



# What protocol in a dog vaccination campaign?

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Nancy laboratory  
for rabies  
and wildlife



WHO Collaborating Centre  
for Research and Management  
in Zoonoses Control



OIE  
Reference Laboratory  
for Rabies



European Union  
Reference Laboratory  
for Rabies



European Union  
Reference Institute for  
Rabies Serology



National  
reference laboratory  
for rabies

# Key points

- 🐾 Final objective of dog control measures: prevention and elimination of the disease in Humans.
- 🐾 The theoretical level of vaccination coverage should be at least 70% (WHO, 2013) to achieve control and eventual elimination of rabies.



**Mass vaccination of dogs is the most successful method for control and possibly elimination of dog mediated rabies (WHO, 2013).**



# Reported and estimated vaccination coverage

## in domestic dog populations

### from various settings in sub-Saharan Africa since 1990

Region	Country	Dates	Vaccines delivered	Dog population	Estimated coverage (%)
N'djamena	Chad	2011	23,560		19.00
Machakos	Kenya	1992			24.00
National	Kenya	2003			33.00
Mzuzu	Malawi	1996-2000	7823	44,932	12.1-20.2
National	Mozambique	1997-2000	175,769	7,000,000	<1
Northern communal land	Namibia	2001		115,000	12.00
Bomo State (urban)	Nigeria	2007			<46.00
Borno State (rural)	Nigeria	2007			<15.6
National	Sudan	1992-2002	37,620	71,540	5.26
Khartoum state	Sudan	2000	2,946	91,000	3.24
National	Swaziland	1994-1998	57,204		63.2-91.7 (dropped to 3% in 1998)
National	Tanzania	1992	11,635		<1
National	Uganda	2001-2003			16.00
National	Zimbabwe	2002	314,319	1,300,000	13.93

Source: Lembo et al., 2010

# Epidemiological constraints

- 🐾 Elimination of canine rabies: control efforts targeted at the maintenance population, i.e. in dogs (Lembo et al., 2010).
- 🐾 Accessible dog proportion for parenteral vaccination is generally  $\geq 85\%$  (WHO, 1998; Cleaveland et al., 2006).
- 🐾 Rapid turnover of dog populations ( $\geq 30\%$  annually) (Lambo et al., 2010).
- 🐾 Rabies vaccines can safely be administered to pups  $< 3$  months of age (Seghaier et al., 1999; Cliquet et al., 2001).

Use of oral rabies vaccines in combination with injectable vaccines.

+

Inclusion of pups in well-planned vaccination campaigns.

= Increase in the vaccination coverage (WHO, 2013).



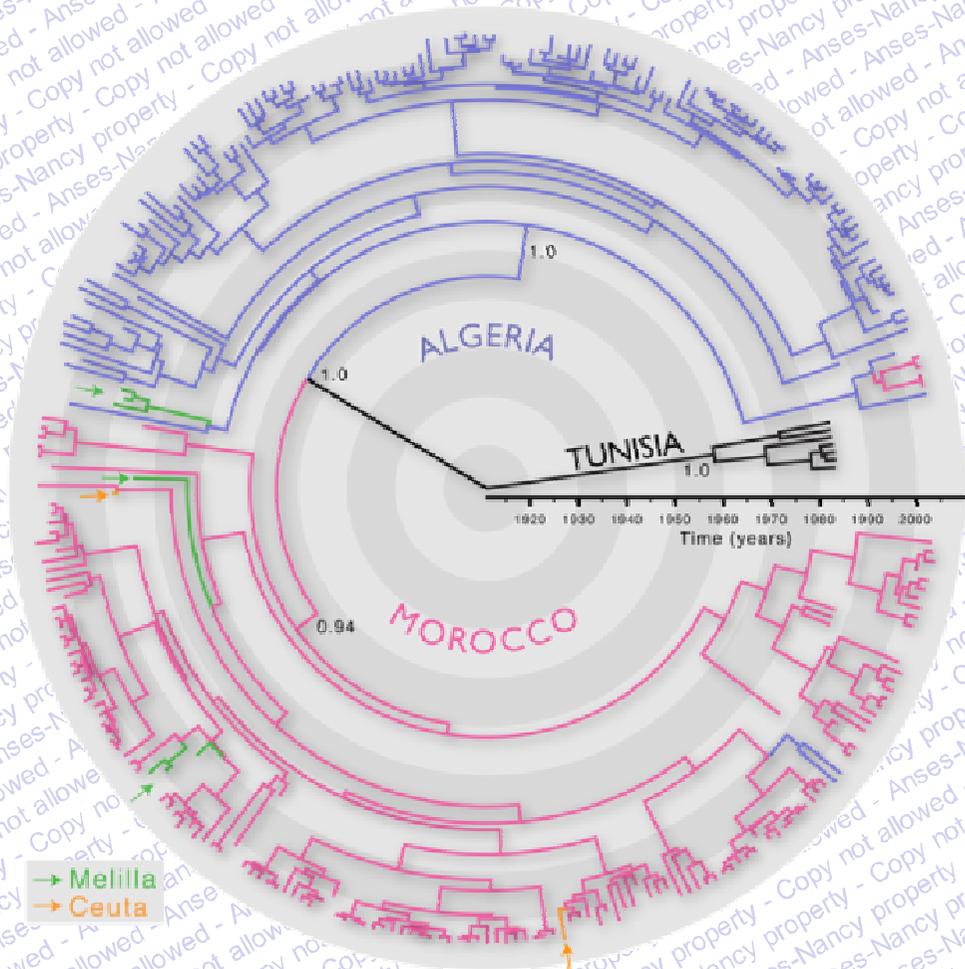
# Regional dynamics of dog rabies<sup>1</sup>

• Bayesian analysis of the dynamics of dog rabies using spacial data (21 cities in Algeria; 28 cities in Morocco) as well as temporal data (virus isolates from 2001 to 2008).

• Distinct lineages in Algeria, Morocco and Tunisia.

• Major geo-political boundaries act as barriers to gene flow.

• Road distances are predictors of movements of dog rabies virus.



**Human-mediated dispersal of rabies virus in North Africa**

Phylogenetic analysis of 287 sequences of the Africa 1 clade from N, P and G-L genes of dog strains showing the spatial structure of the viral lineages.

<sup>1</sup> Talbi et al., 2010

# Categorization of dogs (OIE, 2014; WHO, 2007)

## 🐾 According to the habitat

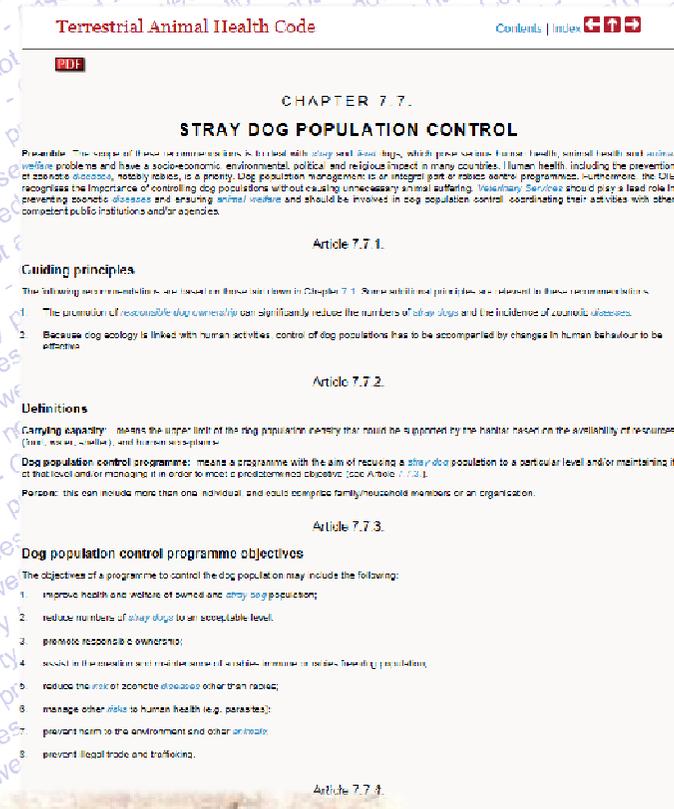
- Urban
- Rural

## 🐾 According to ownership responsibility

- Owned dog supervised (under direct control)
- Owned dog not under direct control at a certain time
- Free roaming dog with no owner
- Feral dog: domestic dog no longer directly dependent upon humans

## 🐾 According to the role of the dog

- Pet
- Farm dog
- Guard dog
- Hunting dog
- ...



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# International available guidelines

🐾 WHO Expert Consultation on Rabies, WHO Geneva, WHO Technical Report Series, 2013, n° 982, 139 p.

🐾 Rabies chapter (2.1.13) of OIE Manual, 2012.

🐾 Stray dog population control, Terrestrial Animal Health Code, chapter 7.7, OIE 2014.

🐾 Blue print for rabies prevention and control ([rabiesblueprint.com](http://rabiesblueprint.com)).

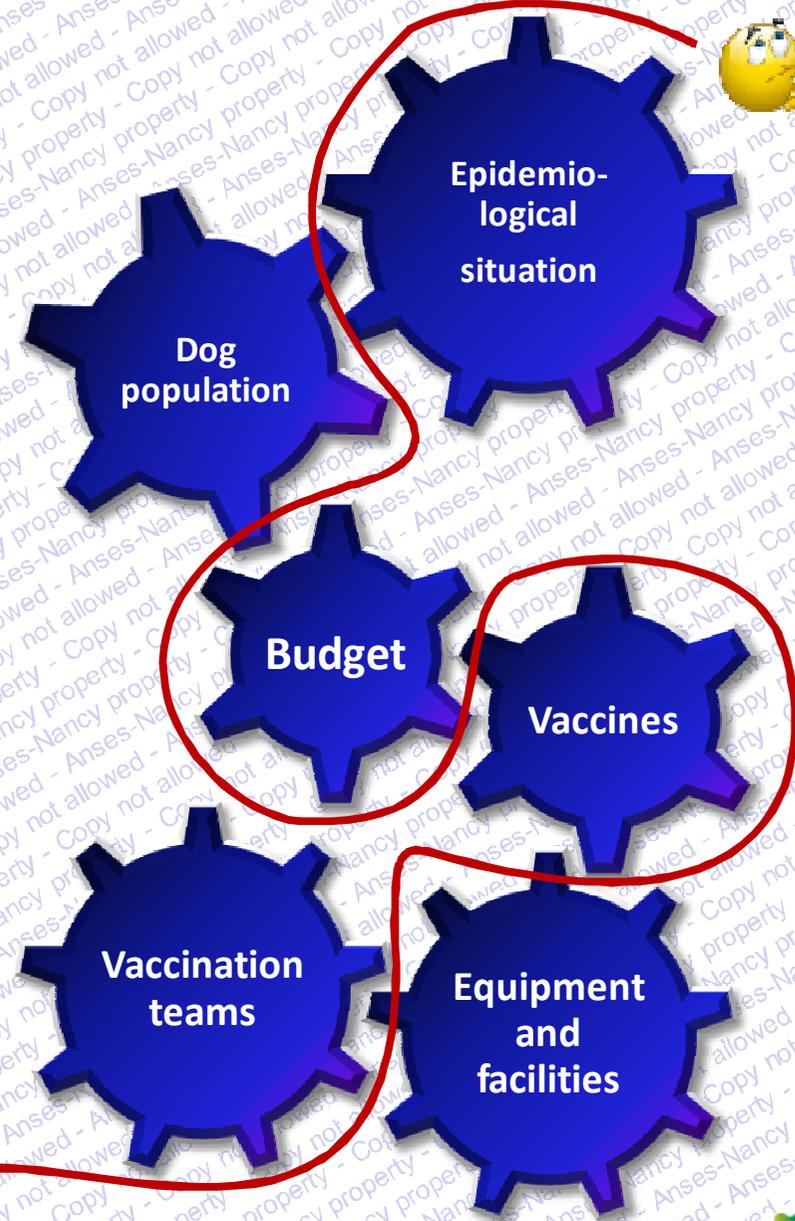
🐾 Oral vaccination of dogs against rabies, WHO, Geneva 2007.

🐾 ... and numerous reports of WHO Expert consultations.



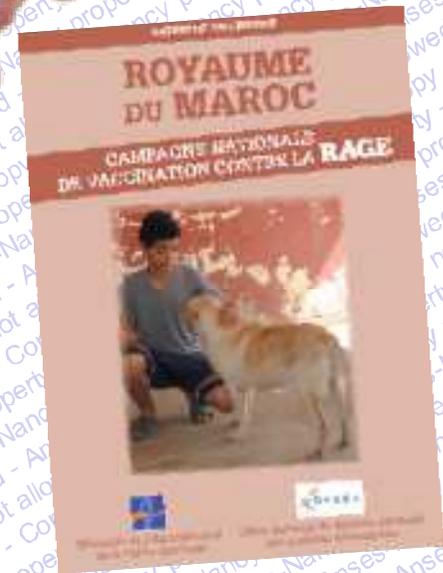
# Pre-requisites for defining the strategy of vaccination programme

- 🐾 Knowledge of the current epidemiological situation
- 🐾 Knowledge of dog population size and ecology
- 🐾 Budget allocated
- 🐾 Availability of vaccines
- 🐾 Availability of equipment and facilities: vehicles, freezers, gasoline...
- 🐾 Trained vaccination teams



## Some other pre-requisites

- Legal basis and long time budget allocation
- Rabies surveillance: before, during and after vaccination campaigns in the whole country
- Awareness campaigns, education of the public
- Evaluation of control programme
- Dog population management (sanitary measures, reproduction control)



# Protocole of vaccination: main requirements

- Areas covered by vaccination
- One person responsible of the overall responsibility of the vaccination plan and other people (vaccination teams) employed
- Injectable vaccine used (batch numbers quoted) and means for storage and transport (cold chain maintained)
- Dog identification method, if any
- Material used (syringes, needles, lassos, ...)
- Duration and frequency of vaccination campaigns
- Models of control grids to complete

**Protocol transmitted to all participating people before the start of the campaign to allow them to get organised.**



# Target animals and timing of campaigns (WHO, 2013)

🐾 All dogs, regardless of:

🦷 Age,

🦷 Weight,

🦷 Health.

🐾 Cats when presented at vaccination point campaigns

🐾 Annual basis but can be conducted more frequently (high turnover)

🐾 During weekends or during school holidays to improve turnout (children often bring their dog)



# Rabies vaccines for dogs: Injectable vaccines

## 🐾 WHO and OIE recommendations

- 🔑 Cell culture produced
- 🔑 Inactivated
- 🔑 Adjuvanted
- 🔑 Possibly combined with other antigens
- 🔑 Potency :  $\geq 1.0$  IU/dose



## 🐾 Quality controls performed by manufacturers and possibly by regulatory authorities

- 🔑 Safety: control of the inactivation process
- 🔑 Stability: during long storage and under liquid or lyophilized forms
- 🔑 Efficacy in target species (challenge assessment)

## 🐾 Indications

- 🔑 Active s.c. or i.m. Injection (i.m. more efficient)
- 🔑 Duration of immunity (1-3 years)

# Potency of 60 batches of 7 vaccines marketed in Europe

Vaccines: Canigen LR, Dog-Vac R, Eurican LR, Quadricat, Rabigen Mono, Rabisin, Rabisyva

Coded vaccines	Potency of the batches tested (IU/dose)										Mean potency (IU/dose)	
<b>A</b>	23,2	49,4	58,2	17,3	27,2							<b>35,1</b>
<b>B</b>	7	92,7	15,5	10	11,7	6,7	12,8	7,9	13,4	7,4		<b>18,5</b>
<b>C</b>	21,4	27,2	5,3	29,8	29,7	22,6	19,8	19,8	14,5	48,3		<b>23,8</b>
<b>D</b>	9,0	33,9	8,6	10,0	14,3	12,7	6,1	19,0	12,8	21,3		<b>15,7</b>
<b>E</b>	3,6	16,5	5,2	39,7	8,9	3,8	17,8	8,9	5,9	8,6		<b>11,9</b>
<b>F</b>	2,7	6,8	4,3	4,0	8,6	3,2	4,4					<b>4,9</b>
<b>→ G</b>	0,4	0,4	0,3	3,5	0,6	1,3	0,3	1,2				<b>1,0</b>

Minimal potency required: 1IU/dose

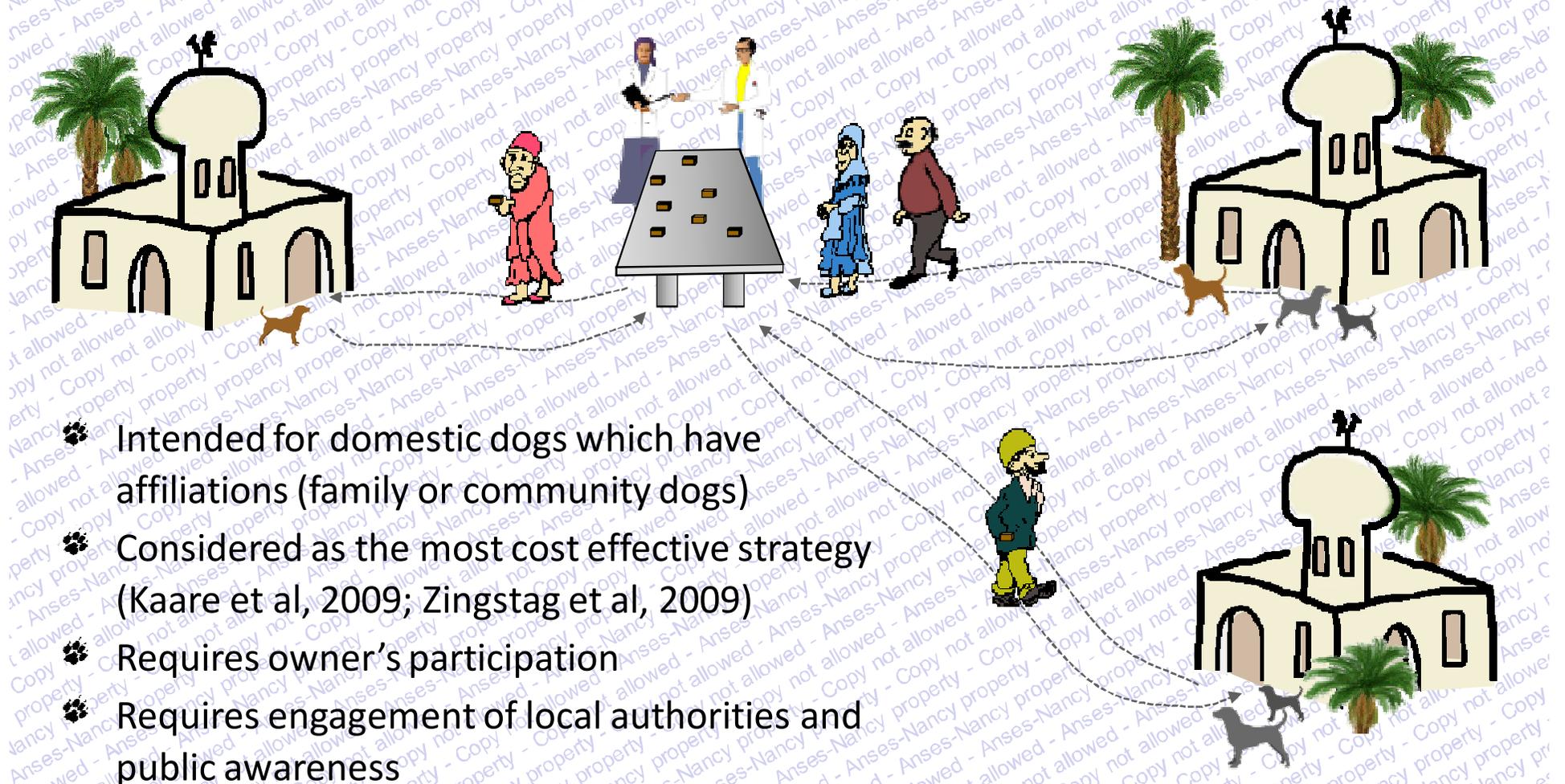
It is recommended to proceed to potency testing of vaccines done in an independent laboratory on randomly selected or all batches used.



Source: Servat et al., 2015

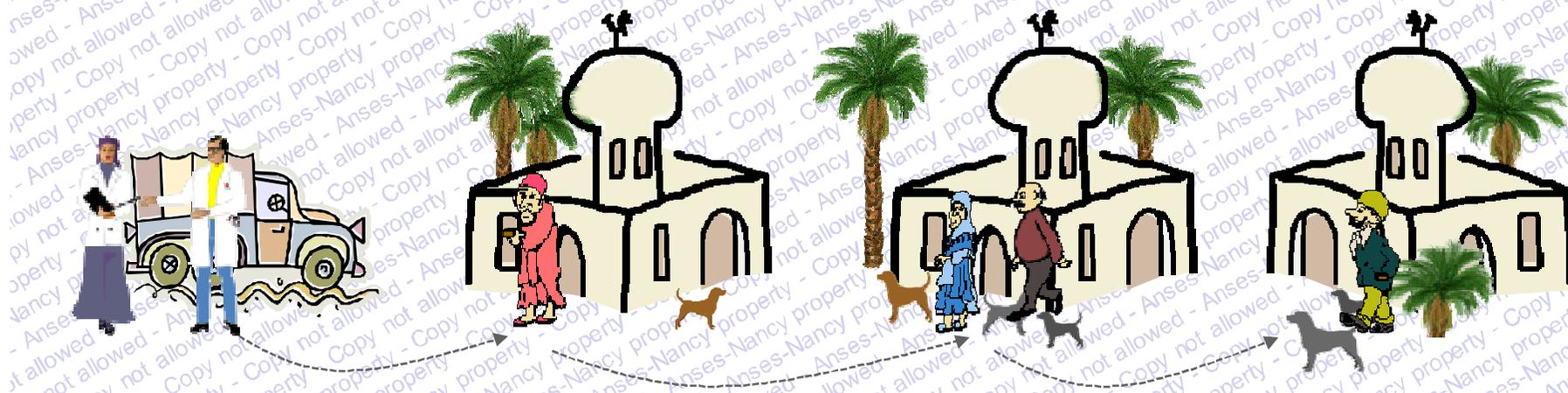


# Central point parenteral vaccination



- Intended for domestic dogs which have affiliations (family or community dogs)
- Considered as the most cost effective strategy (Kaare et al, 2009; Zingstag et al, 2009)
- Requires owner's participation
- Requires engagement of local authorities and public awareness
- Vaccination of dogs against rabies and possibly other diseases
- Possible identification of dogs (plastic collars or coloured tags)
- Possible dog vaccination card/certificate

# House to house (door to door) parenteral vaccination



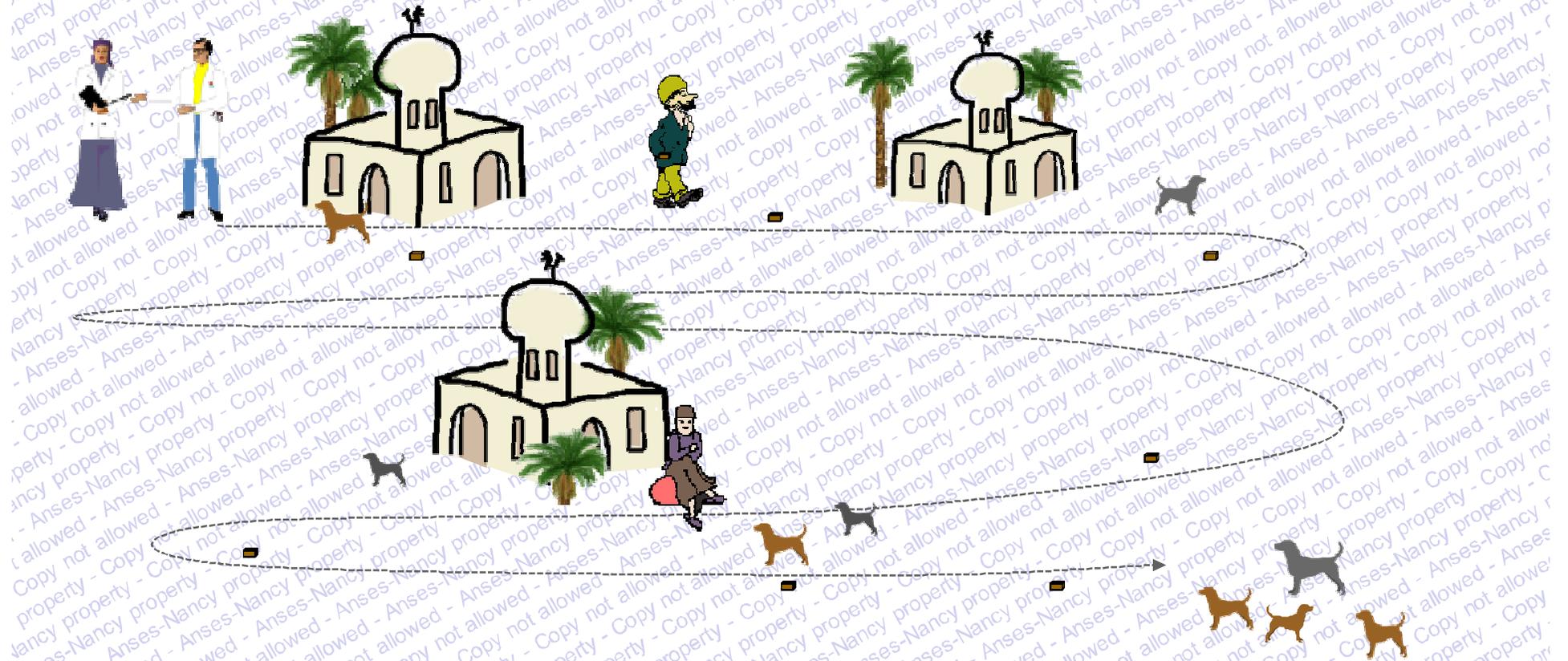
- ☛ Intended for domestic dogs which have affiliations but less accessible (aggressive dogs and dispersed community dogs)

- ☛ Requires:

- ☛ Detailed organizations (maps)
- ☛ Dog owners being present at home
- ☛ Engagement of local authorities and public awareness

- ☛ Vaccination of dogs against rabies and possibly other diseases
- ☛ Possible identification of dogs (plastic collars or colored tags)
- ☛ Possible dog vaccination card/certificate

# Oral vaccination in complement to parenteral vaccination using the wildlife immunization model

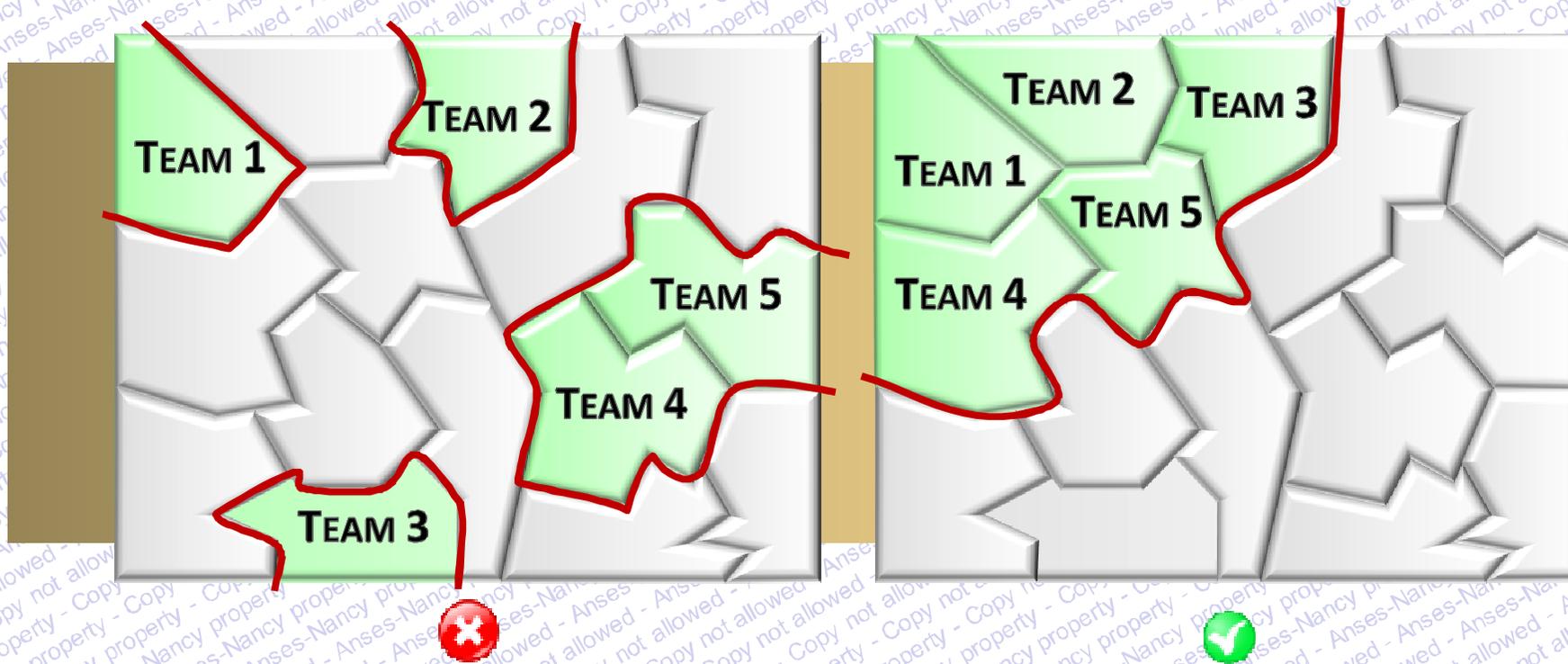


 Cost of vaccine baits: high number required

 Risk of human exposure

# General organisation of vaccination campaigns (1/2)

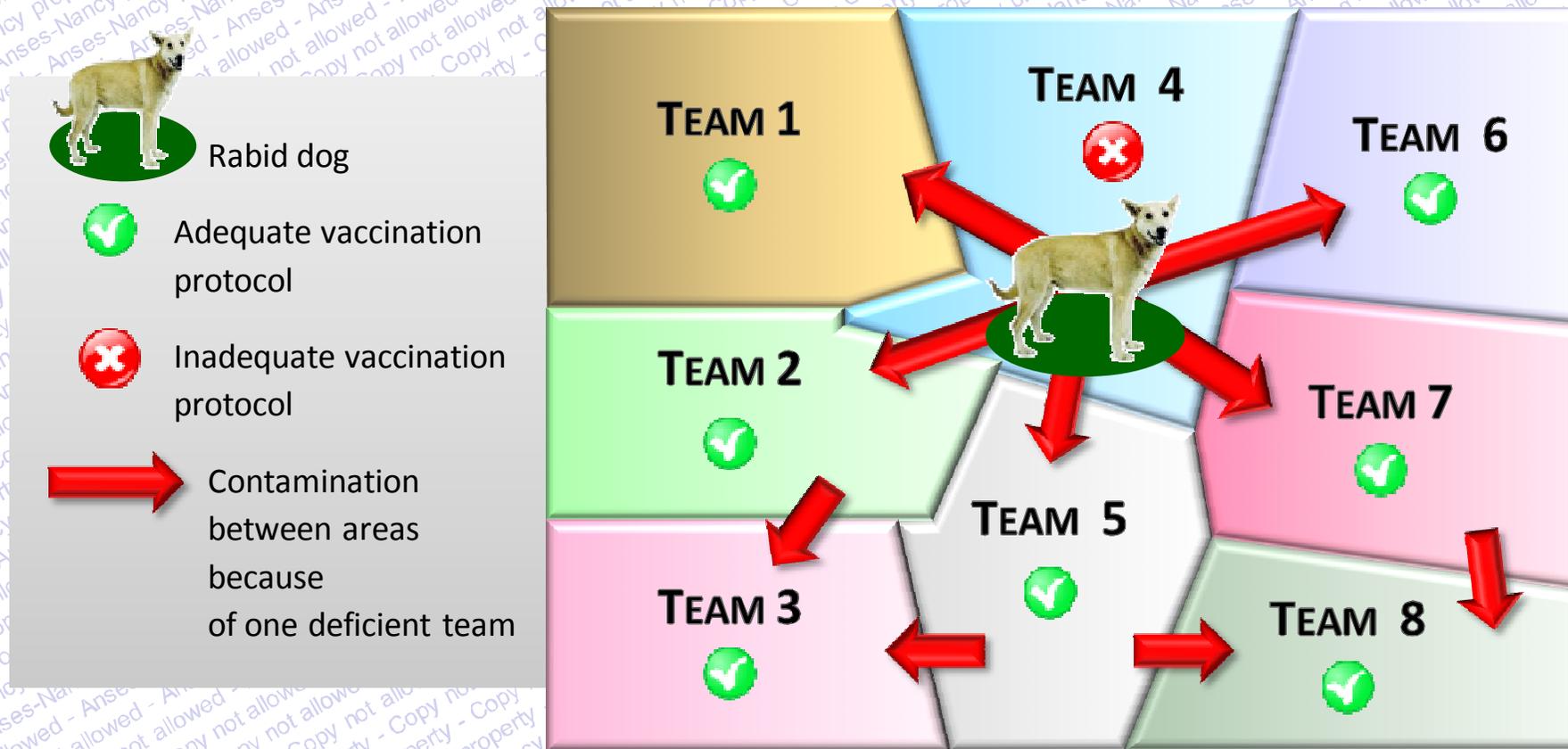
- Systematic vaccination is more effective if it is carried out properly in small contiguous areas rather than in many distant areas.



**If budgets are limited: reduction of the surface area for well-designed contiguous areas to vaccinate**

# General organisation of vaccination campaigns (2/2)

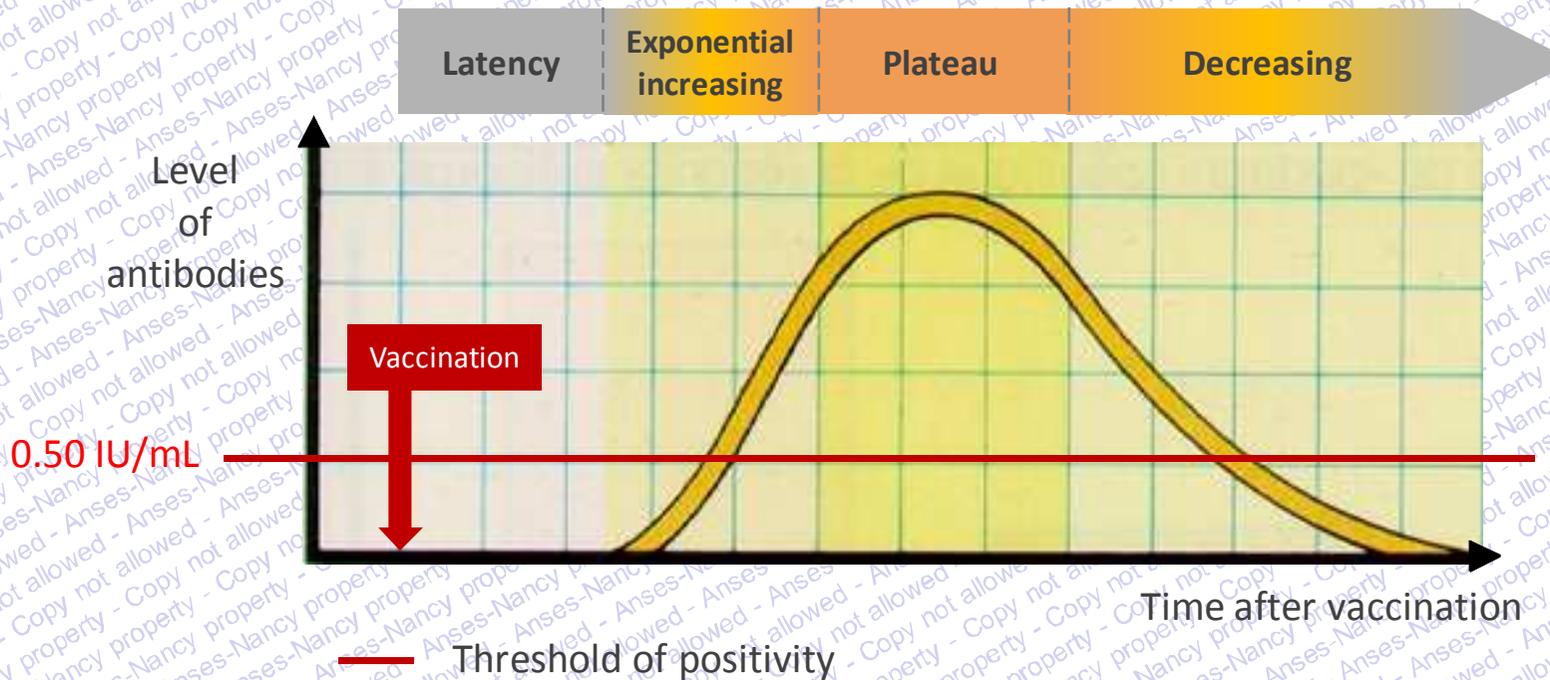
## Schematic representation of vaccination areas



➤ All teams vaccinated correctly dogs except for team 4.

➤ Team 4 had not a methodical organization of vaccination. Result: too large areas insufficiently vaccinated.

# Humoral response to vaccination



🐾 In cats and dogs, the peak of rabies neutralising antibodies is generally reached between 4 to 6 weeks after first antigenic stimulation (Review in Aubert, 1993).



**Monitoring vaccination campaigns with seroprevalence studies should be done only one month, AND NOT LATER, after vaccination**

# Evaluation of the vaccination campaigns

- 🐾 Sero-survey 30 days after vaccination (not later) to evaluate the vaccination coverage.
- 🐾 Ultimate indicator of the success of the vaccination programme:
  - 🦴 Decrease of rabies incidence in vaccinated areas, both in humans and animals.



Vaccinated dogs  
(in millions)



Dog rabies  
cases



Source: Courtesy of FX Meslin



# Conclusions (1/2)

- Mass dog vaccination programmes using injectable vaccines are successful for rabies control in different places (e.g. Latin America, Bohol, Bali, KwaZulu Natal, Sri Lanka).

- To obtain the 70% dog vaccination coverage, it is necessary to:

-  Vaccinate puppies and newborns;

-  Conduct two vaccination campaigns annually, during appropriate periods;

-  Consider oral vaccination for dogs that cannot be restrained or caught.

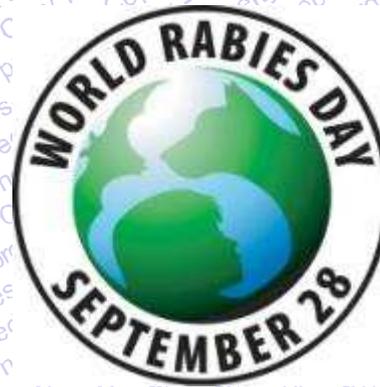
- Importance of local pilot zones to test the feasibility of the vaccination protocol before application at the national level.

- Importance of the evaluation of the programme (surveillance: rabies incidence).

- Rabies vaccination should be undertaken in farm dogs by teams enrolled in livestock vaccinations.

## Conclusions (2/2)

- Priority given by the governments for rabies control is the main prerequisite associated with long term funding insurance.
- To be sustainable, rabies control programmes based on mass vaccination of dogs should be integrated in a multiannual project of rabies elimination according to the One Health concept.
- Importance of GARC, PRP, and Rabies Elimination Demonstration Projects.



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# Thank you for your attention



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