The Role of Veterinary Medicine in the control and elimination of Neglected Tropical Diseases

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World Health Organization
Neglected Tropical Diseases (open ended list)

- **Protozoan Infections**
  - Leishmaniasis (VL, CL and MCL)
  - Human African trypanosomiasis (sleeping sickness)
  - Chagas disease

- **Helminth Infections**
  - Soil-transmitted helminth infections
    - Ascariasis-Trichuriasis-Hookworm
  - Lymphatic filariasis (elephantiasis)
  - Onchocerciasis (river blindness)
  - Dracunculiasis (guinea worm disease)
  - Schistosomiasis
  - Taeniasis/Cysticercosis, Echinococcosis, Foodborne trematodiases

- **Viral Infections**
  - Dengue & dengue haemorrhagic fever
  - Rabies

- **Bacterial Infections**
  - Leprosy
  - Trachoma
  - Buruli ulcer
  - Treponematoses

- Highlighted the need for a **structured framework** and shared principles for action
  - Proposed establishment of Strategic & Technical Advisory Group on NTDs >> guidance and assessment

- Identified **challenges**, underlined the need for **monitoring and evaluation** and singled out strategic areas for action
  - Communications and capacity strengthening, data–sharing, innovation, neglected zoonotic diseases, vector management, partnerships/resource mobilization and **inter-sectoral approach**
The report focuses on 17 neglected tropical diseases and disease groups. There are 149 countries and territories where neglected tropical diseases are endemic, at least 100 of which are endemic for 2 or more of these diseases, and 30 countries that are endemic for 6 or more.

(WHO) recommends five public-health strategies for the prevention and control of neglected tropical diseases:

1. expansion of preventive chemotherapy;
2. intensified case-detection and case management;
3. improved vector control;
4. **appropriate veterinary public health measures**;
5. provision of safe water, sanitation and hygiene.
The place of preventive chemotherapy, case management and transmission control of NTDs in broader health systems

Access to case management, surgery and chronic care

- African trypanosomiasis
- Leishmaniasis
- Dengue
- Chagas Disease
- Rabies
- Buruli ulcer
- Yaws
- Leprosy
- LF
- Schistosomiasis
- Trachoma

Transmission control

- Integrated Vector Management
- Veterinary Public Health
- $H_2O$ & Environmental sanitation

Preventive chemotherapy

- Soil-transmitted helminths
- Schistosomiasis
- Lymphatic filariasis
- Onchocerciasis
- Trachoma
- FBTs, cysticercosis, ...

Education for behavioural change

Link with other Rapid Impact Interventions and their delivery channels

World Health Organization
A roadmap for implementation 2012

- Ambitious but realistic milestones and targets for all 17 diseases (2015 and 2020)

- Concrete actions for adoption by regional and country–level plans of action

- Guidance to policy makers and country programme managers

- Framework to assess progress and encourage partners to maintain and expand commitments
Second WHO report on neglected tropical diseases
January 2013

- Tracks the progress towards achievement of milestones and goals set in NTD Roadmap

- Discusses phased implementation of Roadmap, identifies challenges and proposes plans to mitigate some challenges

- Identifies need to accelerate implementation and capacity-strengthening as top priority for scaling up of interventions at country-level
Endorsement of NTD Roadmap and previous disease-specific resolutions on NTDs

Key aspects:

- **Country ownership** of programmes
- **Integration** of control programmes into primary health care services
- **Expansion of interventions** to reach Roadmap milestones and targets
- Need to match **partners' support** with **national commitment**
Regional differences in the rates of population growth

Annual population growth rate in percent, as listed in the CIA World Factbook (2006 estimate)
Population growth has significant effect on disease transmission

Movement of people into animal habitats

Increasing demand for meat and milk in urban centres

Intensification of livestock production especially in peri-urban areas

Livestock and meat markets unregulated

Meat consumption per capita per year

Kg of meat consumed

Developing World

Developed World

Delgado 2003 The Journal of Nutrition
Intensification of livestock production especially in peri-urban areas

Kawangware slum in Nairobi – trend towards urbanisation

Displaced from recent political unrest or moved from urban area

Pigs particularly kept as a source of protein

Essential feral scavenging on human waste

Poor husbandry and hygiene increases risk of disease transmission
Livestock and meat markets unregulated

Meat seller in Lilongwe District, Malawi

Meat sold primarily through informal markets

Poor channels for reporting findings at meat inspection

© Mike Hauser 2010
Definition of Neglected Zoonotic Diseases

- They mostly affect the **poorest and most vulnerable populations** of the tropical and subtropical areas of the world.
- They largely affect **livestock and animal owners** and their families so that their prevention and control will benefit both human and animal health.
- They occupy a unique position at the interface between human and animal health as their prevention and control require **very strong collaboration and sustained commitment**.
NZDs have a significant economic impact

- 75% of African women are involved in agriculture
- Livestock accounts for approximately 30% of GDP in developing country economies
- Animals represent major asset to many families

*World Bank: World Development Report 2008*
Attributes of NZDs

• There is a lack of
  – information and awareness about the extent of the problem
  – suitable diagnostic and management capacity
  – appropriate and sustainable prevention and control strategies

• There is a false perception that their burden and impact on society is low, such that they neither attract the health resources nor the research needed to control them
  - only 0.6% of international global assistance for health is devoted to the control of Neglected Tropical Diseases. NZDs probably have a share of less than 10% of that: 0.06% of the total (David Molyneux, NZD3, 2010)
Main NZDs & WHO Regions

Rabies, 2003

Source: OIE & WHO, 2004
Main NZDs & WHO Regions

Rabies, 2003

AMR
Rabies
Echinococcosis
Cysticercosis
Leptospirosis
Brucellosis
Bovine TB

Countries/areas reporting rabies cases
Countries/areas for which no data are available

Source: OIE & WHO, 2004
Main NZDs & WHO Regions

Rabies, 2003

EUR
Brucellosis
Echinococcosis
Rabies

AMR
Rabies
Echinococcosis
Cysticercosis
Leptospirosis
Brucellosis
Bovine TB

Countries/areas reporting rabies cases
Countries/areas for which no data are available

Source: OIE & WHO, 2004
Main NZDs & WHO Regions

Rabies, 2003

EUR
- Brucellosis
- Echinococcosis
- Rabies

EMR
- Echinococcosis
- Brucellosis
- Rabies
- ZC Leishmaniasis

AMR
- Rabies
- Echinococcosis
- Cysticercosis
- Leptospirosis
- Brucellosis
- Bovine TB

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ZC Leishmaniasis

SEAR/WPR
Rabies
Echinococcosis
Trematodiases
Cysticercosis
Leptospirosis

Countries/areas reporting rabies cases
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Source: OIE & WHO, 2004
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Brucellosis

SEAR/WPR
Rabies
Echinococcosis
Trematodiasis
Cysticercosis
Leptospirosis

AFR
Rabies
Echinococcosis
Brucellosis
Cysticercosis
Bovine TB
Z. Trypanosomiasis

Source: OIE & WHO, 2004

Countries/areas reporting rabies cases
Countries/areas for which no data are available
Main NZDs & WHO Regions

Open-ended List of NZDs

- Rabies
- Taeniasis/Cysticercosis
- Echinococcosis/hydatidosis
- Zoonotic trypanosomiasis
- Zoonotic leishmaniasis
- Zoonotic schistosomiasis
- Trematodiases
- Brucellosis
- Bovine TB
- Leptospirosis
- ...

Source: OIE & WHO, 2004
NZDs currently prioritized by WHO/NTD for prevention and control activities

- Rabies
- Echinococciosis (cystic and alveolar)
- *T. solium* taeniasis/cysticercosis
- Foodborne trematodiases
- Zoonotic leishmaniasis
- Zoonotic trypanosomiasis
- Zoonotic schistosomiasis
Overlap of NZDs

Overlap of six selected neglected zoonotic diseases (NZDs)* at the country level in Africa.

More than 60% of countries have three or more of these NZDs in various combinations.

*The NZDs are cutaneous leishmaniasis (anthroponotic and zoonotic), zoonotic trypanosomiasis, zoonotic schistosomiasis, echinococcosis, cysticercosis and rabies.
Challenges of NZDs

• In many of the most affected countries the veterinary public health infrastructure is poor or nonexistent
  – leading to indecision as to which sector(s) should take responsibility for investigation and control of NZDs (i.e. veterinary/agriculture versus health sector)

• This situation has led to NZDs control falling into the gap between veterinary responsibilities and medical needs

• Interventions to control NZDs require concerted action between veterinary, livestock and human health sectors
  – a comprehensive and integrated interdisciplinary approach is needed to address the major obstacles for effectively combating them
How to achieve success in combating NZDs

• Establish global and regional leadership to promote and coordinate the “One Health” integrated approach to NZDs by:
  – providing guidelines as to how national VPH/"One Health" units should be established and structured and clarify the role of these Units in the context of their contribution to health care
  – promoting advocacy efforts to inform about the societal burden of NZDs to create demand at all levels of society for their control
  – developing guidance for implementing integrated surveillance, prevention and control activities for NZDs, and
  – conduct, maintain and report inventories of control activities and tools
Achievements: progress since 2005 in moving the NZDs agenda forward

– The **burden** of these diseases is much better known
– Sub-regional, regional and global disease-specific **networks** and building **public–private partnerships** have been established
– A number of **field projects** to control and study diseases as well as research and development projects have been undertaken
– For the first time, **target dates** have been set for eliminating human and dog rabies in Latin America (by 2015) and ASEAN + 3 (including China) countries (by 2020)
WHO initiative: advocating for and promoting integrated control of NZDs
WHO initiative: advocating for and promoting integrated control of NZDs

2005
The Control of Neglected Zoonotic Diseases
A route to poverty

2007
Integrated Control of Neglected Zoonotic Diseases in Africa

Applying the “One Health” Concept
Report of a Joint WHO/ILRI/DBL/FAO/OIE/AU Meeting
ILRI Headquarters, Nairobi, 13–15 November 2007

World Health Organization
WHO initiative: advocating for and promoting integrated control of NZDs

2005
The Control of Neglected Zoonotic Diseases
A route to poverty

2007
Integrated Control of Neglected Zoonotic Diseases in Africa
Applying the WHO Initiative

2010
The Control of Neglected Zoonotic Diseases
Community based interventions for prevention and control
**Accelerating work to overcome the global impact of neglected tropical diseases - a roadmap for implementation**

**Table 1a. Targets and milestones for elimination and eradication of neglected tropical diseases, 2015–2020**

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eradication</td>
<td>Global elimination</td>
</tr>
<tr>
<td>Rabies</td>
<td></td>
<td>✔ Latin America</td>
</tr>
</tbody>
</table>

**Table 1b. Targets and milestones for control of neglected tropical diseases, 2015–2020**

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
</table>
| Taeniasis/cysticercosis and echinococcosis/hydatidosis | • Validated strategy for control and elimination of *T. solium* taeniasis/cysticercosis available  
  • Pilot projects to validate effective echinococcosis/hydatidosis control strategies implemented in selected countries as a public-health problem | • Interventions scaled up in selected countries for *T. solium* taeniasis/cysticercosis control and elimination  
  • Validated strategy available for echinococcosis/hydatidosis and interventions scaled up in selected countries for their control and elimination |
| Foodborne trematode infections | • Foodborne trematode infections included in mainstream preventive chemotherapy strategy  
  • Morbidity due to foodborne trematode infections controlled where feasible | • 75% of population at risk reached by preventive chemotherapy  
  • Morbidity due to foodborne trematode infections controlled in all endemic countries |
Examples of VPH interventions for the sustainable prevention and control of NZDs

- **Rabies**
  - vaccination of dogs
  - neutering of dogs

- **T. solium taeniasis/cysticercosis**
  - treatment of pigs with oxfendazole
  - vaccination of pigs
  - improved meat inspection, control and handling
  - better pig management (no free-roaming)

- **Cystic echinococcosis**
  - vaccination of sheep and other intermediate hosts
  - improved meat inspection, safe disposal of offal
  - control of stray dogs
  - no feeding of raw viscera to dogs

- **Foodborne trematodiases**
  - treatment of domestic animals
  - fencing off or drainage of suspected grazing lands
WHO, FAO and OIE unite in their goal to eliminate human rabies and control the disease in animals

Rabies kills more than 60,000 people each year

02 October 2013 | Geneva

Rabies is a zoonotic disease caused by a virus. It is spread to humans through close contact with infectious material, usually saliva through bites or scratches.

Dogs are the source of the vast majority of human rabies deaths, with more than 95% of fatalities occurring in Asia and Africa. Four out of every ten people who die from rabies are children.

This year on World Rabies Day (28 September), three international organizations – the Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (OIE) and the World Health Organization (WHO) - issued a joint statement promising to eliminate human rabies and control the disease in animals.

Read full statement
Arabic | Chinese | English | French | Russian | Spanish
FAO, OIE and WHO unite to eliminate human rabies and control the disease in animals
28 September 2013

United against rabies

The Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (OIE) and the World Health Organization (WHO) unite in their goal to eliminate human rabies and control the disease in animals.

Every year, an estimated 60,000 people die an agonizing death from rabies, many of whom are children bitten by rabies-infected dogs.

Rabies is preventable!

Awareness and education

Community participation, education and public awareness are important elements of successful rabies control programmes, and mass vaccination of dogs is critical. Communities need to take responsibility for their dogs, prevent dog bites and know what to do when bitten.

Break the cycle

More than 100 countries report cases of rabies in dogs putting people at risk. Vaccinating at least 70% of dogs breaks the cycle of transmission in dogs and to humans. Rabies programmes need to incorporate free-roaming and street dogs with options for dog population management.

Safe, efficacious and affordable dog rabies vaccines are available, and countries embarking on rabies elimination need easy access to quality-assured dog vaccines for vaccination campaigns and for outbreak management. Vaccine banks can help facilitate procurement and deliveries.

When a person is bitten

A person who is bitten by a rabid animal still has the chance to survive if the wound is cleaned immediately and thoroughly with plenty of water and soap and post-exposure prophylaxis is provided in time (a course of vaccines and, in severe cases, immunoglobulins).

Preventive rabies vaccination can be given to people at high risk of exposure from domestic or wild animals, such as animal health workers, veterinarians or laboratory personnel, to protect them before they are exposed.
**Taenia solium taeniasis/cysticercosis**

"Hotspots"
- Latin America/Haiti
- SubSaharan Africa
- India/Nepal/Bhutan
- SW China
- Papua, Indonesia

Neurocysticercosis (NCC) • most frequent preventable cause of epilepsy in developing world

WHO 2010 Systematic Review: proportion of NCC among people with epilepsy was 29% in DEC

Reduces market value of pigs and makes pork unsafe to eat
Co-endemicity of NTDs

Overlapping risk factors
High pig density
Lack of large scale mapping of co-endemicity

12 million people have epilepsy
Tanzania 14% of epilepsy maybe associated with NCC

1 Preux & Druet Cabanac 2005  2 Winkler et al 2008
Taeniasis/Cysticercosis

Prevention and treatment of porcine cysticercosis
Improved meat inspection
Improved pig husbandry
Management of neurocysticercosis

Schistosomiasis

PZQ treatment
$5^{1-10^2}mg/kg \ 40mg/kg$
Sanitation
Behavioural Change

Control of water contact
Snail control

Synergies in Control Strategies

1 Cruz et al 1989, 2 Sarti et al 2000
Echinococcosis causes significant morbidity
Foodborne trematodiases - overview -

- Over 100 species of foodborne trematodes (FBTs) are known to cause infection in humans

- Clonorchiasis, opisthorchiasis, fascioliasis and paragonimiasis are those that pose the most significant public health burden

- Different epidemiological patterns: from local to global

- Strictly linked to human behavioural patterns

- Significant zoonotic reservoir

- N infected: 40-85 million; population at-risk: 750 million

- Burden: unknown (calculations ongoing)
Complex biological cycles of FBT

- Usually involving a first and a second intermediate host
- Infection is caught by ingesting the larval stages of the worm encysted in the tissues of edible animals or attached to plants

Keiser & Utzinger, Clinical Microbiology Reviews
July 2009:466-483
### Complementary public health interventions for FBT

<table>
<thead>
<tr>
<th>Category</th>
<th>Interventions</th>
</tr>
</thead>
</table>
| **Aquaculture**           | • Reduce faecal contamination of aquaculture systems and cultured fish/crustacean ponds  
                           | • Food-safety measures on aquatic products in the premarketing stage          |
| **VPH & Husbandry**       | • Treatment of domestic animals                                               
                           | • Fencing off or drainage of suspected grazing lands                          |
| **Sanitation**            | • Reduce contamination of freshwater streams with feces & sputum (community-led total sanitation) 
                           | • Control of snail intermediate hosts                                         |
| **Education**             | • Information, education & communication on safe food practices               |
Role of the veterinary profession
Animal interventions as a method of controlling human disease

Control of human rabies by vaccination and neutering of dogs

Benefits to human health only considered
Comparison of cost per DALY averted for interventions for brucellosis in Mongolia, rabies in two districts in Tanzania, echinococcosis globally and malaria in very low income settings

<table>
<thead>
<tr>
<th>Disease</th>
<th>Intervention</th>
<th>Cost per DALY averted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabies</td>
<td>Dog vaccination</td>
<td>US$ 10</td>
</tr>
<tr>
<td>Brucellosis</td>
<td>Cattle vaccination</td>
<td>US$ 19</td>
</tr>
<tr>
<td>Echinococcosis</td>
<td>De-worming domestic and stray dogs</td>
<td>US$ 10-12</td>
</tr>
<tr>
<td>Malaria</td>
<td>Provision of nets &amp; insecticide treatment</td>
<td>US$ 19-85</td>
</tr>
<tr>
<td>Malaria</td>
<td>Residual spraying (two rounds per year)</td>
<td>US$ 32-58</td>
</tr>
</tbody>
</table>
Vets have a significant role in the delivery of medical services

Simultaneous vaccination program targeting both livestock and children

Approximately 10% of nomadic children were fully immunized for the first time

More children and women were vaccinated per day during joint vaccination rounds

Vets contribute to the health work force

With minimal training veterinarians can be incorporated in public health initiatives and may help to alleviate staff shortages seen in many remote rural areas that often hamper service provision.

Information and Data Collection

Raise awareness of disease control and hygiene measures, in “Information-Education-Communication” (IEC) campaigns

Timely and reliable collection of data on determinants of health as and performance of the health system

Medical products

In addition, joint teams were able to develop a market for drugs of assured quality and efficacy

Financing

Sharing of logistics costs (i.e., personnel, transportation and cold chain costs)

15% cost reduction in some regions in Chad

Cost effectiveness studies for brucellosis and rabies

Thank you