SUMMARY OF THE WORKSHOP ON THE CONTROL AND ERADICATION OF PESTE DES PETITS RUMINANTS (PPR)

INTERNATIONAL SHEEP VETERINARY CONGRESS

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WORKSHOP GOALS:

- *To support PPR global eradication through understanding the epidemiology of the virus, vaccine technologies, and the political, social and economic context for eradication.*
- *To identify best strategies for producers, veterinarians and other stakeholders to contribute to PPR eradication efforts.*

FOREWORD:

The Food and Agriculture Organization of the United Nations (FAO) and the World Organization for Animal Health (OIE) have developed a programme to eradicate PPR and the virus that causes it, by 2030. This program is termed the Peste des Petits Ruminants Global Eradication Programme or the PPR-GEP[1]. This workshop was organized by the International Goat Association (IGA) to present multiple perspectives on the benefits and challenges of this massive undertaking. IGA has been the advocate of goat research, production and development to benefit humanity since 1982, and is a member of the PPR-GEP Advisory Council.

SUMMARY FROM THE PRESENTERS

The participants congratulate FAO, OIE and other partners for the 2030 vision of global freedom of Peste des Petits Ruminants. Eradication will improve small ruminant production that can contribute to gender empowerment, food security, poverty alleviation and resilience as well as biodiversity conservation, if done correctly. We request each ISVC participant to advocate for this vision to donors and decision makers to financially support the implementation of PPR Global Eradication Programme.

PPR is the third viral disease targeted for global eradiation, after smallpox in humans, and rinderpest in cattle. The selection of PPR indicates the importance of small ruminants for human livelihoods and nutrition, and environmental impacts, and presents an opportunity for us to expand public knowledge and attitudes about sheep and goats for the future.

SUMMARY OF PRESENTATIONS:

SESSION I - TECHNICAL ASPECTS OF PESTE DES PETITS RUMINANTS

MOLECULAR EPIDEMIOLOGY OF PESTE DES PETITS RUMINANTS
DR. DALAN BAILEY

From this presentation, it is clear that PPR is a disease that is widespread, spreading and has devastating effects on animal health and on the economies of the poorest people in the poorest countries. Some facts

[1] http://www.oie.int/fileadmin/Home/eng/Media_Center/docs/pdf/PortailPPR/EN_GEP_PPR_Finalweb.pdf

offered by Dr. Bailey: PPR has now spread to over 70 countries in Africa, Middle East and Asia. More than 1.7 billion sheep and goats are at risk of PPR; this amounts to 80% of the global population of these species. Poor farmers rely on small ruminants; the estimated number is 330 million – the demand for small ruminant meat and milk continues to rise and by 2030 is expected to be at 177% of current numbers. Finally, PPR is estimated to cause 1.45 to 2.1 billion USD losses per year.

PPR is caused by a morbillivirus (PPRV) related to rinderpest (eradicated in 2011) of cattle and human measles. There is some evidence that there is cross-protection between the two livestock viruses. The acute disease is a systemic viral infection that attacks the epithelia and immune cells. Goats are more severely affected than sheep. When a region is first infected, morbidity is very high (100%) as is mortality. The signs are high fever, nasal discharge, erosive lesions of the respiratory tract, diarrhea, pneumonia, dehydration and high case fatality rate. Other diseases may appear similarly: contagious caprine pleuropneumonia (CCP), bluetongue (BT), orf, foot and mouth disease and pneumonia due to *Mannheimia haemolytica*. Asymptomatic infection of cattle frequently occurs with PPRV in the wild. The virus is quite simple – only 6 genes, and is an enveloped RNA virus.

Vaccination forms the backbone of a PPR control or eradication program. Dr. Bailey reviewed some of the requirements of an effective PPR vaccine. The vaccine must be able to confer life-long immunity and be safe, cheap and broadly available. It should be easy to administer (e.g. oral or intranasal instead of injectable). The dose should be a small volume to lessen the volume for transportation. It should confer protection very soon after vaccination and not allow carrier states. It should protect against all lineages. It should be safe and effective in very young animals as well as adults. Live attenuated vaccines often provide a better immune response but must be thermostable to break cold chain requirements. These vaccines must also be produced in facilities that can ensure Good Management Practices (GMP) standards are met and yet be responsive to changing and increasing demand for product. At this point, there is no DIVA PPR vaccine (DIVA = Distinguish naturally Infected from Vaccinated Animals). DIVA vaccines use genetically modified organisms – will this be an impediment to adoption? A DIVA vaccine is important to assure PPRV eradication has occurred, i.e. in the later stages of eradication as it will allow the ability to serologically differentiate vaccinated from naturally infected animals.

Diagnosis of PPR infections is important to understand the changing range of this disease – both geographically and species. This will impact how the PPR eradication program is executed in that particular country or region. Different methods are used: direct virus isolation using highly permissive cells lines; antigen detection using antigen capture ELISA (lateral flow device – research tool only at this point); genetic detection using Polymerase Chain Reaction (PCR), reverse transcriptase PCR (rtPCR), LAMP PCR (uses a florescent dye); and / or antibody detection using either Virus Neutralization (VN) or Competitive ELISA (C-ELISA).

When determining if PPR is the agent operating in the population, the OIE manual recommends the use of C-ELISA unless needing to confirm its presence in a clinical case in which virus isolation or PCR is recommended. Virus neutralization is the recommended method for detecting an immune response at the individual or population level. Immunocapture ELISA is used for confirmation of clinical cases.

Use of molecular epidemiology can be used to determine the source and spread of PPRV. There are four separate phylogenetic lineages – all are the same serotype and have no differences in pathogenicity or serological response. It appears that the Lineage IV virus is the one that has spread recently into north Africa and east Asia.

There have been many recent advances in PPRV diagnostics including the development of penside (i.e. point of care) tests and better understanding of the virus, the tissues it infects and the different immunological responses. Some of this research has shown that cattle may become infected with PPRV in some regions – there is debate on whether cattle may be carriers as well as other ruminant and non-ruminant wildlife. More work needs to be done including: improving vaccines and their implementation; developing more

diagnostic capacity to improve surveillance activities; better understand the virus, host susceptibility and resistance, transmission and environmental stability; learn more about the impact of PPR and translate that for the public; and understand more about the role of co-morbidities (e.g. BT and sheep & goat pox) and how that will affect an animal's immune response and thus control and eradication of PPR.

EPIDEMIOLOGY OF PESTE DES PETITS RUMINANTS
DR. RICHARD KOCK

Dr. Kock worked in rinderpest (RP) eradication and noted that it took 60 years to eradicate this virus after a vaccine became available. What was important to the success of RP eradication is that the virus is not sustained in other non-bovine populations. It also requires a large population of susceptible animals to perpetuate the disease. RPV has been shown to either kill the host or if the host recovers, it has life-long immunity. It would be a mistake to assume the same is true with PPRV.

It is important to understand the role of wildlife in PPR eradication plans. Buffalo were used to monitor for serological status to indicate if RPV was circulating in a geographic region. PPRV infection can only be differentiated from RPV using virus-neutralization serology (VN). In 2004, there was evidence of PPRV infection in buffalo in Uganda but at a low level. Because of the risk of having trade restrictions imposed if PPRV was found, the local government didn't follow-up with additional surveillance until 2007 when expression of PPR amongst livestock was countrywide and OIE was advised. In 2015, in the same region, buffalo were found to be 87% seropositive. At that point, there was only 500 sheep in the park and no illness was detected. So, the question is – how is PPRV infection being introduced to the buffalo? Is it through trade and movement of livestock or is the virus circulating in the wildlife populations? There is also evidence of PPRV infection in buffalo and various antelope in the Serengeti; both antibody and antigen found – but no evidence of disease yet.

This is different than what has been happening recently in Central Asia where many outbreaks of disease in mountain caprines and desert gazelles have been reported and most recently in Mongolia in Saiga antelopes in 2017 where over ½ the population has died in 3 months. This was after an epidemic had started in sheep and goats in the region but also interestingly involving yak. In both cases, these species are dying of PPR. Dr. Kock indicated that it is critical to more fully understand the species range of this virus and its virulence in the different species, including those that are endangered. He also mentioned that the risk to humans needs to be better understood.

The good news is that surveillance tools are available that don't require an expensive infrastructure. Also, the vaccine is highly immunogenic if properly made (quality control) and if also thermotolerant, the vaccine is inexpensive and practical for large-scale vaccination programs. He did indicate that livestock keepers want control of vaccination initiatives.

Key epidemiological questions that need to be investigated: how might PPRV persist including under heavy vaccination pressure; are there other PPRV reservoir species; could the virus change in a multispecies environment – has it changed; and do we understand how vaccination strategies should be best adopted to the different livestock systems that the program will encounter? He is not convinced by current thinking on the molecular epidemiology; which suggests a regional evolution of virus lineages. For example, in East Africa, multiple lineages have been found and their origin is not easily explained on a geographic basis. But studying the molecular epidemiology should in time help to identify how it is spreading.

A question from the audience asked how sure we are that RPV is truly eradicated? Since 2001 there is no evidence of seropositivity in wildlife which strongly suggests that RPV is no longer. There is always the possibility that if RPV and PPRV are eradicated that a new virus will "take its place" as ecological niches don't tend to stay empty very long.

ADVANCES IN MORBILLIVIRUS VACCINE TECHNOLOGY
DR. JEREMY SALT

The current PPRV vaccine is very good. The vaccine is a lyophilized modified-live virus (MLV) of a single serotype. The current vial size and volume of administration fits the needs of the OIE FAO PPR-GEP. Dr. Salt brought up the need for increased production capacity needs that must also ensure quality. There are some other considerations to improve the vaccine.

Combination vaccines that include other important viral pathogens could be included. This could be done as a conventional combination vaccine, e.g. Lyopox +PPR (PPR/SGP, MCI, Morocco). This could be also done as a vectored vaccine, i.e. one made from another modified live virus (MLV) that has been genetically modified, antigenic genes for PPRV have been inserted into the MLV genome. This vaccine would then protect against both pathogens. Another example of this is a capripoxvirus-vectored F or H PPRV vaccine (VIDO/OVI; CIRAD). Both of these vaccines are currently experimental. The advantage to a combination vaccine is that the animal could be protected against more than one important disease but only vaccinated once. This may be important if other circulating pathogens (e.g. sheep and goat pox) may interfere with the animal's ability to mount an effective immune response to PPRV and thus interfere with the success of the eradication programme.

Because many of the animals will be located in remote areas, it would be very helpful to have a vaccine that is thermotolerant. There have been several PPR vaccines developed that are stable at high environmental temperatures for days, weeks and even months.

Finally, as has been previously mentioned it will be necessary to develop a DIVA vaccine that can be used in populations where PPR is believed to have been eradicated, or is near to being eradicated. This will allow serological surveillance of vaccinated populations to determine if the virus is still present.

DISCUSSION – SESSION 1

Q1. Are there things about the epidemiology of the infection that maybe we don't understand well enough yet or that may affect our ability to successfully eradicate this infection?

It is very important to clarify the nature of PPRV infection in other species. For example, sick yaks in Kazakhstan – can they transmit the infection to sheep & goats? Camels have been implicated but probably are not good transmitters. A concern is that pigs may be able to transmit the virus and they are increasing in numbers in Africa. It is important to not delay launch of the FAO OIE PPR-GEP while this information is gathered. It may be that the virus will burn out in other species if the susceptible population is lowered through vaccination. But if it gets into the 2 million Mongolian gazelles, what will happen?

Q2. How do we best use vaccination in eradication of PPR?

Sheep and goats have a shorter generation time than cattle; this changes the dynamics of virus and vaccination. (PM Note – it is important to revisit vaccinated flocks in the following year to make sure youngstock are vaccinated.)
The tools are there but there are some major issues to be concerned about. Human resources may be one of the biggest – there is a lack of veterinarians or trained people to carry out the vaccination programs in the field. Vets have low status in many of these countries. Many of the affected countries are politically unstable or have marked civil unrest (Somalia, Sudan, Afghanistan, Pakistan). How do we get the vaccine to the animals in these areas? However, both Somalia and Morocco have controlled PRR through NGO efforts at vaccination (2012-14). We can learn from these efforts and people and make this program work in other countries.

We must convince the farmers that the vaccine has value to their animals. Apparently, this was more straightforward with cattle as vaccination and the special ear tag that came with it raised the value of the animal; sheep and goats don't have the same status. Farmers won't invest in a vaccine for their small ruminants however currently the vaccine is free.
Need to take an ecosystem approach to vaccination, not a political approach. This is because animals can move across borders. So, need to engage adjoining countries to start on a vaccination program at the same time.

Q3. Other Discussion Points
How practical is it to control animal movements to control PPR?
Where PPR is endemic (e.g. Turkey) it is more difficult to motivate the government to act. Endemic PPR is not as evident, then the public isn't alarmed.
Host susceptibility is of interest, are there genetics involved in this and can resistant animals be selected?
Goats are more susceptible than sheep; animals on a poor plane of nutrition are susceptible and show more severe signs.
Authorities don't know when sheep and goats die. Because they are not considered as valuable as cattle?
The blank areas on the map doesn't mean that PPR isn't there, just that it has not been declared – government isn't willing or interested in determining or announcing PPR status?
To declare freedom from PPR, serological status must be negative, there must be adequate surveillance.

SESSION 2. ERADICATION OF PPR

INTRODUCTION TO THE FAO OIE PPR GLOBAL ERADICATION PROGRAMME
DR. FELIX NJEUMI

Dr. Njeumi presented statistics similar to those presented by Dr. Bailey – this is a devastating disease in countries where it is present. Very importantly, "the related loss of livestock causes pastoralists and farmers to migrate away from their lands and cultures in search of alternative livelihood". He discussed the socio-economic aspects of the disease, most specifically that selling animals or products provides resources to access food, educational and social services for their families. Eradication of PPR will foster the economic empowerment of women in parts of the world where empowering women is game changing. Eradication of PPR will improve food security – sheep and goat meat and milk provide high quality protein, vitamins and minerals.

The effects of a PPR outbreak were discussed including the devastating economic consequences of losing their livestock and creating instability in their communities, which may result in migration movements and volatile security situations. ***"Eradicating PPR will therefore sustainably improve the resilience of poor farmers and their communities, and foster their capacity to deal with other shocks and threats, mitigating further migratory trends."*** Eradication of PPR will contribute to the Sustainable Development Goals and in particular SDG1 and SDG2.

In 2015, high-level authorities and Chiefs Veterinary Officers from 70 countries endorsed a global PPR control and eradication strategy[2]. The strategy has the following goals:

[2] FAO – OIE PPR
http://www.fao.org/ppr/en/?amp%3Butm_campaign=featurebar&%3Butm_medium=web

Component 1: to develop a plan for eradication of PPR in infected countries; to encourage those without PPR to demonstrate PPR free status;
Component 2: to strengthen national veterinary services;
Component 3: to also reduce the prevalence of other important small ruminant infectious diseases such as sheep and goat pox, brucellosis, rift valley fever, contagious caprine pleuropneumonia and FMD. For the latter, however it is important that PPR eradication efforts not be diluted with attempts to control the other diseases, i.e. it must be a good fit for the PPR programme.

It is estimated that annual expenditures on PPR vaccination is currently USD 270 – 380 million; the annual cost of the disease is estimated at USD 1.45-2.1 billion. It is estimated that an undiscounted control and eradication programme cost over 5 years is 2.5 billion. The budget for the first 5 years of the eradication programme is estimated at USD 996 million.

Since 2015, there have been numerous meetings in various countries to help to develop regional strategies to PPR eradication. Each country, depending on its current status – sets a plan to achieve PPR OIE-Free Status before 2030. Some countries are already on the road to eradication whereas some have not yet begun.

From the FAO-OIE Global Strategy for the Control and Eradication of PPR[3]. The global strategy will operate according to the following underlying principles:

- The programme must take into account the lessions learned from rinderpest eradication and address the disease at source.
- Adopt a progressive risk-based approachusing quality ensured vaccines.
- Focus on pastoral and agro-pastoral production systems.
- Global political support from national and regional governments, international communities, etc.
- Communication is key with envolvement of all stakeholders.
- The delivery system must be capable of reaching all producers.
- All countries need to contribute to the goal of PPR control as improving animal health is a global public good.
- The cost of control & eradication activities are to be shared – firstly among animal owners during control procedures and then subsidized for compulsory eradication procedures.
- Each country should have an appropriate institutional environment through good governance of veterinary services and the use of OIE standards.
- The Global Strategy must use existing international and regional organizations rather than creating new ones.
- The use of incentives in the PPR eradication programme may be useful although eradication alone is a powerful incentive.
- Capacity building is a major element as more than 85% of activities are at the country level.
- Advocacy for increased investment in PPR eradication should be based on cost-effectiveness of the programmes, particularly at the smallholder farmer level and for rural development
- Monitoring and evaluation activities are indispensable

The PPR GEP has divided its programme for control and eradication into nine regions: East Asia, South-East Asia, China and Mongolia; South Asia; Central Asia; Middle East; Europe; North Africa; Eastern Africa; Southern Africa; Central Africa and West Africa. A PPR Regional Strategy has been developed in 6 of the 9 regions.

In each country, the overarching Strategy is based on four stages that determine how the five-year PPR GEP will operate within its framework. These four stages combine decreasing levels of epidemiological risk with increasing levels of prevention and control. At Stage 1 the epidemiological situation is assessed. At Stage 2, control activities

[3] FAO-OIE PPR GEP document http://www.fao.org/3/a-i4460e.pdf

including vaccination are implemented. PPR is eradicated at Stage 3. At Stage 4 vaccination must be suspended; the country must provide evidence that no virus is circulating at zonal or national level and that it is ready to apply for official OIE PPR-free status. The approach comprises a multi-stage, multi-country process involving assessment, control, eradication and maintenance of PPRV-free status. Implementation requires the concerted delivery of preparedness plans, capacity building, and stakeholder awareness and engagement, as well as establishing appropriate legal frameworks.

Additionally, there is a need to advocate and raise awareness of decision makers and stakeholders. Countries must all establish their PPR National Committees. Infected countries must develop their national strategic program and technical documents. Target infected countries must be supported in identifying PPR risk hotspots, and adopt a risk-based vaccination programme. Non-infected countries need to apply for OIE free status. Other regions need to develop their roadmaps as well.

MITIGATING THE PPR RISK TO EUROPE: RESULTS OF THE PPR RISK ASSESSMENT
DR. ALESSANDRO BROGLIA

PPR is exotic to the EU but on its doorstep, e.g. Turkey and North Africa. It is considered a transboundary disease. The European Food Safety Authority (EFSA) conducted a risk-assessment with respect to PPR and other exotic diseases[4]. PPR transmission requires contact with infected animals. Cattle and pigs can be infected but show no clinical signs. Camels and some wild ruminants can develop clinical disease. PPRV can survive in fresh / chilled meat but lowering the pH (5.6-5.8) will reduce survival. It is likely that it can survive in frozen or salted meat if frozen before the pH drop of rigor mortis. Risk from wildlife and food products requires more research.

The risk assessment began with understanding the current status of PPR, its spread and the number of outbreaks reported. Animal movements were described including trade of animals and risky animal products, and animal migration as well as the socio-political drivers of those movements. These were developed into flow maps. Movement of live animals to the EU from third countries is currently forbidden but uncontrolled movement could occur. Movement of small ruminants related to trade is the most likely mode of spread of PPR across borders (e.g. east Africa and Arabian Peninsula). Currently Turkey is an infected country and vaccination is practiced. However, a recent outbreak on the border with Bulgaria, points out that this disease is very close to Europe.

Infected sheep and goats (live animals) are considered the most efficient pathway of spread. Infected animal products are considered very low risk and unlikely to spread PPR. Introduction of PPRV via fomites (e.g. livestock vehicles returning to EU after delivery of infected animals) could occur. Using outbreaks in Tunisia in 2012 as an example, the median speed of propagation of PPR is 3.9 km/day (range 0.3 – 65.5 km).

In the European scenario – goats are considered more susceptible than sheep. There is considerable difference between population densities of sheep and goats. If PPRV entered an area with high sheep and low goat densities it is likely that the infection would be widespread before it was detected. Additionally, because the clinical signs of PPR are not specific, all suspected cases should be confirmed using laboratory testing (see Dr. Bailey's talk).

The main recommendations from the EFSA report are to enforce biosecurity measures; continue to improve PPR vaccines including a protective and safe DIVA vaccine; invest in awareness-raising campaigns and training for farmers and veterinarians; harmonize data collection of outbreaks from infected countries and their neighbours; and encourage cooperation with the EU and neighbouring countries will enhance preparedness.

[4] EFSA Scientific Opinion on peste des petits ruminants
http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2015.3985/full

ECONOMIC CONTEXT OF PPR ERADICATION
DR. BRYONY JONES

Dr. Jones used examples from East Africa to inform about the economic context of PPR eradication

Example 1: Afar Region, Ethiopia

Agriculture in this region is transhumanance pastoralist and agropastoralist. Livestock is comprised of camels, cattle, sheep and goats (6 million) and donkeys. Live animals for meat and butter are sold from the small ruminants. More recently there has been a loss of key grazing resources to wildlife reserves and crop production, reduced mobility and drought. Additionally, cattle numbers have declined and sheep and goat numbers have risen, mostly due to decreased grazing and drought. PPR is endemic. Vaccination programmes are employed sporadically.

In 2013-2015, small ruminant management in this region was studied. Communal grazing was practiced near available water; migration is opportunistic and flocks follow the rainfall for grazing. Animals are exchanged socially as gifts and are slaughtered as needed or at social events. Most animals in these flocks are > 3 years of age or are < 1 year. Animals give birth 1-2 X per year and animals are sold every 1-2 weeks. Morbidity and mortality is high with sheep and goat pox, pneumonia, PPR, skin diseases, diarrhea, brucellosis (abortion), lameness and predators being identified as most important. This has a significant impact of loss of animals, products and lowering of value of animals in the market.

Livestock keepers use both traditional treatments and modern medicines purchased from the vet pharmacy or the market, but availability is limited. There are government veterinarians, animal health technicians and Community-Based Animal Health Worker (CAHWs) but very limited resources means that services are sporadic.

An EC SHARE (Supporting Horn of Africa Resilience) project was conducted in 2016-2018 (ongoing) with the aim of strengthening the resilience of pastoralists. Its goal is to strengthen surveillance, develop and validate a PPR rapid test kit, use mobile phones to collect data, and to vaccinate against PPRV and sheep and goat pox virus (SGPV).

Example 2: Ngorongoro, Tanzania

This region is a Maasai area – pastoralist and agropastoralist. The small ruminant population is 1.2 million and it is also a wildlife conservation area. In 2008, PPR was first confirmed. Vaccination was instituted in 2011-12, which reduced the incidence, however PPR reports rose again in 2014-15.

The production system in this semi-arid region is a mixed species agro-pastoralism. Flock size median is 225 with a 50:50 mix of sheep and goats. Live animals and milk are sold but animals are exchanged or slaughtered at social events and other key events. Animals are mostly transported to slaughter or market on foot although some are moved by vehicle to major markets. One means of PPR spread through the region is by trade.

A major issue is the clinical diagnosis of PPR, which has variable clinical signs and can easily be confused with other diseases. In 2015, a study was conducted in which 33 flocks were visited where PPR was suspected. An investigation confirmed 9 PPR outbreaks with a morbidity median of 14% (4.3-66.6%) and mortality median of 2.2% (2.5-25.0%). The investigators also found a lot of variation in reported clinical signs and local disease terms, which may lead to confusion when trying to determine if PPR is an issue in a region. Other diseases such as BT, sheep and goat pox, CCCP may also be present. To demonstrate the difference in outbreaks, several laboratory confirmed PPR outbreaks are described. *Outbreak 3:* called “orkipei” which means “lungs”. About 50% of animals had nasal discharge; a few goats also had lacrimation, mouth / lip lesions, diarrhea, coughing and submandibular edema, and mortality was low at 1.5%. *Outbreak 1:* called “olodwa” which was a term used for rinderpest. A high proportion of goats had peri-oral lesions as well as the other signs. The main sign in sheep was nasal discharge. The mortality rate 1.2%. *Outbreak*

9: called “oloroibi” which is a term usually associated with FMD. This outbreak was a neighbor to outbreak 1 but here the disease was more severe in sheep with mortality of 17% in mostly young animals. Signs were mouth and muzzle lesions, frothy salivation, sneezing and coughing, severe nasal discharge and diarrhea. PPR was confirmed in a goat but one sheep was BTV PCR positive. Outbreaks 25 & 26 called “ngorotik” which means diarrhoea. The signs were mostly diarrhea, with a few cases of nasal discharge, lacrimation and oral erosions, with mortality in lambs and kids. All of these outbreaks were confirmed to have PPRV present by PCR.

Animal health services are supported by District Veterinary Offices (DVO), Ngorongoro Conservation Area Authority (NCAA), and the Veterinary Investigation Centre in Arusha. Livestock assistants and CAHWs provide much of the veterinary care. To control these outbreaks, some livestock keepers purchased vaccine from Kenya to vaccinate their own flocks. Veterinary medicines are available via veterinary pharmacies in most towns, but there are problems with fake drugs or drugs that didn’t contain sufficient active ingredient.

NAVIGATING POLITICAL AND CULTURAL CHALLENGES FOR PPR CONTROL & ERADICATION, LESSONS LEARNED FROM RINDERPEST ERADICATION

SHUBH MAHATO

Nepal has a very complex agricultural system because of the variability in land use and altitude, particularly in eastern Nepal. Sheep and goats are present at all altitudes with yaks also present at the high altitudes. 80% of the goats and 35% of the sheep are sedentary (non-migratory). Mostly women manage the sedentary flocks. In the northern districts of Nepal, the migratory flocks are sheep and goat mixed.

Rinderpest was first reported in Nepal in 1939 with outbreaks occurring throughout many districts until 1990. There were substantial government efforts to control including diagnostic capacity, field services, legislation and vaccine production. After 1990, and after cessation of vaccination, no outbreaks were detected and clinical serological surveillance conducted from 1997 to 2000 confirmed no evidence of RPV infection. OIE declared Nepal RP free in May 2002.

Millions of animals were vaccinated from 1952 to 1987 with the largest peak from 1974-79 (4.49 million). The second phase of vaccination was to form a vaccinated population along the Nepal-Indian border to lower the risk of reintroduction. There was considerable monetary investment in this vaccination program including outside funding from India, OXFAM/FAO, ADB Loan, EU Grant and FAO. Dr. Mahato’s lessons learned are summarized:

- Diseases like rinderpest can be eradicated if there is real commitment from all the concerned bodies.
- Strong government commitment to build the capacity, and provide required resources and legal authority to the National Veterinary Services is necessary for formulation and implementation of any disease control/eradication programme.
- Coordinated effort at Global level in general and Regional level in particular is crucial to achieve success in control/eradication of any Transboundary Animal Disease
- Participation and cooperation from the farmers is vital for achieving success in any disease control/eradication program.

PPR was first seen in Nepal in 1994-95. Ring vaccination was carried out with the rinderpest vaccine and later PPR vaccine was imported for mass vaccination; in 2000, the MLV Nigerian strain vaccine was used for the first time. The national PPR control program was launched in 2001 but in the last 2 decades PPR outbreaks have been reported in 68 of 75 districts. Although the vaccine is effective, vaccination coverage has been very low (12-48%) despite using millions of doses of vaccine.

Technical challenges in its control are several. Not enough vaccine is produced to vaccinate all of the sheep and goats (2.5 million doses annually versus > 10 million animals). There is a need for cold chain maintenance of the vaccine due to the remoteness of the villages and poor power supply. The reconstituted

vaccine is only stable for < 2 h, difficult in hilly regions. There is a high turnover of animals so that annual vaccination is necessary. The topography of the land and scattered settlements makes it difficult to reach all farmers and communities for training, communication and efforts at vaccination and disease surveillance.

There are also political challenges. When there is political instability control of animal diseases is not a priority. Veterinary budgets are inadequate and there is ineffective enforcement of veterinary legislation and too few people to enforce it. Additionally, the open border between India and Nepal means uncontrolled animal movement.

Sociocultural challenges also exist. Smallholder farmers prefer using traditional treatments for small ruminants and chickens and need education to make them understand that vaccination is required to control this disease. Sick animals may be slaughtered for human consumption so that the source of PPR outbreaks are difficult to trace. The consumption of goat meat during festivals means that large numbers of goats are moved, many illegally – suitable circumstances for an outbreak. Finally, women do most of the care of small ruminants but often have little power and are ignored.

Dr. Mahato felt that the South Asia Association for Regional Cooperation nations (SAARC) should work together in order to effectively implement the programme. That rinderpest was eradicated indicates that it is possible to eradicate PPR. NGOs can play an important supportive role in social capital building.

GENDER AND SOCIAL ASPECTS OF PPR KNOWLEDGE, VACCINATION AND ERADICATION
ROMONA NDANYI

There are 27 million goats and almost 17 million sheep in Kenya. They are a valuable source of household nutrition, income and insurance. PPR was first detected in Kenya in 2006 and is now endemic although it may not be always recognized and may be confused with other diseases, particularly CCPP. It reduces the resilience of the pastoralist and agro-pastoralist. Kenya's PPR eradication scheme, in line with the PPR-GEP, includes awareness creation along the value chain, active and passive surveillance for early warning, movement control, mass vaccination and slaughter and compensation. Awareness of PPR and its eradication entails engagement of all stakeholders all along the value chain starting with livestock keepers – both men and women. The nature and level of engagement will depend on the stakeholder group. Gender issues at the animal owner level need to be considered. It does require the good will of the government (national and local) and others.

What is gender? It refers to a socially constructed role, behaviour, activities and relations between men and women; it not referring to biological differences between male and females. Perceptions of gender are deeply rooted, vary widely within and between cultures, and change over time. Gender determines power relations and resources for females and males.

Why gender? Women occupy the major role in care of small ruminants and poultry in smallholder livestock systems and are often poorer than those cared for by men. A study by the FAO, 2011 determined that if women had the same resources as men, farm yields would increase by 20-30%, which would raise agricultural output by 2.5-4% overall. Income controlled by women is generally used to improve family welfare. Women spend 90% of their income on their families whereas men spend 30-40%. It makes sense then to strengthen women's household decision-making powers.

Gender variables that affect PPR eradication includes:

- Who owns the small ruminants?
- What are each's role and responsibility in small ruminant production and who has access and control of those resources?
- What is the knowledge of small ruminant diseases and the control of those diseases?

- Who has access to animal health services?
- How affordable are those services?
- How literate are the livestock keepers, particularly in pastoral communities?

Men own everything including the women and children as well as livestock. An exception is females who are heads of the household may own livestock assets in some communities. Because in pastoralist communities, women are often responsible for the care of the small ruminants, i.e. they have close contact or access with their animals, they would notice signs of illness sooner and thus would be the persons to present animals for PPR vaccination. Unfortunately, access doesn't always mean the women have control, i.e. decision making power over resources such as when to treat and vaccinate, when to sell animals (e.g. 75-100% access versus 10-17% control among Somali pastoralists).

Local knowledge of PPR is often confused with other diseases such as CCPP and is often mainly described by the symptoms. More education and surveillance is required to determine risk of PPR in a region. However, literacy levels are often low and lower in women (72% illiteracy in Somali pastoralists). Literacy in English is even lower, meaning that extension materials in English may have little value. There is also gender disparity in access to services; women are often barred from contact with male extension workers because of cultural and religious beliefs. Efforts should be made to reach women. Many of the control measures (e.g. surveillance, vaccination) are not affordable to these households and require subsidization.

In conclusion, it is important to use a gender lens when designing and implementing a PPR eradication program. Need to ask:

- **Who does what**, e.g. treatment, vaccination, reporting suspected cases
- **Who knows what**, e.g. disease symptoms, disease patterns, where animals are grazed and moved, market structure
- **Who controls what**, e.g. income from the animals, grazing lands, disposal decisions
- **Who has access to what**, e.g. information, services
- **Who is affected by what**

Recognition, control and eradication of PPR will require some level of social capital – active involvement of both men and women at all levels.

DISCUSSION SESSION 2

Q1. What are the best strategies for engaging sheep and goat producers and other stakeholders in the eradication program?

There was general consensus that we build on the success of RP eradication. Need to ask "what did we do then that we haven't done now?" One issue is to involve women more than in the past or is currently being done. Need to engage local livestock owners in their own language and understand better what they are doing so that the eradication program can be adapted to it. This means being very respectful of livestock owners and not imposing a system "top down". Utilize previously trained and educated Community Animal Health Workers (CAHWs), use them for communication and good will within the community.

A question was asked about how mobile phone technology could be used? Many have mobile phones – this technology can be used in monitoring vaccination and other control measures. Use the phones to also report cases and confirm if vaccinated by speaking directly to the producer. Funding can be tied to this kind of reporting.

A question was asked about education of PPR in small holder and pastoralist communities. Could PPR (and other livestock diseases) be taught in primary school curriculum? This way, children could help to teach the parents, particularly the women what signs of disease are and participate in surveillance and control

measures. It was also suggested that soccer players could do TV spots on PPR eradication. Go through churches was also suggested as another route of communication.

Communication with people who are less literate could be done through pictures and songs. T-shirts with a simple and strong message could be given out. A template of the message could be converted at the local or regional level. This was done with RP eradication. But a feed-back mechanism needs to be built in as well so there is two-way communication.

Disease surveillance may decrease in importance post-vaccination. A suggestion was to have children do animal health projects on their community's animals.

Getting an entry point into communities to start vaccination was discussed. In the past human vaccination programmes (measles) were tied to RP vaccination. The vaccination teams travelled together but when the thermotolerant rinderpest vaccine started to be used, it was not practical to combine the campaigns in more remote regions because the measles vaccine wasn't thermotolerant. But there was benefit to working together when trying to reach all remote communities (shared resources).

Tying vaccination to another animal health procedure (e.g. deworming) may be seen as valuable, particularly if the procedure were subsidized. With RP eradication, a special ear notch was use to denote vaccinated animals and this increased the value of the cattle greatly. The ear notch was visual proof of better health. Regardless the entry point must be important to the community being reached.

It was mentioned that the CAHWs were a resource that is being lost after the investment of RP eradication. It is important to use these people and their education and to also involve them in other aspects of animal health, not just vaccination. These people may be able to work in less politically stable areas (e.g. Taliban controlled areas of Pakistan) because they are local and integrated in the community. But the programme must support their (re)education and tools to carry out the PPR eradication program. Two examples of such programmes are in Nepal – the Agrovet programme and in Kenya – Pastoral Field Schools. Veterinaires sans Frontiers supported the community-based animal health programme in South Sudan that was the foundation of rinderpest eradication from that country, and continues to support such programmes in many parts of sub-Saharan Africa and Asia.

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