




One Health: A global perspective on concepts and approaches

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10th AHEAD -GLTFCA Working Group Meeting
 24-26th February, 2010, Mpumalanga, South Africa




Who we are.....

Multidisciplinary research unit within the Department of Epidemiology and Public Health at the **Swiss Tropical and Public Health Institute (www.swisstph.ch)** with partnerships in seven countries in Africa and Central Asia.

Focus:
 Health systems for nomadic pastoralists
 Control of zoonoses in developing countries
 Bovine tuberculosis, Rabies, Brucellosis, Anthrax, Avian Influenza



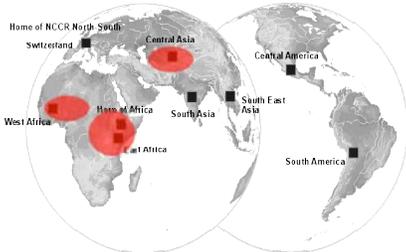


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National Centres for Competence of Research North-South
www.nccr-north-south.unibe.ch

7 Swiss Institutions: NRM, Conflict, Governance, Sanitation, Livelihood, Health, Urban planning together with their South partners
 Funded by Swiss National Science Foundation and Swiss Development Cooperation



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Overview

- Brief history of human and veterinary medicine?
- „One medicine“ in a the broader conceptual landscape
- Integrated methods assessing the animal-human linkage
 - Causality of the animal-human linkage
 - Modelling the animal human interface (Brucellosis and Rabies)
 - Health services
- What is the added value of „one health“?
 - Summary of an integrated approach and examples of global impact.
- What does it mean to wildlife conservation?
 - Conceptual move towards a systemic approach.
- Conceptual outlook to Health in Social-Ecological Systems

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Brief history of integrative thinking in medicine

- Ancient healers: pathological skills -> purity for sacrifice (Leviticus 1,3).
- Papyrus of Kahun, 1800 BC, humans and animals as the "flock of God"
- India: metempsychosis (transmigration) and reincarnation.
- Chou Dynasty in China (11-13th century): integrated public health system including medical doctors and veterinarians.
"The foundations of veterinary medicine are as comprehensive and subtle as those of human medicine and it is not possible to place one above the other" Hsü Ta-ch'un 18th century
- Arab world: Distinct medical and veterinary texts: Kitab al Baytara, كتاب بيطري
- Human medicine in the medieval European universities, Claude Bourgelat, first veterinary school in Lyon (1762) heavily criticised wanting human clinical training for the veterinary curriculum
- 19th Century: Strong interest in comparative medicine:
"Between animal and human medicine there is no dividing line – nor should there be. The object is different, but the experience obtained constitutes the basis of all medicine." Rudolf Virchow

19th to 20st century

- Sir William Osler** (1849 – 1919) McGill University, University of Pennsylvania in Philadelphia, first chief of staff at Johns Hopkins Hospital, apparently coined the term "one medicine". Dukes TW (2000)
- Karl F. Meyer**, a veterinarian from Basel, Director of the Hooper Institute (1921-1951), discoverer of the Horse Encephalitis Virus, founded the first American Public Health Course.
- In the 20th century both medicines became increasingly specialised, separating themselves into multiple sub-disciplines

The „one medicine“ by Calvin Schwabe's has its origins in his work with Dinka pastoralists in Sudan in the 1960s

„There is no difference of paradigm between human and veterinary medicine. Both sciences share a common body of knowledge in anatomy, physiology, pathology, on the origins of diseases in all species.“



Schwabe C. (1964, 1984 3rd Edition): Veterinary Medicine and Human Health. Williams and Wilkins, Baltimore

„One medicine“ as a General Medicine

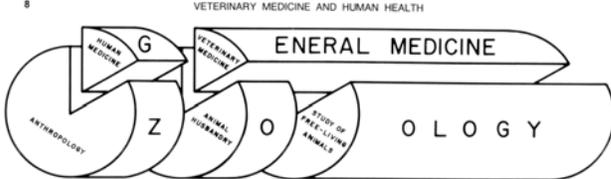


Figure 1.1. Zoology and its animal and medical components.

Schwabe C. (1964, 1984 3rd Edition): Veterinary Medicine and Human Health. Williams and Wilkins, Baltimore

Conceptual landscape

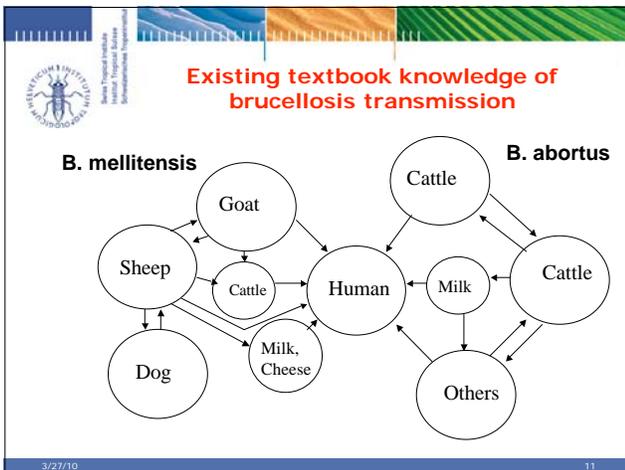
- **Veterinary Public Health (VPH)**
 - Contribution of veterinary sciences to Public Health (WHO)
- **Natural Nidality of Transmissible Diseases**
 - Evgeny Pavlovsky (1966): Concept of "disease nidality":
- **Ecosystem approach to health (IDRC)**
- **Agro-ecosystem Health (OVC and others)**
 - Investigation of agricultural **systems** in holistic view encompassing ecology, economy and health
 - Ecosystems can be looked at from a „health“ perspective e.g. a "healthy" ecosystem.
- **"One Health – One World"**TM:
 - Osofsky SA, Cleaveland S, Karesh WB, et al. World Conservation Union IUCN, 2005.
 - Consortium for Conservation Medicine. www.conservationmedicine.org
- **Extension of health concept to whole ecosystem**
 - Evolution from "one medicine" to "**one health**" (Zinsstag et al. Lancet, 2005)

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Causality of the animal-human linkage in infectious disease

- Existing knowledge
 - Type of causing agent
- Spatio-temporal relationship
 - Level of aggregation and scale
 - Time sequence of occurrence
- Contact network
 - Occupational, consumer, environmental exposure
- Molecular genetic homologies
 - Consider homoplasmy, marker diversity
- Statistical and mathematical linkages
- Study designs, diagnostic capacity in animals and humans

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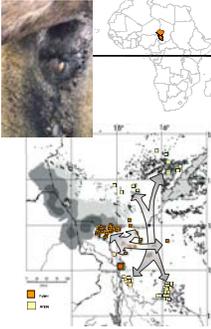


Mixed teams assessing human and animal health

1. Zoonosen 12

Zoonotic seroprevalences of nomadic pastoralists and their livestock in Chad from a cross-sectional study

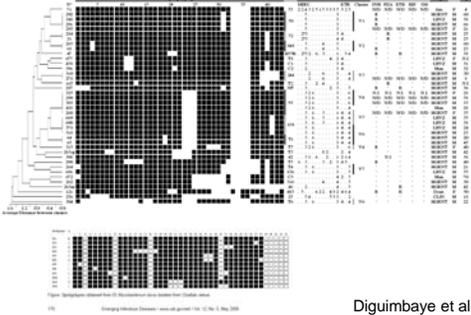
- Identification of possible sources of exposure of pastoralists
- Brucellosis seroprevalence cattle 7% and positive association with history of abortions
- Human brucellosis seroprevalence 2%: professional risk and raw milk consumption
- Being a camel breeder was a significant risk factor for Q-fever seropositivity in humans



Schelling et al., 2003

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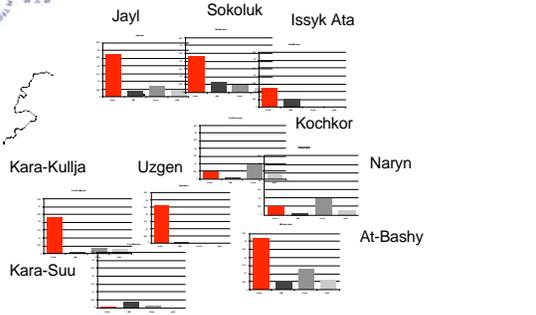
Molecular typing of human and bovine tuberculosis in Chad



Diguimbaye et al. 2006a+b

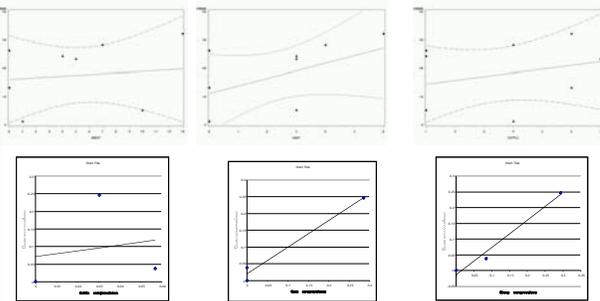
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Representative sero-prevalence of human and livestock brucellosis in Kyrgyzstan

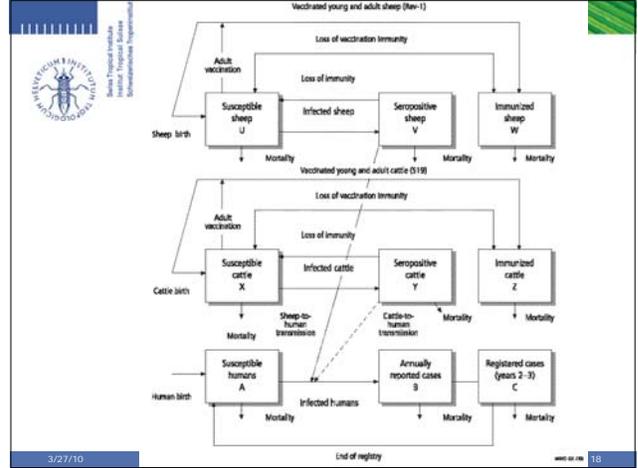
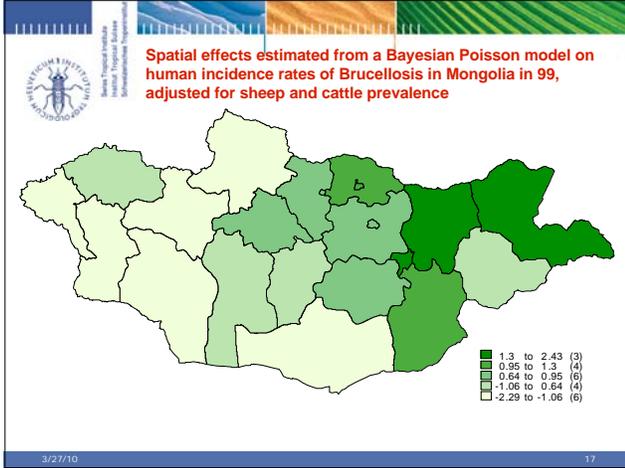


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Human / livestock regression of apparent sero-prevalence



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$$\frac{dU}{dt} = \epsilon \cdot Y \cdot \tau_{sheep} \cdot W + (\alpha_s(U + V + W)(1 - \eta(\frac{V}{U + V + W})))(1 - (c_{sv} v_{sheep})) - \mu U - \gamma \beta_{UV} UV - c_{sv} v_{sheep} (0.333)U \quad (1)$$

$$\frac{dV}{dt} = \gamma \beta_{UV} UV - \epsilon \cdot V - \mu V \quad (2)$$

$$\frac{dW}{dt} = c_{sv} v_{sheep} (0.333)U + (\alpha_s(U + V + W)(1 - \eta(\frac{V}{U + V + W})))(c_{sv} v_{sheep}) - \mu W - \tau_{sheep} W \quad (3)$$

$$\frac{dX}{dt} = \epsilon \cdot Y + (\alpha_c(X + Y + Z)(1 - \eta(\frac{Y}{X + Y + Z})))(1 - (c_{sv} v_{cattle})) - \mu X - \gamma \beta_{XY} XY - c_{sv} v_{cattle} (0.333)X + \tau_{cattle} Z \quad (4)$$

$$\frac{dY}{dt} = \gamma \beta_{XY} XY - \epsilon \cdot Y - \mu X \quad (5)$$

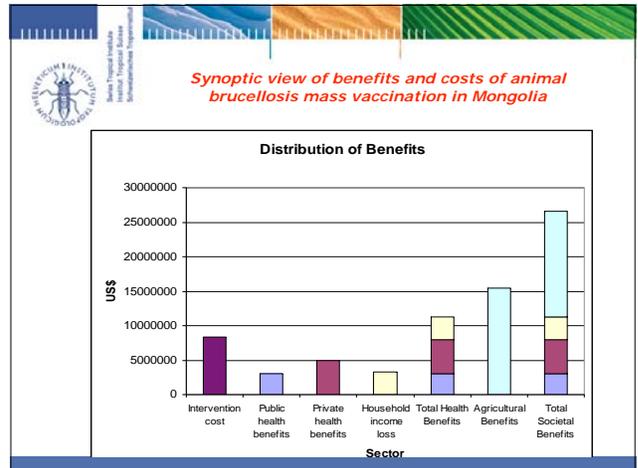
$$\frac{dZ}{dt} = c_{sv} v_{cattle} (0.333)X + (\alpha_c(X + Y + Z)(1 - \eta(\frac{Y}{X + Y + Z})))(c_{sv} v_{cattle}) - \mu Z - \tau_{cattle} Z \quad (6)$$

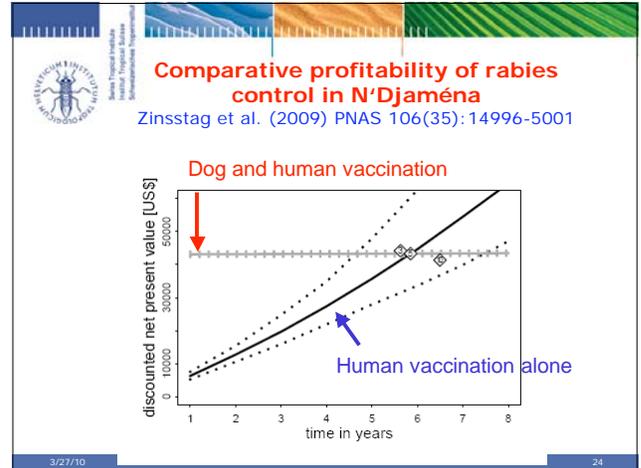
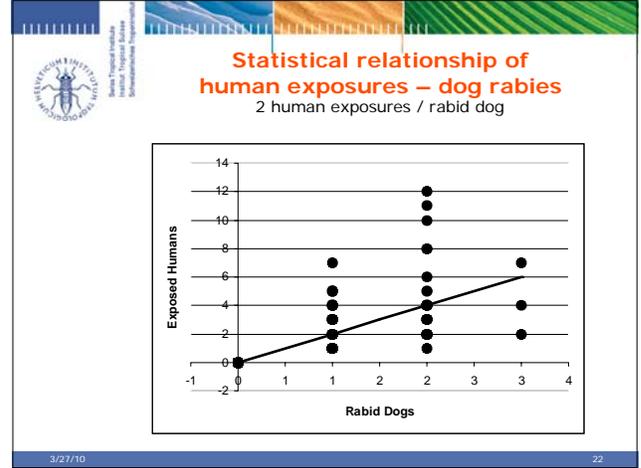
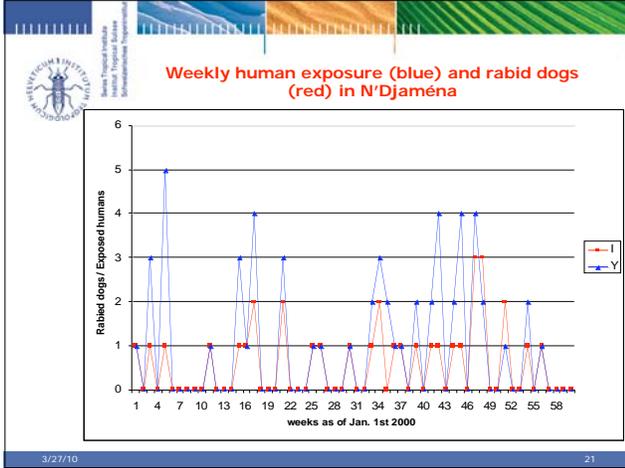
$$\frac{dA}{dt} = \alpha_h(A + B + C) + \lambda C - ((\beta_{ah} \gamma_{AY}) + (\beta_{ah} \gamma_{AV})) - \mu_h A \quad (7)$$

$$\frac{dB}{dt} = ((\beta_{ah} \gamma_{AY}) + (\beta_{ah} \gamma_{AV})) - \mu_h B - \lambda C \quad (8)$$

$$\frac{dC}{dt} = \lambda B - \mu_h C - \lambda C \quad (9)$$

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 International Program on
 Insect Physiology and
 Systematics

- Health of nomadic pastoralists

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Proximity to livestock and hardship of mobility



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Large distances



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Livestyle and access to water



Austerity

Difficult access to water of poor quality

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Traditional organization and societal structure



Patriarchal:
-Low autonomy
-Early marriage



Institutional tension:
National State vs. Customary
+ Colonial heritage
Fokou et al. Med. Trop (2004)

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Lack of social services and supplies




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Fragile natural resources



Use of natural resources that could not be used Otherwise

Overgrazing, commune de Ber



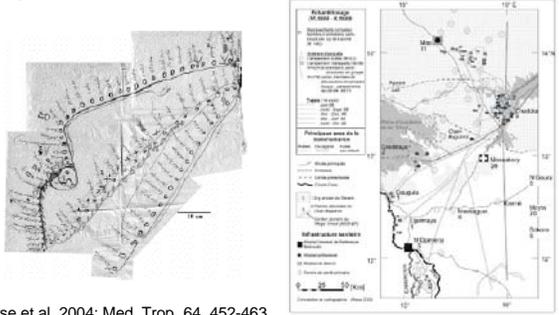
Animal malnutrition and starving

Doing research in a crisis region

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Participatory cartography of mobility



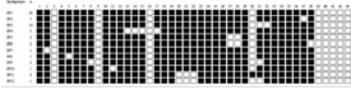
Wiese et al. 2004; Med. Trop. 64, 452-463

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Animal and human health: Tuberculosis
Long standing North-South Research partnerships (www.kfpe.unibe.ch)

1998 E. Schelling: PhD on Health of nomadic pastoralists in Chad
 17% PPD positive cattle.
 Nomadic pastoralists no access to DOTS

1999 C. Djaibe-Diguimbaye: PhD on Tuberculosis in Chad
 First TB laboratory in Chad

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 12, No. 5, May 2006

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Cooperation between Public Health and Humanities: Perception of health and illness among Kel Tamacheq, Mauritanian Bedouins, Chadian Arabs and Fulbe




- Tuberculosis perceived as **inherited and incurable**
- Highly diverse terminology determine help seeking (Medical syncretism)
- Towards "mobile DOTS"



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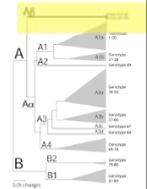
Gendered perspective

- **Researchers:** more North Women more South men.
- Pastoralist research shows strong **gender differential**: Men don't know about vaccination of children but of cattle (animal health as entry point to public health). Childhood vaccination must be addressed via the women. Women have no access to health care without the consent of their husbands.
- Kel Tamacheq women consider Western medicine as usefull but the lack of Gods blessing prevents them from accessing it more often

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Communities become members of research groups

- Prevalence of fully immunized nomadic children in Chad zero
- Demand of measles, whooping cough vaccination
- Compulsory vaccination of cattle
- Pastoralists recognize loss of efficacy of anthrax vaccine.
 - Detection of contamination problem in Anthrax vaccines in Chad and Mali
 - Novel genetic lineage in the A cluster




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Intervention oriented: Joint human and animal vaccinations improve access to health care for pastoralists



- Costing study: public health sector could save up to 15% of infrastructure, cold chain and staff costs
- Private veterinarians' interest in capitalising on transportation infrastructure

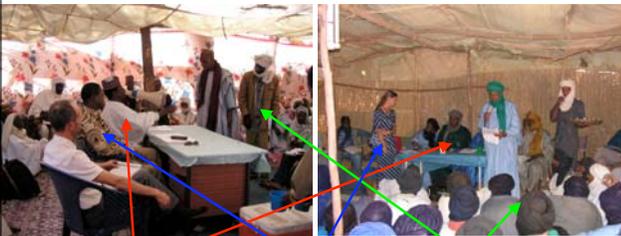
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South-South exchange and Networking



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Participatory stakeholder seminars to define priorities of the populations and the authorities jointly provide shortcuts to policy



Decision makers Scientists Concerned population

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Policy outcome on national, regional and international level

PROGRAMME d'Appui Intersectoriel AUX COMMUNAUTES NOM ADES EN REPUBLIQUE DU TCHAD

MINISTERE DE LA PROMOTION ECONOMIQUE ET DU DEVELOPPEMENT
 MINISTERE DE L'ELEVAGE
 MINISTERE DE LA SANTE PUBLIQUE
 MINISTERE DE L'ENVIRONNEMENT ET DE L'HYDRAULIQUE
 MINISTERE DE L'EDUCATION
 MINISTERE DE L'INTERIEUR ET DE L'AMENAGEMENT DU TERRITOIRE

THE CONTROL OF NEGLECTED ZOOONIC DISEASES

A ROUTE TO POVERTY ALLEVIATION

REPORT OF A JOINT WHO/WHO-ANIP MEETING 20 and 21 September 2005 WHO Headquarters, Geneva

AVANT PROJET Institut Tropical Suisse

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Summary of the approach

- Conceptual foundation:
 „one health“ -> „systems approaches to health“
- **Transdisciplinarity**
 - Interdisciplinary teams (Nat. Sci. – Humanities)
 - Participatory stakeholder approach linking communities – authorities and scientists
 - Gender sensitivity
 - Interventionist (local priority)
- North-South partnership
 - Joining local knowledge and technical expertise
- South-South exchange and networks
- Strengthening existing institutions
- Strengthening human resources and capacity
- Active policy dialogue
- Connect to development with GO and NGOs
- Self reflexivity / Cultural sensitivity / Languages

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Added value of a „one health“ research approach

- Rapid identification of sources of zoonotic diseases through joint surveillance.
- Interventions become profitable for society that are not to the public health sector alone.
- Health care provision to communities that have no access from a public health planning perspective alone.
- Joint risk analysis to minimize transmission.
- **Caution: get the animal-human linkage right**

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Towards a „one health“ toolbox

Zinsstag et al. Veterinaria Italiana 45(1) 119-131

- Integrated human and animal disease surveillance
 - Integrated Demographic Surveillance Systems
 - Including community surveillance (OIE)
 - Cost savings
- Integrated human and animal epidemiological study design (e.g. EU FP-7 Integrate control of zoonotic diseases in Africa ICONZ).
- Integrated human and animal health service provision
- Institutional reform along the OIE PVS Tool and Public Health reforms
- Conceptual move from „one health“ to „health in social-ecological systems“

Zinsstag et al. ISVEE Durban keynote PVM 2010

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What does an integrated approach mean to conservation?

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Wellcome Trust Animal Health in the Developing World
 Imperial College – Armauer Hansen Research Institute –
 Veterinary Laboratory Agency – Trinity College –
 International Livestock Research Institute:
 Bovine tuberculosis in the developing world
 (Ethiopia):

Training and Education
 Training of staff of the national parks

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Wellcome Trust Animal Health in the Developing World
 Imperial College – Armauer Hansen Research Institute –
 Veterinary Laboratory Agency – Trinity College –
 International Livestock Research Institute:
 Bovine tuberculosis in the developing world
 (Ethiopia):

„On farm“ research is often the only contact by
 institutions with populations in remote areas

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**Mycobacterium bovis: Wildlife –
 Livestock – Human Interface**

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Changing our point of view
www.canarydatabase.org
 Rabinowitz, et al. (2008): EcoHealth, 5:224-229.

- From “us versus them” to “shared risk” between humans and animals.
- From “Shared risk” to humans as a determinant of “risk to ecosystem health”.
- High cancer rates of Beluga in the Saguenay fiord (Martineau 2002)
- Beluga cancer incidence as a proxy outcome for ecosystem quality
- **But, humans and human activity are an integral part of ecosystems!**

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**Extending Schwabe's
„General Medicine“ to
„Health in Social-Ecological Systems“
(HSES)**

Zinsstag et al. (2010) Preventive Veterinary Medicine (ISVEE 2009 keynote, in press)

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Acknowledgement!

- **Colleagues and collaborators:**
 - Marcel Tanner, Esther Schelling, Kaspar Wyss, Brigit Obrist, Ursula Kayali, Monica Wymann, Peter Steinmann, Manuel Hetzel, Markus Hilty, Felix Roth, Mitchell Weiss, Rea Tschopp (Swiss Tropical Institute), Colette Diguimbaye, Richard Ngandolo, Service Naissengar, Maho Angaya (Laboratoire de Recherches Vétérinaires et Zootechniques de Farcha, N'Djaména), Bassirou Bonfoh, Adama Fané (Institut du Sahel, Central Veterinary Laboratory, Bamako), Mahamat Bechir, Abbani Abicho, Mahamat Abdoulaye, Doumagoum Daugla, Yémadjji Ndjékhôr (Centre de Support en Santé Internationale, N'Djaména), Jacques Nicolet, Joachim Frey, Herbert Hächler (IVB), Gaby Pfyffer, Franca Baggi (SZM), Reto Zanoni (STZ), Abraham Aseffa (AHRI), Douglas Young (IC), Glyn Hewinson (VLA), Sarah Cleaveland (CTVM).
- **Funding agencies:**
 - Swiss National Science Foundation (SNSF), Swiss Development Cooperation (SDC), Federal Veterinary Office (BVET), United Bank of Switzerland (UBS), Vétérinaires sans Frontières Suisse (VSF-Suisse), World Health Organization (WHO), UNICEF, EMDO Foundation, Swiss Tropical Institute, Zürcher Hochschulverein, Freie Akademische Gesellschaft, Task Force Sight and Life, Wellcome Trust, EU FP7/CONZ

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