

## DECLARATION

I, Ricky Chazya (Dr.) do hereby declare that this dissertation, submitted by me to the University of Zambia for the degree of Master of Science in One Health Analytical Epidemiology has not been submitted at any other university.

Signature:.....

Date:.....

## CERTIFICATE OF APPROVAL

The dissertation of **Ricky Chazy** (**Dr**) has been approved as fulfilling the requirements for the award of Master of Science in One Health Analytical Epidemiology by the University of Zambia.

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## ABSTRACT

Peste des petits ruminants (PPR) was recently reported in Zambia's neighbouring countries of Tanzania, Democratic Republic of Congo (DRC) and Angola. This situation presents a threat of illegal and legal trade-related incursions of the disease into Zambia. To determine the likelihood of this event, qualitative and quantitative risk assessments were performed using the OIE risk analysis framework, evaluating the risk of introducing PPRV into northern Zambia from Tanzania via live goat trade. The assessment was based on data collected during a four week mission to Tanzania and three districts in northern Zambia. Information was also obtained from published and grey literature, and online searches. Using a binary outcome Markov Chain model, the risk of PPRV introduction into northern Zambia was qualitatively evaluated as a function of the product of the probability of hazard (PPRV) release, exposure of susceptible hosts and the consequences of spread beyond the index case. These elements were assessed using the following parameters: prevalence of infection, volume of trade, competitive enzyme linked immunosorbent assay (C-ELISA) and quarantine screening missing an infected animal, capacity of the PPRV to survive in transit, and the virus potential for infection. The magnitude of the consequences was derived from the probability of transmission and spread and the impact of PPR introduction and establishment. Taking into account the combination of the above parameters, the probability of occurrence of PPR into northern Zambia was rated as "high". The economic consequences of potential transmission and spread of PPR was also rated as "high." Finally, the overall risk of introducing PPR into northern Zambia from Tanzania at the time of the assessment was rated "high." At 95% level of confidence, the quantitative assessment revealed that the annual risk of introducing PPR from Tanzania into Zambia through importation of at least one infected live goat from an annual consignment of 4612 animals from Tanzania was evaluated to be approximately 1 or 100%. Therefore, the probability that PPRV will be introduced in Zambia through importation of live goats from Tanzania is high. It can therefore be concluded that import of goats and sheep be prohibited until efficient and adequate measures to reduce the risk have been put in place and verification procedures be effected to ensure safe implementation. The sensitivity analysis, revealed that the prevalence of PPR in goats in Tanzania was the major contributor to the ultimate risk. Therefore importing goats from the disease free areas could significantly reduce the risk. Since Zambia has not yet reported PPR disease, it is also possible that small ruminants in the study area are naïve to the disease and as such are prone to infection once exposed. This is shown in the sensitivity test where the spread of the disease will be high and causing huge financial losses. A few points for risk management options such as quarantine, vaccination and emergence preparedness are discussed.

## **DEDICATION**

This work is dedicated to my parents, Mr. David Chazya and Mrs. Clementina Kombe Chazya for educating me and making the best out of me; to my wife Naomi Bulenge Chazya, for her support and understanding and my beautiful daughters Olipa, Niza and Ndanji for putting up with the absence from home of both their parents who were in school at the same time.

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## LIST OF ABBREVIATIONS AND ACRONYMS

PPR	Peste des petits ruminants
PPRV	Peste des petits ruminants virus
MeV	Measles Virus
RPV	Rinderpest Virus
CDV	Canine Distemper Virus
SADC	Southern African Development Community
FAO	Food and Agricultural Organisation
OIE	International Organisation for Animal Health
DRC	Democratic Republic of Congo
GDP	Gross Domestic Product
NALEIC	National Livestock Epidemiological Information Center
MLFD	Ministry of Livestock and Fisheries Development
LTC	Livestock Technical Committee (of SADC)
DFID	Department for International Development
RNA	Ribonucleic Acid
UV	Ultra Violet
PCR	Polymerase Chain Reaction
RT-PCR	Reverse Transcription Polymerase Chain Reaction
ELISA	Enzyme Linked Immunosorbent Assay
C-ELISA	Competitive Enzyme Linked Immunosorbent Assay
ICE	Immunocapture Enzyme Linked Immunosorbent Assay
rRT-PCR	Real Time Reverse Transcription Polymerase Chain Reaction
AGID	Agar-Gel Immunodiffusion Test
AGIDT	Agar Gel Immunodiffusion Test

CIRAD	Center for International Research in agriculture Development
EMVT	Elevage et Médecine Vétérinaire Tropicale (French: Institute of Tropical Breeding and Veterinary Medicine)
SLAM	Signalling lymphocyte Activation Molecule
TADs	Transboundary Animal Diseases
PANVAC	Pan African Veterinary Vaccine Centre
TCID	Tissue Culture Infective Dose
$R_0$	Basic Reproductive Number
WHO	World Health organisation
TAZARA	Tanzania–Zambia Railways
DVO	District Veterinary Officer
VA	Veterinary Assistant
LFOs	Livestock Field Officers
CVRI	Central Veterinary Research Institute
DVS	Department of Veterinary Services
SOPs	Standard Operating Procedures
FMD	Foot and Mouth Disease
CBPP	Contagious Bovine Pleuropneumonia
CCPP	Contagious Caprine Pleuropneumonia
SUA	Sokoine University of Agriculture
GIS	Geographic Information Systems
GPS	Global Positioning System
CI	Confidence Interval
EMPRES	Emergency Prevention System for Animal Health
DIVA	Differentiation of Infection from Vaccinated
VNT	Virus Neutralization Test