Epidemiology in decision making: experience of brucellosis in Kyrgystan

Bonfoh et al.

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COMMENT

Research in a war zone

Bassirou Bonfoh and others offer lessons from a West African institute that has survived ten years of conflict.

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We are…

Multidisciplinary research group in the Department of Epidemiology and Public Health of the **Swiss Tropical and Public Health Institute (www.swisstph.ch)** with a hub at the **Centre Suisse de Recherches Scientifiques in Côte d'Ivoire** and partners in eight countries in Africa and Asia.

Research focus:
The health of nomadic pastoralists in the Sahel and Central Asia
Controlling zoonotic diseases in developing countries: Bovine Tuberculosis, Rabies, Anthrax, Brucellosis, Avian Influenza.

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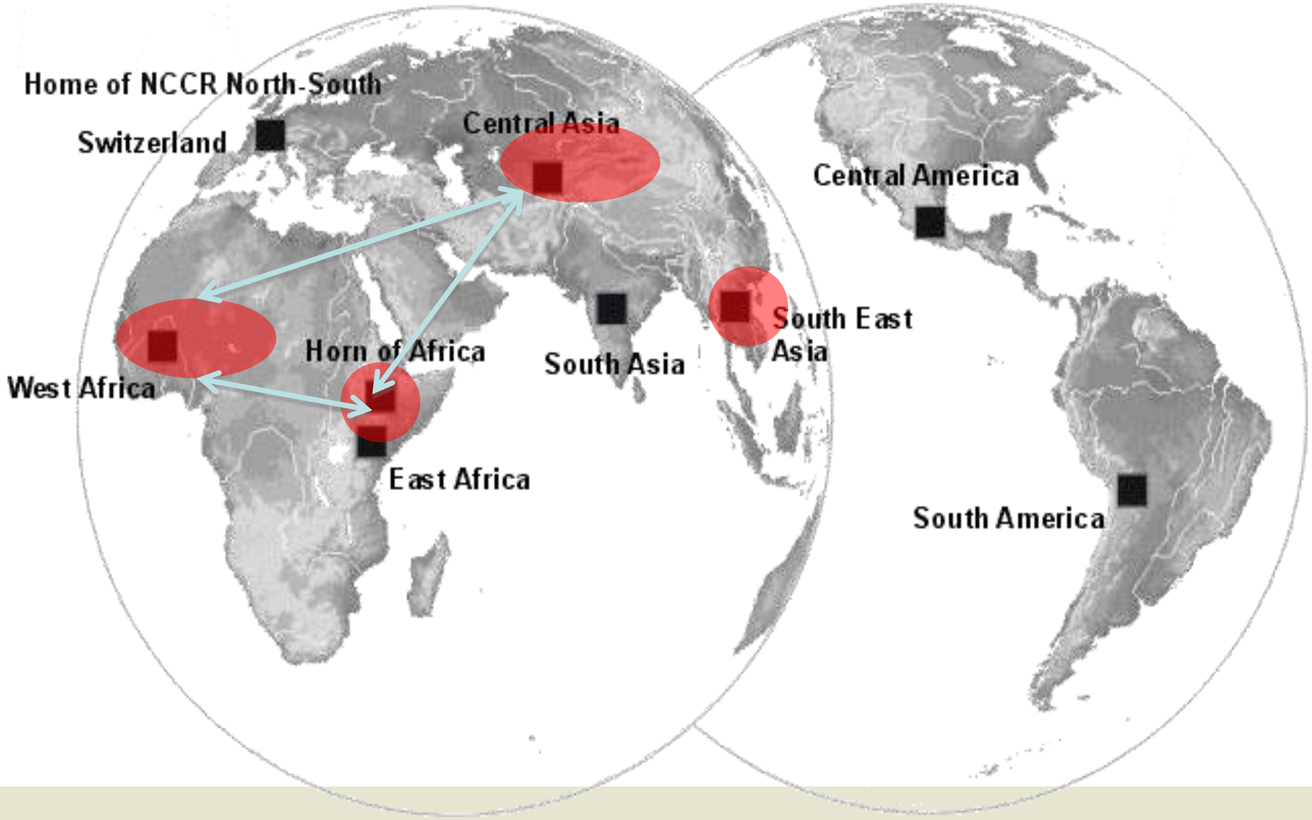
National Centre of Competence in Research North-South

www.nccr-north-south.unibe.ch

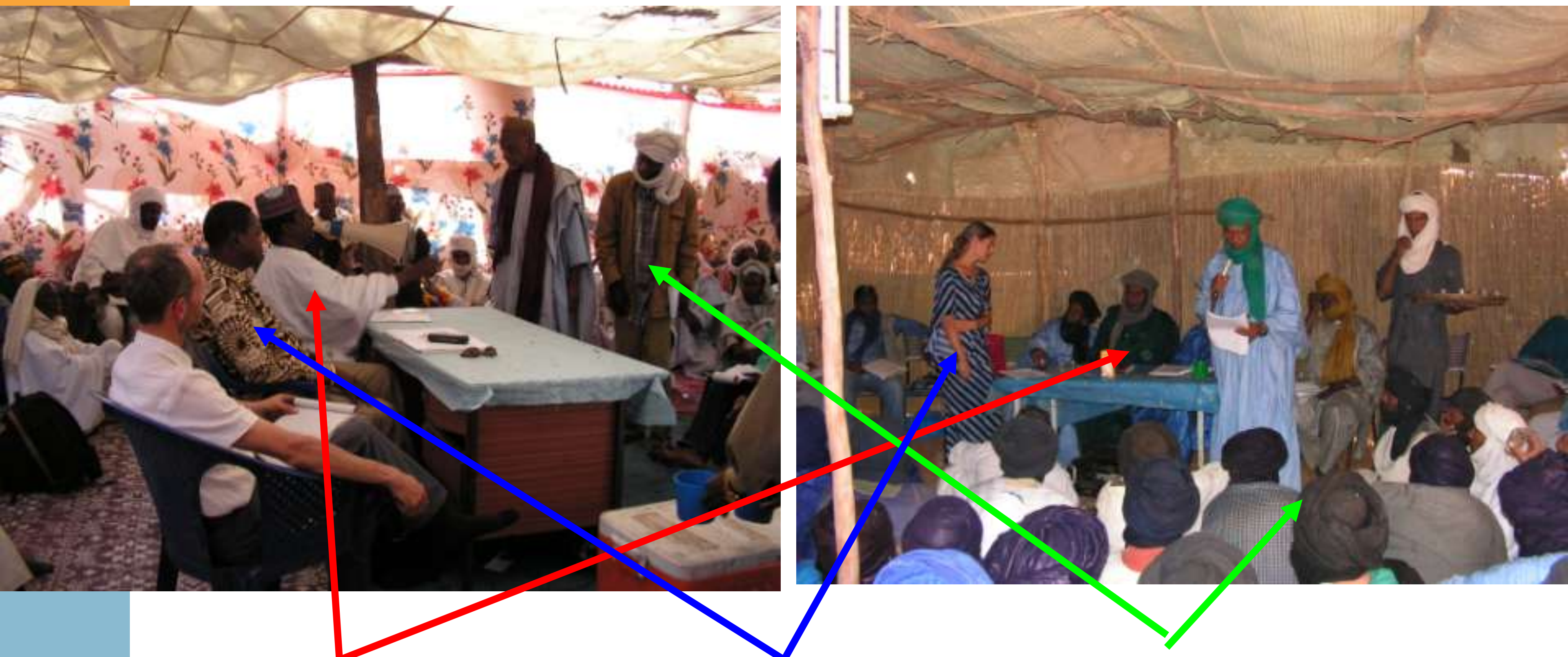
7 Swiss Institutions: Natural resources, conflict transformation, governance, water and waste water, livelihoods, health, urban planning
Financed by the Swiss National Science Foundation and the Swiss Agency for Development and Cooperation



Joint human and animal vaccinations improve access to health care for pastoralists *(equity, transdisciplinary)*

- 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

Participatory processes identify priorities and enable direct connection between research and implementation



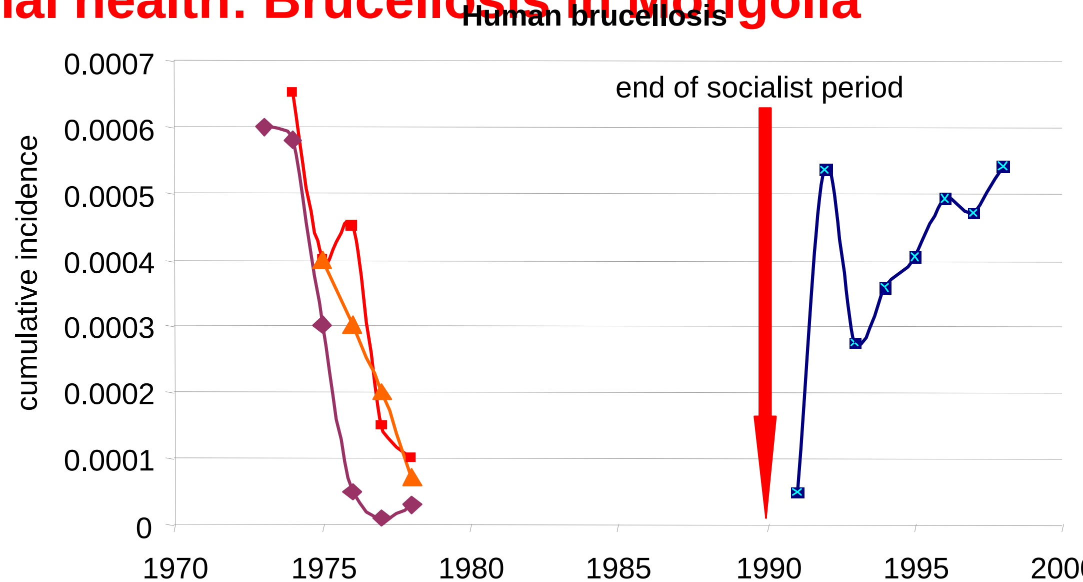
Authorities

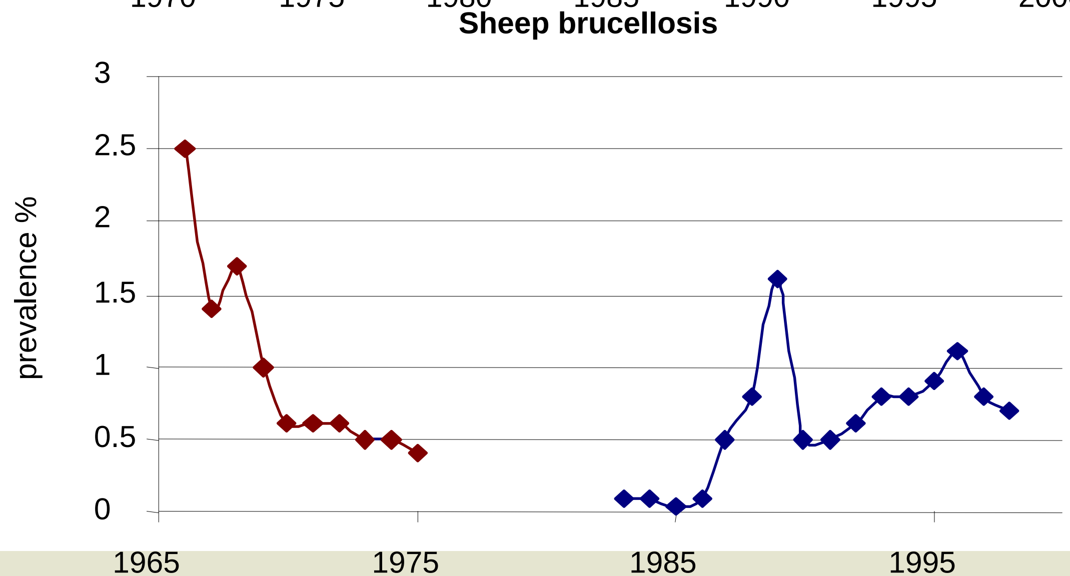
Researchers

Target community

Cross-sector human and animal health: Brucellosis in Mongolia

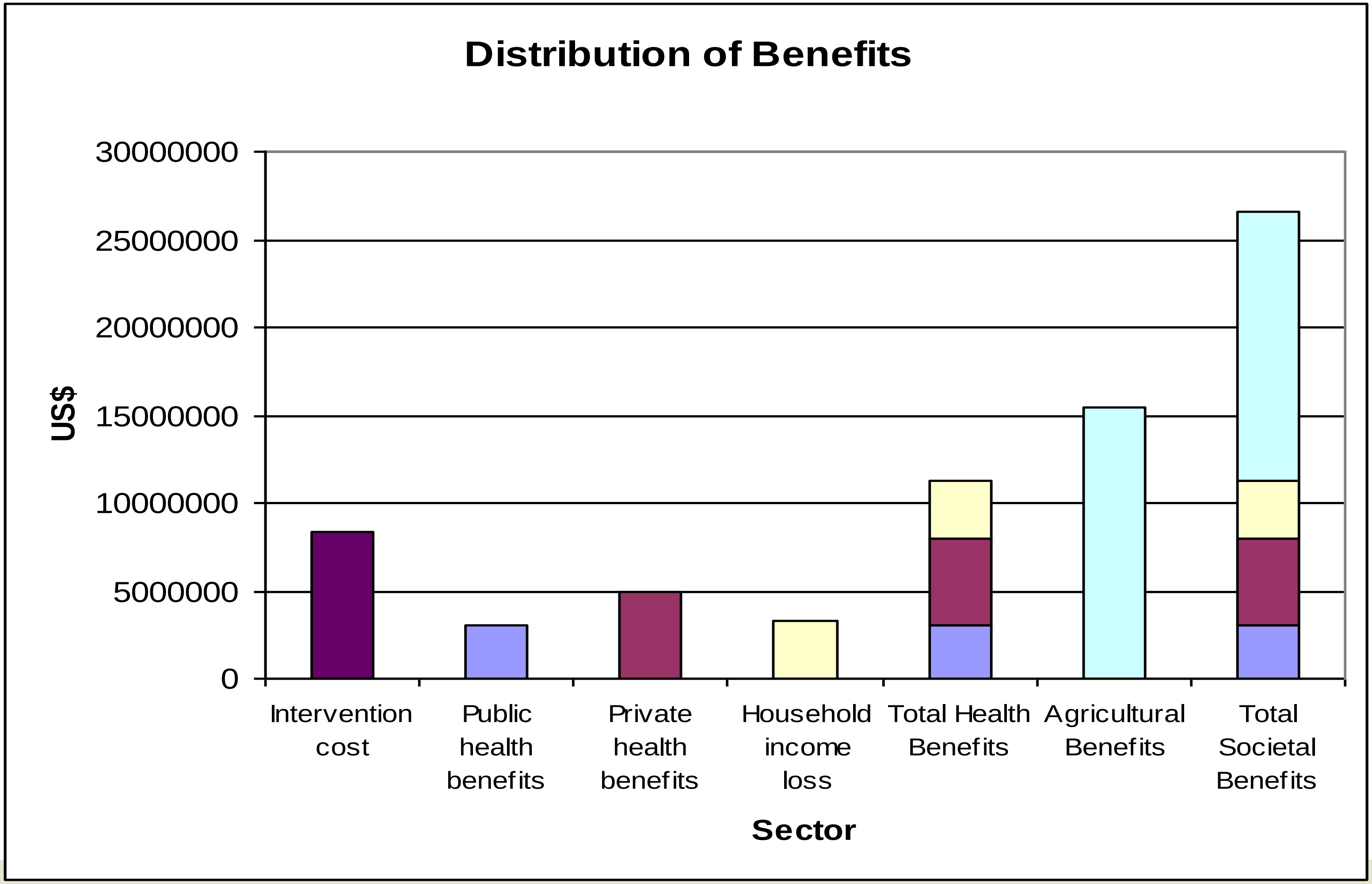
- Test and Slaughter 1960ies; Vaccination in 1970/80ies
- 1990: Privatisation and breakdown of surveillance





- vaccination campaign

Synoptic view of benefits and costs of animal brucellosis mass vaccination in Mongolia

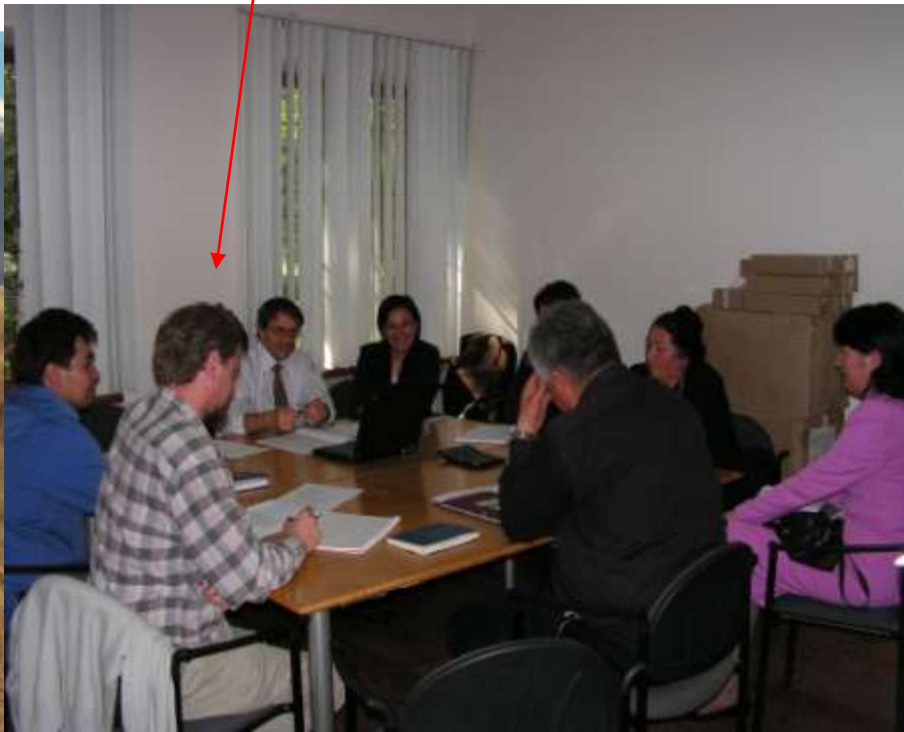


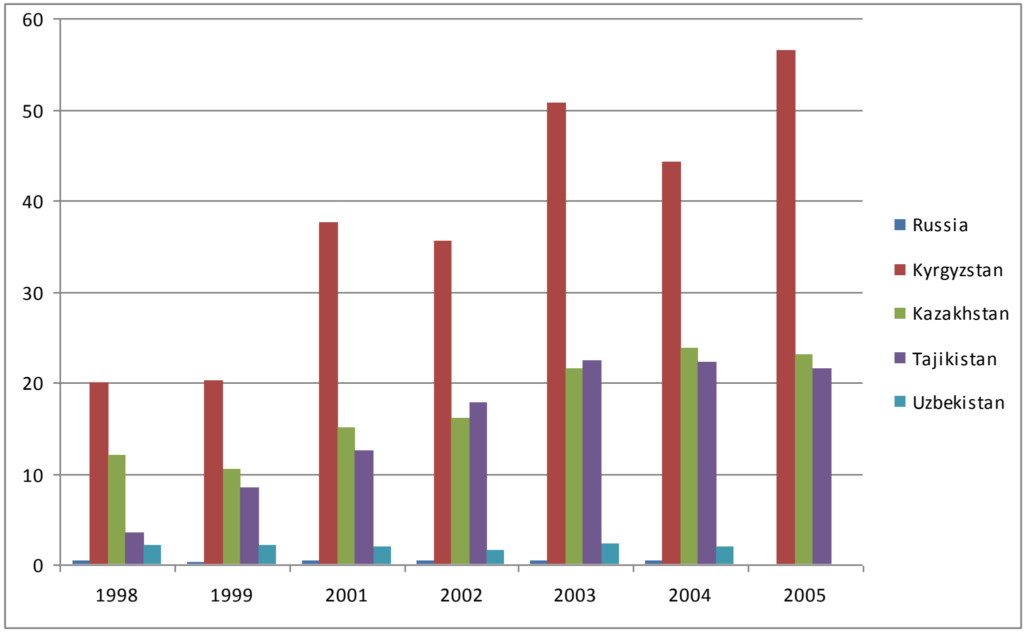
Networks and dialog:
Kyrgyzstan-Mongolia: Rev1 vs S19

Dialog

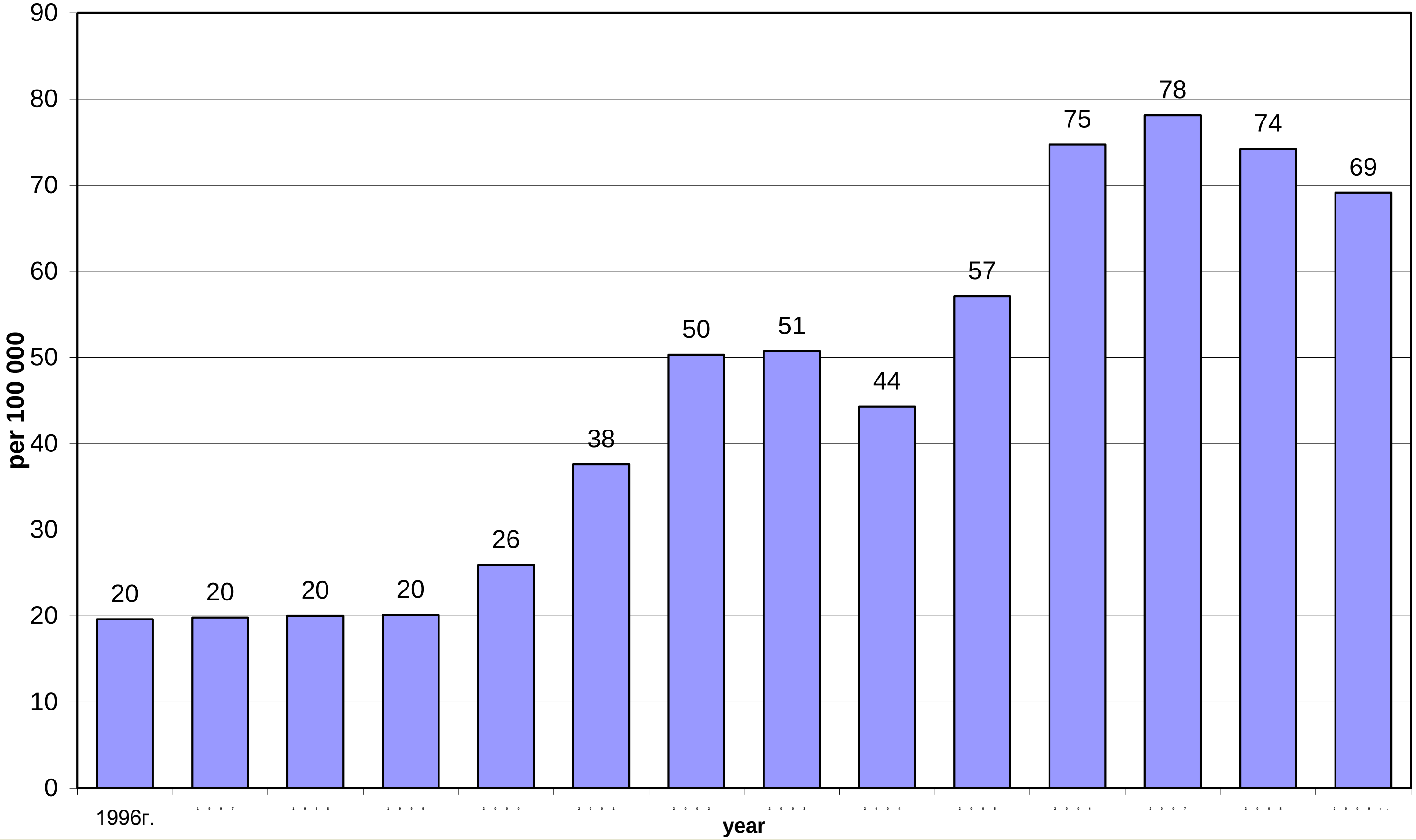
Role of individuals

Change agent




60
50
40
30
20
10
0
1998
1999
2001
2002
2003
2004
2005
Russia
Kyrgyzstan
Kazakhstan
Tajikistan
Uzbekistan

Human Brucellosis Prevalence in Kyrgyzstan



Learn the language of decision makers

- After which criteria should decision be made?
- Which indicators whould be used for that purpose (Habicht 1999)

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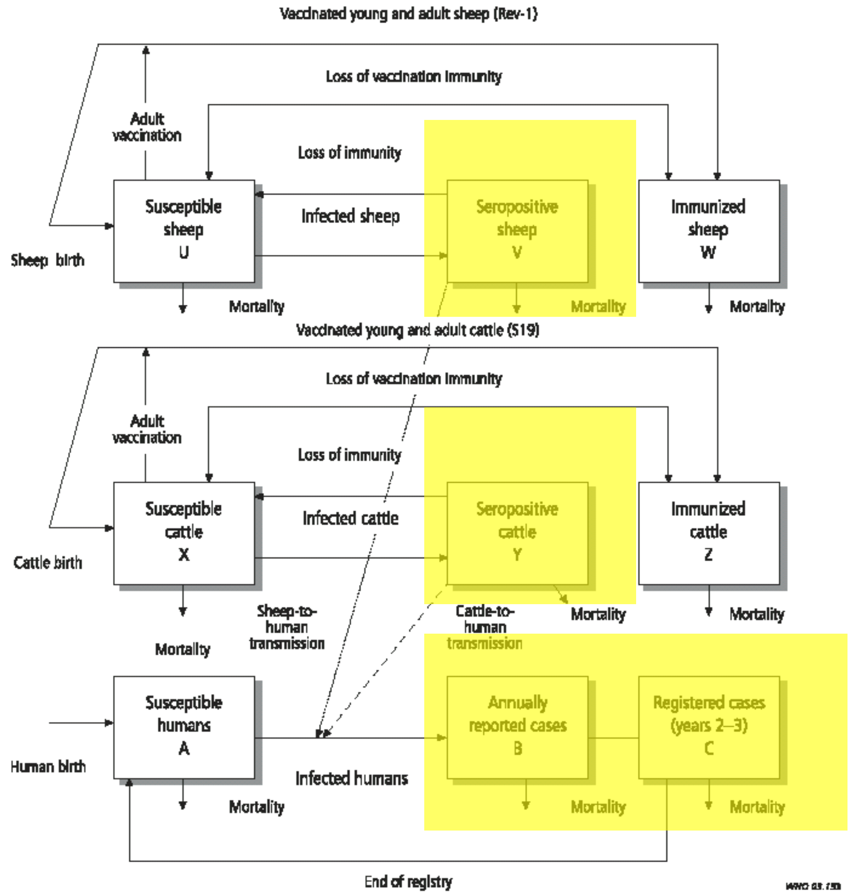
Human health benefits from livestock vaccination for brucellosis: case study

Felix Roth,[1] Jakob Zinsstag,[1] Dontor Orkhon,[2] G. Chimed-Ochir,[3] Guy Hutton,[1] Ottorino Cosivi,[4] Guy Carrin,[4] & Joachim Otte[5]

Bulletin of the World Health Organization 2003;81:867-876



Ministry of Agriculture
Criteria for animal brucellosis

Ministry of health criteria
For human brucellosis

Context

- After the collapse of soviet union: very weak vet services according to OIE evaluation
  - Transformation of the livestock production system;
  - Collapse of vet services;
  - Knowledge on livestock keeping;
- Kyrgyzstan has one of the highest brucellosis incidences:
  - 36 reported annual human cases per 100'000 people (2002)
  - 78 per 100'000 people (2007)
- Isolated health system and conflict situation between vet & public health services
  - 36 reported annual human cases per 100'000 people (2002)
  - 78 per 100'000 people (2007)
  - Claim for efficient brucellosis control program

Steps

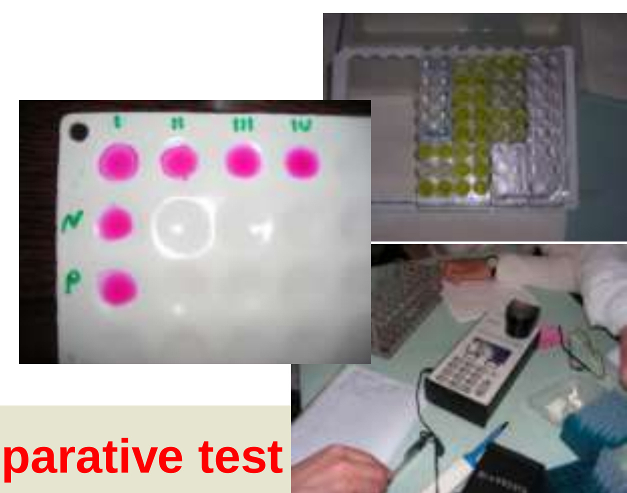
1. Project design
2. Dialog (institutions, policy makers involvement, appropriation)
3. Logistics organisation & capacity building (agreement)
4. Sampling methods & field work
5. Laboratory work & data entry/ validation
6. Data analysis & results validation (workshop)
7. Control strategy
8. Policy

Joint human and animal brucellosis prevalence study in KG yields a mass vaccination (*capacity building*)

Negotiation
Training
Joint team

Complexity
Target
Involvement & participation
Time/ intervention
Validation

Joint sampling & questionnaire



Comparative test

Inter-transdisciplinary group

- Based on national control program in Mongolia;
  - Swiss Red Cross
  - Livestock services
  - Public health services
  - NCCR North-South program under Swiss TPH
  - Pastoral communities

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Methods

- Representative and cross-sectional study on the sero-prevalence of brucellosis in humans (1800), cattle, sheep and goats (5369)

➔Cooperation between public health and veterinary partners

➔Capacity building

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Sampling

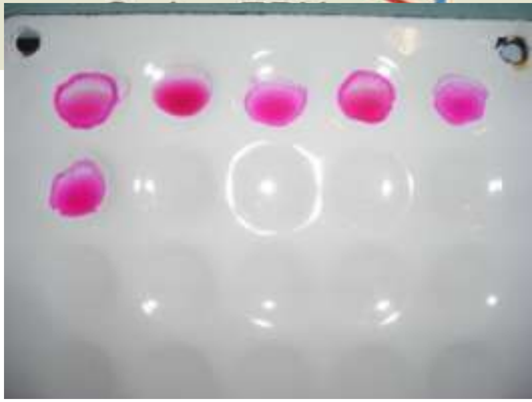
- The frame is a multistage cluster sampling by levels of **Oblast**, **Rayon, village** and **households**
- Sampling proportional to the size of the village

Overview of Sample numbers

Species	per Oblast	No of Oblast	No of Repetitions	Total N
Sheep	600	3	1	1800
Goat	600	3	1	1800
Cattle	600	3	1	1800
Human	600	3	2	3600
Total No. Of samples				**9000**



Laboratory tests



Tests of interest for test characteristics by species	Test 1	Test 2	Third test
	Priors required	No priors required	For population determination
Cattle, sheep, goats			
FPA	ELISA (ruminant)	FPA	RBT (Ukraine)
ELISA (ruminant)	FPA	ELISA (ruminant)	RBT (Ukraine)
RBT (Ukraine)	FPA	RBT (Ukraine)	ELISA (ruminant)
RBT (Ukraine)	ELISA (ruminant)	RBT (Ukraine)	FPA
Humans			
ELISA (human)	RBT (Biorad)	ELISA (human)	Huddleson
RBT (Biorad)	ELISA (human)	RBT (Biorad)	Huddleson
Huddleson	ELISA (human)	Huddleson	RBT (Biorad)
Huddleson	RBT (Biorad)	Huddleson	ELISA (human)

Socio-economic analysis

- Questionnaire
  - The study was complemented by a socio-economy household questionnaire on livestock production and a patient based survey on the cost of brucellosis.

Link of disease data to livestock production and human health cost

- Human Health
  - Number of cases = Population * Exposure constant * Incidence (Prop IgM positives)
- Livestock productivity (only fertility and milk production)
  - Baseline Fertility: annual number of offspring per breeding female
  - Fertility= baseline fertility * (1 – (0.15)*Prevalence)

E.g.

Fertility	Baseline	Factor	Prevalence
0.6979	0.7	0.15	0.02

Figure 1: Tour Map of LDPS[2] in the "Welcome" sheet

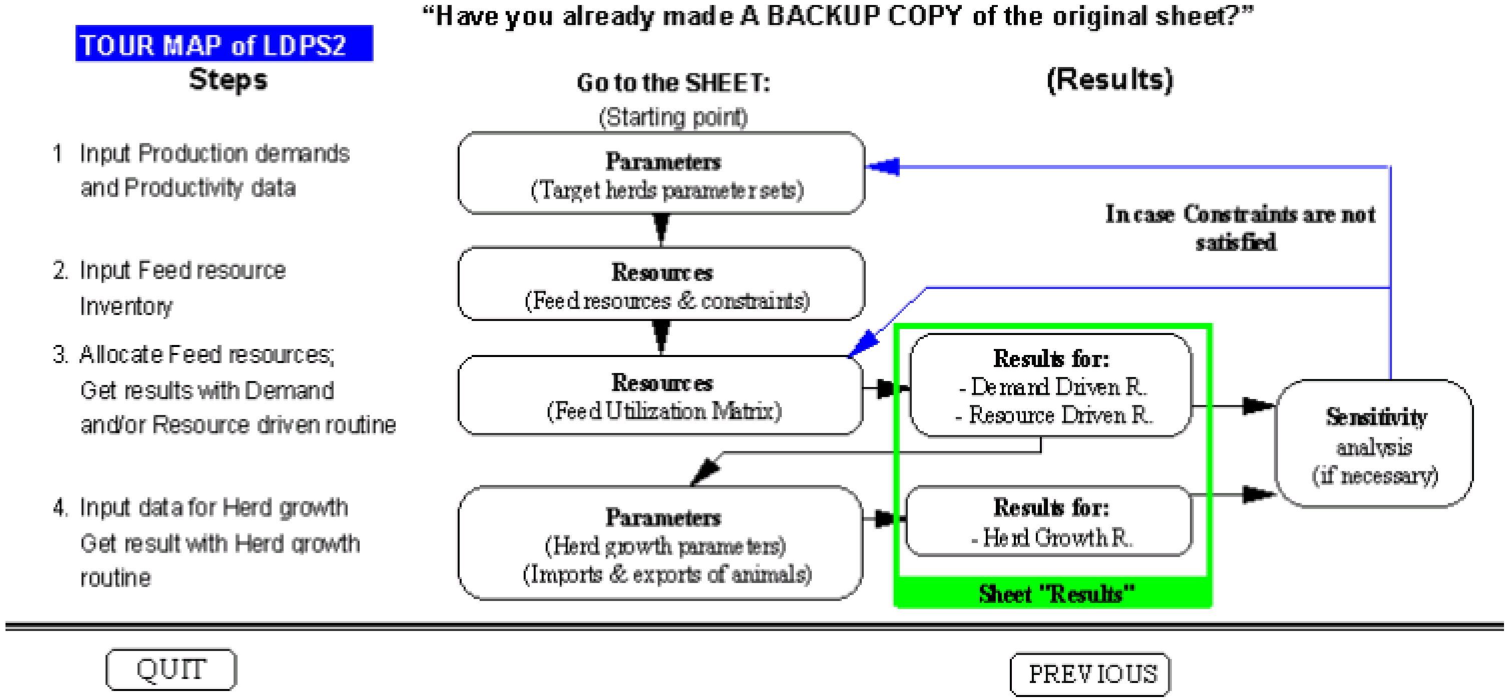


Figure 2: Sheet tabs of LDPS[2]

Figure 3: Sheet "Labels"

Labels | Back to Tour Map | (Blue text: User-defined)

Production systems labels

System #	Type	Sub-type
1	Dairy Cattle	System 1
2		System 2
3		System 3
4		System 4
5	Beef Cattle	System 1
6		System 2
7		System 3
8		System 4
9	Sheep	System 1
10		System 2
11		System 3
12	Goats	System 1
13		System 2
14		System 3
15	Buffalo	System 1
16		System 2
17		System 3
18	Pigs	Combined
19	Poultry	Combined

Feed types and sub-types labels

Sub-types #	Crop residues	rimary product	Crop by-products	Fodder
1	Straws	Maize	Bran of wheat	Silages etc.
2	Potato vine	Wheat	Bran of rice	Pelagic meals
3	Vegetables	Rice	Bran of maize	skim milk
4	Pulses	Other cereals	Bran of millet	whey fresh
5		Soybeans	Bran of other cer.	
6		Potatoes	Cake of groundnuts	
7		Sweet potatoes	Cake of cottonseed	
8		Cassava	Cake of rapeseed	
9		Sugar cane	Cake of Soya beans	
10		Sugar beats	Cake of other crops	

Breeds of Dairy cattle
holstein
ayrshire
jersey
user-defined

Edit Breed data

Welcome | Labels | Parameters | Resources | Results | Sensitivity

Figure 4: Sheet "Parameters"

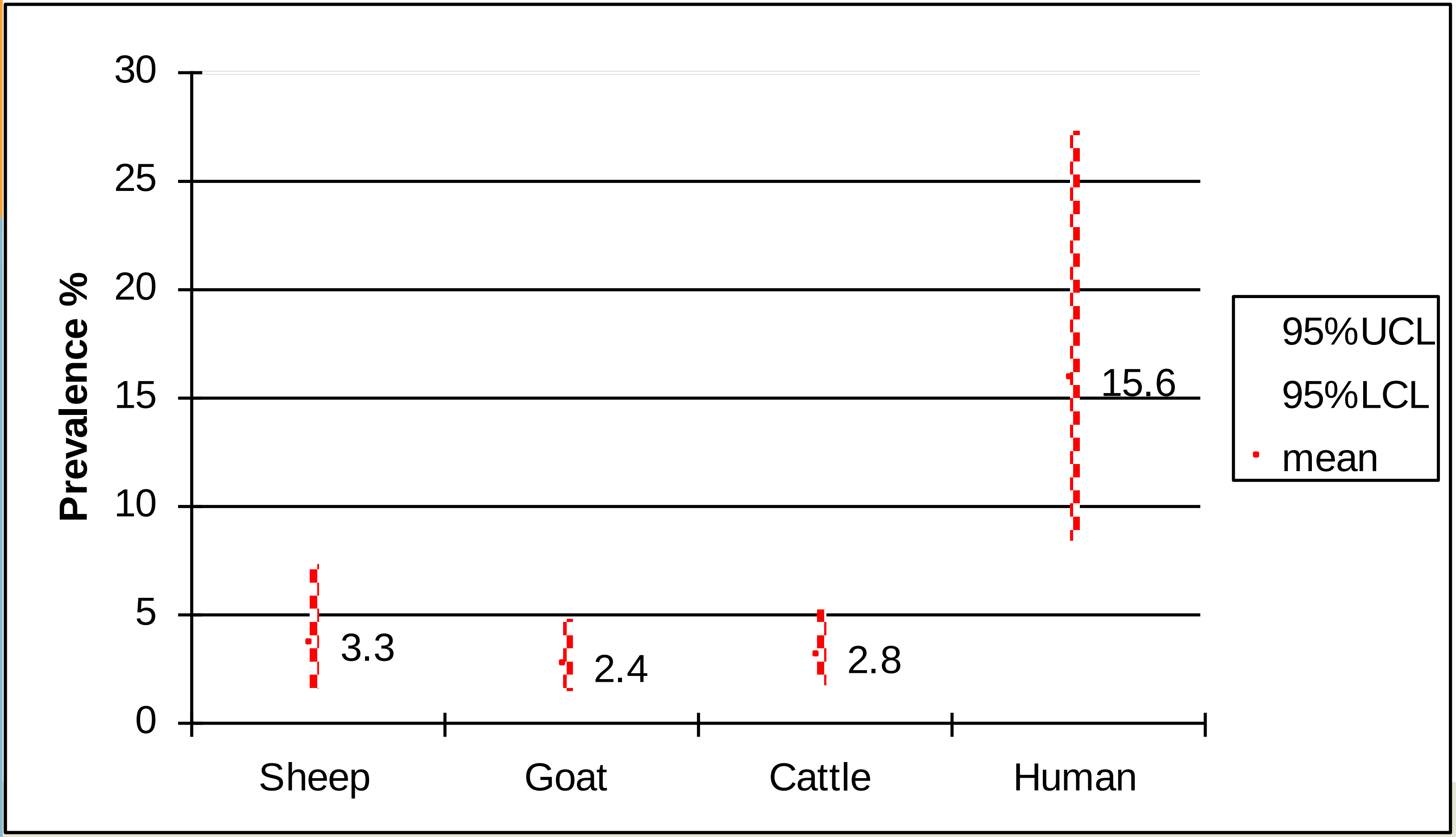
Target herds parameter sets | Back to Tour Map

	No	Parameter name	Dairy Cattle System 1	Dairy Cattle System 2	Dairy Cattle System 3	Dairy Cattle System 4
5	1	Milk production demand	1,515,000	3,224,000	1,025,000	0
6	2	Distribution losses	0.000	0.000	0.000	0.000
7	3	Fertility rate	0.750	0.900	0.900	0.000
8	4	Prolificacy rate	1.000	1.000	1.000	0.000
9	5	Breeder males per breeder female	0.001	0.001	0.001	0.000
10	6	Milk yield per lactation	2.000	4.500	4.500	0.000
11	7	Fraction of females milked	0.900	0.900	0.900	0.000
12	8	Cow mortality rate	0.030	0.040	0.040	0.000
13	9	Bull mortality rate	0.030	0.040	0.040	0.000
14	10	Female replacement mortality rate	0.030	0.040	0.040	0.000
15	11	Male replacement mortality rate	0.030	0.040	0.040	0.000
16	12	Female young mortality rate	0.070	0.060	0.060	0.000
17	13	Male young mortality rate	0.070	0.060	0.060	0.000
18	14	Other stock mortality rate	0.030	0.040	0.040	0.000
19	15	Draught animals mortality rate	0.030	0.040	0.040	0.000
20	16	Years in breeding herd, cows	5.000	4.500	4.500	0.000
21	17	Years in breeding herd, bulls	5.000	5.000	5.000	0.000
22	18	Years in replacement herd, females	1.000	1.000	1.000	0.000
23	19	Years in replacement herd, males	1.000	1.000	1.000	0.000
24	20	Years from young to slaughter, other stock	1.000	1.000	1.000	0.000

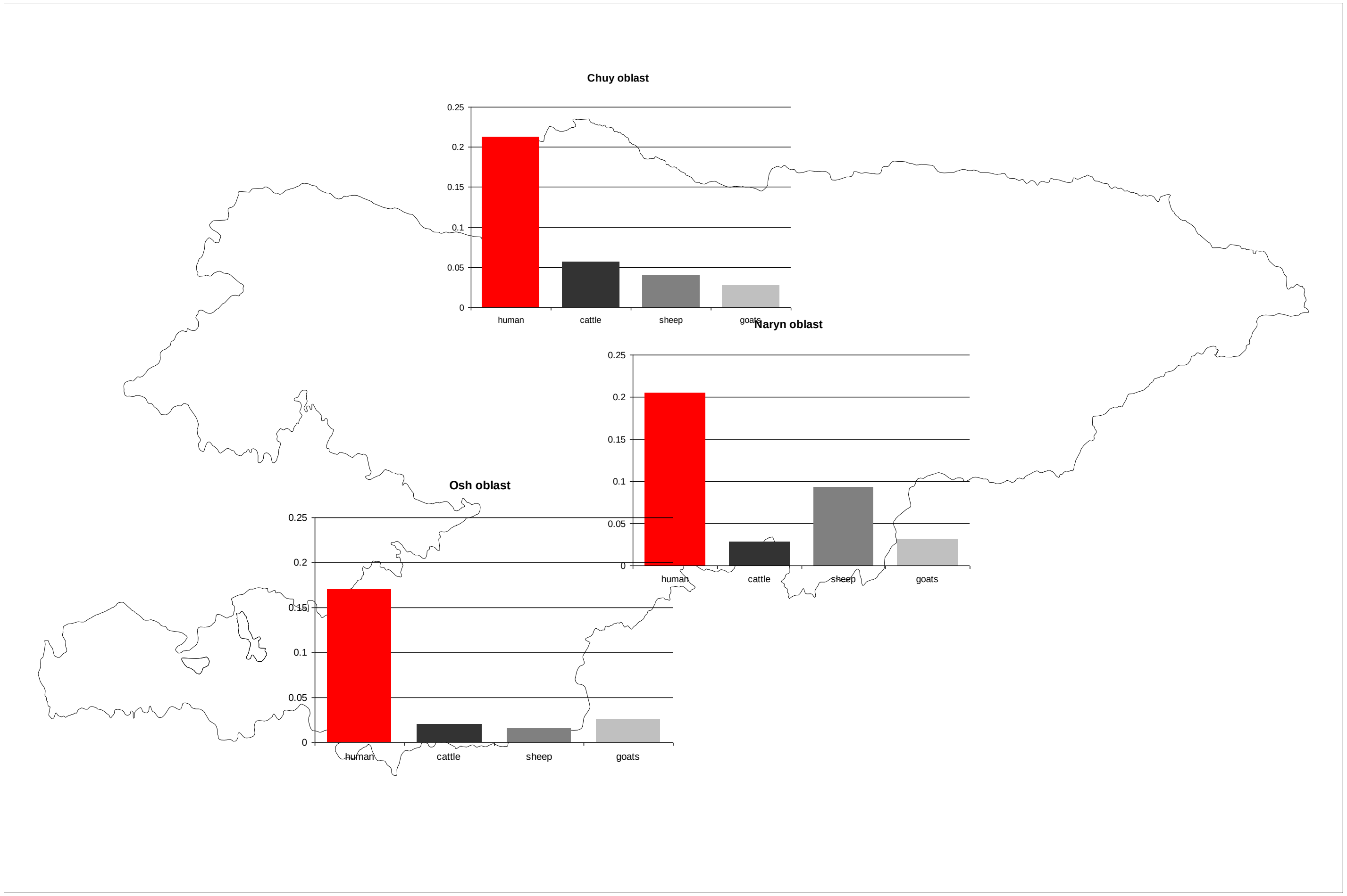
Welcome | Labels | Parameters | Resources | Results

Apparent country sero-prevalence

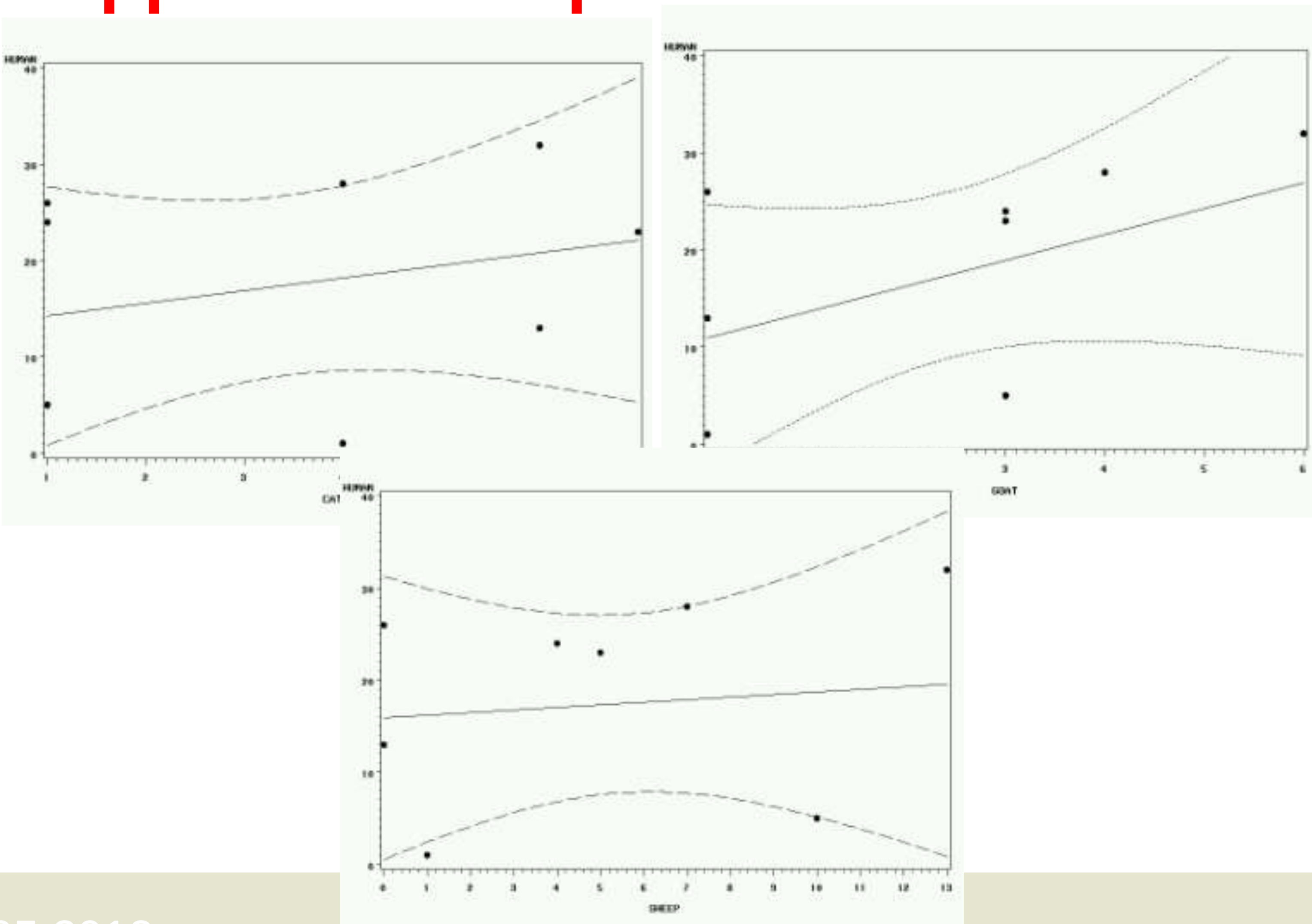
- Representative sampling for the country/ logistic regression with random effect for the level of rayon.



Geographical distribution of sero-prevalence in humans and livestock



Human / livestock regression of apparent sero-prevalence



Cost estimates (annual)

- Social and private health cost: 0.6 Mio US$
- Losses to the livestock sector: 10 Mio US$.

➔Losses for the country is estimated at 5-15 Mio US$.

  - Intervention cost share: 6-17%.
  - Intervention cost share: 83-94%.

Full sensitivity analysis pending
Additional private cost and coping cost to be considered

Validation at a stakeholder workshop (June 2008 in Koi-Tash/ KG)

- Mongolia, Kazakhstan, Uzbekistan, Tadjikistan, Kyrgyzstan, United States, Africa and Switzerland.
- Mass vaccination campaigns reaching a coverage of at least 80% is cost-effective to reduce transmission of brucellosis and thus the incidence in human if combined with public awareness.

The way forward

- Considerable cost of brucellosis to Kyrgyz society
- Reduce effort of mass testing if the objective is to know the prevalence and not test and slaughter
    - This study is representative and has been done with 65‘000 US$
    - Use resources for vaccination campaign rather for testing and slaughter
- Proof of transmission pathways -> NEW KYRGYZ-SWISS PROJECT
  - Molecualar epidemiology of strain circulation
  - Abattoir surveillance

Policy message

- **Brucellosis control by livestock mass vaccination is profitable for the whole society in Central Asian countries.**
- **Mass vaccination of sheep, goats, cattle and yaks reduces transmission among animals and to humans. Annual vaccination should reach at least 80% of animals.**
- **If less than 1% of livestock is affected, mass vaccination can be replaced by restricting on vaccination of young replacement animals.**
- **Access to human treatment should be secured by education campaigns and availability of diagnostic and treatment at district level.**
- **Control through animal vaccination is the best way to reduce human infections. Moreover, education on safe animal handling and boiling of milk and milk products can considerably decrease the human cases.**

Steps	Constraints/ problems	Activities	Epidemiology tools	Decision processes
1	Responsibility in disease incidence increase	Problem statments, project design	Comparison with Mongolian case	Research questions •*Priority in the region*
2	Bringing both public and veterinary health sectors together	Dialog between sectors, policy makers, communities involvement	Stakeholder workshop "transdisciplinary methods"	Involvement and ownership •*Meeting thanks to a "changing ator"*
3	Equipement and knowledge on new and conventional diagnostic tools	Logistics organisation and training of lab technician	Diagnostic test introduction with ROC test (receiver operating characteristics)	Capacity building •*Origin and choice of diagnostic* •*Test performance*
4	Surveillance sampling based on outbreaks and proportion to the livestock population, high cost of surveillance system (labour)	Sampling, laboratory work, data entry, data analysis	Cross-sectional study representative to the country with random sampling Statistics tools	Evidence based results •*Choice of sampling method and analysis model*
5	Vaccine used not adapted and test & slaughter without compensation	Disease control strategy developement	Mass vaccination with conjunctival REV1 vs S19	Cost-benefit analysis •*Origin and choice of type of vaccine*
6	Comparison to the official data in ther reports	Results dissemination at the stakeholders workshop	Transparency and limitations "causality & biasis"	Validation •*Choice of reference data*
7	Mediators and resource allocation to support the policy	Key findings and key messages dissemination	Resource mobilisation Cost-benefit analysis with sensitivity test with FAO/ LDPS	Influence policy •*Policy change with the help of external donors*

Thanks to:
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CDE
CAMP Alatoo
Swiss Development Cooperation
Swiss National Science Foundation
World Bank
Pastoral communities