

Studies and interventions in Animals

NZ-based Projects and Perspectives



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This presentation

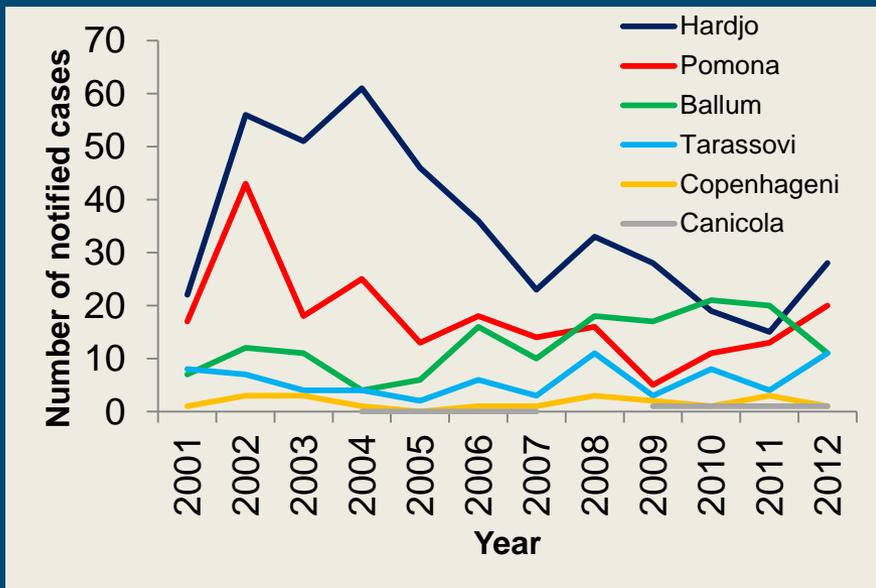
- *Human data as a driver for animal studies*
 - *Animal studies*
 - *Interventions: mainly vaccination*

Presentation conducted during the *International Workshop of the Oswaldo Cruz Institute/FIOCRUZ for Leptospirosis Research Based on Country Needs & the 5th Global Leptospirosis Environmental Action Network (GLEAN) Meeting* on November 10-12, 2015, in Rio de Janeiro, Brazil .

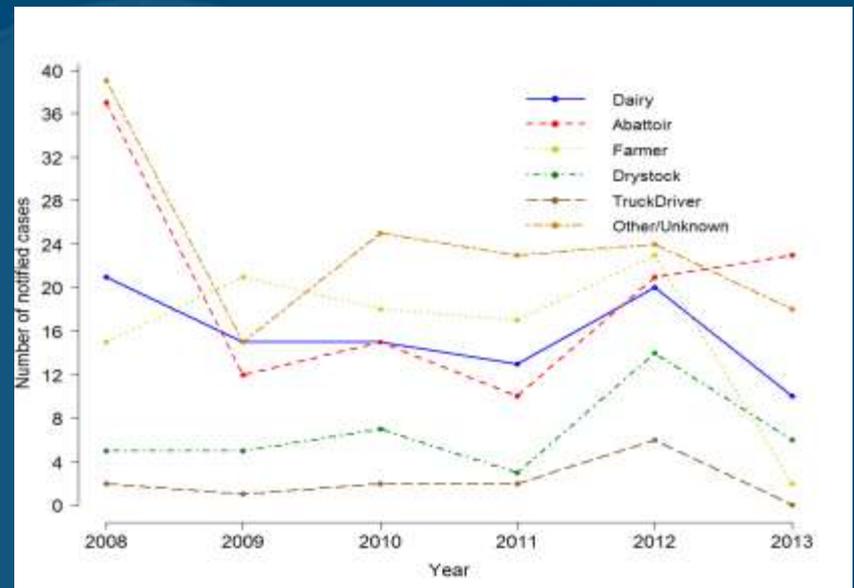
Human data informing animal studies:

E.g. NZ Notified Leptospirosis Cases: 2001 - 2012

By Serovar



By Occupation



Rate: ~2- 2.5:100,000

Leptospira Sero-surveys in Occupational Groups

Group	No.	Seroprevalence	Serovars Tested
Meat workers*	582	12	P,H
Veterinarians	277	5.1	P,H,B
Vet. Students	302	0	P,H,B
Farmers	173	6.6	P,H,B,T,C

P = Pomona, H = Hardjo, B = Ballum, T = Tarassovi, C = Copenhageni



NZ Pastoral Livestock and Leptospira

Species	~No. Farms	No. livestock (m)
Dairy	12,000	6.6
Beef	25,000	3.7
Sheep	25,000	31
Deer	3000	1.1



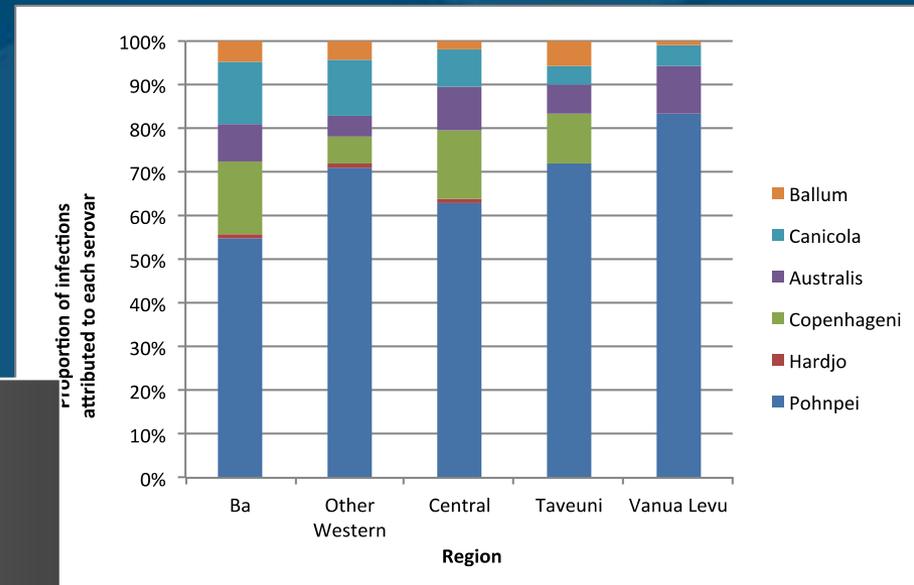
	Farms				Animals			
	n	Hardjo	Pom	H or P	n	Hardjo	Pom	H or P
Beef	116	92%	72%	97%	2,308	50%	25%	58%
Deer	98	60%	49%	76%	1,992	26%	10%	34%

In NZ, livestock are clearly the major source for human leptospirosis

Leptospirosis in Fiji

Human data informing animal studies

- High human disease incidence
 - E.g. 2012 floods: ~2500 cases, 52 deaths
- Population screening (n=2193) (Lau et al unpublished)
 - Seroprevalence Overall 19.4%
 - Serovars: Pohnpei 16.3% (84% of +ves)
- Acute febrile patient sera (n=199)
 - Similar serovars and seroprevalence



Data has informed animal studies

Region
Households
Animals
Serovars

Population screening for serovar and seroprevalence (N=2193)
Source: Lau et al (Unpublished)

Fiji Animal Leptospirosis Study

- Informed by the human data
- Case:control study:
 - Unit = household
 - 50 sero-positive: 50 sero-negative
 - Villages and farms
 - Highest sero-prevalence region: Ba
 - Animal Species
 - Cattle, bullocks, goats, horses, sheep, dogs, rodents, mongoose
 - Serology
 - PCR typing
 - opportunistically collected kidney



Samples Jul 2013

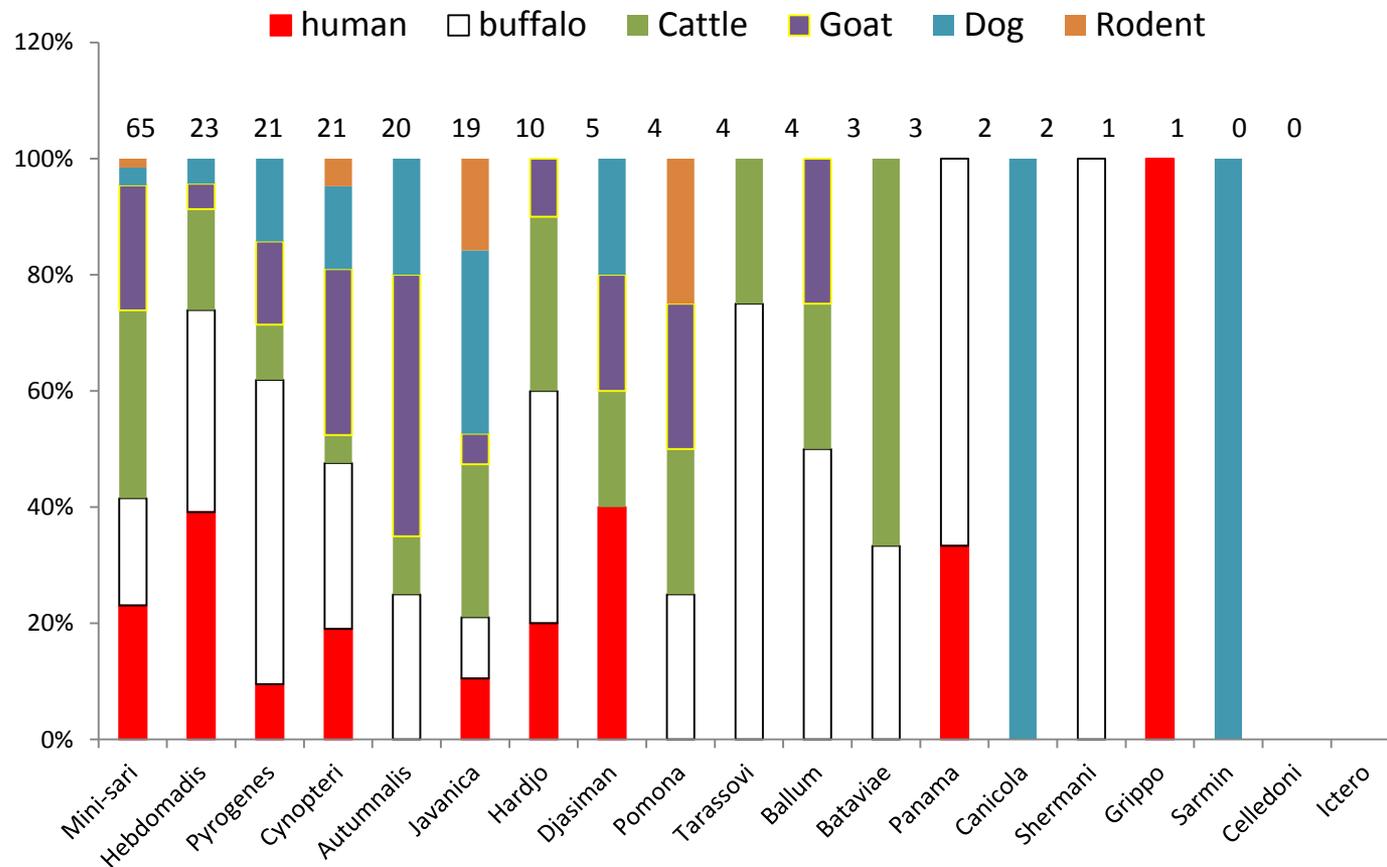
Acute patients	138
Convalescent patients	35
Animal samples	31
<i>Buffalo</i>	13
<i>Cattle</i>	3
<i>Goats, dogs, rat</i>	15

Massey Leptospirosis Study, Nepal (Prof Cord Heuer)



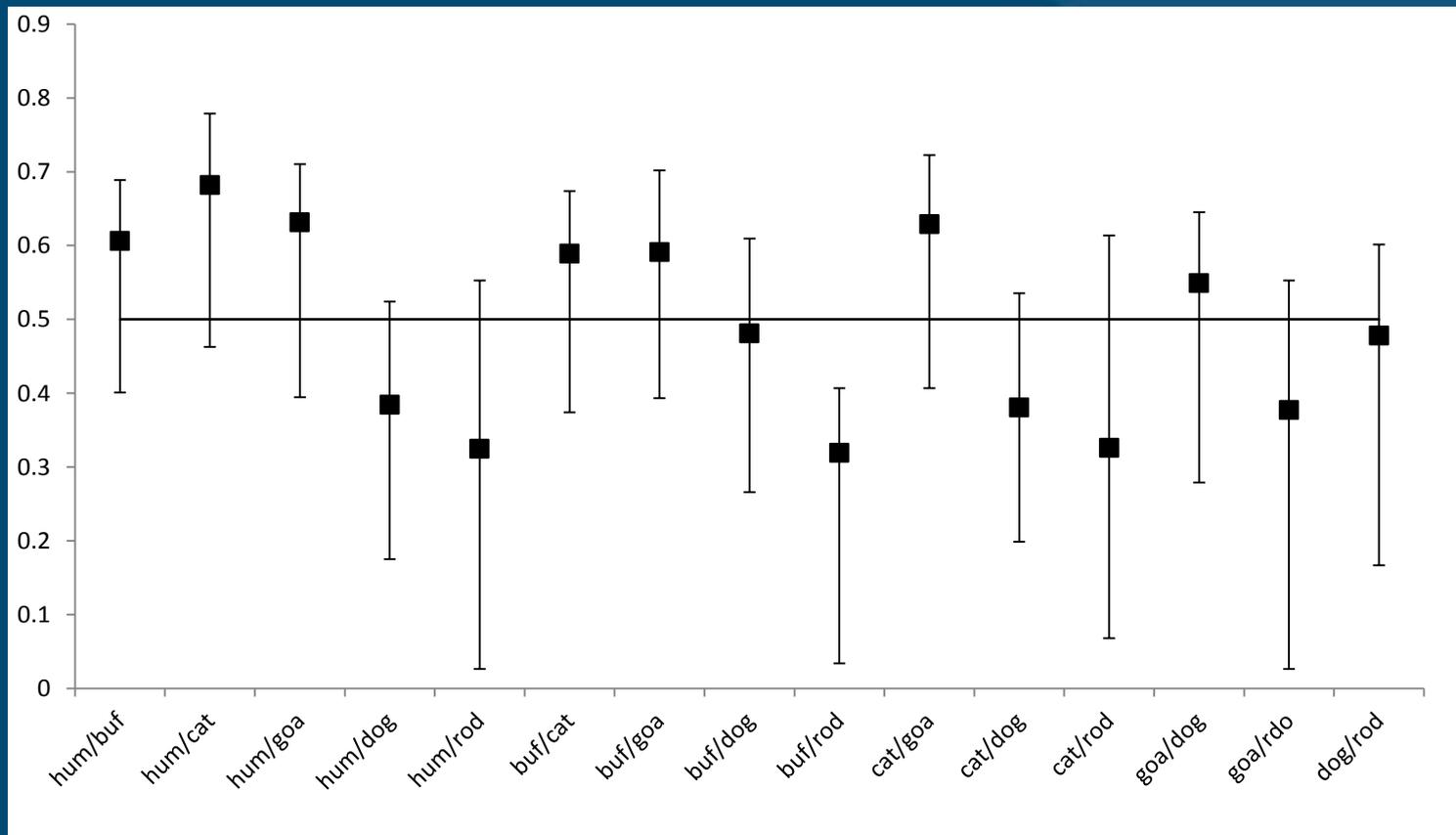
Serovars and hosts in Nepal:

Proportion of hosts within serovars



Animal: human association, Nepal

- Proportional Similarity Index
 - *e.g. identifies likely transmission pathways*



Principles and practice for interventions

- Firstly: Identify serovar/reservoir/target population
- Awareness
 - E.g. media/website/educational material
 - www.leptospirosis.org.nz
- Personal protection
 - Reduce exposure
 - Situation-dependent
 - Farm animal/rodents
- Animal vaccination: reduces shedding
 - Protects animals, and therefore people
 - Likely the most effective measure
 - But often difficult to implement



Are vaccines efficacious? -

Urine shedding

- Efficacy range: 0 - 100%!!!
- \geq ~70% in natural challenge situations
- **Cattle, sheep and Deer (NZ)**
 - Shedding after vaccination in already infected herds
 - Deer: ↓ 44%, Cattle: ↓38%, ~ 9 months after vaccination.
 - If vaccinated before natural challenge
 - Zero shedding \geq 9 months in some studies



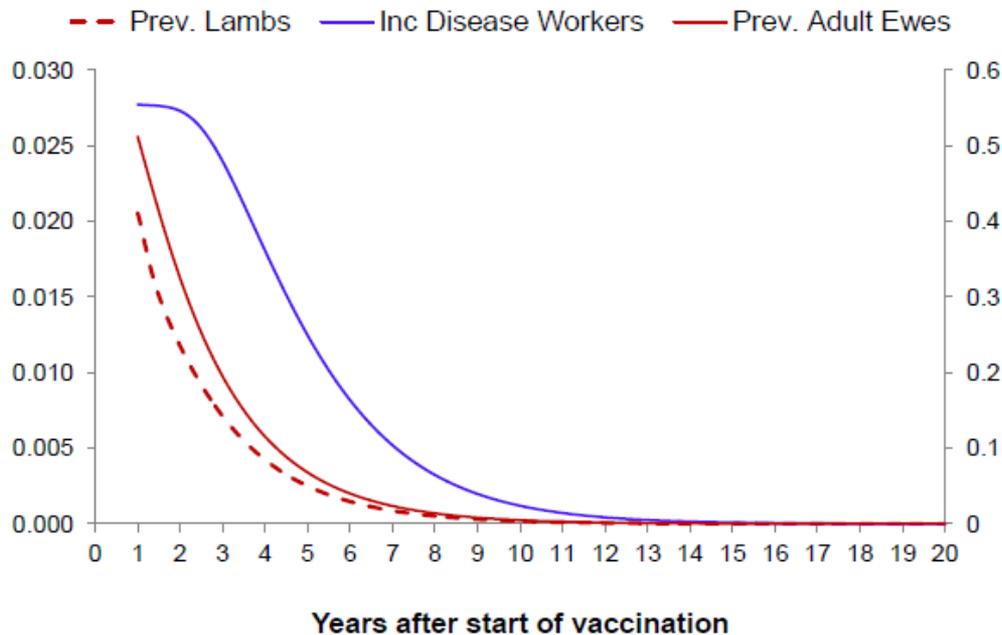
Meta-Analysis : 18 trials, 12 papers

- **VE (Culture): 79.9% (CI 69.6%–86.8%)**
(Sanhueza et al ILS 2015)

Are vaccination programmes effective?

Modelling vaccine effect on human disease: sheep example
(Heuer et al)

Infection in sheep and workers' disease over time



Concluding comments: Animal studies and interventions

- Animal studies
 - Linkage to human data is essential
 - Identify targets for interventions
 - Interventions
 - 3 principles
 - Awareness, personal protection, vaccination
 - Vaccination
 - Relevant for domestic animals only
 - Vaccination programmes are effective
- But**
- Difficult to implement in many situations
 - Practicality, esp. in developing countries
 - Vaccine serovar specificity
 - Cost
 - One of the greatest challenges for lepto control in many countries



This presentation

- Human epidemiological data:
 - How it drives and informs animal studies
 - A classic One-Health approach
 - New Zealand, Fiji, Nepal examples
- Animal studies
 - Serovar distribution
 - Relationship between human and animal exposure
- Interventions
 - Vaccination
 - Other



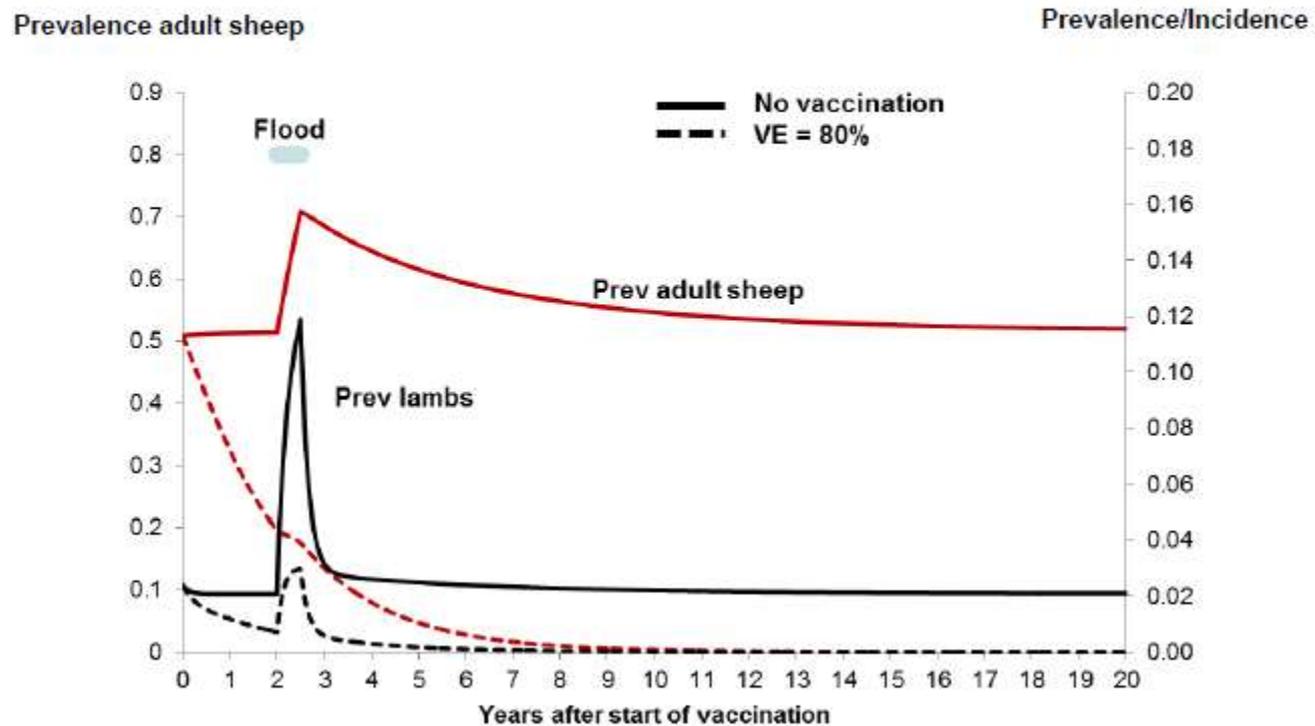
Vaccination uptake by farmers: herd/flock

Stock	Study	Class	No. herds/flocks	%
Dairy	Estimated	All		95
Beef	Thomas 2008	Adult	97	5
		Heifer	84	7
		Calves	89	9
	Dreyfus 2013	All	116	18
Sheep	Dreyfus 2013	All	162	0.6
Deer	Wilson et al 2008	All	174	5
	Dreyfus 2013		99	5



Modelling: flood

Effect of a flood with/-out vaccination



Drivers/Incentives for Leptospirosis interventions

- Human
 - Public health/welfare
 - Occupational health and safety legislation
 - Economic
 - NZ estimate ~\$30m/yr
- On-farm
 - Economic wastage
 - Clinical/subclinical disease, abortion, mortality
 - Worker protection



Health and Safety
in Employment Act
1992

