



Feed the Future Innovation Lab for Livestock Systems

Rwanda:

Livestock Disease Management and Food Safety Brief

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This Brief is a work in progress. It will be updated with additional information collected in the future.

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1. Introduction

In Rwanda, livestock plays a crucial role in rural and national economies and contributes 8.8% to the national gross domestic product (Karenzi et al., 2013). During the war of 1994, Rwanda lost 90% of its national cattle herd (Bazarusanga, 2008). In subsequent years, however, the livestock population has gradually increased and the proportion of Rwandan households keeping cattle has risen (34.4% in 2005/2006, 47.3% in 2010/2011, and 50.4% in 2013/2014; SYB, 2015). MINAGRI (2013) considers the cattle (especially dairy) subsector as an important part of Rwandan agriculture and livestock, and a pathway out of poverty. Because of Government of Rwanda's (GoR) prioritization on cattle, the focus of this brief is on cattle subsector.

Livestock diseases are significant challenges to the cattle subsector in Rwanda. East Coast Fever (ECF), anaplasmosis, babesiosis, trypanosomiasis, anthrax, brucellosis, tuberculosis, foot and mouth disease (FMD), contagious bovine pleuropneumonia (CBPP), and parasites are common. The losses due to diseases account for 25% of the value of cattle production (Juvenal and Edward, 2010). A 2007 survey of three districts of Eastern Province, which has about 40% of the Rwanda's cattle population, identified the following animal health problems: dystocia (37%), retained placenta (33%), tick-borne diseases (27.6%), gastrointestinal parasites (18.4%), abortion (13%), blackleg and anthrax (9.0%), FMD (8.3%), trypanosomiasis (8.2%), and lumpy skin disease (7.9%) (Chatikobo et al., 2009). In the following sections, major diseases of cattle in Rwanda are briefly described, with emphasis on dairy cows, foodborne disease burden, and zoonoses.

2. Major Cattle Diseases

Disease Prevalence and Variation by Region and System

- **East Coast Fever (ECF) and other tick-borne diseases** – ECF is an endemic tick-borne cattle disease in Rwanda. The existence of four *Theileria* blood parasite species (*T. parva*, *T. mutans*, *T. taurotragi*, and *T. velifera*) was reported in 97 (36.7%) of 264 samples examined in the country. The prevalence of infection due to *T. parva* was 25.3% (66/264) (Bazarusanga et al., 2007b). The prevalence of *T. parva* infection was significantly higher in the highland agro-ecological zone than the lowland zone, in contrast to the distribution of its tick vector, *Rhipicephalus appendiculatus* (Bazarusanga et al., 2007a). In a previous experiment conducted in the country, 23 of 72 Ankole cattle (32%) infected by *T. parva* died, while 21 of 33 crossbred cows died (64%), indicating higher susceptibility of crossbred cows to *Theileria* infection than the Ankole breed (Paling et al., 1991). ECF also has been noted as a challenge to the breed improvement program of the Rwandan government to increase milk production and alleviate poverty (Bazarusanga, 2008). Other tick-borne diseases are also present in Rwanda. A survey conducted in Bugesera district, Eastern Province, showed that the incidence of bovine carriers of *Theileria parva*, *Babesia* spp., and *Anaplasma* spp. based on blood smears were 24%, 0.04%, and 0.04%, respectively (Kabagambe et al., 1988). Between 2005 and 2009, anaplasmosis killed 12 of the 540 cows that were distributed to farmers in Kayonza and Rwamagana districts, Eastern Province (Mutandwa and Ngendabanga, 2015).
- **Bovine Tuberculosis (BTB)** – A survey conducted in Bugesera district showed that the prevalence of BTB in cattle was 11% based on the tuberculin test (Kabagambe et al., 1988). In Kigali abattoir, 16,753 cattle were examined, and 148 of them had typical BTB lesions, a prevalence of 0.9%. *Mycobacterium bovis* also was isolated from 21 of 36 tissue samples by conventional bacteriological procedures (Habarugira et al., 2014).
- **Brucellosis** – Serum samples were collected from 998 cattle from 205 herds in Nyagatare district, Eastern Province; 62 herds (30.2%) and 99 animals (9.9%) were positive to Rose Bengal Plate test (RBPT) for brucellosis (Chatikobo et al., 2008). Earlier high incidences of dystocia, retained placenta,

and abortion were observed in this district (Chatikobo et al., 2009). In another study, animal level brucellosis prevalence rates of 2.03% using RBPT and 1.7% using C-ELISA were reported from three districts around Kigali city (Manishimwe et al., 2015). Similarly, 7.4% and 8.3% within-herd prevalence rates were documented in two farms in Huye district, Southern Province (Rujeni and Mbanzamihiho, 2014). However, records of animals coming for insemination (natural and artificial) to the Kabutare Veterinary School's farm between 2002 and 2006 showed a declining trend of the prevalence of brucellosis from 9.6% to 4.6% in Huye district, Southern Province, (Rujeni and Mbanzamihiho, 2014).

- **Contagious Bovine Pleuropneumonia (CBPP)** – CBPP is an endemic cattle disease in Rwanda (Amanfu, 2009). In February 2010, there was an outbreak of a respiratory disease suspected to be CBPP in Eastern Province. Of the 81 cattle sampled, 53 (65.4%) tested positive for CBPP by ELISA assay (Enyaru et al., 2012).
- **Foot and Mouth Disease (FMD)** – Sporadic outbreaks of FMD occur in Rwanda. Tanzania and/or Uganda are suspected to be the sources of the infection due to cross-border animal movement (APHIS, 2006). FMD outbreaks were reported in Kayonza and Gatsibo districts of Eastern Province in November 2012 (euFMD, 2012).
- **Lumpy Skin Disease (LSD)** – No published data for Rwanda.
- **Mastitis** – Based on a study conducted in Nyagatare district, which is the largest dairy district in the country, the prevalence of subclinical mastitis at farm level was 51.8% (Iraguha et al., 2015). Prevalence was found to be associated with breed and husbandry systems: 74.3% in pure exotic breeds, 51.8% in crossbred animals, and 36.0% in the local Ankole cows, 34.1% in semi-intensive and 65.5% in extensive (open grazing) systems. The authors isolated the causative agents, of which 87.5% were coliforms, indicating a poor management system. Another study in Nyabihu and Musanze districts of Rwanda documented that mastitis reduced the lactation period from 305 days to 245 days, and resulted in financial losses of RWF 23,800 (US\$31.46 based on the exchange rate of May 2016, RWF756.52=US\$1) per cow per year per lactation from discarded milk, of RWF19,950 (US\$26.37 per above rate) for increased preventive veterinary services, and RWF9,600 (US\$12.69 per above) for treatment (Mwabonimana et al., 2015). The Government of Rwanda (GoR) has developed a mastitis control and prevention plan for 2015 to 2020 (<http://rab.gov.rw/about-rab/news>).
- **Internal parasites** – A survey conducted in 1986 showed that *Coccidia* (19%), *Oesophagostomum* (15%), *Paramphistomum* (15%), *Haemonchus* (19%), and *Moniezia* (3%) are common in livestock in Rwanda (Kabagambe et al., 1988). More recently, based on an abattoir survey of 1,470 randomly sampled slaughtered animals, a 4.6% prevalence of bovine dictyocaulosis was reported, with significantly higher prevalence rates in animals that originated from highland areas compared to lowland agro-ecologies and in younger rather than adult cattle (Juvenal et al., 2010).
- **External Parasites** – Ticks are abundant in all agro-ecologies of Rwanda (Juvenal and Edward, 2010). The presence of six species of the tick genus *Ixodes* was reported across the country with *Rhipicephalus appendiculatus*, the main vector for ECF, as the most abundant (91.8%), followed by *Boophilus decoloratus* (6.1%), *Amblyomma variegatum* (1.2%), *R. evertsi evertsi* (0.46%), *R. compositus* (0.31%), and *I. cavipalpus* (0.08%) (Bazarusanga et al., 2007a). Ticks are more prevalent in the lowland agro-ecological zone compared to the highland zone (Bazarusanga et al., 2007a, Juvenal and Edward, 2010).
- Other diseases that occur in Rwanda are Trypanosomiasis, Anthrax and Blackleg.

Animal disease trends

Mutumura (2016) noted that control methods, including vaccination and restrictions on movement of cattle, have reduced outbreaks of FMD and blackleg during the past few years. Additionally, Rwanda has a zero tolerance program for brucellosis, and all imported ruminants are initially tested for reactors. Animals testing positive are not allowed into the country, and calves are vaccinated against brucellosis

using RB51. On the other hand, the number of LSD cases has been increasing in recent years. Mutimura (2016) also indicated that there is still a challenge for the tick-borne diseases (ECF and anaplasmosis).

Documented impacts

In Rwanda, outbreaks of diseases disrupt trade of livestock and livestock products due to the movement restrictions imposed by the government until an outbreak is contained. In 2008, LSD, FMD, and anthrax outbreaks resulted in a 15% reduction of milk production compared to 2007; the milk production loss was estimated at US\$10 million. The estimated value of destroyed, slaughtered, and dead cattle was US\$163,000 (Giertz et al., 2015). Livestock disease statistics for 2002 to 2012 are shown in Table 1.

Table 1. Average Number of Livestock Disease Outbreaks, Susceptible Animals, Deaths, and Destroyed and Slaughtered Animals in Rwanda, 2002 to 2012

	FMD	CBPP	LSD	Anthrax	Total
New Outbreaks	48	12	123	160	343
Susceptible	266,429	351,219	730,195	929,906	2,277,749
Cases	758	1,706	2,434	2,097	6,995
Deaths	93	97	81	362	633
Destroyed	262	27	91	122	502
Slaughtered	68	-	-	106	174

Source: OIE 2014 cited in Giertz et al. (2015)

Factors impacting incidence of diseases

- **Cross-border animal movement** – The increased incidences of some livestock diseases are attributed to the movement of cattle across the borders with Uganda, Tanzania, and the Democratic Republic of Congo (Giertz et al., 2015, APHIS, 2006). Diseases such FMD are endemic in neighboring countries; lack of an integrated approach between countries to control transboundary diseases is a big challenge in the region (Bouslikhane, 2015; FAO, 2001).
- **Breed-improvement program** – Improved breeds of dairy cows are distributed to resource-poor households through the Girinka program. However, these cows with exotic bloodlines are more susceptible to endemic diseases such as tick borne diseases (ECF and Anaplasmosis) than local cows (Bazarusanga, 2008).
- **Other factors** – Ticks are a predominant vector of disease in livestock, and ticks are increasingly becoming resistant to acaricides. Other diseases are becoming more prevalent for various reasons: for example, reduction of stringent control measures, such as bi-annual vaccinations, has resulted in an increase in LSD; inadequate knowledge of mastitis means more cases; and FMD transmission is increased by cross border movement of animals (Mutimura, 2016).

3. Food-borne Disease Burden and Zoonoses

In 2014, diarrhea accounted 20% (103,044 cases) of the causes of morbidity of children under five years of age in Rwanda (SYB, 2015). In the same year, intestinal parasites, gastro-intestinal disease, and diarrhea accounted for 8%, 5%, and 3%, respectively, of the 8,112,766 outpatient diseases in Rwandan health centers. Additionally, HIV/AIDS opportunistic infections and diarrhea ranked fifth and ninth, respectively, as causes of death in 2014 with respective deaths of 570 and 259 people (SYB, 2015). Following are brief descriptions of major food-borne and zoonotic diseases in Rwanda:

- **Internal parasites** – A study of 583 children under five years of age in Southern Province of Rwanda revealed a high prevalence of internal parasites, and the major identified etiological agents were *Giardia duodenalis* (prevalence = 60.1% by PCR and 19.8% by microscope), *Ascaris lumbricoides* (31.6%), *Cryptosporidium parvum* (4.9%), *Necator americanus* (2.7%), *Entamoeba histolytica* (1.1%), and *Trichuris trichiura* (1.9%) (Ignatius et al., 2012). The prevalence of soil-transmitted helminthes and *Schistosoma mansoni* among 8,313 school children across the country (10-16 years

old) was 65.8% and 2.7%, respectively. Six species of soil-transmitted helminthes were identified, with *Ascaris lumbricoides* (38.6%) the predominant species, followed by *Ancylostoma duodenale* (31.6%), and *Trichuris trichiura* (27%) (Mupfasoni et al., 2009). Five years after the implementation of a nationwide soil-transmitted helminthes control program, the prevalence of soil-transmitted helminth infection in Southern Province dropped to 38% in rural and 13% in urban schoolchildren (Staudacher et al., 2014). On the other hand, a cross sectional study was conducted on 109 students attending a medical clinic in Kigali Institute of Education in 2010: the prevalence of *Entamoeba histolytica* was 54.5%, *Trichomonas intestinalis* and *Ascaris lumbricoides* were 20.0%, *Giardia duodenalis* was 3.6%, and *Ancylostoma duodenale* was 1.8% (Emile et al., 2013).

- **Milk-borne pathogens** – In Rwanda, milk and dairy products, particularly dairy products that are sold through informal markets, are known to have safety and quality problems. In a study of 330 milk samples collected from farms, milk collection centers, milk processing plants, and milk shops, *Staphylococcus aureus* and *Salmonella* were isolated from 175 (53.0%) and 25 (7.6%) samples, respectively, with the highest isolation rate from cheese samples originating from milk shops (Kamana et al., 2014). *Listeria monocytogenes*, however, was not detected in any of the samples. Absence of refrigeration and lack of temperature monitoring were found to be prevailing safety issues in Rwanda's milk chain.
- **Salmonella** – Reporting on the more serious nontyphoidal *Salmonella* is lacking in Rwanda. Typhoidal *Salmonella enterica* serotype Typhi and *Shigella* species were identified from 91 and 10 stool and/or blood samples, respectively, collected from 220 patients (Gatabazi, 2013).
- **Cysticercosis** – This disease caused by tapeworms is endemic in Rwanda (Zoli et al., 2003). Cysts of bovine cysticercosis were detected in 9 of 291 cattle slaughtered in the Nyagatare abattoir, Eastern Province (Nzeyimana et al., 2015). National data are lacking on bovine cysticercosis in humans, but a serosurvey conducted in Southern Province showed that 21.8% of epileptics and 4% of people in a control group were positive to neurocysticercosis, which is caused by infection of the central nervous system with *Taenia solium* (Rottbeck et al., 2013).
- **Toxoplasmosis** – Women attending antenatal care in four health centers in Kigali city were screened for presence of antibodies against *Toxoplasma gondii* using the ELISA test; 12.2% of the 384 pregnant women tested positive (Esperance, 2014). In this study, drinking untreated water and eating undercooked meat were found to be significantly associated with seropositivity. A previous study conducted in two rural communities of Ngenda and Nyarutovu (Bugesera District, Eastern Province) showed that 50% of the adults in both communities had antibodies to *T. gondii* as detected by direct agglutination technique (Gascon et al., 1989). Published data on toxoplasmosis in animals could not be found.
- **Brucellosis** – A seroprevalence study was conducted on 60 women presenting with aborted and stillborn fetuses of unknown cause in two hospitals of Huye district, Southern Province. *Brucella* antibodies were detected in blood samples taken from 15 of the women (25%) using RBPT. Milk consumption and contact with livestock were identified as risk factors (Rujeni and Mbanzamihigo, 2014). In rural households, consumption of unpasteurized milk and undercooked or fresh meat is common (Chatikobo et al., 2008).

Disease burden by region, gender, age, and ethnic group

Although diarrhea has decreased by 70% (from second to fifth as a cause of premature death) from 1990 to 2010, it is still one of the leading causes of premature death in Rwanda, with 218,000 years of life lost in 2010 (GBD, 2010). There is lack of literature on the distribution of food-borne diseases and zoonoses by region, gender, age, and ethnic group in the country. Generally, children, the elderly, and immunocompromised people are highly susceptible to food-borne diseases (Lund, 2015). In 2014, Rwanda had about 210,000 (190,000 to 230,000) patients living with HIV who are at higher risk of secondary infections from food-borne diseases

(<http://www.unaids.org/en/regionscountries/countries/rwanda>).

Based on the report of WHO's Foodborne Disease Burden Epidemiology Reference Group (FERG) on global burden of foodborne diseases, Rwanda was categorized in Africa Subregion E, a subregion that had the second highest food-borne disease burden in the world in 2010 (Havelaar et al., 2015). In this subregion, diarrheal disease agents, such as *Norovirus*, *Campylobacter* spp., *E. coli*, *Salmonella* spp., and *Cryptosporidium* spp. contributed to the major proportion of the food-borne disease and disability-adjusted-life-years (DALYs; as indicated in Table 2).

Table 2. 2010 Median Rates of Disability Adjusted Life Years (DALYs) per 100,000 Population Due To Foodborne Diseases for Africa Subregion E (including Rwanda), with 95% Uncertainty Intervals

Causes of Foodborne Diseases	DALYS (95% UI)	Causes of Foodborne Diseases	DALYS (95% UI)	Causes of Foodborne Diseases	DALYS (95% UI)
Diarrheal disease agents	824 (447-1,326)	Invasive infectious disease agents	147 (55-343)	Helminths	184 (141-240)
Viruses	76 (0-225)	Viruses		Cestoda	178 (136-235)
Norovirus	76 (0-225)	Hepatitis A virus	18 (3-55)	<i>Echinococcus granulosus</i>	0.8 (0.2-16)
Bacteria	712 (393-1,160)	Bacteria	104 (40-277)	<i>Echinococcus multilocularis</i>	0 (0-0)
<i>Campylobacter</i> spp.	70 (33-177)	<i>Brucella</i> spp.	0.3 (0.007-18)	<i>Taenia solium</i>	176 (134-229)
Enteropathogenic <i>Escherichia coli</i>	138 (6-327)	<i>Listeria monocytogenes</i>	1 (0-21)	Nematoda	5 (1-11)
Enterotoxigenic <i>Escherichia coli</i>	105 (17-240)	<i>Mycobacterium bovis</i>	34 (21-48)	<i>Ascaris</i> spp.	5 (1-11)
Shiga toxin-producing <i>Escherichia coli</i>	0.08 (0.02-0.2)	<i>Salmonella Paratyphi A</i>	12 (0-43)	<i>Trichinella</i> spp.	0.001 (0-0.002)
Non-typhoid <i>Salmonella enterica</i>	193 (44-336)	<i>Salmonella Typhi</i>	52 (0-187)	Trematoda	0.02 (0.008-0.07)
<i>Vibrio cholera</i>	143 (4-383)	Protozoa	20 (9-37)	<i>Clonorchis sinensis</i>	0 (0-0)
Protozoa	21 (5-66)	<i>Toxoplasma gondii</i>	20 (9-37)	<i>Fasciola</i> spp.	0.01 (0.005-0.04)
<i>Cryptosporidium</i> spp.	12 (0-45)	Chemicals and toxins	7 (3-21)	Intestinal fluke	0 (0-0)
<i>Entamoeba histolytica</i>	5 (0-41)	Aflatoxin	3 (1-8)	<i>Opisthorchis</i> spp.	0 (0-0)
<i>Giardia</i> spp.	0.7 (0-3)	Cassava cyanide	1 (0.3-9)	<i>Paragonimus</i> spp.	0.008 (0.002-0.02)
		Dioxins	0.2 (0.09-9)		
Total DALYs 1,179 (726-1,764)					

Source: Havelaar et al. (2015)

Factors impacting disease incidence

Published data could not be found.

Evidence of nutritional impact

Published data could not be found.

4. Recommendations of National and International Assessments

A veterinary services gap analysis is regularly conducted using the principles of World Organization for Health, Office International des Epizooties (OIE). The assessment areas include disease diagnostic services, capacity to carry out diseases surveillance and monitoring of disease spread across borders, and capacity to inspect animal products (Mutimura, 2016).

5. Ongoing Control Programs and Impact

Ongoing disease control programs in Rwanda include vaccination against brucellosis, blackleg, anthrax, and LSD; active surveillance for brucellosis; and passive surveillance for blackleg and LSD. In addition, the OIE progressive control pathway is implemented to control FMD (Mutimura, 2016).

6. Actors and Stakeholders for Animal Health and Food-borne Diseases

Main actors in Rwandan animal health

The main actor for animal health and food safety is the Veterinary and Laboratory Services Unit that performs monitoring of abattoirs and slaughterhouses. A Directorate of Veterinary and Animal Products Inspection has been recently created to carry out the inspection function. In addition, there is the Rwanda Agriculture and Livestock Inspection Services Directorate that works in conjunction with the Rwanda Agriculture Board in strengthening the inspection of animal products, especially those that are imported into or exported from Rwanda (Mutimura, 2016).

One health platform

One Health brings together experts from human health, animal health, and environmental health to exchange information, plan, and act together to tackle human-animal-ecosystem health problems. In Rwanda, a One Health committee has been established and a strategic plan was developed, but there is no One Health policy. The University of Rwanda is a member of the One Health for Central and Eastern Africa alliance (<http://ohcea.org/>). One Health activities are carried out jointly between the University of Rwanda, the GoR Ministry of Health, and One Health for Central and Eastern Africa (Mutimura, 2016).

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