Biorisk: African Experience

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**Africa: a major source of animal proteins**

Huge livestock population
Extensive breeding
Variable bio-products
Rich wildlife & biodiversity

<table>
<thead>
<tr>
<th>ANIMAL SPECIES</th>
<th>POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asses</td>
<td>18,946,358</td>
</tr>
<tr>
<td>Horses</td>
<td>6,058,131</td>
</tr>
<tr>
<td>Mules</td>
<td>1,023,087</td>
</tr>
<tr>
<td>Cattle</td>
<td>312,327,289</td>
</tr>
<tr>
<td>Goats</td>
<td>374,380,445</td>
</tr>
<tr>
<td>Sheep</td>
<td>340,749,117</td>
</tr>
<tr>
<td>Buffaloes</td>
<td>3,949,287</td>
</tr>
<tr>
<td>Camels</td>
<td>23,533,724</td>
</tr>
<tr>
<td>Pigs</td>
<td>34,332,061</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1,080,967,438</strong></td>
</tr>
</tbody>
</table>
**Africa: source of major pathogens**

Diseases of terrestrial animals listed by the OIE

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Total</th>
<th>Africa</th>
<th>Asia</th>
<th>Europe</th>
<th>America</th>
</tr>
</thead>
<tbody>
<tr>
<td>multispecies</td>
<td>23</td>
<td>18</td>
<td>14</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Cattle</td>
<td>14</td>
<td>14</td>
<td>10</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Small ruminant</td>
<td>11</td>
<td>11</td>
<td>9</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Equids</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Swine</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>others</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>67</strong></td>
<td><strong>59</strong></td>
<td><strong>46</strong></td>
<td><strong>35</strong></td>
<td><strong>35</strong></td>
</tr>
</tbody>
</table>

90% of OIE listed diseases of terrestrial animals are present in Africa
OIE official control programmes

• The five contagious diseases with official recognition policy and procedures are all endemic in Africa (African horse sickness, Classical swine fever, Foot and mouth disease, Contagious bovine pleuropneumonia and Peste des petits ruminants)

• Very few African countries presented a recognition status or an official control programme (AHS in North Africa, FMD in Botswana, Madagascar, Morocco, Namibia and South Africa (5 out of 55 affected countries)
Veterinary laboratories in Africa

• Academia
• Diagnosis
• Research
• Vaccines
North Africa

- **ALGERIA**: National Institute of Veterinary Medicine (INMV)
- **EGYPT**: National Centre for Radiation Research and Technology (NCRRT)
- **LIBYA**: Central Veterinary Laboratory
- **MOROCCO**: Agronomic and veterinary institute Hassan II ONSSA: Laboratory of Analysis and Research
- **MAURITANIA**: National Office for Research and Development of Livestock (ONARDEL)
- **SUDAN**: Animal Research Institute
- **TUNISIA**: Institute of Veterinary Research (IRVT), Pasteur Institute
Communauté économique des États de l’Afrique de l’Ouest (CÉDÉAO)

Laboratoire central vétérinaire (LCV) Mali
Laboratoire National d’élevage et recherche vétérinaire (LNERV) Senegal
  • Laboratoire National d’Elevage (LNE) Guinea
  • Laboratoire national vétérinaire (LABOCEL) Niger
  • Laboratoire National Vétérinaire (LNV) Guinea Bissau
  • Laboratoire Central Vétérinaire (LCVB) Côte d’Ivoire
  • LABOVET Laboratoire vétérinaire Burkina Faso
  • LADISERO Laboratoire de diagnostic et de sérosurveillance Benin

Ghana – Togo - Nigeria - Gambia - Capo Verde - Sierra Leone – Liberia
Laboratoire Central Vétérinaire (LCV) Bamako, Mali:
Diagnostic and vaccine production
Advantage: production income is covering diagnostic and research activity
Biorisk issue: no clear separation between three activities
Central Africa

CAMEROON: Laboratory LANAVET National Vet. Laboratory
CHAD: Vet and livestock Research Laboratory Farcha
ANGOLA: Central Laboratory for Veterinary Pathology Regional laboratory of the Institute of Veterinary Research (IIV)
DEMOCRATIC REPUBLIC OF CONGO: Kinshasa Veterinary Laboratory
CENTRAL AFRICAN REPUBLIC: National Agency Livestock Development (ANDE)
Eastern Africa

**BURUNDI**: National Vet Laboratory

**ETHIOPIA**: National Veterinary Institute

**KENYA**: National Veterinary laboratory

**SEYCHELLES**: Central Laboratory or Laboratoire Central d’Elevage (LABOCCEL)

**SOMALIA**: Central Veterinary Laboratory

**TANZANIA**: Central Veterinary Laboratory

**UGANDA**: National Animal Disease Diagnostics and Epidemiology Center
Example: Kenya

- Veterinary Vaccines Production Institute (KEVEVAPI): several vaccines manufactured, dedicated facilities for FMD bio-risk issue
- ILRI International Research Centre, high standard laboratory not necessarily accredited
- Agriculture and Research Organisation, KALRO, good animal facilities, several challenge models developed, could lead technology transfer to other labs
Southern Africa

**BOTSWANA:** Veterinary National Laboratory (BVNL)
**COMOROS:** Centre de recherche et de veille
**LESOTHO:** National Institute of Veterinary Research
**MADAGASCAR:** National Laboratory of Veterinary Diagnosis (LNDV)
**MAURITIUS:** Animal Health Laboratory Livestock and Veterinary Division
**NAMIBIA:** Central Veterinary Laboratory
**SOUTH AFRICA:** Onderstepoort’s Vet Institute
**ZIMBABWE:** Central Veterinary Laboratory
**ZAMBIA:** Central Veterinary Research Institute
Example : South Africa

- Onderstepoort Biological: long history vaccine production, now under renovation in order to comply with modern biosafety standards
- Onderstepoort Veterinary Institute for diagnostics and research, several laboratories accredited
- Other compliant labs (academic, private, etc.)
Five Dedicated PCR laboratories

Lab 1: Setting up an RT-PCR mix reaction in Lab 1

Lab 2.1: Sample processing for nucleic acid extractions

Lab 2.2: The MagNaPure automated RNA extraction-96 samples

Lab 2.3: The nested PCR room

Lab 3: Thermocycler

Lab 4: Agarose gel electrophoresis

Lab 5: GelDoc system
World Distribution of OIE Reference Laboratories

OIE Reference Laboratories
- 1 to 3 OIE Reference Labs
- 4 to 10 OIE Reference Labs
- 11 to 20 OIE Reference Labs
- more than 20 OIE Reference Labs
- no OIE Reference Labs

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OIE Reference Laboratories in Africa

- **Onderstpoort Veterinary Institute**
  Pretoria, SOUTH AFRICA
  African horse sickness, African swine fever, Bluetongue, Foot and mouth disease, Lumpy skin disease, Rabies, Rift Valley fever, Sheep/Goat pox

- **Institut Agronomique et Vétérinaire Hassan II**
  Rabat, MOROCCO
  Echinococcosis

- **Botswana Vaccine Institute (BVI)**
  Department of Animal Health and Production
  Gaborone, BOTSWANA
  Bovine contagious pleuropneumonia, FMD
<table>
<thead>
<tr>
<th>Country</th>
<th>Laboratory Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana</td>
<td>BVI vaccine institute (LTD),</td>
</tr>
<tr>
<td>Cameroon</td>
<td>National Vétérinaire (LANAVET) de Garoua</td>
</tr>
<tr>
<td>Chad</td>
<td>Institut national de recherche vétérinaire de Farcha, Ndjamena</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Institute national vétérinaire, Debré – Zeit</td>
</tr>
<tr>
<td>Egypt</td>
<td>Abassia Centre for Serum and Vaccine</td>
</tr>
<tr>
<td>Kenya</td>
<td>Veterinary Vaccines Production Institute (KEVEVAPI)</td>
</tr>
<tr>
<td>Mali</td>
<td>Laboratoire Central Vétérinaire (LCV) de Bamako</td>
</tr>
<tr>
<td>Morocco</td>
<td>Biopharma and MCI Santé Animale Laboratoire</td>
</tr>
<tr>
<td>Nigeria</td>
<td>National Institut of Veterinary Research, (VOM)</td>
</tr>
<tr>
<td>Niger</td>
<td>Laboratoire Central d’Elevage (LABOCEL) Niamey</td>
</tr>
<tr>
<td>Senegal</td>
<td>Institut National d’Elevage et de Recherche Vétérinaire</td>
</tr>
<tr>
<td>South Africa</td>
<td>Onderspoort Biological Products</td>
</tr>
</tbody>
</table>
Geographical localisation of vaccine laboratories in Africa
Some countries have high bio-containment laboratories operating in:

- Diagnostic: OVI (South Africa), Botswana
- Research: ILRI Kenya
- Vaccines: MCI Morocco, BVI Botswana

ISO accreditation in progress in some of them
Most African veterinary laboratories operate at a low biosecurity standard level:

• Obsolete facilities & infrastructure
• Lack of appropriate equipment
• No maintenance of basic equipment
• No implementation of quality system in daily running work

Lack of income from diagnostic activities and poor subsidies from government prevents implementation of quality system and maintenance

Efforts in staff training have been made at different levels but they are challenged by lack of resources, infrastructure and political commitment.
Challenges of establishing the safe and secure laboratory

- Building BBS capacity: limited expertise of personnel
- Changing the culture
- Maintaining functional laboratories – building capacity
- Maintaining biorisk awareness in all workers
- Commitment Management
Need for international support

Examples of successful international assistance:

- OIE twinning programme
- PANVAC: vaccine quality control laboratory
- International Federation of Biosafety Associations
- IAEA funding for equipment and proficiency tests
- FAO ECTAD programme
Laboratory Twinning programme is functioning well.

Contributing to improving global disease control capacity.

Countries in all five OIE regions are benefiting.

Demand and interest remains high.
Status May 2017

- 39 projects completed
- 31 projects underway
- 12 projects pending ("in the pipeline")

- Most popular topics
  - Avian influenza and Newcastle disease
  - Brucellosis
  - Rabies
  - Foot and mouth disease
OIE Laboratory Twinning Projects

Parent laboratories
- Projects completed
- Projects on-going

Candiate laboratories
- Projects completed
- Projects on-going

Appointed as OIE Reference Centre
Projects Completed: (15)

- UK with Morocco (African horse sickness and Bluetongue)
- Spain with Kenya (African swine fever)
- Germany with Egypt (Avian influenza and Newcastle disease)
- UK with Botswana (Avian influenza and Newcastle disease)
- Italy with Tunisia (Bluetongue)
- Italy with Eritrea (Brucellosis)
- UK with Sudan (Brucellosis)
- Italy with Botswana (CBPP)
- Italy with Zimbabwe (Brucellosis)
- South Africa with Nigeria (Rabies)
- Italy with Namibia (Food safety)
- Italy with Tunisia (Food safety)
- UK with Uganda (Improved diagnostic capacity)
- Switzerland with Namibia (Ovine chlamydiosis)
- South Africa with Nigeria (Rabies)
Situation in Africa

Projects underway: (11)

- France with Burkina Faso (African trypanosomiasis)
- Italy with South Africa (Animal welfare)
- UK with South Africa (Avian influenza and Newcastle disease)
- UK with AU-PANVAC, Ethiopia (Biosafety and biosecurity)
- Belgium with Nigeria (Foot and mouth disease)
- UK with Ethiopia (Foot and mouth disease)
- France with Morocco (Peste des petits ruminants)
- UK with Tanzania (Peste des petits ruminants)
- South Africa-France with Yemen (Rift valley fever)
- Sweden with Uganda (African swine fever and FMD)
- Italy with Tanzania (Trichinella)
Created by African union to improve vaccine production level in Africa
Distribution of production seeds, strains
Evaluation of produced batches
Support by International Federation of Biosafety Associations

• International non-profit NGO established in 2001

• 39 Member national & regional biosafety associations:
  
  Regional African Biological Safety Association
  
  National: Mali, Nigeria, Côte d’Ivoire, Cameroon, Ghana, Egypt, Morocco, Tunisia, Kenya, Uganda, South Africa, etc.

• Official observer organisations including African Society for Laboratory Medicine, WHO, OIE, etc.)
Creating new partnerships between the African biosafety community and **medical laboratory technologists communities** to strengthen biosafety & biosecurity in laboratories: Ethiopia 2014 (Cameroon, Nigeria, Ethiopia, Egypt, Kenya, Mozambique, Namibia, South Africa, Tanzania, Uganda, Zambia)

Securing biological materials (highly dependent on the competency of the individuals with access to these materials)

Previously no mechanism to assess competency in biosafety & biosecurity - IFBA created new professional certification programme
Other initiatives

• Disease-specific regional networks (example: FMD in East Africa EARLN)
• Initiatives for data collection using mobile technology
• New diagnostic techniques requiring low level of biosecurity (e.g. LAMP [loop-mediated isothermal amplification])
• Mobile high containment laboratories
In the future, Africa will be the only continent that still hosts major pathogens, which constitutes a global risk that should be the responsibility of all.

Awareness raising of stakeholders is the key factor to improving biosafety at all levels. Technical and financial assistance and political support are highly needed.

The regional approach is the best strategy to reducing costs and improving biorisk management in veterinary laboratories. Creation of specialised labs by pathogen or activity should be encouraged.

New biotechnologies could contribute to addressing some of the current infrastructure and logistical challenges.
Thank you for your attention

Organisation mondiale
de la santé animale

World Organisation
for Animal Health

Organización Mundial
de Sanidad Animal