists and using cattle for payment of a bride price (15).

Identifying the policy problem

Figure 1 shows the problem tree analysis used to identify the challenges involved in implementing CBPP control, and the resulting market failure in providing CBPP control to

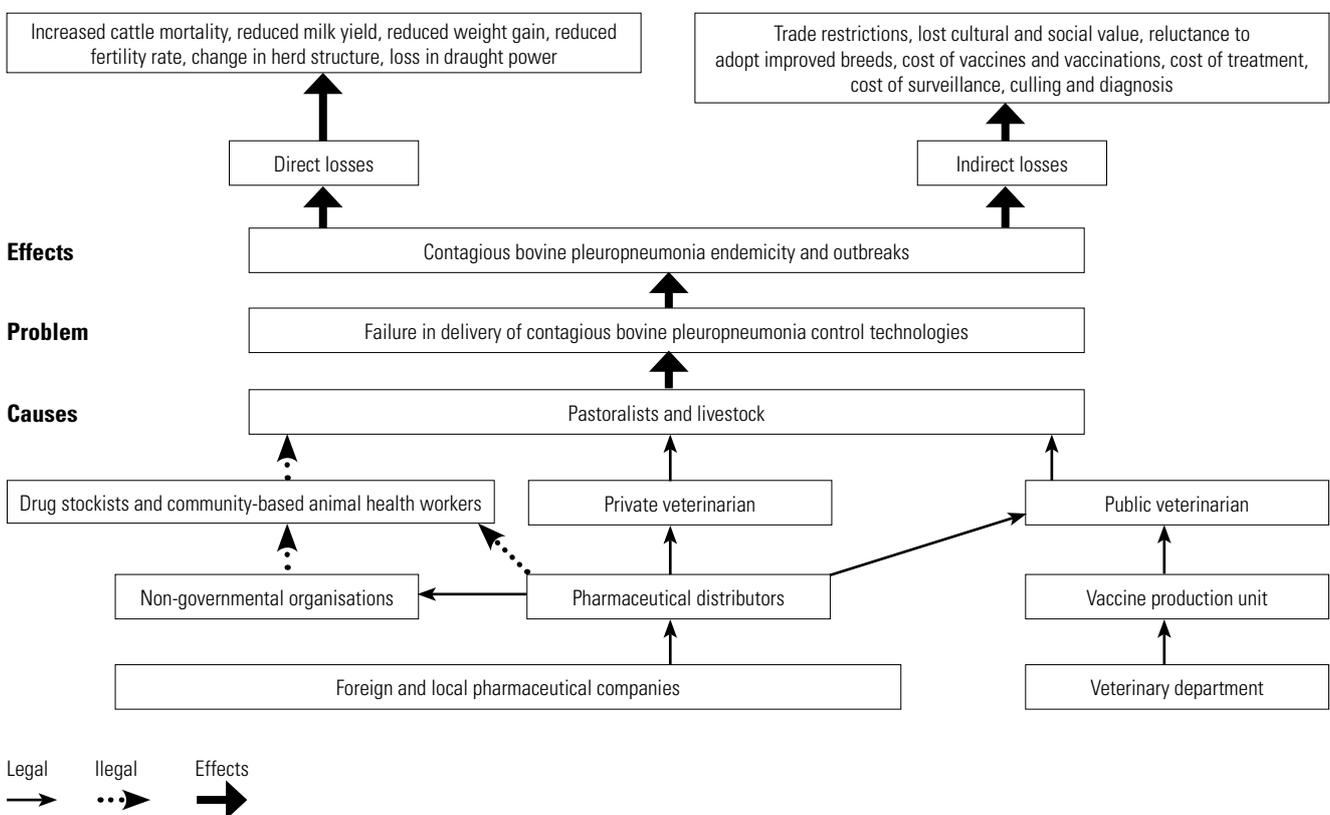


Fig. 1
Identification of contagious bovine pleuropneumonia control challenges in semi-arid pastoral areas

under-served cattle farmers in arid and semi-arid pastoral areas. This policy problem arises from the fact that drug stockists and community-based animal health workers (CBAHWs) are the personnel supplying pastoralists with veterinary care. In Narok County in Kenya, they supply approximately 80% of pastoralists with veterinary services, while extension services from the public sector are minimal (14, 21). Qualified private veterinary practitioners do not practise in these pastoral areas. Furthermore, drug stockists and CBAHWs who are supported by non-governmental organisations (NGOs) are not licensed to handle veterinary drugs and vaccines. Moreover, they are not authorised to deliver veterinary services either. Most of the NGOs which operate in these environments are registered with the Department of Social Services, and do not report to the Veterinary Services. Finally, vaccines used against CBPP are solely handled by qualified veterinarians working under the Veterinary Services (3, 4). Thus, CBAHWs and drug stockists who supply most pastoralists with veterinary services do not have access to vaccines against CBPP.

Searching for evidence of the policy problem

Delivering animal health services in pastoral areas involves several challenges (22). These include the distance that must be travelled by veterinary service providers and pastoralists, time spent while seeking veterinary services and the high cost of veterinary services (21, 23). For the most part, pastoralists rely on CBAHWs and untrained drug stockists for the delivery of veterinary services (4, 21, 24). Wood (25) has described the importance of distance as a transaction cost in delivering animal health services in Zimbabwe. She reported that, as the distance between animal health providers and farmers increased, the number of farmers who requested these services decreased and there was a reduction in the ability of animal health service providers to supply veterinary services. These challenges have also affected the delivery of vaccination services against CBPP in most pastoral areas of sub-Saharan Africa. Furthermore, the poor road network in most of these areas also contributes to the challenges of delivering vaccination services against CBPP.

Policy options for contagious bovine pleuropneumonia control in pastoral areas

A review of the state of animal health service delivery in Africa provided a number of suggestions for improving the delivery of veterinary services (26). These included:

the need to retain para-professionals in veterinary delivery systems; the importance of enhancing relationships between veterinary professionals and para-professionals; the development of state contracting procedures to assist the private delivery of veterinary services and the strengthening of professionalism in service delivery.

Private veterinary practitioners, who are contracted through signed agreements with the public Veterinary Services, could offer essential services, such as vaccinations against CBPP. These private practitioners could provide vaccinations at particular times of the year when cattle are at high risk of exposure to CBPP infection, but the public sector would subsidise the cost of vaccines and vaccine delivery. This policy is based on a suggestion by Leonard (26) that contractual agreements between the public sector and private veterinary professionals are essential to deliver animal health services in sub-Saharan Africa. The FAO/World Organisation for Animal Health (OIE)/African Union Interafrican Bureau for Animal Resources (AU-IBAR) Consultative Group for CBPP Control in Africa also proposed that engaging the private sector in delivery channels for vaccines would improve the delivery of these services (27). The social enterprise business model operated by Sidai Africa is an example of how this policy could be implemented (www.sidai.com). Sidai Africa is a social enterprise operating in Kenya, which aims to deliver quality animal health services to livestock farmers. The services and product range include vaccines, quality feeds, diagnostic services, financial services and livestock insurance for livestock farmers. These businesses are managed by qualified veterinarians and livestock technicians who charge a competitive price for veterinary products and services.

Antibiotic treatment for clinical cases of CBPP can be enhanced by the services offered by CBAHWs, who have basic training in animal health and work under the supervision of a trained veterinary professional (28). This strategy will tap the network that these personnel have with local communities, not only to treat cases of CBPP, but also to improve the reporting of disease outbreaks. This policy approach is based on the need for improvement in the relationship between veterinary para-professionals and qualified veterinarians.

Pastoralists can be trained to identify CBPP cases through enhanced extension services. This training should be supported with an enhanced reporting mechanism for CBPP outbreaks, to facilitate a fast response, either through implementing a stamping-out policy or imposing movement controls on cattle from outbreak foci. Traditionally, agricultural extension approaches have focused on production. But a new school of thought views extension from the perspective of community livelihoods (29). This view suggests that effective extension should focus on approaches that enhance livelihoods, through increased

benefits to the community as producers, labourers or consumers. Such approaches should improve livelihood security for household members and reduce vulnerability through strategies that prioritise, avoid and reduce risks; by providing an environment that empowers people by developing their negotiation skills with other market actors and extension providers; and by institutionalising reforms that define how state and non-state actors can interact to provide extension services. Yet Kenya lacks adequate extension services in pastoral areas (30). The common practice among pastoralists during outbreaks of CBPP is home slaughter of clinical cases, or treatment with antibiotics which are obtained from drug stockists.

The practice of home slaughter cannot eliminate exposed cattle from herds since subclinical cases are left behind. For effective eradication of CBPP, the preferred strategy is testing and slaughter of both infected and in-contact cattle herds (11, 31). This control strategy was implemented in the 1996 outbreak in Botswana (32), and the Kazungula district of Zambia during an outbreak in 2004 (24). In the Zambian case, the involvement of the private sector was reported to have benefited both the community and the disease control strategy. In this outbreak, a total of 16,800 head of cattle with an approximate value of US \$5.6 million were slaughtered and farmers were compensated by the private sector, which bought the carcasses of the slaughtered cattle and sold them through their meat retail networks. The eradication of infected cattle and in-contact herds enabled farmers to restock their herds once the movement ban was lifted and the area declared free from CBPP. Community members were encouraged to form CBPP task forces that ensured that no animal was introduced into the area during or immediately after the eradication campaign. In addition, farmers were educated on the importance of not mixing cattle in grazing fields or with animals from neighbouring districts and countries.

In the Botswana case, a total of 320,000 head of cattle were slaughtered in the Ngami district and the cost of eradication and compensation was estimated at US \$97.5 million (11, 32).

Abattoir surveillance is another control strategy that can be effective and one that was helpful in the eradication of CBPP in Italy (1). The strategy has advantages because CBPP has typical and specific pathological lesions that are found in the lungs of affected animals. This, together with proper records on animal movement, can help to trace back the origins of cattle when a positive case is identified in an abattoir. Additionally, it can be used to declare an area free from CBPP after the implementation of various control strategies. The concept paper published by the FAO Expert Consultation on the Emergency Prevention System (EMPRES) on the control of contagious bovine pleuropneumonia in southern and eastern Africa (2) proposed the need to intensify abattoir

surveillance, by training meat inspectors to recognise CBPP lesions and take appropriate samples to the laboratory for confirmation. This was coupled with field surveillance in areas where cattle are known to gather, such as dip tanks.

Projection of policy outcomes on contagious bovine pleuropneumonia control

Vaccines require proper handling and management of the cold chain. Accordingly, personnel who handle vaccines should be trained in the handling and delivery of vaccination services. Private veterinary professionals who enter into contracts with the public Veterinary Services can deliver vaccination services against CBPP, to protect cattle herds against infection. The vaccine strains of *Mycoplasma mycoides* subspecies *mycoides* small-colony biotype which are recommended for CBPP control in Africa by the Pan African Veterinary Centre include T1-SR and T1/44 (48). According to Nkando *et al.* (33), the T1/44 vaccine strain, which is used to control the disease in eastern Africa, offers immunity for a period of more than one year. However, this contradicts earlier reports, which concluded that immunity from the CBPP vaccines used in Africa would not last more than three months after vaccination (34). The protection obtained from vaccination would reduce production losses in cattle: deaths, losses from reduced milk yield, weight loss and abortions. The effectiveness of various vaccination strategies against CBPP infection is predicted through mathematical modelling techniques (5, 35, 36). These models have shown that biennial vaccination of susceptible herds, when conducted for a period of five consecutive years, significantly reduces the prevalence of CBPP. Moreover, vaccination is the preferred control strategy of pastoralist communities. For example, Kairu-Wanyoike *et al.* (37) reported that pastoralists in Narok County in Kenya were willing to pay US \$3 for vaccines and vaccination services against CBPP. Antibiotic treatment of clinical cases by trained CBAHWs, who are trained and supervised by veterinarians, would enhance the supply of quality veterinary drugs, used at the right dosage. Furthermore, CBAHWs who are supported by NGOs to deliver animal healthcare services would have better access to quality antibiotics (28). Treating CBPP cases has the potential to reduce the spread of CBPP to other susceptible cattle herds, hence reducing production losses (19, 38). Treating clinical cases with antibiotics is reported to result in carrier status (39); however, this proposition has not been supported by empirical evidence. Reports from experimental trials have shown that some antibiotics, including oxytetracycline, danofloxacin, advocin, florfenicol, spectinomycin, tulathromycin and tilmicosin, have beneficial effects for

CBPP control. These include a reduction in the rate of disease spread between infected and in-contact herds (19, 38); *in vitro* mycoplasmastatic effects (40, 41, 42); and reduced formation of sequestra in infected cattle (43). Experiments have yet to demonstrate that antibiotics have mycoplasmacidal effects on natural infections.

Educating pastoralists to recognise the early signs of CBPP infection and culling infected herds has the potential to reduce the spread of CBPP. However, since most cases of CBPP are subclinical in nature, there are problems with reliance on this approach (44). Moreover, the diagnostic tests used in the field have low specificity and sensitivity. Culling infected and in-contact herds has adverse effects on farmers and their communities, due to the high costs of implementation, in addition to the negative social effects on farming households (45). More available and more affordable point-of-care tests with high sensitivity and specificity would greatly enhance the targeted culling of infected and in-contact herds during outbreaks.

Abattoir surveillance and keeping proper cattle movement records are important in tracing infected cattle back to their source if they are delivered to abattoirs. This enables targeted action, through vaccination, movement restrictions or slaughter of infected and exposed cattle herds. As a result, this strategy would complement other strategies during the implementation of control programmes.

Evaluation of policy options for contagious bovine pleuropneumonia control

The evaluation criteria were based on the outcomes of potential policy interventions (8). These criteria included whether an intervention contributed to enhancing the implementation of CBPP control services to pastoralists, its projected economic efficiency and its overall positive impact on cattle production.

As explained above, adopting contractual agreements signed between public Veterinary Services and private veterinary professionals is important for the proper management of vaccines and the cold chain. This would eventually result in higher vaccination coverage, as compared to the current coverage rates of between 4% and 39% by public Veterinary Services in the region (4, 12, 17). Vaccinations against CBPP have the potential to protect a large number of cattle herds. In addition, this policy is economically profitable, based on past economic analyses. According to Tambi *et al.* (46), the implementation of a vaccination strategy across 12 countries in sub-Saharan Africa was profitable. The financial return on investment in CBPP control was

positive, with benefit–cost ratios ranging from 1.61 to 2.56. Furthermore, an analysis by Onono *et al.* (47) showed that vaccination was the most economic control strategy for pastoralists, with an estimated cost of US \$192 per herd of 100 head of cattle. In comparison, slaughtering clinical cases had an estimated cost of US \$912 per herd, while antibiotic treatment for clinical cases had an estimated cost of US \$210 per herd. However, the T1/44 vaccinal strain used has residual virulence and may cause post-vaccinal reactions in a small fraction of vaccinated cattle (34, 48).

Antibiotics used for the treatment of clinical cases are currently available from drug stockists or CBAHWs. In theory, the use of antibiotics for CBPP may lead to a reduction in the severity of clinical disease and the spread of CBPP to susceptible cattle herds, hence a potential positive return to livestock farmers (38, 43, 49). However, agents with mycoplasmacidal activity are yet to be discovered.

The slaughter of clinical cases and in-contact herds is technically effective for CBPP control; however, it has huge economic consequences. For example, in Botswana, the cost of slaughtering 320,000 head of cattle in Ngamiland was US \$97.5 million (11). Furthermore, according to Boonstra *et al.* (45), applying this strategy led to food security challenges for children under five years of age. This was evident from the increase in the relative risk of malnutrition during the eradication period in Ngamiland, where the outbreak occurred. The practice by Kenyan pastoralists of slaughtering clinical cases was also shown to result in high economic costs (47). Nevertheless, this strategy was useful for the eradication of CBPP in Australia (31). Furthermore, the involvement of the private sector in applying this policy in Zambia was successful. This was a case of public–private partnership to control disease, and farmers benefited by obtaining the salvage value of the slaughtered cattle (24).

Weighing outcomes: policy trade-offs for contagious bovine pleuropneumonia control

A decision on the best policy option must be based on whether this strategy is expected to improve the delivery of CBPP control services. Applying the test-and-slaughter strategy requires specialised diagnostic techniques. In addition, its high cost requires funding from the government and development partners, or collaboration with the private sector, as reported from Zambia (24).

Vaccination, on the other hand, can be delivered by private veterinary professionals who are contracted to the public Veterinary Services, or through adoption of the social

enterprise model by practitioners who operate in the affected areas. Engaging the services of these private veterinary professionals will improve vaccination coverage at times of increased risk for CBPP infection. But the effectiveness of the social enterprise model requires further evaluation to see how this approach can address competition from unlicensed drug stockists, who dominate the provision of animal health services in these areas. The adoption of community-livelihood-focused extension services would help to build the capacity of pastoralists in regard to early recognition and reporting of outbreaks. Furthermore, abattoir surveillance should be intensified, animals with characteristic lung lesions identified, and tracing-back systems initiated to enable the detection of the origin of diseased cattle. However, with weak regulations on animal movement controls from infected to infection-free areas, this strategy still faces implementation challenges. Furthermore, culling infected and in-contact cattle herds will have huge economic costs for pastoralists and is undesirable for these resource-poor communities. Although antibiotic treatment of clinical cases is common in semi-arid pastoral areas, this only provides temporary relief, as untreated animals are still at high risk of infection. In addition, antibiotic treatment enables CBPP to persist in cattle herds and risks the creation of carrier animals.

Policy decision on contagious bovine pleuropneumonia control for pastoralists

Policy analysis suggests that adopting contractual agreements between the public and private sector is the best way forward to effectively deliver vaccination services in pastoral areas. Moreover, untrained people who operate drug stores and CBAHWs can be integrated into the

delivery of animal health services in pastoral areas. This could be achieved through continual, compulsory, short-course training, and supervision by qualified veterinary professionals. Their integration will strengthen disease surveillance activities within their areas of operation. Furthermore, they can take part in coordinating grassroots vaccination campaigns during times of high risk for CBPP infection.

Conclusion and recommendations

In conclusion, the policy analysis framework was useful for the careful consideration of options for the effective implementation of CBPP control strategies in pastoral areas. The framework took into account the benefits and shortcomings of each policy alternative. The option of vaccinating susceptible herds of cattle, with minimum cost to pastoralists and positive returns, is recommended. However, to increase vaccination coverage of susceptible cattle in endemic areas, signed contractual agreements between the public and private sectors should be adopted. Additionally, extension services that focus on the enhancement of community livelihoods should be initiated to build pastoralists' capacity to identify positive cases and encourage early reporting of CBPP during outbreaks.

Analyse des politiques en vue de la mise en place de stratégies de lutte contre la péripneumonie contagieuse bovine en Afrique subsaharienne

J.O. Onono, B. Wieland, A. Suleiman & J. Rushton

Résumé

Les auteurs présentent une analyse des politiques afin de décider des stratégies de lutte à mener contre la péripneumonie contagieuse bovine (PPCB) dans les régions d'élevage pastoral d'Afrique subsaharienne, où la maladie sévit à l'état endémique. Un cadre d'analyse des politiques a été configuré pour les besoins de cette étude. Ce cadre comporte huit étapes principales : définition du contexte des

políticas à mener ; identificación del problema ; investigación d'elementos factuales relativos al problema ; identificación de las medidas envisajables ; definición de los resultados esperados ; evaluación de las opciones potenciales ; comparación de los resultados ; toma de decisión.

Las datos y la información reunidos durante la investigación d'elementos factuales, las soluciones propuestas para resolver el problema y los resultados esperados de cada opción provenían de fuentes publicadas así como de la literatura gris. El resultado de este análisis es que el principal problema en materia de lucha contra la PPCB en África subsahariana es la ausencia de servicios apropiados destinados a los ganaderos de los que los bovinos son particularmente expuestos al riesgo de infección. Los autores proponen recurrir a acuerdos contractuales que comprometan al sector tanto público como privado en apoyo de la vacunación de los rebaños sensibles en las regiones endémicas. La puesta en marcha de esta política permitiría incrementar la cobertura vacunal del ganado bovino sensible, que actualmente está a un nivel mediocre.

Mots-clés

África subsahariana – Análisis de políticas – Partenariado público-privado – Péripleumonía contagiosa bovina – Tecnologías de lucha contra las enfermedades – Vacunación.

Análisis de las políticas para aplicar estrategias de lucha contra la perineumonía contagiosa bovina en el África subsahariana

J.O. Onono, B. Wieland, A. Suleiman & J. Rushton

Resumen

Los autores presentan un análisis de las políticas de aplicación de estrategias de lucha contra la perineumonía contagiosa bovina en regiones de pastoreo del África subsahariana, donde la enfermedad es endémica. Para llevar a cabo el estudio se adaptó un modelo de análisis de políticas que consta de ocho pasos principales: definir el contexto de la política; acotar el problema al que la política debe dar respuesta; buscar datos empíricos que evidencien el problema; determinar diferentes opciones políticas; proyectar los resultados de cada política; evaluar las posibles opciones políticas; comparar sus resultados; y decidirse por una u otra política.

Los datos y la información utilizados para buscar datos probatorios del problema, determinar posibles opciones para resolverlo y proyectar los resultados que vayan a deparar esas opciones procedían de fuentes bibliográficas publicadas y de documentación inédita. Se llegó a la conclusión de que el problema de las políticas de lucha contra la perineumonía contagiosa bovina en el África subsahariana reside en la ausencia de servicios zoonosanitarios en beneficio de los ganaderos cuyos animales están muy expuestos al riesgo de infección. Los autores proponen que el sector público y el privado suscriban acuerdos contractuales para respaldar la vacunación de los rebaños susceptibles en las regiones de endemismo. La aplicación de esta política incrementará la cobertura de vacunación de los rebaños vacunos susceptibles, que en la actualidad es escasa.

Palabras clave

África subsahariana – Análisis de políticas – Asociación público-privada – Perineumonía contagiosa bovina – Tecnología de control zoonosanitario – Vacunación.

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