NATIONAL STRATEGY FOR PREVENTION AND CONTROL OF BRUCELLOSIS IN HUMANS & ANIMALS

2018-2023

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LIST OF ABBREVIATIONS

AU-IBAR	African Union- International Bearau of Animal Resource
CBO	Community Based Organization
COSTECH	The Tanzania Commisison for Science and Technology
CUHAS	Catholic University of Health and Allied Sciences
DTRA	Defense Threat Reduction Agency
DVS	Director of Veterinary Services
FAO	Food and Agriculture Organisation
FBO	Faith Based Organization
ICT	Information Communication and technology
IDSR	Intergrated Disease Surveillance and Response
IEC	Information Education and Communication
IHI	Ifakara Health Institute
KCRI	Kilimanjaro Clinical Research Institute
LITA	Livestock Institute Training Agency
MoLF	Ministry of Livestock and Fisheries
MOHCDGEC	Ministry of Health Children Development Gender Elderly and Children
MOU	Memorandum of understanding
MUHAS	Muhimbili University of Health and Allied Sciences
NGO	Non-Governmental Organization
NIMR	National Institute for Medical Research
NM-AIST	Nelson Mandela-African Istitute of Science and Technology
OIE	World Organization for Animal Health
PAHSP	Private animal health Service Provider
PMO-OHU	Prime Ministers Office – One Health Unit
PO-RALG	President's Office – Regional Adminstration and Local Government
PPR	Peste Petit des Ruminants
RVF	Rift Valley Fever
SPS	Sanitary and Phytosanitary
SUA	Sokoine University of Agriculture
TALIRI	Tanzania Livestock Research Institute
TAWIRI	Tanzania Wildlife Research Institute
TFDA	Tanzania Food and Drug Authority
TVI	Tanzania Veterinary Institute
TVLA	Tanzania Veterinary Laboratory Agency
USAID	United State Agency for International Development
VCT	Veterinary Council of Tanzania
VPO	Vice President's Office
WHO	World Health Organization
ZVC	Zonal Veterinary Centres

EXCUTIVE SUMMARY

Brucellosis is a contagious bacterial zoonotic disease, which affects humans, livestock and wildlife. Brucellosis is a highly prevalent disease in many areas of Tanzania, however very limited data is available regarding its distribution, affected host species and impact. Studies indicates that the disease causes significant production loss and potential public health problems. In Tanzania, most patients presenting at hospitals with febrile illness tend to be clinically diagnosed as malaria or enteric fever, largely because of the high endemic nature of these two infections but also due to similarity with clinical presentations of other infections prevalent. In livestock, brucellosis results in reduced productivity, abortions and weak offspring and is a major impediment for trade.

Prevention of human brucellosis depends a great deal on control of the disease in domestic livestock. Effective control of these, needs cooperation between human and animal health sectors with regard to research and actions directed to disease control.

Furthermore, there is a lack of harmonized protocol for the diagnosis, prevention and control of the disease in humans and animals. Therefore, a comprehensive One Health strategy for prevention and control of the disease in humans and animals is desirable. The present National Strategy for Prevention and Control of Brucellosis articulates measures for prevention and control of Brucellosis in Tanzania mainland. The strategy provides guidance on early warning to enable rapid detection, reporting and response.

This strategy took into consideration existing legislation guiding prevention and control of animal and human diseases as well as guidelines and recommendations of International Organizations such as the Food and Agriculture Organization (FAO), the World Organisation for Animal Health (OIE), and the World Health Organization (WHO).

AKNOWLEDGEMENT

The development of the National Strategy for Prevention and Control of brucellosis is a great achievement in ensuring systematic mechanism of addressing priority zoonoses in the country. This is a multi-sectoral strategic document to guide prevention and control of brucellosis in human and animal in Tanzania and has been prepared in line with the National One Health Strategic Plan (2015), National Integrated Surveillance Guidelines and the recommendations drawn from Joint External Evaluation (JEE) and Global Security Health Agenda (GHSA).

The development process was coordinated by the Prime Minister's – One health Coordination Unit under the Disaster Management Department in collaboration with Ministry of Livestock and Fisheries, Ministry of Health Community Development Gender Elderly and Children and Ministry of Natural Resources and Tourism. Other contributors include technical backstopping from PREDICT, P&R, FAO and WHO.

The contributions made through stakeholders' consultative meeting are highly appreciated as they shaped the Strategy significantly.

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CHAPTER ONE

1. INTRODUCTION

Brucellosis is a contagious bacterial zoonotic disease, which affects humans, livestock and wildlife. It is considered by the Food and Agriculture Organisation (FAO), the World Health Organisation (WHO) and the Office International des Epizooties (OIE) as one of the most widespread zoonoses in the world. The disease is caused by bacteria in the genus *Brucella*. Three species including B*. melitensis, B. abortus and B. suis* are of great zoonotic potential and are the ones known to be prevalent in Tanzania.

Human brucellosis is characterized by awide range of symptoms marked by non-specific recurring fever, headache, chills, joint pains, undue fatigue, anorexia, night sweats, among others (John et al., 2010), which make the diagnosis difficult. The disease also requires prolonged treatment with a combination of antibiotics (Seleem *et al*., 2010). In animals mainly cattle, the disease is characterized by late term abortion, infertility and reduced milk, calf crop production as a result of retained placenta and secondary endometiritis. Bulls suffer orchitis, epididymitis, seminal vesiculities, hygroma particularly at carpal joints.

The major ways of *Brucella* transmission to people are through direct contact with infected fetus and fetal membranes during parturition and consumption of unpasteurized milk and milk products. The disease can also be transmitted through consumption of raw blood and meat. Farmers and people working with animals (butcherers, animal health attendants, animal attendant's, lab attendants etc) can also be infected through direct contact with infected animals, aborted fetuses and discharges and accidentally through needle injection during mass vaccination and during laboratory manipulation. Transmission through inhalation and consumption of contaminated dairy products has been widely documented in many parts of the world (John *et al.,* 2010). Wildlife may be the source of the diseases to humans especially those living in proximity to wildlife due to intense overlap of these species, including game meat handling.

Brucella has traditionally been considered a biological weapon. It was the subject of extensive offensive research in the past, and still belongs to category B pathogens on most lists. Its propensity for airborne transmission and induction of chronic debilitating disease requiring combined antibiotic regimens for treatment, its abundance around the world and its vague clinical characteristics defying rapid clinical diagnosis are some of the characteristics that apply to the pathogen's weapons potential.

1.1 Situation Analysis

The global burden of human brucellosis remains enormous; it causes more than 500,000 infections per year worldwide (Dean *et al*., 2012). The annual impact of Brucellosis to smallholders across sub-Saharan Africa and South Asia is estimated at USD $500 million per year (GalvMed, 2017). Brucellosis has been reported from almost all countries in Africa (Mangen *et al.*, 2002). In Africa, the prevalence varies from 5-55% in humans and 8-46% in animals (Mangen *et al*., 2002).

Brucellosis is a highly prevalent disease in many areas of Tanzania. Brucella *spp* that have been isolated in the country include *B. abortus*, *B. melitensis* and *B. suis* (Bouley AJ *et al*

2012, Swai *et et al* 2005,) however very limited data is available regarding their distribution, affected host species and impact.

Available studies indicate Brucella sero-positivity between 0.5-15% (Table 1) among wildlife, pigs, cattle and small ruminants. Similarly, prevalence rates of brucellosis ranging from 0.6% to 23% have been reported in cattle reared in different production and ecosystems in Tanzania (Table 2). In fully susceptible spp abortion rates may vary from 30% to 80%.

Several free-ranging wild animal species, such as the African buffalo (*Syncerus caffer*), hippopotamus (*Hippopotamus amphibius*), impala (*Aepyceros melampus*), blue wildebeest (*Connochaetes taurinus*), zebra (*Equus burchelli*) and eland (*Tragelaphus oryx*), have been consistently reported to be seropositive, indicating possible persistent foci of infection in these animals. Due to this, brucellosis has been a problem in wildlife and domestic ruminants in the selected animal-human interface areas.

There are few reports of clinical brucellosis in Tanzania (John *et al* 2010). Much of the published work on human brucella infections are based on sero-survey of occupational high-risk groups such as livestock herders, farmers, butchers and other abattoir workers, and veterinarian and febrile presenting patients at hospitals (Table 3). Our observations, based on these few previous sero-epidemiological reports, suggest that the magnitude of human brucella infections may be greater than has been appreciated and the disease can easly be misdiagnosed with other febrile illnesses.

Table 1: Brucellosis seroprevalences by livestock production system, species and tests used

	Production system	Spp	Tests	Prevalence	Source
1	Agro pastoral northern Tanzania	cattle, sheep, goats	RBPT/c-ELISA	4.2-8.7%	Mtui-Malamsha 2001, Shirima 2005
2	Agro pastoral northern Tanzania	cattle	RBPT	12%	Swai et al 2005
3	Agro pastoral lake zone Tanzania	cattle	RBPT	10.8%	Jiwa et al 1996
4	Agro pastoral southern Tanzania	cattle	RBPT	15.2%	Ottaru et al 1985
5	Agro pastoral northern eastern Tanzania	cattle	RBPT	0.6-7.9%	Swai et al 210
6	Pastoral northern Tanzania	cattle, sheep, goats	RBPT/c-ELISA	4.9-6.5%	Shirima 2005
7	Dairy and Pastoral Eastern Tanzania	cattle	RBPT	10.6-12.3%	Swai, 1997, Weihupl et al 2000
8	Slaughter stocks	Pigs	RBPT &Riv T	0.7%	Simon et al 2016
9	Dairy and Pastoral Tanzania	Cattle, small ruminants	RBPT/c-ELISA	8.2%	Alonso et al 2016

Table 2: Brucellosis seroprevalences by ecosystem species and tests used

	Ecosystem/Interface	Spp	Tests	Prevalence	Source
1	NCCA	Cattle, sheep, goats	RBPT/MAT	6-23%	Mellau et al 2009
2	Serengeti	Buffalo, zebra, wildbeest	RBPT	1-24%	Fyumagwa et al 2009
3	Mikumi-Selous		RBPT	0.6%	Temba 2012
4	Katavi-Rukwa	Cattle, sheep, goats	RBPT, ELISA, PCR, Riv T	1.6-7.9%	Assenga et al 2015

Table 3: Brucellosis seroprevalences by occupational group, febrile presenting patents and tests used

	Groups	Spp	Tests	Prevalence	Source
1	Febrile patients, Moshi, Tanzania	Human	SAT	3.5%	Bouley et al 2012
2	Occupational group, Tanga	Human	RBPT	5.5%	Swai et et al 2005
3	Livestock keepers(Pastoralist)-Serengeti	Human	c-ELISA	?%	Shirima and Kunda 2016
4	Agriculture/livestock keepers(agro-pastoralist)-northern, Tanzania	Human	RBPT, ELISA,	8.3%	Shirima 2005
5	Livestock keepers(Pastoralist) -Katavi	Human	RBPT, ELISA, Riv T	0.6 %	Assenga et al 2015
6	Fever presenting outpatients, Kilosa	Human	RBPT, ELISA (B. abortus) (B. Melitensis)	7% 15.4%	Chipwaza et al 2015

Effective prevention and control of brucellosis rely mainly on vaccination and test and slaughter policy of positive reactor animals. Moreover, broad use of vaccine is constrained by several factors related to delivery system, pathogen factors (Brucella spp is not host spp specific and varied brucella pathogens), host factors (affecting multiple animal spp) and varied production system (pastoral, agropastarol, intensive) complicating vaccine uptake and participation in vaccination program. Vaccines and vaccination campaign is lacking and where available it is only one type (S.19) that has been in use in cattle, which may not confer protection across the species. Combinations of all these technical, policies and operational challenges are among of the factors that impede effective disease control.

1.2 Socio-Economic Impact and Justification for Control

Brucellosis is endemic in Tanzania with studies indicating a significant production loss and potential public health problems. Brucellosis causes severe debilitating disease that may result to permanent disabling sequel, and considerable medical expenses in addition to loss of income due to loss of working hours in human. In Tanzania, most patients presenting at hospitals with febrile illness tend to be clinically diagnosed as malaria or enteric fever, largely

because of the high endemic nature of these two infections but also due to similarity with clinical presentations of other infections prevalent in Tanzania. Symptoms and signs are non-specific, and several other febrile illnesses may be simulated, for example glandular fever, toxoplasmosis, influenza and other enteric infections. Also, when an unusual complication is present, it may be overlooked. Clinical diagnosis of brucellosis is therefore difficult to establish leading to it being misdiagnosed, mismanaged and underreported.

In livestock, brucellosis results in reduced productivity, abortions and weak offspring and is a major impediment for trade. Prevention of human brucellosis depends a great deal on control of the disease in domestic livestock. Effective control of brucellosis in Tanzania, like in other endemic countries, needs cooperation between human and animal health sectors with regard to research and actions directed to disease control. Despite of few research reports available, detailed disease information covering wide geographical areas and multiple susceptible host spp are missing.

Furthermore, there is a lack of harmonized protocol for the diagnosis, prevention and control of the disease in humans and animals. Therefore, a comprehensive One Health strategy for prevention and control of the disease in humans and animals is desirable.

1.3 National Policies/Strategies and Legal Framework

There are a number of legislation and regulations guiding the prevention and control of brucellosis in Tanzania. These include;

- **National Livestock Policy of 2006**
  The policy gives provision for control of zoonotic diseases including brucellosis in view of safeguarding the public health
- **Animal Disease Act No. 17, 2003** make provision for certification, animal disease outbreak investigation, control, notification and compensation
- **Public Health Act -2009: -**This is an Act to provide for the promotion preservation and maintanance of public health with a view to ensuring the provision of comprehensive functional and sustainable public health services to the general public. Th serves for **controlling diseases including zoonoses, Act** provide provision guiding outbreak notification and investigation.
- **Tanzania National Health Policy 2003**-the policy puts emphasis on the provision of equitable, quality and affordable basic health services, reduction of disease burden, maternal and infant mortality and increase life expectancy; availability of drugs and equipment; availability of health services to all people (urban and rural); as well as human resource capacity development.
- **Tanzania National eHealth Strategy 2013**- the strategy recognizes the potential of information and communication technology (ICT) it can offer in transforming healthcare delivery by enabling information access and supporting healthcare operations, management, and decision making

- **National Action Plan for Health Security** 2017-
- **URT One Health Strategy Plan 2015 - 2020**
  Other laws/acts that regulate the prevention and control of brucellosis in Tanzania include;
- Presidential Circular No 1 2002: Restricts movement of animals from disease infected area

The Food, Drugs and Cosmetic Act No 1 of 2003: Food Hygiene Regulations 2006 - TFDA

- The Animal Welfare Act No 19 of 2008
- Livestock Registration, Identification, and Traceability Act No 12 of 2010
- The Local Government (District) Authorities Act No 7 of (1982)
- Local Government (Urban Authorities) Act (1982)
- Disaster Act No 7 of 2015: Provides for risk management of disasters including outbreaks of infectious diseases

International policies/guidelines/regulations

- OIE /FAO/WHO – provide broad guidance and protocols on disease surveillance, contingency planning, preparedness and response to zoonotic diseases
- World Organization for Animal Health (OIE) terrestrial animal health code that set standards for the improvement of animal health and welfare and veterinary public health worldwide; OIE manual for diagnostic tests and vaccines for terrestrial animals.
- WHO: World Health Organization (WHO) is the body of the United Nations (UN) responsible for directing and coordinating human health, main function includes; providing leadership on matters critical to health and engaging in partnerships where joint action is needed; shaping the research agenda and stimulating the generation, translation and dissemination of valuable knowledge; setting norms and standards and promoting and monitoring their implementation; articulating ethical and evidence-based policy options; providing technical support, catalysing change, and building sustainable institutional capacity and monitoring the health situation and addressing health trends
- FAO/OIE: Proggesive Control Pathway (PCP) for Brucellosis -
- AU IBAR: Integrated regional coordination mechanism sets mechanism for prevention and control of zoonoses

1.4 Stakeholders' Mapping

1.4.1 Major stakeholders – line Ministries/partners

A number of stakeholders will join forces to address specific interventions. Interventions and correlating stakeholders are summarised in table no. below.

Table 4: Stakeholders invovled and their corresponding area of intervention

Area of Intervention	Stakeholders involved
Policies, standards and regulations development and implementation resource mobilization	MoLF, MNRT, MOHCDGEC VPO-Environment
Technical backstopping, capacity buiding and resource mobilization for disease for prevention and control	FAO WHO OIE UNICEF NGO's
Reinforcement of policies and laws and control intervention implementations	PO-RALG, Home Affairs and other relevant NGO's and private sector and livestock keeping community
Biosafety and Biosecurity	MoLF, MNRT, MOHCDGEC, PO-RALG, and other relevant NGO's and private sector, Institute (e.g. Universities and colleges – SUA, UDSM, LITA. MATI, etc)
Research, training, consultancy and vaccine production	National: Tanzania Veterinary Laboratory Agency (TVLA), DVS, COSTECH, NIMR, TAWIRI, TALIRI, IHI SUA, NM-AIST, UDSM, LITA International: Glasgow, University of Minesota, Pennystate University, Washington University, University of Edinburgh among others
Advocacy and Ethical standards	Professional bodies: TVA, MAT, MCT, VCT, Pharmacies, Nurses, allied Association, Tanzania Public Health Association (TPHA)
Public awareness and prevention and control	MALF, MNRT, MOHCDGEC, PO-RALG, and other relevant NGO's PMO-DMD (OHCU), Community and private sector, FAO, WHO
Implementers	MoLF: Director of Veterinary services (DVS), Tanzania Veterinary Laboratory Agency (TVLA), Veterinary Council of Tanzania (VCT)) MoHCDGEC: DPS, PO RALG: RAS, Local Government Authorities (LGAs) MNRT: TAWIRI, TANAPA, TAWA NGOs: BRAC Tanzania, and other private NGO or CBO such as World Vision, CARE, Catholic Relief Services, Global Services Corps.

CHAPTER TWO

2. STRENGTH, WEAKNESS, OPPORTUNITIES AND CHALLENGES (SWOC) REGARDING BRUCELLOSIS PREVENTION AND CONTROL

Brucellosis is a complex infectious zoonosis with economic importance in livestock world-wide and is endemic in Tanzania.Prevention and control approaches are challenged by several factors including its complex epidemiology, policies related to its control, vaccine complexities, surveillance and diagnostic challenges, husbandry practices and social cultural values of the community. However, generally there are strengths and opportunities that could be harnessed to facilitate prevention and control with eventual eradication of brucellosis in the country. In addition, there are weaknesses and challenges, which must be addressed for effective prevention and control of the disease.

Critical issues to be considered includes:

1. Frameworks in support for brucellosis prevention and control (political will)
2. Skilled and motivated human resource to support brucellosis control
3. Institutional organization
4. Financial resources
5. Tools for brucellosis surveillance and control (vaccines, reporting system, feedback and response system)
6. Research, training and development
7. Knowledge about brucellosis among public (advocacy, communication and social mobilization)
8. Partnership and multi-sectoral collaboration
9. Monitoring and evaluation

Table 5: Strengths, weaknesses, opportunities and challenges

Issue	Strengths	Weaknesses	Opportunities	Challenges
Frameworks in support for brucellosis prevention and control (political will)	Existence of national sectoral policies, strategies and legal frameworks e.g. National Livestock Policy of 2006, and Animal Diseases Act, 2003 Public Health Policy 2016 Public Health Act, 2009 National Health Security Plan,2017 Second five-year Development Plan (2016-2020) Tanzania National e-Health Strategy, 2013 Presidential secular No 1of 2002, The Food, Drug and Cosmetics Act, 2003 (Food borne surveillance system) Occupational Safety and Health Administration(OSHA) Livestock Registration, Identification and Traceability Act No 12 of 2010 Local Government Authority Act No 7 of (1982) One Health Strategic Plan of 2016 List of national priority zoonotic diseases Involvement of other law enforcers, example Police, Judiciary etc.	Limited Law enforcement Inadequate enforcement of disease control and livestock movement laws. Lack of policy guidelines Generally low awareness among stakeholders (high awareness in some communities where brucellosis has been widely studied eg northern Tanzania (ref Zhang *et al.,* 2016)	Availability of global guidelines and standards from international bodies like FAO, OIE, WHO Presence of Global Health Security Agenda 2017 Presence of International Public Health Regulations	Delay in policy review and implementation to support reprogramming where necessary

Issue	Strengths	Weaknesses	Opportunities	Challenges
Skilled human resource	Available skilled human resource at various levels. (human, animal and environmental health experts and laboratory technologists)	Insufficient number of trained personnel (human, veterinary, environmental health experts and lab technologists) Inadequate continuous professional development programmes	Availability of training institutions /facilities Technical backstopping from partners (FAO, WHO and OIE)	Funding to support build up human resource
Institutional organization	Presence of human and animal health structures and facilities including OH Coordination Unit (under Prime Minister's Office) Presence of relevant ministries and departments/Agencies (egTFDA Existence of other control plans (e.g. for Rabies, Avian influenza, RVF and PPR)	Weak communication/sharing of information to ensure detection and response Overlap of the implementation of activitie Integrated Disease Surveillance and Response (IDSR) for human doesn't capture brucellosis	OH, coordination frameworks/ networks Presence of International organizations (FAO, WHO, OIE)	Weak sharing of data and information; broken chain of command for animal and human health)
Financial resources to support brucellosis prevention and control	Annual budgetary allocation for disease surveillance and control	Inadequate funding	Partnerships with development and bilateral partners, development initiatives/ programmes at national, regional and international levels e.g Defence Threat Reduction Agency (DTRA), Welcome Trust, Bill and Melinda Gates foundation, USAID Presence of several consortia addressing brucellosis e.g. Afrique One-ASPIRE, ZELS	There is no single basket fund for zoonoses control including brucellosis Weak sharing of resources between sectors (weak collaboration and coordination)

Issue	Strengths	Weaknesses	Opportunities	Challenges
Tools for brucellosis surveillance and control (diagnostics, vaccines, reporting system, feedback response system)	Presence of locally made vaccines for animals Availability of laboratory diagnostic capacity Presence of guideline for surveillance of prioritized zoonotic diseases (in pipe line) Availability of epidemiological data on animal sector (several researches going on)	Inconsistent and fragmented research data (no national wide representative data- biased data) Lack of vaccination in small ruminants (only in cattle) Low vaccination coverage associated with availability and accessibility – (distribution - cold chain) of vaccine There is no national standadised and validated diagnostic tests	Presence of reference laboratories for diagnosis, research and training (Animal, Plant Health Agent (APHA)-UK an OIE reference lab for *Brucella*) Availability of technical backstopping (FAO, WHO, OIE)	Financial resources Inadequate engagement LGAs Strain typing (appropriate vaccines) Husbandry practices
Research, training and development	Presence of Research and Training Institutions (SUA, MUHAS, TAWIRI, NIMR, IHI, TVLA, NM-AIST, CUHAS, KCRI, NHLQA) Research regulation - COSTECH Political will for allocating 1% of total budget for research (Government commitment) Presence of pool of local experts on brucellosis Presence of networks with ongoing research activities on brucellosis	Weak coordination of research initiatives Absence of national research agenda for priority zoonotic diseases	Presence of reference laboratories for diagnosis, research and training Collaboration with international reference laboratory (UK) and partners (DTRA, Welcome Trust, Bill and Melinda Gates Foundation, WHO, FAO) and Univerities in the UK, USA, Australia, Japan etc *Brucella* being bio agent increase likelihood of getting external research funds	Inadequate funding Inadequate research findings especially on circulating strains

Issue	Strengths	Weaknesses	Opportunities	Challenges
Knowledge about brucellosis among public	Existence of elaborate administrative structures down to grass root level (from the Ministry to the village) that can support extension services Presence of various media outlet Good coverage of mobile networks and social media groups	Inadequate knowledge among farmers (only 20% of farmers access extension services) Lack of advocacy materials, (posters, flares, and protocols) at all levels in animal and human health workers Disjoint communication during and after abortion in animals)	Globally, brucellosis fact sheets and protocols are available	Socio-cultural values and beliefs
Partnership and multi-sectoral collaboration	Presence of OH Coordination Unit OH Technical working groups One health strategic Plan (2016) The National Strategy for Income Growth and Poverty Reduction 2010 (NSGRP-MKUKUTA)-It emphasizes multi-sectoral collaboration in disease control Surveillance guidelines for priority zoonotic disease (in the pipe line)	Weak multi-sectoral collaboration (There is little coordination and collaboration between the human and animal health sectors and other relevant sectors for brucellosis control) Lack of signed MOU between sectors Lack of formal communication strategy	Available OH networks/forums/ organizations both globally and regionally	Fear among individuals Different priorities and concerns result into lack of trust among team members Poor communication and lack of common understanding among collaborators

Issue	Strengths	Weaknesses	Opportunities	Challenges
Monitoring and evaluation	Presence of surveillance guidelines for priority zoonotic diseases (in the pipe line)	Underreporting and inadequate feedback in the animal health sector Few laboratories for disease confirmation Lack of national reference lab for brucellosis diagnosis	• Use of mobile tools to promote reporting • Technical backstopping from partners (FAO, WHO) • Presence of international reference laboratories for diagnosis, research and training (OIE reference lab in UK)	Funding to support active and passive surveillance Lack of infrastructure and motivation among animal and human health workers Lack of link between research and practice to guide effective monitoring
Biosecurity and biosafety at various levels	Presence of relevant regulations (refer critical issue no1 above) Presence of bio-safety facilities and tools at various levels (field, lab, on transit)	Inadequate biosecurity and biosafety facilities at farm level Inadequate knowledge on biosecurity and biosafety issues for experts and farmers Limited biosecurity and biosafety guidelines	• Presence of guidelines from international reference laboratories • Technical backstopping (OIE- sanitary and phytosanitary (OIE- SPS), WTO, WHO) • Presence of experts on biosafety issues	Animal husbandry (management and care of animals) (difficult to enforce animal movement control, vaccination etc)

CHAPTER THREE

3. GUIDING PRINCIPLES OF BRUCELLOSIS PREVENTION AND CONTROL STRATEGY

3.1 Vision
To have the nation that is free from brucellosis

3.2 Mission
Ensuring the wellbeing of people by improving safety of animal source products and livestock productivity through an integrated brucellosis control strategy.

3.3 Goal
To control and eventually eradicate brucellosis in the country through an integrated intervention strategy.

3.4 General Objective/Objective of the Strategy
To reduce the burden and socio-economic impact caused by brucellosis in human and animal populations in Tanzania.

3.5 Key Strategic Objectives for Brucellosis Control
1. To enhance awareness and knowledge on brucellosis for professionals, policy makers, community and the general public
2. To initiate a national vaccination programme for livestock using public private partnership
3. To streamline and harmonise appropriate legal /policy framework and institutional arrangement in the implementation of the plan
4. To institutionalise Brucellosis testing among the febrile human cases in public and private health facilities
5. To support implementation of functional and quality integrated surveillance and diagnostic activities using One Health Approach
6. To promote and coordinate research and innovation in Brucellosis interventions
7. To facilitate and support application of bio-security and bio-safety targeting risk groups
8. To advocate and mobilize resources for supporting implementation of the plan

3.5.1 Prevent and Control of brucellosis in human
The prevention and control of human brucellosis hinges on elimination of contacts between people and infected animals or their products as well as avoiding risk behavioural practice. Measures for brucellosis should include public education on the risks, transmission avoidance and control of brucellosis. Among the commonly used approaches to prevent brucellosis in human include; personal hygiene, protection of the environment and food hygiene (adequate boiling of fresh milk intended for drinking or making other milk products). Adoption of safe working practices including use of PPE is highly encouraged in high risk occupations when handling potentially infected materials, eg aborted foetus, placenta, gravid uterus etc will be promoted. Other measures include employing good animal husbandry and management practices.

3.5.2 Prevention and control of brucellosis in food animals

The prevention and control in animals will focus on managing and altimately eradicate *B. abortus* and *B. melitensis* infections in cattle and goats to reduce economic losses and protect general public fro the disease

The main prevention and control will include

i. Vaccination of female calves and goats.
ii. Strengthen brucellosis surveillance using One Health Approach
iii. Awareness and sensitizing livestock keepers on proper disposal of aborted fetuses, placenta and placenta fluid
iv. Promote good husbandry practices including bio-security measure
v. Test and slaughter of the positive animals in targeted farms

3.5.3 Strengthen institutional capacity to control brucellosis

- Surveillance and diagnostics capacities for prioritized zoonoses including Brucellosis will be strenhthened at national and subnational levels through training of field and lab personel to support brucellosis surveillance
- Equip laboratories for brucellosis diagnosis. Efforts will be made to introduce testing schemes in targeted farms and incorporate brucellosis in existing surveillance systems, such as Integrated Disease Surveillance and Response (IDSR).
- Quality vaccine production capacity at Tanzania Vaccine Institute – Kibaha will be strengthened to support vaccination programmes (including vaccines for small ruminants).

3.5.4 Promote and coordinate research and innovation in brucellosis interventions

OH, stakeholders comprising of animal health, medical, public and environmental health, anthropologist and other experts to identify and undertake interventional research, eg. Efficacy of current vaccines, vaccine delivery model, pathogen/infection dynamics, Knowledge, Attitude and Practices (KAP) studies, system's research etc

In addition, research focusing development and validation of rapid field and laboratory confirmatory tests.

3.5.5 Enhance awareness and knowledge on brucellosis for proffesionals, policy makers, community and public

Awareness raising and sensitizing various stakeholders (Livestock keepers, consumers, policy makers, FBO/CBO leaders) using different avenue including but not limited to schools, Churches, Mosques, mass media (Radio, TV, Brochures, social media) and meetings at different levels will be enhanced. Livestock keepers will be made aware on risks related to improper disposal of aborted fetuses, placenta and placenta fluid and good husbandry practices including bio-security measure will be promoted.

3.5.6 Enhance Partnerships and One Health Approach/Multi-Sectoral Collaboration

Establish a way to allow sharing of disease reports, other information and discussions among

the animal health and human health departments at various administrative levels. This may include joint implementation where applicable

3.5.7 Streamline and harmonise appropriate legal and policy framework and institutional arrangement for the implementation of strategy.

Legal/ policy framework will be streamlined and harmonised to support zoonoses control. In addition, law enforcers will be engaged to raise awareness to all stakeholders regarding legal aspects providing for animal disease control including brucellosis. This will facilitate compliance to application of control measures.

CHAPTER FOUR

4. IMPLEMENTATION PLAN OF THE STRATEGY

Progressive (step-wise) approach for the control of brucellosis is adopted as suggested by OIE (FAO, 2013)., The approach entails to progressively move from one stage to the stage immediately after and is based on four different stages each with a situation analysis, expected outcome and summarized key activities as indicated in table 5. Stage 1 is where the epidemiological situation is being assessed and stage 4 is when the evidence is provided that there is no bacteria circulation either at zonal or national level and is ready to apply for the OIE official country status of brucellosis freedom.

Table 6: Road Map for the Progressive control of Brucellosis

Stage 1	Stage 2	Stage 3	Stage 4
Situation			
• Brucellosis is known to be present but with limited information • No structured control plan	Known situation of the disease with a control programme underway	Brucellosis at low levels within susceptible livestock and human population	No evidence of brucellosis in livestock No human cases
Outcome			
Better understanding of the disease situation.	Brucellosis prevalence/ incidence rates in livestock and human reduced by 20% by 2020	Reduced impact of brucellosis in livestock and humans by 50% by 2025	Self –declared free from brucellosis with/without vaccination

CHAPTER FIVE

5. INSTITUTIONAL AND FINANCIAL ARRANGEMENT

5.1 Institutional Arrangement

A national Strategy for Prevention and Control plan of brucellosis will be implemented through the existing structures that include the line Ministries, Local Government Authorities and stakeholders including development partners. At the regional, district and village levels the respective Primary Health Care Committee (PHC) will be responsible in their respective areas. However, at the levels of MoLF and MoHCDGEC in the Directorates of Veterinary Services and Preventive Services respectively, there shall be a coordinator for overseeing the day-to-day activities of the control strategies. The One Health Coordination Unit – at the Prime Minister's office shall be the coordinator of multi-sectoral activities pertinent with brucellosis control. It is expected that the control measures will involve all the areas with animals known to be important in the epidemiology of the disease in the country.

Table 7: Institutional responsibilities and roles

Institution	Roles/Responsibility
Ministry responsible for Finance	Provision of funds and other resources Oversees budget preparation and execution
• **Ministry responsible for Livestock** • **and Fisheries** • **Ministry responsible for Health** • **Ministry responsible for wildlife**	Formulation and harmonisation of policies and strategies Information and data collection Provision of technical support and implementation of activities
President's Office, Regional Administration and Local Government(PORALG)	Implementation of Vaccination activities Creation of brucellosis awareness Participate in brucellosis surveillance
VPO – Environment	Enforcement of government laws Surveillance
Ministry of Home Affairs	Enforcement of government laws
Ministry responsible for Justice and Constitution Affairs	Interpretation and custody of government laws
Prime Ministers Office – One Health Coordination Unit	Coordination of multi-partners and multi-sectorial activities related to One-Health and resource mobilization
TFDA	To ensure quality, safety and effectiveness of medicines by evaluating and registering of quality vaccines, control the importation of vaccines and conducting post marketing surveillances for vaccines
TVLA, TVI	Diagnosis, research and vaccine production, vaccine quality control
TANAPA	Coordination of wildlife related activities and control of brucellosis in wildlife buffer zones

ZVCs, Health facilities	Surveillance in humans and animals
Academic and Research Institutions (e.g: NM-AIST, KCMC, SUA, MUHAS,IHI, TAWIRI, NIMR etc)	Research, training, diagnosis, consultancy and vaccine manufacture
PAHSP (Private Animal Health Service Providers)	Surveillance, provision of veterinary services and reporting
NGOs both local and International	Provides technical support, public awareness, funding and linkages with communities and outreach activities
Food processors (eg Abattoirs, Milk plants etc)	Surveillance
Development Partners (e.g, B&MGF, WHO, OIE, FAO, UNICEF, USAID, CDC etc)	Support of brucellosis vaccination activities, funding of outreach activities

5.2 Financial Arrangement

Funding will be sourced from the Tanzania central government ministries (Ministry of Livestock and Fisheries (MoLF) and Ministry of Health, Community Development, Gender, Elderly and Children, Ministry of Natural Resources and Tourism, President's Office, Regional Administration and Local Government (PO-RALG), Prime Minister's Office, Development Partners and NGOs, CBOs and FBOs. Private sector will be engaged to support activities. Community own resources will be requested to support local activities.

CHAPTER SIX

6. MONITORING AND EVALUATION

The National Strategic Plan for Prevention and Control of Brucellosis will be implemented through Ministries responsible for Livestock, Health and Wildlife. Other Ministries are those responsible for Local Government Authorities and other stakeholders. A national Brucelosis control task force will be established to report to the ministries responsible for animal and human health. At regional, district and ward-levels, representatives of One Health Committees will be responsible for their respective areas. Designated officer (at DVS and DPS) shall be coordinators responsible for overseeing day-to-day activities of the programme. The One Health Coordination Unit – at the Prime Minister's office shall be coordinator of multi-sectorial activities within a One Health framework.

Monitoring and Evaluation (M&E) of the anthrax prevention and control strategic plan will be critical to measure the effectiveness of interventions. Indicators will be used to determine whether the interventions are making progress towards achieving objectives and goals of the anthrax prevention and control strategic plan. Each activity bears a monitoring indicator to be measured in the process of its implementation. Monitoring and evaluation frameworks will incorporate both process and outcome indicators. Individual Ministries/institutions/ bodies will have responsibility for monitoring and evaluating relevant identified activities and feeding information, findings and recommendations into the overall M&E process. A mid-term review will be done after three years to monitor the implementation of the plan. End-of-term evaluation will be conducted in 2023.

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8. APPENDICES

Appendix 1: LOGICAL FRAMEWORK MATRIX

Outcome	Objectives	Activity	Indicator	Data source/ Means of Verification	Baseline
Better understanding of the disease situation	To enhance awareness and knowledge on brucellosis for professionals, policy makers, community and the public	• Conduct knowledge, Attitude, Practice (KAP) studies in different social, policy and professional group • Develop/review communication and advocacy strategy for the brucellosis diseases (cross cuting) • Develop, produce and disseminate IEC materials. • Conduct advocacy, communication and social mobilization on brucellosis • Carry out baseline survey and epidemiological investigation and undertake risk mapping	• Number of, KAP studies conducted and shared • Comunication and advocacy strategy in place • IEC materials put in place and disseminated to the target groups at different levels. • Number of meeting for advocacy conducted • Surveys and investigations and risk mapping undertaken	Baseline survey report, post intervention survey reports	Derived from pre-existing Published data
Vaccination of livestock using public private partnership	To initiate a national vaccination programme for livestock using public private partnership	• Develop national vaccination plan • Production/procure of vaccine • Conduct monitoring of vaccination programme • To conduct vaccination campains at National and subnational levels	• National vaccination plan document • Number of Vaccine produced/ procured and consumed • Number of vaccination campaign/ monitoring visits	Availability of Reports and document on the activities conducted	No Existing data

Outcome	Objectives	Activity	Indicator	Data source/ Means of Verification	Baseline
Institutiona-lised brucellosis testing among febrile human cases in public and private	Institutionalise brucellosis testing among febrile human cases in public and private health facilities	• Procure diagnostic reagents, • Train personnel (Epi-Laboratory on biosafety and biosecurity) • Develop SOP for testing of human febrile cases guided by evidence / research • Orient professionals on SOP, biosafety and biosecurity	• Availability of materials and health centers/facilities involved. • Number of training and trained individuals by districts.	Availability of SOP document Training and orientation reports	No pre-existing
Supported and implemented functional and quality integrated surveillance and diagnostic activities using One Health Approach	To support implementa-tion of functional and quality integrated surveillance and diagnostic activities using One Health Approach	• Train personnel and equip Epidemiolgy Unit for brucellosis surveillance. • Train personnel and equip Lab Unit for brucellosis detection. • Train clinicians for proper case management • Train and equip field staff/health officers for data collection and reporting. • Develop joint outbreak investigation protocol in animals • Undertake active surveillance in animals	• Reports of number of supplies and, equipments. Number of trainings and surveillance. • Number of districts equipped with data collection and reporting tools. • Joint investigation protocal developed	Reports and documents	No pre-existing data
Streamlined and harninised appropriate legal/policy framework and institutional arrangement for implementation of the plan	To streamline and harmonise appropriate legal /policy framework and institutional arrangement in the implementation of the plan	• To carry out legal and policy analysis, spot some weakness and amend accordingly • To carry out advocacy and operationalize legal frameworks • To carry out stakeholder's engage	• Report of Revised document • Number of advocacy meeting conducted • Number of stakeholders meeting conducted	Reports and documents from activities	Existing policies/legal frameworks

Outcome	Objectives	Activity	Indicator	Data source/ Means of Verification	Baseline
		ment meeting especially for the low enforcers and DEDs to involve them in disease control • Facilitate Interministrerial arrangement through development of MoUs • To establish linkage mechanism for research between line ministries and research institutions to support the control of brucellosis • To develop community base policy institutional and legal frameworks to support community engagement in the control of brucellosis • To develop appropriate regulations for the control of brucellosis and other disease of importance	• Availability of MoU • Established linkage between line ministries and research institution to support control of brucellosis • Established policy • Availability regulations		
Cordinated research and innovation on Brucelosis intervantion	Promote and coordinate research and innovation on brucellosis interventions	• Conduct innovative Brucellosis research to inform legislation and intervention planning • Research on Policy and coordination structure which support implementation and interventions • Research on disease epidemiology in wildlife, livestock and humans • Research on interactions which lead	• Number of research GAPs identified • Number of proposals developed and sent for funding • Reports/publications and documents	Reports Proposal documents	Existing publications and reports on brucellosis

Outcome	Objectives	Activity	Indicator	Data source/ Means of Verification	Baseline
		into outbreaks btn the compartments • Research in new technology on rapid detection, identification and differentiation of species. • Validation of existing vaccines • Conduct research on making new vaccine materials and antigen for vaccines • Research on other options for Brucellosis control • Research on other susceptible groups and groups at risk of getting disease • Research on socio-cultural drivers on Brucellosis transimission, prevention and control			
Improved application of biosecurity and biosafety targeting risk groups	Facilitate and support application of bio-security and bio-safety targeting risk groups	• Review, update and disseminate the biosafety and biosecurity policy and curricula • Creation of awareness to the first responders - farmers, extension officers • Train and equip biosafety officers including meat inspectors and market staff • Inventory of lab research and detection • To designate laboratories for handling and identification of Brucellosis	• Brucellosis outbreak response plan. • Number of staff trained. • Number of equipments procured. • Availability of lab research and detection • Availability of designed lab for handling and identification of Brucelosis • Availability of SoPs	Presence of PPE, Presence of safety cabinet in the laboratory	Not existing

Outcome	Objectives	Activity	Indicator	Data source/ Means of Verification	Baseline
		• Development and dissemination of SOP's on biosafety and biosecurity on suspected cases of Brucellosis to avoid contamination			
	Advocate and mobilize resources for supporting implementation of the plan	• Development of brucellosis proposals to support implementation of the plan • Conduct development partners mapping for resource mobilization within and outside Tanzania.	• Number of brucellosis proposals developed. • An inventory of funding agencies available	Reports of implementation. Funding proposals.	Not existing

Appendix 2: DETAILED PREVENTION AND CONTROL STRATEGY FOR BRUCELLOSIS

STRATEGIC OBJECTIVES	KRAs	ACTIVITIES	Target year for initiating output / activity									
	.		1		2		3		4		5	
To enhance awareness and knowledge on brucellosis for professionals, policy makers, community and the public		Conduct knowledge, Attitude, Practice(KAP) studiesin different social, policy and professional group										
		Develop/review communication and advocacy strategy for the brucellosis diseases (cross cuting										
		Develop, produce and disseminate IEC materials										
		Conduct advocacy, communication and social mobilization on brucellosis										
		Carry out baseline survey and epidemiological investigation and undertake risk mapping										
To initiate a national vaccination programme for livestock using public private partnership		Develop and implement national vaccination plan										
		Production/procure of vaccine										
		To conduct vaccination campains at National and subnational levels										
		Conduct monitoring of vaccination programme										
Institutionalise brucellosis testing among febrile human cases in public and private health facilities		Procure diagnostic reagents,										
		Train personnel (Epi-Laboratory on biosafety and biosecurity)										
		Develop SOP for testing of human febrile cases guided by evidence / research										
		Orient professionals on SOP, biosafety and biosecurity										
		Procure diagnostic reagents,										

STRATEGIC OBJECTIVES	KRAs	ACTIVITIES	Target year for initiating output / activity									
	.		1		2		3		4		5	
To support implementation of functional and quality integrated surveillance and diagnostic activities using One Health Approach		Train personnel and equip Epidemiolgy Unit for brucellosis surveillance.										
		Train clinicians for proper case management										
		Train and equip field staff/ health officers for data collection and reporting.										
		Develop joint outbreak investigation protocol in animals										
To streamline and harmonise appropriate legal /policy framework and institutional arrangement in the implementation of the plan		To carry out legal and policy analysis, spot some weakness and amend accordingly										
		To carry out advocacy and operationalize legal frameworks										
		To carry out stakeholder's engagement meeting especially for the low enforcers and DEDs to involve them in disease control										
		Facilitate Interministrerial arrangement through development of MoUs										
		To establish linkage mechanism for research between line ministries and research institutions to support the control of brucellosis										
		To develop community base policy institutional and legal frameworks to support community engagement in the control of brucellosis										
		To develop appropriate regulations for the control of brucellosis and other disease of importance										

STRATEGIC OBJECTIVES	KRAs	ACTIVITIES	Target year for initiating output / activity									
	.		1		2		3		4		5	
Promote and coordinate research and innovation on brucellosis interventions		Conduct innovative Brucellosis research to inform legislation and intervention planning										
		Research on Policy and coordination structure which support implementation and interventions										
		Research on disease epidemiology in wildlife, livestock and humans										
		Research on interactions which lead into outbreaks btn the compartments										
		Research in new technology on rapid detection, identification and differentiation of species.										
		Validation of existing vaccines										
		Conduct research on making new vaccine materials and antigen for vaccines										
Facilitate and support application of bio-security and bio-safety targeting risk groups		Review, update and disseminate the biosafety and biosecurity policy and curricula										
		Creation of awareness to the first responders - farmers, extension officers										
		Train and equip biosafety officers including meat inspectors and market staff										
		Inventory of lab research and detection										
		To designate laboratories for handling and identification of Brucellosis										
		Development and dissemination of SOP's on biosafety and biosecurity on suspected cases of Brucellosis to avoid contamination										

STRATEGIC OBJECTIVES	KRAs	ACTIVITIES	Target year for initiating output / activity									
	.		1		2		3		4		5	
		Review, update and disseminate the biosafety and biosecurity policy and curricula										
		Creation of awareness to the first responders - farmers, extension officers										
Advocate and mobilize resources for supporting implementation of the plan		Development of brucellosis proposals to support implementation of the plan										
		Conduct development partners mapping for resource mobilization within and outside Tanzania.