



Banna meeting: Presentation of achievements, ongoing projects and future perspectives

Participants:

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The Partners for Rabies Prevention Banna meeting was sponsored by the Bill and Melinda Gates Foundation through a grant to the World Health Organisation.



1. – Global Communication

1.1. Review of the current situation: roadmap, WRD report and future goals - Louise Taylor (& Peter Costa)

Since its establishment, the Global Alliance for Rabies Control (GARC) has built a community that continues to work together to increase global advocacy for rabies prevention and control with the objective of improving national and international policies for rabies control and prevention and to find and allocate sufficient resources to make implementation of programs possible and effective. The list serve of GARC continues to increase, with a growing list of more than 6,500 persons, it includes people from a wide range of backgrounds, from international organizations and national government officials to wildlife rabies control officers, veterinarians and anyone with an interest in rabies control worldwide. GARC extends its outreach through list serves of various partners.

The Partners for Rabies Prevention (PRP) first met in May 2008 and GARC serves as the secretariat for the PRP. During the first meeting, PRP developed a roadmap focused on control and prevention of rabies throughout the world. In 2009, the PRP developed a *Blueprint for the elimination of canine rabies and the prevention of human rabies* that is now freely accessible on the www.

1.2. Major activities of the Global Alliance for Rabies Control

A global communication network

The GARC is a virtual organization, working essentially through e-mails, Skype, teleconferences, its electronic newsletter and websites (www.rabiescontrol.net and www.worldrabiesday.org). All GARC's educational resources are freely downloadable from anywhere in the world. Since the beginning of 2010, the combined websites have had over 39,000 visitors from over 175 countries. GARC is using Twitter, Facebook, YouTube and Flickr to share news, videos and photographs.

Newsletter

The newsletter is issued five times a year, with French and Portuguese translations. An increasing number of articles are submitted from authors from all over the world. All current and past issues are on the website, and links to new issues are e-mailed through the listserv. It is further disseminated through the World Veterinary Association, the One Health Initiative and several other networks, and, through partnership outreach, reaches over 500,000 people.

World Rabies Day

World Rabies Day (WRD) is the only global event focused on raising awareness and funding to control and prevent rabies throughout the world. The impact of WRD has been evaluated via the web traffic (Google Analytics), a feedback survey and media monitoring (online news search and Lexis Nexis Utility).



The numbers of visits for the WRD website has increased by more than 50% each year over the 3 years that the campaign has been in place. The WRD website has been viewed by people from more than 200 countries/territories since its inception. In 2009, during September (WRD month) there were 16,000 visits.

The feedback surveys show that the WRD campaign grew from 75 countries in 2007 to 85 in 2008 and 105 in 2009. Over the 3 years, events have been reported from 125 countries.

In 2009, there were more than 300 separate reported events, directly involving more than 775,000 participants. Many more events were held but not reported back to GARC. Over 1.3 million animals were vaccinated as part of WRD events and educational messages reached an estimated 18.7 million people. A *Vaccine* special issue, "Rabies in the 21st Century - A Global Challenge" was published in November 2009, as well as specific articles on rabies in the PLoS Neglected Tropical Diseases journal.

For WRD 2010, the WRD team is planning, together with the CDC, a series of webinars broadcast over a 24 hour period. Some of these will be talks from international rabies experts, but a large contribution will also be from rabies control workers around the world. Current plans have participants from more than 30 countries taking part. The webinars will be broadcast online via the software, and up to 1,000 simultaneous logins will be able to access them. These could then be broadcast in conference rooms to reach as many people as possible.

Programs

In addition, the ARC is developing tools and participating in the implementation of field projects. Through the Partners for Rabies Prevention (PRP), the ARC has been able to establish a Blueprint for rabies control and human rabies prevention (*see section 3.1*).

GARC has been able to secure funding for a number of field projects from small scale educational interventions (China, Guatemala, Kenya, Peru and Vietnam) to much larger pilot projects designed to provide proof of the concept that rabies control through education and dog vaccination really does work.

The Bohol project is in progress, with rabies deaths dropping from 10 in 2007 (prior to the project) to 0 in just 2 years. 71% of the dog population has now been vaccinated against rabies (*see section 6.1*).

1.2. Review of global opportunities and direction of rabies prevention - Deborah Briggs

Tools are available for rabies control:

Biologicals :

- vaccines for humans - pre- and post-exposure, IM and ID regimens; RIGs (HRIG, ERIG, MABs)
- Vaccines (oral and parenteral) for animals

Animal population control: through animal welfare, including surgical or chemical sterilization (immunological sterilization under development)



Diagnostics: using new molecular techniques, FAT, Rapid tests, dRIT (*see section 3.2*)

Surveillance: using molecular techniques, computer programs and geographic information systems (GIS)

Communication: through media, education and the ARC blueprint in a global network

Modelling: to evaluate the rabies burden in terms of deaths and costs, and the impact of various interventions

Expertise: is available, we have established partnerships in all fields.

The missing piece of the puzzle is adequate funding. There are several funding programs that currently support public health, including those from USAID, the World Bank, GAVI, the Bill & Melinda Gates foundation, UNICEF, individual countries.

Rabies was considered for funding by the GAVI Alliance in 2007, among a shortlist of other diseases, but it was not selected. Analysis of the reasons for this failure can help us to be successful when GAVI will re-evaluate their strategy in three to five years.

The GAVI Working Group determined that more work needed to be done to identify appropriate strategies for preventing rabies, and to evaluate their impact and cost-effectiveness.

http://www.gavialliance.org/vision/strategy/vaccine_investment/index.php

http://www.gavialliance.org/resources/WG_retreat_DC_29_30_Sept_FINAL_REPORT.pdf

To this aim, it is important to:

- re-evaluate the rabies burden
- define the vaccination strategy options:
 - simplify the options
 - examine options for pre- and post-exposure prophylaxis
- provide health impact data (through modelling)
 - number of deaths averted
 - number of deaths in children <5 years averted
- provide data on costs (cost-modelling)
 - vaccine costs and the most cost-effective regimens
 - cost per death averted
 - Implementation costs

Consequently, we suggest re-evaluating the global rabies burden, modelling the impact and cost effectiveness of the various prevention strategies, and evaluating the most cost-effective vaccination regimens.

2. – Advocacy

2.1. Re-assessing the global burden of rabies – presentation of draft model - Laurent Coudeville



The starting point will be the work (and estimates) initially published by Knobel et al (Bull WHO, 2005). These data need to be updated and expanded (for instance the Knobel model underestimates the cost of prophylaxis). The PRP will be hosting the project and the Alliance will be coordinating the project. The main objective will be to build and validate the model, supply, review the data, and discuss the results. A steering committee should be established by June 15, with the Alliance to take the lead in coordinating the project; a detailed time-schedule will be established. The final validation will be made in May 2011, during the next PRP meeting in Banna. The main objective will be for PRP to submit the revised global burden data for publication before 2011 WRD.

The presentation made by Laurent Coudeville was not aimed at providing preliminary results, but rather at describing the methodology, so that PRP members could evaluate the process.

It was agreed to:

- *express the rabies burden in DALYs (as in Knobel's paper);*
- *maintain segmentation into rural and urban areas;*

It was suggested to:

- *include areas where rabies is endemic (Africa, Asia) and expand the study to other parts of the world where rabies is endemic (Eastern Europe and Middle East, Latin America);*
- *use specific country data, in contrast to Knobel et al who used overall estimates for Africa and Asia; to use a clustering approach of country specific data (reference countries) could be used to make up for missing data;*
- *collect and use data for year 2009. The results will give a snapshot which can be updated;*
- *identify experts in the countries of interest, who could help collect and evaluate the (reference) country data,*
 - *experts of the AREB (Asian), AfroREB (Africa), and MEEREB (Middle East & Eastern Europe), SEARG or other network dedicated to rabies could serve as focal points;*
- *identify (at least) two experts per country (one for human rabies, and one for animal rabies);*
- *keep track of relevant information sources; a record needs to be kept on the gaps in information (geographic, etc.), as they are expected to be important;*
- *regularly update the data; as necessary upon publication. If feasible maintaining a dynamic model with the ability to regularly revise the data based on situation evolution was suggested.*
- *estimate number of rabies exposures, PEP administered, human death by rabies;*
- *use cost categories: direct and indirect treatment costs; travel costs, dog rabies control and livestock rabies costs, surveillance costs.*

PRP members were asked to suggest names of KOLs who could help to provide data. Discussions addressed the issue of adjusting for patients not going to the hospital and those who are not listed in the official statistics. Concerns were expressed on the validity of final results, due to a lack of reliable information for some parameters. In counterpart it was acknowledged that the existing Knobel paper



also faced the same problems and the information from the Knobel paper is somewhat dated as the rabies situation considerably evolved since the publication of the paper, and in consequence there is an urgent need to run the proposed update.

A means by which veterinary data can be obtained needs to be determined (outside dog bite statistics/exposure rates), knowing that the Knobel paper only uses a very broad extrapolation of data collected in Africa. Concerns included: How can we appropriately balance the information concerning dog rabies incidence and control? Do we need two experts per country, more than one expert per human or veterinary specialist, what is expected from experts? How to address the lack of data in most countries?

How to deal with issues of veterinary vaccine quality? What to reflect? How to manage the potential political issues at country level?

Once the burden is defined, then the work of building a strategy starts. Focus will be on finding the most effective strategies that will allow a reduction in the rabies burden focusing on the impact of the strategies on the global rabies burden. Zinsstag proposes to build a dynamic transmission model for urban and rural rabies once the data on burden are available.

Use of the model should include eventual publication and should allow for applying for funding.

2.2. Cost-efficacy of various rabies post-exposure vaccination regimens in low income countries - Katie Hampson

Human rabies deaths still occur, while there are safe and effective PEP regimens. Several reasons have been identified:

- Governments generally do not purchase enough vaccines for human patients, RIGs are generally in short supply or not purchased by local health system, and distance from cities aggravates access to vaccine and RIG.
- Often several people are bitten, which causes the dilemma of how to use vaccines if vaccines available.
- Vaccines are often paid for (\$2.5 + travel cost), but often families do not have enough funds available.

Several different vaccination regimens have been approved by the WHO or ACIP, or have been published in the literature with different routes of administration (IM or ID) and different vial sizes available (0.5 or 1 mL vials):

Regimen	Clinic Visits	Schedule (day)	Injections Per visit	Total vials required for entire series	Volume (mL)**	Route	Approval
Essen 5-dose	5	0,3,7,14,28	1,1,1,1,1	5	5(2.5*)	IM	WHO 1992-
Essen 4-dose	4	0,3,7,14	1,1,1,1	4	4(2*)	IM	ACIP 2009-



Zagreb	3	0,7,21	2,1,1	4	4(2*)	IM	WHO 1992-
8-site	4	0,7,28,90	8,4,1,1	4(5*)	4.4-1.7	ID	WHO 2005-
TRC ID	5	0,3,7,28,90	2,2,2,1,1	5	0.8	ID	WHO 2005-
Updated TRC ID	4	0,3,7,28	2,2,2,2,	5	0.8	ID	WHO 2005-
4-site economical	4	0,7,28,90	4,4,1,1	4	0.8-0.9	ID	Not approved
1 week ID	3	0,3,7	4,4,4	3	1.2-1.5	ID	Not approved

*Calculations based on use of 0.5 mL vials

** For ID regimens that use 0.4 or 0.8mL of vaccine on the 1st consultation, variation in volume used varies based if there is some wastage/ a whole vial is divided between vaccination sites.

The quantity of vaccine used varies according to the regimen. ID regimens are more economical, since lower quantities of vaccine are used. Some ID regimens are more robust for patients with poor compliance than are others.

ID always uses less vaccine than IM, even in low throughput clinics. In high throughput clinics, savings are massive. Using 1mL vials is more cost-effective, with higher gains in higher throughput clinics: with the same amount of vaccine, far more treatments can be administered – enabling more confident coverage of suspected exposures.

But provision of PEP is often on a cost-recovery basis. The number of patients/clinic/timestep is hard to predict. It is affected by the incidence of exposure, compliance, catchments.

Several pricing mechanisms can be used: either patients share costs based on daily co-occurrences, or the 1st patient pays for the vial, which allows for poor patients to have the injection for free, or according to estimated sharing costs. This sets the price/injection a US\$2.50, or \$3 ~25-30% of the vial cost. The price can also be set for the whole course (paid at the first consultation): \$10 or \$15, i.e. ~25-38% of IM; or divided between the first and the second consultations: \$10 each, \$20 total ~50% of IM course.

Comparisons of the cost of the various regimens, taking into account the travel costs, show that ID regimen that use lower quantities of vaccine, are cost-saving compared to IM regimens.

Discussion: *It was noted that the current recommendation concerning the ID dose does consider a volume, not the antigen content; and that a minimum potency per ID dose should be defined, to ensure that each patient receives the same minimum amount of antigen, independently of the brand of vaccine used, as it is the case for each and any known vaccine whatever injection route is recommended.*

For ID vaccination, WHO currently recommends the use of 0.1mL of the IM cell-culture vaccine (with a minimal potency of 2.5 IU per IM dose) per ID dose. Since the rabies vaccines that are WHO pre-qualified are reconstituted with either 0.5 or 1.0mL diluent, this means that the minimal amount of antigen administered per ID dose is different, depending on the vaccine used. WHO pre-qualified vaccines for ID have an antigen content that is >2.5 IU per IM dose. But the use of new rabies vaccines with an antigen content =2.5 IU per IM dose in 1.0 diluent (or more) could lead to sub-optimum



vaccination, leading to vaccination failures. It was requested that the WHO Recommendations should include a specific antigen content.

2.3. Global conference announcements and rabies group brief reports

7-10 June 2010	1st MEEREB Meeting - Istanbul, Turkey
17-22 October 2010	RITA (Rabies in the Americas) - Guadalajara, Mexico
November 2010	6 th AREB Meeting - Goa, India
January 25-28, 2011	10 th SEARG (Southern and Eastern African Rabies Group) meeting - Maputo, Mozambique
March 2011	3 rd AfroREB Meeting - Morocco
7-9 September 2011	OIE Global conference on Rabies Control - Seoul, Republic of Korea

RITA (C. Rupprecht): An operational/working group focusing mainly on rabies prevention and control issues in the Americas. Recent accomplishments have included approval of the North American Rabies Management Plan. The meeting will continue to be held annually as long as there are problems with rabies in the Americas.

SEARG (L. Nel): SEARG represents the English speaking countries in Africa and thrives to share data in order to define actions to control rabies. Most human rabies cases are dog rabies transmitted, but an estimated 95% of human cases are not reported. Data are not accurate and not conclusive: SEARG tries to generate more balanced and validated data to document the true story of rabies in AFRICA, for example the data reported at SEARG, WHO Rabnet and OIE WAHID differ.

AfroREB (M. Wateba): AfroREB participants are representing most of the French speaking African countries but have reached out to collaborate with the SEARG group in order to have a more complete understanding of rabies in Africa. The purpose of AfroREB is to collect data on the burden of rabies, to broadly increase awareness of rabies, to train rabies educators, to assure sufficient supply of rabies vaccines and immunoglobulins, to increase dog vaccination and to support the strengthening of Rabies infrastructure in the country.
AfroREB acknowledges an unlimited grant from Sanofi Pasteur

AREB* & MEEREB (B. Dodet):**

AREB: This informal group consists of experts from 9 Asian countries (China, India, Indonesia, Pakistan, Vietnam, Thailand, Bangladesh and Pakistan), , support each others in use and improvements of available tools and supports WRD. Proceedings of their meetings are published in international journals, including *Vaccine*.

* *Asian Rabies Expert Bureau*

***Middle East & Eastern European Expert Bureau*



MEEREB: The first meeting to be held in June, gathering an informal group of experts originating from Eastern Europe (Ukraine, Croatia, Serbia, Georgia) and Middle East (Egypt, Iran, Turkey) region, AREB and MEEREB acknowledge an unlimited grant from Sanofi Pasteur

RIEA (L. Knopf): Previously, regional OIE/FAO/WHO conferences on rabies were held in 2005 in Kiev and in 2007 in Paris. Now OIE, in collaboration with FAO and WHO, will organize a global conference, investigating why rabies control at the animal source still does not work: This global conference is scheduled for 7-9 September 2011 in the Republic of South Korea. The aim of this conference is to develop strategies of how to overcome the barriers currently limiting the control of rabies at its animal source.

3. - Research and Development

3.1. Blueprint – a tool for elimination of canine rabies and control of human rabies – T. Lembo

A Blueprint for canine rabies elimination and human rabies prevention (www.rabiesblueprint.com) has been developed to help countries to establish their own rabies control program. It is based on a user-friendly, question-and-answer format, in a simple language that can be understood by persons in the field as well as professionals. It will be placed on the web and be widely available and easily updated.

Part 1 of the Blueprint – elimination of canine rabies is aimed at assisting and guiding individual countries on implementation of canine rabies control programmes:

- if rabies is present;
- if rabies is re-introduced after a period of absence.

The information is presented in a concise manner (with many take-home messages), with examples from countries that have implemented such programmes; more detailed information is provided as hyperlinks. 'Yellow pages' also give addresses of contact rabies experts for further information.

Introduction: defines the target audience and describes the structure of the Blueprint, gives basic information on rabies, and the measures available for rabies control, with emphasis on cost-effectiveness of dog vaccination vs human rabies prophylaxis.

Section 1.- Roles and responsibilities: identifies critical agencies that should be involved, and their role, with emphasis on inter-sectoral collaboration.

Section 2.- Infrastructure, legislative framework, costs and funding: provides guidelines for minimum infrastructure required; notification of animal and human rabies; relevant laws and regulations; budget and resources requirements; costs and suggestions for fund raising.



Section 3.- Communications plan: highlights the importance of communication planning to raise awareness; gives a framework for communication planning and guidelines for development of country-specific communication plans for rabies.

Section 4.- Operational activities: describes what is needed for implementing a programme aiming at eliminating canine rabies (epidemiological data; field, laboratory and clinics supplies, training, dog ecology surveillance, dog vaccination and dog population management; human rabies prophylaxis, evaluation and mechanisms for sustainability, etc.).

The first draft was reviewed by PRP group, other rabies experts and students with little or even no knowledge about rabies. The final draft has been completed and sent to PRP members for final comments and approval; two major improvements were made: (1) the section on management of rabies re-introduction into rabies-free countries was greatly expanded with hyperlinks to other sections of the document, and (2) a section on mechanisms for sustainability of rabies control programmes (CR) was added.

A partnership was established with FAO Bamako who agreed to support the development of the website in English and French. The English version was completed and required minor revisions only, while the French translation is ongoing. The website has been launched www.rabiesblueprint.com, in both English and French and the French version is currently being further edited. More language versions are to follow at a later stage with the support of the European Commission (Spanish, Portuguese, and possibly Russian and Arabic).

For those who have no internet access, CD copies will be provided with the support of Novartis, and updated every year.

The Blueprint will be advertised by articles in scientific journals, by announcements hopefully in ProMed mail, an entry in Wikipedia, and at upcoming rabies meetings.

It will be tested in workshops (in particular during the first MEEREB Meeting), to both evaluate its perception by users and help the creation of national programmes.

Part 2 of the Blueprint - a tool for elimination of wildlife rabies - The second part will address wildlife rabies and other subjects to be debated. It will begin with section on rabies elimination in foxes. Thomas Müller, Alex Wandeler and Charles Rupprecht to start working on the draft.

3.2. Expanding the tools for rabies prevention - Charles Rupprecht

New tools have been developed or are under development.

dRIT

At the Centers for Disease Control and Prevention (CDC), USA, a direct rapid immunohistochemical test (dRIT) has been developed to detect rabies virus using an immunoperoxidase technique. The dRIT uses highly concentrated and purified biotinylated anti-nucleocapsid monoclonal antibodies to rabies virus (a cocktail of 2 highly purified and concentrated mAbs produced in vitro – RIT1 and RIT2). After



incubation with a streptavidin-peroxidase complex, the antibody reagent is made visible with 3-amino-9-ethylcarbazole. The result can be read after less than one hour, using a light microscope. No homogenization of brain material needed as for commercial ELISA. The dRIT shows a sensitivity and specificity equivalent to those of the DFA, considered as the gold standard. The test is simple, requires no specialized equipment or infrastructure, and is easy to use under field conditions as shown in a variety of countries (Tanzania, Congo, China, NA ORV programs). It can be successfully performed on brain samples preserved in glycerol solution for 15 months or frozen for 24 months and in variable conditions of preservation.

The antibody cocktail recognized 240 rabies virus isolates obtained from 7 different countries in Latin America, and was shown to be reactive with thousands of isolates belonging to all rabies strains, collected from different animal species in the US, Mexico, the Caribbean, Africa, Asian dog isolates, and various bat lyssaviruses (European, Australian, Central Asia, Russian bats).

This technique could greatly enhance epidemiologic surveillance in remote areas where rabies incidence data are difficult to obtain; it could improve the ability to respond to outbreaks with effective management decisions, and be valuable in guiding decisions regarding rational use of rabies PEP.

A collaboration of CDC and USDA/wildlife services has used dRIT in many states (for testing strange behaving animals, dead animals -not road kills-, road killed surveys, removal from rabies focus, nuisance removed animals), and tested >38,000 samples with dRIT. A strong correlation with DFA results has been shown. The test has been proposed for use alongside with WHO/OIE confirmatory tests.

Training has been already provided in Afghanistan, Cameroon, Chad, China, Ethiopia, Guatemala, India, Iraq, Mexico, Nigeria and other countries. Future development of an integrated international dRIT cocktail is based upon planned PRP collaborations.

A commercial partner to produce biotinylated antibodies is to be found. Future development of an integrated international dRIT cocktail based upon planned PRP collaborations is under consideration.

Research on rabies biologics is continuing. It includes:

- Reverse genetics-recombinant rabies vaccines: these vaccines have shown their non-inferiority, as concerns both safety and efficacy, and may hold promise for future development as oral immunogens for important carnivore species, such as dog.
- Recombinant canine and human/primate adeno-rabies vaccines;
- One health - dual use (human/ vaccines (PV virus, VERO);
- DNA vaccines with modified glycoprotein gene from the ERA rabies virus strain and enhanced effectiveness (Osinubi et al, Vaccine, 2009);
- Plant-based products (e.g. rabies vaccines produced in corn, rice, etc.).



Hormonal contraceptives for animal population management

As part of the CDC program to develop tools for managing animal populations, new immunocontraceptive vaccines are being developed.

- Gonacon™ is an adjuvanted vaccine made of synthetic gonadotropin-releasing hormone (GnRH) linked to a foreign protein. GnRH triggers the production of sex hormones. The immune response neutralizes the hormone's function, resulting in infertility in both males and females. Field trials conducted by the USDA/National Wildlife Research Center have shown that one shot can induce long-lasting infertility.

The CDC is also developing combined vaccines for rabies and immunocontraception. The GnRH coding sequence is inserted within the rabies virus ERA glycoprotein (G) gene, after the Glycoprotein or after the Phosphoprotein gene (Wu et al, Vaccine 2009).

Various baits for oral rabies vaccines for dogs have been tested in Navajo lands, where dog vaccination rates may be as low as 5 to 20%. Bait acceptance was 75% with coated sachets while enrobed sachets had a lower acceptance.

3.3. Dogs and their role(s) in society - Dog population management - Katinka de Balogh

Dogs have various functions in societies and cultures. They are used for hunting, for herding livestock, for guarding, used in rituals (initiation, good fortune), dog racing and betting, dog fighting. They are sledge dogs, waste removers, rescuers, or live as community dogs, pets/family members. They are also a food source in some Asian countries (China, Indonesia), or in particular circumstances (during wars, protein deficiencies).

Rabies control requires a multi-dimensional approach, especially cooperation between the animal and the human health sectors, and an ideal example is the One Health approach.

Public threat from dogs depends on their degree of free roaming:

- Restrained dogs present low public health threats.
- Completely unrestrained dogs (including abandoned and lost dogs) present a medium to high threat to public health. Feral dogs usually roam in garbage areas, near markets and slaughterhouses. They are a rabies reservoir where temporarily unrestrained dogs get contaminated.
- Unrestrained or temporarily unrestrained dogs (owned dog or community dog) present a high threat for public health. They are frequently in contact with their owner and/or the community members and play with children in the community.

These last two groups are the basis of rabies epidemiology in sub-saharian Africa, being both vectors and transmitters. They also transmit rabies to the wildlife.



Dog population control is likely to be introduced in countries that are experiencing different situations regarding the status of rabies including: “rabies free”, “rabies newly introduced”, “rabies outbreaks” or “rabies endemic”.

There are many options for dog population management:

- promotion of responsible dog ownership, which facilitates:
 - birth control
 - tie-up orders (time limit)
 - waste management;
- temporary vs. permanent removal of dogs, which goes through:
 - shelters/pounds
 - adoption programme
 - capture and release
 - elimination of dogs (poisoning, shooting, CO₂, euthanization)
 - no kill policy.

Dog population management is part of the prevention and control programmes, which vary according to local conditions and political commitment. The level of organisation of control programmes varies according to countries, from nothing (Phase 0) to developed programmes (Phase 4), as following:

- Phase 0: no responsible entity for dog population control; no legislation, or if it is available, it is not implemented; no resources (e.g. Sudan);
- Phase 1: no responsibility, some kind of legislation, NGOs active, but with a fairly small impact (e.g. Algeria, Sierra Leone, Bali before 2008);
- Phase 2: legislative framework, often coordinated with rabies campaigns, but with no clear structures and no particular funds; municipalities act, some with some without NGOs, with bad or no coordination (Bali, India, Morocco, Peru);
- Phase 3: clear national rabies control program, legislation (including registering) available; some resources earmarked, some rabies vaccination campaign activities; dogs collected and placed in shelters with dog removal if no adoption, NGO support (e.g. Brasil);
- Phase 4: affluent country model, with substantial resources; dog owners pay; shelters (adoption and removal).

3.4. International Companion Animal Management Coalition (ICAM) report on animal welfare in the Gates funded rabies control projects - Elly Hiby



The ICAM Coalition (www.icam-coalition.org) includes the largest animal welfare NGO funders of humane dog population management programmes and relevant expert groups, the World Society for the Protection of Animals (WSPA) being the coordinator. It participates in the rabies projects funded by the Bill & Melinda Gates foundation, to:

- review activities within the rabies projects with the potential to impact negatively on animal welfare; identify any practices that fall below minimum standards and make recommendations for improvements, and provide training capacity to raise standards where they are below minimum;
- provide advice/training on additional components to improve animal welfare/population management - if requested;
- provide advice/training on data collection methods for indicators relating to dog population dynamics/animal welfare - if requested.

ICAM/WSPA representative was mandated to visit the B&M Gates project sites, develop a report and recommendations, and provide training/additional support as required or requested.

Animal welfare, described as good or high if the individual is fit, healthy, free from suffering and in a positive state of wellbeing, is important to make rabies control practices sustainable and to foster the compliance of dog owners.

ICAM/WSPA developed a set of standards for the practices used in rabies projects to ensure a minimum level of animal welfare. They are based on research into stress and pain responses, national veterinary standards from a range of countries (e.g. the American Veterinary Medical Association - AVMA), and international standards, such as those of the OIE and the World Small Animal Veterinary Association (WSAVA), and the experience in project implementation of the ICAM co-members.

WSPA visited the sites and determined animal welfare standards using a minimum animal welfare standard approach:

KwaZulu-Natal: Visit of the KwaZulu-Natal project showed good respect of animal welfare standards. Standard operating procedures (SOPs) have been written in collaboration with the local Society for the prevention of Cruelty to Animals (SPCA), and cover the majority of practices. Some additional protocols were provided to improve surgical sterilisation used in primary health care campaigns run by the local SPCA.

Tanzania: team leaders receiving training in humane handling techniques (e.g. capture with a net), proper injection and marking techniques as well as euthanasia techniques, support in development of SOPs.

The ICAM Coalition:

- provided training to vaccination campaign team leaders, including:
 - advice on safe and humane handling of dogs (e.g. capture with a net);
 - Proper injection preparation and technique;
 - Marking dogs and post vaccination surveys;



- Humane euthanasia;
- Supported the development of SOPs.

Other visits to vaccinators in the field are planned to review practices and provide refresher training or training to addition staff if required.

Visayas Islands, Philippines: The project carried out in Visayas Islands (Philippines) represented the greatest challenge. The ICAM Coalition worked with the project director to develop a programme to train the trainers utilising local expertise.

Training was required in euthanasia methods, catching techniques, vaccination protocols including handling, pound management and surgical sterilisation techniques including anaesthesia

Role of animal welfare NGOs in rabies issue – current challenges

Animal welfare NGOs provide a valuable resource for national rabies control programs and animal welfare should be a major consideration but in reality it is still a challenge to implement appropriate animal welfare standards in ongoing programs. Governments and NGOs should continue to strive to find ways to work together for the best results.

Since rabies is a public health issue, why are animal welfare NGOs concerned?

Rabies is the leading motivation for killing dogs using inhumane methods. Animal welfare is important to make rabies control practices sustainable and to foster the compliance of dog owners.

Mass culling without vaccination (e.g. China, Flores)

Some countries cull dogs when problem is acute and then vaccinate those who remain. This is not useful, both animal welfare and human health lose. Sudden constraints imposed or registration orders put owners in front of insurmountable problems and lead to animal welfare problems as a result. In addition, they may engender a decrease of human compliance with related initiatives such as rabies vaccination. Theoretically culling should be done humanely, even if it is more costly. Culling creates a lack of dogs and may increase animal movement, including from areas with rabies which in return increases the risk of rabies. The logic of humane removal of dogs is not easily taken on board by the government and requires lots of advocacy, training and information.

Mass vaccination without culling (e.g. Tanzania)

Mass vaccination programs without culling (such as in Tanzania) are great but exceptions. Experts agree this is a great approach - both animal welfare and human health are aligned. Culling is not needed to achieve rabies control, particularly if a very potent vaccine is used, but often both approaches are maintained side by side.

Mass vaccination associated with culling

The issue is more difficult to solve when/if culling and vaccination collide to create effective rabies control. There are examples of success in terms of human health but where the animal welfare costs



has been high - from countries like Malaysia, the Philippines and Indonesia. The definition of culling for WSPA is the mass killing of healthy animals - euthanasia of suspect dogs and unvaccinated dogs that have been in contact with a rabid dog is not only accepted but encouraged.

In Gianyar (Bali), the ICAM Coalition is building the evidence that culling is not necessary and vaccination alone is sufficient to control rabies in owned dogs - also more humane and ethically aligned with the Balinese culture. The evidence alone may not be enough to stop culling.

In Tabanan regency (Bali), 85% of the dog population has been culled using strychnine and threatening people with fines and using anti-dog propaganda until out of fear people agreed to kill their own dogs. In June they will start vaccinating the remaining dogs. It will probably work, and they may use this approach for the rest of the island.

This dog population reduction, however, will only be short term; people have already started to replace the culled dogs, apparently building a healthy dog selling market on the island which is likely to be fed in time by illegally imported dogs from neighbouring infected islands. It has also built a lot of bad feeling and mistrust of the local authorities.

We are left with a few questions:

- If culling using inhumane methods leads to saving human lives is it OK?
- If humane culling methods were used would it be OK?
- What if these humane methods were more costly?
- We have an extremely effective vaccine proven to control rabies without culling, so do we have an ethical obligation to use vaccination in preference to culling when dogs are accessible to vaccination?

The answer to these questions depends on one's ethical standpoint.

However, it is useful to consider these questions as this will lead to differences of opinions on what we define as a 'successful' rabies control. It will also affect how each of us use the word 'humane' when describing a rabies programme -the avoidance of animal suffering and animal wastage when there was another option is required for a project to be defined as humane.

In any case, these differences of opinion should not be considered a reason for conflict between the stakeholders of the rabies movement - we consider ourselves part of that movement - and as such we will work to find truly humane solutions to rabies control that benefit people and animals, in collaboration with the assembled audience and others.

3.5. The Morris Animal Foundation - Paul Rayboud

The Morris Animal Foundation (MAF) was founded in 1948 by a veterinarian; it is the world's largest non profit foundation funding research to protect, treat and cure animals worldwide. Its mission is to improve the lives of companion animals and wildlife by funding human health studies and disseminating information about these studies.



The Foundation supports the research One Health approach for childhood education: “*Learning to Love Dogs Safely*”. This programme brings together veterinary and medical practitioners and students to address the benefit of dogs in children's lives, and aims to reduce adverse events in early childhood (e.g., dog bites) through identification of risk factors and implementation of successful dog ownership. Several partners participate in this programme:

- P&G Live Learn Thrive
- American Society for the Prevention of Cruelty to Animals (ASPCA)
- Children's Hospital of Philadelphia
- School of Veterinary Medicine, University of Pennsylvania
- One Health Kansas at Kansas State University

Phase One Pilot Survey: a web-based survey including 256 veterinarians and veterinary technicians and 85 pediatricians was conducted in the US in the summer of 2009, to assess veterinary and pediatric professionals’ knowledge, attitudes and practices on dog bites provoked by children. Results of the survey indicate that:

- veterinarians are more likely to view dogs as an injury risk to children than pediatricians;
- 98% of the veterinarians and 91% of the pediatricians rated dog bite education as important;
- only 21% veterinarians and 5% pediatricians reported that they received knowledge about dog bites from veterinary or medical school;
- only 15% veterinarians and 4% pediatricians indicated that they follow a formal protocol for educating families about dog bite prevention.

Phase Two: The study will be expanded:

- to demonstrate that the collaborative model employed in phase one can be replicated in other U.S. states;
- to include wildlife rabies in the U.S. and the impact on pet dogs and humans.

The collaborative One Health approach will be used to promote prevention and control of dog bites in a country/region where dog bite rabies is a significant health issue.

Several key performance indicators will be used in the study:

- The number of children reached in classroom settings on dog bite prevention and rabies awareness
- The reduction of dog relinquishment and euthanasia
- The number of veterinary, medical and masters in public health students trained in One Health concepts
- The number of veterinary scientists trained via MAF scholarship and fellowship programs
- The reduction in rabies exposure of children.

6. - Pilot Projects



6.1. Rabies elimination in Bohol 2007 - 2010, Philippines - Betsy Miranda

Bohol is the 10th largest island in the Philippines, part of the Visayas archipelago (population: 1.139 million inhabitants). It is organised in municipalities (47 municipalities/1 city) and villages (called *barangays*, 1,109).

The number of rabies cases has been increasing steadily between 2000 and 2007. With 10 human cases in 2007, Bohol was the province with the 4th highest number of rabies cases. **Between 2006 and 2007, 2.6% of the dogs were vaccinated; and in 2007-2008, coverage increased to 44%. In 2008-2009, 70% of the dog population was vaccinated.**

Objectives and strategies

A 4-year programme was established in 2007, with the objective to eliminate rabies in humans and animals by 2010. The Bohol Rabies Prevention and Eradication Program (BRPEP) is mainly supported by the Bohol Provincial Government, the Alliance for Rabies Control and a Private Swiss Foundation.

The specific objectives were:

- Prevention of human & canine rabies contracted in Bohol
- Improvement of dog management practices & decrease the free-roaming dog population
- Increased educational awareness in all sectors of society
- Reduction by 70% dog bite incidence
- Assure sustainability of the control program

Implementation strategies:

- Social mobilization
- Massive public education campaign
- Dog population & movement control
- Mass dog vaccination
- Dog bite management
- Strengthened surveillance and monitoring
- Promotion of responsible pet ownership in the prevention and control of rabies.

A legal framework was already in place (the Anti-Rabies Act of 2007, a Provincial Ordinance and the national Animal Welfare Act 1998 or AWA). Implementing bodies were established: the Bohol Rabies Prevention and Eradication Council (PRPEC), the Municipal Bohol Rabies Prevention and Eradication Council (MRPEC) and the Bantay Rabies SA Barangay (BRB), bringing together representatives of the Ministries of Agriculture, Public Health, Tourism, Security, as well as representatives of several NGOs.

They were in charge of organisation of:

- Registration of dogs and dog owners and collection of registration fees
- Humane reduction of unwanted free-roaming dogs
- Dog vaccination
- Surveillance of rabies and dog-related incidents
- Settlement of agreements between bite victims and dog owners



- Promotion of responsible dog ownership.

Results

A very large public support was obtained at all levels. ARC advocacy at governor's level was a key driver.

498,000 USD were mobilized over 4 years for the Rabies Programme: 46% from the provincial government, 16% from the national government, 33% from the Alliance for Rabies Control through a donation from a Swiss Foundation, 4% from the WHO country office and 1% from 2 local foundations.

Information and education campaigns were conducted in English and in vernacular languages. More than 1,100 copies of the manual "How to make a Barangay rabies free" were distributed; briefing kits and other rabies information materials on responsible pet ownership were provided as reference in the discussion and for distribution to the barangay constituents during their assemblies, with pet shows and free clinics; over 7,700 village-based rabies watchers were trained. Educational films were presented to school children, their families and to villages. Information was given in schools.

Rabies & responsible pet ownership lessons were integrated in elementary school curriculum. This was piloted during school year 2009. Province-wide integration is ongoing in 2010. Launching of the province-wide curriculum entailed briefing of school heads and turn over of 7,200 copies of instruction manuals to every elementary school teacher province-wide, reaching 182,039 pupils (16% of total population).

Bohol's version of celebrating WRD was highlighted by candle lighting ceremonies and offering of prayers for the dead victims of rabies. This was held simultaneously in elementary schools province-wide on Sept. 26 and was made possible through the issuance of a directive from the Provincial Governor to Department of Education-Bohol.

One of the sustainability mechanisms employed by the program is the collection of dog registration fee, which shall entitle a dog to rabies vaccination, a dog card and tag. This system was started Aug. 2007, undertaken at the *barangay* level, and continues up to the present. Compulsory registration of dogs (and dog owners) was established, which permitted traceability of biting incidents. Revenues from registration fees were shared between the village (50%), the municipality (20%) and the provincial government (30%). Campaigns for dog leashing were conducted. Dog population was controlled through castration and neutering of dogs. Unwanted free-roaming dogs were humanely euthanized. The mode of elimination adopted in the municipalities was based on AWA guidelines. Veterinary quarantine services ensured that only vaccinated dogs with registration cards would enter and leave the province. Mass dog vaccination campaigns resulted in 70% dog vaccination by September 2009, in spite of collection of dog registration fee.



Members of the Rabies Task Force received pre-exposure vaccination, and 5 new animal bite treatment centres were established and health workers were trained; PEP was subsidised by the government for owners of registered/vaccinated dogs.

Laboratory personnel were trained for rabies confirmatory diagnosis; and the case referral system was strengthened. Surveillance and diagnostics: reinforcement of laboratory capacities and creation of a rapid response task force, regular surveys, visits at village level.

The workforce implementing the rabies control programme increased from 124 to 7,991 persons.

The number of rabies human deaths decreased by half in 2008 and no case of human and canine rabies case has been observed in Bohol since January 2009. The bite incident reporting was enhanced (773 in 2005, 1,497 in 2006, 2,906 in 2007, 2,287 in 2008 and 2,276 in 2009). The number of dog bites is now decreasing, and PEP is used more appropriately.

There was a reduction of the free-roaming dog population and wider practices of dog confinement and dog-leashing. This also resulted in a dramatic reduction of dog-related motorcycle accidents on public roads.

The rabies programme is currently incorporated in the *Annual Integrated Area Community Safety Plan*.

Current/future challenges

1. **Achieving “Rabies-free Bohol” by 2010**, with reliable monitoring & surveillance data to prove the presence or absence of rabies in the province;
2. **Maintaining adequate canine herd immunity** (targeted mass dog vaccination to sustain 70% coverage island-wide);
3. **Strengthen animal bite management and improve access to vaccines** (enforcement of PEP subsidy ailment scheme; establishment of additional strategic ABTCs; pre-exposure of children 4-15 yrs old in areas with high biting incidence & emergent rabies cases);
4. **Maintaining community attitude towards RESPONSIBLE PET OWNERSHIP.**

Additional funding has recently been received for maintaining rabies-free status and assuring sustainability of the program. This will be used for:

- Bringing in a CDC expert to test dRIT for diagnosis and surveillance
- Mobile veterinary clinic to use for dog population control
- Field trial on alternative methods for non-surgical sterilization
- Continuing education program

6.2. Opportunities for investing in rabies elimination in the Americas - Fernando Leanes



Most countries in the Americas have eliminated or are on the road to eliminating human rabies transmitted by dogs, thanks to strong national and international political commitments, and PAHO coordination.

In 1983, a PAHO/WHO-sponsored regional programme was launched that helped drastically reduce the incidence of human and canine rabies. In 1984, 268 cases of human rabies were recorded; in 2009, with the improved surveillance and reporting systems, only 16 cases were recorded, 10 of which being transmitted by dogs (>95% reduction).

This achievement is the result of the mass vaccination of dogs, in which all levels of government and society participated. In 2009, 12 Latin America and Caribbean countries (including some limited parts of Argentina, Brazil, Mexico, Peru and Venezuela; Bolivia, Dominican Republic, Haiti, Cuba, el Salvador, Guatemala) had sustained dog-to-dog transmission of rabies with a high risk for humans; the rest of countries of the Americas have a moderate or low risk of human rabies.

PAHO/WHO is preparing a document to assess gaps and opportunities for rabies elimination in Latin America, with the aim of reducing to zero the number of human rabies cases in 2011 (Bolivia and Dominican Republic) or 2015 (Haiti).

The project aims to strengthen country capacities to design, implement and monitor programmes for the surveillance and elimination of canine rabies and to strengthen post-exposure prophylaxis in patients exposed to rabies; it should aid countries to elaborate financial proposals to cover their gaps. The countries should act on the WHO and OIE Code recommendations on effective protection for people who have been exposed, prevention of the spread of canine rabies across borders, the strengthening of monitoring and international reporting mechanisms, and articulation of the alert mechanisms spelled out in the International Health Regulations (IHR [2005]) and the OIE Terrestrial Animal Health Code 2008.

Implementation of the project represents an annual investment of around 20 million USD for 4 years: 70% of funds are raised by countries, 3% by PAHO/WHO and additional funding is to be found. Most programme costs are due to vaccines (48%) and vaccination related costs (17%).

***Discussion:** Progress in canine rabies elimination was acknowledged. It was suggested to invite representatives from Latin America to meetings on rabies in Africa to share their experience.*

6.3. Comparative cost-effectiveness of rabies control in an African city - Jakob Zinsstag

In the framework of a research partnership between the Swiss Tropical Institute (STI), and the National Centres for Competence of Research North-South, the Laboratoire de Recherches Vétérinaires et Zootechniques de Farcha (LRVZ), and the Centre de Support en Santé Internationale au Tchad (CSSI/T), studies were carried out on rabies in N'Djamena, Chad.

N'Djamena, capital city of Chad, with a human population of 775,000 inhabitants in 2001 (993,500 in 2009), is situated on the border with Cameroon; the city serves as the centre of economic activity in



Chad, despite violent civil conflicts. People live in small houses made of mud bricks, with gated yards; roads are unpaved, with open waste dumps.

At the request of Chadian veterinary authorities, the mouse inoculation test was replaced by the standard immunofluorescence test (RIT); and the direct rapid immunohistochemical test (dRIT), which is easier.

Dog-population density in N'Djamena was estimated 0.03 dogs per person (1 dog for 20 persons), for an estimated dog population of ~ 25 000 dogs. There is a low level, endemic, stable rabies transmission among dogs, and from dogs to humans, in the city of N'Djamena. The annual canine rabies incidence was estimated at 1.71/1000 dogs per year. The canine vaccination rate was low (19%) for various reasons, including limited financial resources, absence of transportation, unavailability of vaccination facilities, ignorance and negligence. According to the Chadian law (1961), all roaming dogs should be shot, but the law is not enforced. The effective reproductive ratio estimated from the model was close to 1, indicating that interventions directed at dogs would be feasible and effective in reducing transmission.

A small-scale mass vaccination campaign showed a high community participation, and the vaccination coverage was >70%, and parenteral dog vaccination can probably be recommended. But with an estimated dog population of 15 000-40 000 dogs (with 5-10% stray dogs), is it profitable and cost-effective to vaccinate 25 000 dogs to prevent human rabies?

Available deterministic models of rabies transmission between dogs were extended to include dog-to-human rabies transmission. Model parameters were fitted to routine weekly rabid-dog and exposed-human cases reported in N'Djamena. It showed a stable low-level endemic transmission, with 2 human exposures/rabid dog. The estimated transmission rates between dogs were $0.0807 \text{ km}^2/(\text{dogs week})$ and between dogs and humans $0.0002 \text{ km}^2/(\text{dogs week})$.

The transmission model was used as a tool to assess the cost-benefit and the cost-effectiveness of different interventions in humans and dogs.

A simulation of the effects of mass dog vaccination and the culling of a percentage of the dog population on human rabies incidence showed that a culling policy is less likely to interrupt transmission (particularly for owned dogs) as compared to a mass-vaccination strategy, and socially not acceptable. Among the compared intervention strategies, mass vaccination of 70% of the dog population is the most profitable and cost-effective intervention, sufficient to interrupt rabies virus transmission for 6 years. As effective transmission may occur at a much higher rate than observed, mass vaccination should aim for coverage as high as possible. The addition of transmission from dogs to humans in the deterministic model revealed a critical dependence of human-rabies incidence on the contact rate between dogs, the biological properties of the rabies virus, the pathophysiology of rabies in dogs, and sociocultural determinants of human-dog interaction



Under the current conditions of endemic stability, and assuming a discount rate of 5%, a single parenteral mass dog-vaccination campaign reaching 70% coverage is, on average, profitable after 6 years, and more cost-effective over a period of longer than 7 years when compared to PEP for exposed humans alone.

In the context of N'Djamena, which is comparable to many African cities, combining dog mass vaccination with PEP is within the most cost-effective interventions in public health. There is additional savings if psychological suffering is taken into account, since people suffering psychological trauma become less effective in their work or may abandon their professional activity; this affects not only the patient, but his whole family.

A mode of calculation was proposed, that integrates the burden of perceived psychological distress, the number of patients exposed, time-dependent decrease in suffering (time to wound healing), perceived adequate counselling, and the number of family members and the number of care givers per patient.

A national Conference on Zoonoses will take place in N'Djamena in 2010; negotiations with the Chadian government are under way, research and intervention funds are to be raised.

6.4. Rabies elimination in Europe - Thomas Müller

Thanks to oral rabies vaccination (ORV), wildlife rabies has been eliminated in Western Europe, while reduction of fox populations to control rabies failed. Once fox rabies is eliminated in a given area, re-infection from neighbouring infected countries is a permanent threat. Today the wildlife rabies problem is essentially localised in Russia, Belarus, Ukraine, Moldova, the Baltic States, Bulgaria, Romania, and the West Balkan countries, e.g. Croatia, Serbia, Montenegro, Bosnia and Herzegovina, and Italy. For Albania, Kosovo and FYROM the situation is unclear as surveillance is poor or not existing. Not systematically addressed today is the stray dog problem in certain Eastern European cities.

The EU currently finances projects outside Europe in the following countries:

- Turkey: €13M (2007-2010) for developing a sustained EU-compliant rabies control system (dog rabies elimination and fox rabies elimination using ORV)
- Russia-Kalingrad: €1.8M for ORV (aerial and manual distribution) for 3 years (2009-2011)
- Western Balkans (Croatia, Serbia, Montenegro, Albania, Kosovo, FYROM, Bosnia-Herzegovina): 5 year programs (IPA programme) for the elimination of rabies and classical swine fever (overall budget ~€95M for 5 year period, of which 54.5 M€ will be spent for rabies elimination = ~€10M per year for ORV), financed through EU enlargement funds, will include bait purchase/distribution and campaign monitoring. The IPA programme consists of a national



component with 7 country projects (5 years) and a regional component dedicated to the overall co-ordination (2x2 years).

- Responsible desk officers in the European Commission: Panayiotis DEMETRIOU and Olga ZORKO

The EU co-finances at a level of 50% the costs incurred by its Member States for the purchase of vaccine, bait distribution and laboratory tests (rabies surveillance, bait-uptake, herd immunity) for the monitoring of campaigns. The European financial contribution to ORV programmes in Member States amounted to 7.7M € in 2008 and 10.2M € in 2009.

The EU intends to provide financing for the creation of border vaccination belts along the eastern borders with Russia (other than Kaliningrad), Ukraine and Belarus. Actually no legal basis exists for direct co-financing of those neighbouring third countries by the EU, however, this financing could take place indirectly by including these border activities to the approved ORV programmes of the neighbouring EU Member States and cover vaccine purchase and distribution up to maximum limits.

A big problem is the re-introduction of fox rabies into Italy. Italy had been officially recognised as rabies-free since 1997. But since October 2008, over 270 cases of animal rabies have been confirmed in north-eastern Italy. The first rabies cases occurred in the vicinity of Udine in the Friuli-Venezia Giulia region close to the border with Slovenia, and spread in recent months to neighbouring provinces of Veneto, Trento and Bolzano leading to the need for the implementation of oral wildlife rabies vaccination campaigns in 2009 and 2010.

A request for financing an emergency oral vaccination project in an expanded area has been submitted to the European Commission for 2010 whereas from 2011 onwards EU will provide financing through the eradication programmes procedure as with other Member States. It is hoped that the problem is brought under control rapidly, but there is a real risk of spread into Austria and Switzerland. The vaccination areas will be drastically enlarged in future campaigns.

Following the recent outbreaks, the preventative measures implemented in the affected areas of Italy include compulsory rabies vaccination of dogs and domestic herbivores at risk of infection (i.e. cows, horses, sheep and goats kept outdoors), prohibition of hunting with dogs, enhanced surveillance in the wild animal population and implementation of oral vaccination of foxes. Furthermore, an informative campaign on the risk for the local population, as well as visitors and tourists, has been implemented and a protocol for post-exposure prophylaxis and recommendations for pre-exposure immunisation for individuals at high risk (such as hunters, forest workers, game wardens, veterinarians) have been sent to all healthcare facilities and medical associations in the affected area.

6.5. The Gates rabies elimination projects - François-Xavier Meslin

The WHO Department of Control of Neglected Tropical Diseases has received a project grant of nearly US\$ 10 million to demonstrate the feasibility of, and promote an evidence-based strategy for,



controlling and eliminating human rabies in low-income countries through control and elimination of the disease in the domestic dog.

The demonstration project is carried out in three countries where dog rabies is endemic: KwaZulu-Natal (South Africa), the United Republic of Tanzania (East Africa), and the Visayas archipelago (Philippines).

WHO works in close collaboration with responsible agencies in the three countries. In the United Republic of Tanzania, the Ministry of Livestock Development and Fisheries has a prominent role in obtaining the objectives, while in South Africa, the Department of Agriculture Veterinary Services has the responsibility of coordinating the project with other sectors. In the Philippines, the Department of Health, the Department of Agriculture and the local government units work in collaboration.

The Philippines project

WHO manages funds for the Gates Projects in the Philippines, with the collaboration of the Department of Health, the Department of Agriculture and the local government units. The rabies-free Visayas project was launched recently. Visayas is one of the three island groups in the Philippines (the other two being Luzon and Mindanao), Bohol being part of the Visayas. Almost one-third of the total cases of human rabies in the Philippines occurred in the Visayas region, which has a population in excess of 17 million (19% of the Philippine population). The project, funded by the Bill & Melinda Gates Foundation and coordinated by WHO, is conducted through the collaborative efforts of the Department of Health, the Department of Agriculture, and local governmental units. It aims to prevent human rabies through the control and eventual elimination of canine rabies. The main strategy of the project is based on community participation and relies on increasing dog vaccination coverage while concomitantly optimizing management of humans exposed to rabies. The project also includes promotion of local community involvement in understanding 'responsible pet ownership' as well as increased education on how to prevent rabies.

Summary statements from WHO

Rabies within WHO is one of the 7 zoonoses dealt with as part of the Neglected Zoonotic Diseases (NZDs) platform within the Department of Neglected Tropical diseases (NTD). The NTD Department will soon release its first report on Neglected Tropical Disease which covers 14 conditions including 3 zoonoses: rabies, echinococcosis and cysticercosis. WHO is also revising the 2007 WHO position paper on rabies vaccines. The new version will be published soon and include updated recommendations from the WHO Consultation on Human and Dog Rabies and Prevention held in Annecy, France in October 2009. WHO will also soon issue a monograph on the immunological basis of rabies immunization. Recently the Tropical Disease Research (TDR) programme which is sponsored by the World Health Organization, the United Nations, and the World Bank and also involved in combating major tropical diseases has established in collaboration with WHO/NTD a Disease Reference Group on Zoonoses and Marginalized Infectious Diseases (DRG – ZOOM-IN) which include rabies. The disease reference group ZOOM-IN will synthesize and harmonize relevant research evidence and identify gaps to facilitate priority setting for selected zoonoses (including rabies)



and marginalized infectious diseases of poverty in a report to be published in early 2011, which will contribute to the TDR Global Report for Research on Diseases of Poverty to be released later in 2011.

The rabies situation on Bali is very serious. More than 12 human rabies deaths per million inhabitants have occurred on the Island (total population 3.5 million) since the outbreak was first reported in November 2008. The death toll continues to increase. WHO participated in a workshop organized by the Thai Red Cross (Drs Wilde, Hemachuda, Boonlert and Veera) in January 2010 and in a conference organized by the Australian AID in March 2010 to present best strategies for human and dog rabies control based on WHO recommendations and in line with international animal welfare principles. The local animal husbandry authorities however continue to promote a strategy based on indiscriminate mass culling whilst providing only minimal dog vaccination coverage.

6.6. Gates rabies elimination project report 1Q2010 in KwaZulu-Natal - Louis Nel / (K. LeRoux)

KwaZulu-Natal, located on the eastern seaboard of the South Africa, is one of the smallest (92,100 km²) but most populous (ca. 9,500,000) of South Africa's nine provinces. It extends from the international borders with Swaziland and Mozambique in the north, to the province of the eastern Cape in the south, while inland it is bound by the Free State and Mpumalanga provinces and by Lesotho. The human:dog ratio has been recorded as 6.5:1 in the tribal and informal land areas, and these areas have therefore been targeted for the implementation of activities to control dog rabies. This project is designed to be rolled out to neighbouring regions and countries in order to open up the southern African subcontinent in a massive effort to eliminate canine rabies. Stronger commitments from provincial authorities have alleviated many of the logistic, financial and managerial difficulties in implementing and maintaining successful dog vaccination strategies. External support will help KwaZulu-Natal to exert the final push towards the elimination of rabies in the province.

International status of the project led to the approval of \$1.8M for primary dog health activities in KwaZulu-Natal. Recently, another \$4,1M was approved to include the entire country and neighbouring countries. Rabies control activities consume most of these funds. Submissions of samples are up, surveillance and diagnostics are speeding up and being moved out to other provinces.

To date, 70,000 dogs have been vaccinated (state vets and mobile campaigns) in KwaZulu-Natal. 700,000 doses of Merial's Rabisin have been purchased to be deployed over time. Positive trends emerge where vaccination takes place: positive cases were decreased by 29% compared to 2009 and by 37% compared to 2008 status (447 cases in 2007 vs 334 cases in 2008).

Field trials with 5000 SAG2 oral rabies vaccines are planned.

6.7. Gates rabies elimination project report in South Eastern Tanzania - Sarah Cleaveland



The Gates rabies elimination project sites in the south-east of the country includes the Dar-es-Salaam, Lindi, Morogoro, Mtwara and Pwani regions. It comprises 24 districts and 459 wards, with a population of 6,200,000 humans (based on projections from the 2002 census data) and 400,000 dogs (estimated from specific demographic and geographic dog:human ratios). The project zone exploits natural boundaries to facilitate establishment and maintenance of a rabies-free area. The area comprises a range of cultural settings (coastal, urban, agro-pastoral and pastoral), allowing data to be generated on dog vaccination and rabies surveillance measures in different communities. The Tanzanian site is distinct from the other project sites because it includes a large wildlife-protected area (the Selous Game Reserve). This will allow hypotheses to be examined in relation to the role of biodiverse wildlife areas as buffers against infection, and/or the potential of wildlife as constraints to eliminating canine rabies (considered less likely). The site also includes Mafia Island and Pemba Island, for comparison of the dynamics of canine rabies elimination in island and inland settings.

The major objectives of the project in each area have been defined and implementation is in progress:

a. Objectives and accomplishments

The measurable objectives of the project are to be accomplished through several key activities.

A national coordinator (MoH) and an assistant for the livestock sector have already been recruited.

Objective 1: Collect or estimate baseline/denominator data

- **Collection of baseline data on human population size, human bite injuries, rabies cases and human PEP**
 - A clerk in charge of data collection has been appointed, an office has been equipped, and a database has been established;
 - The Ilala district reported the highest number of human bite injuries;
 - Data collection on dog bites, human rabies cases, PEP and dog population data is ongoing; the project proposal has been elaborated.

- **Collection of data on dog population size, animal rabies cases and submissions for diagnosis, existing GIS data and information on dog movements**
 - Baseline data already available have been analysed, using human:dog ratios for urban, rural, coastal and inland regions;
 - A mobile phone reporting system which sends data directly to central data bank has been developed (linked with Optimus foundation Project) and users have been trained; additional data were collected from all districts using mobile phone reporting system;
 - Data on animal rabies cases and submissions for diagnosis have been compiled, but they are very limited;
 - Geographic Information Systems (GIS) data have been collected; database and maps are available;
 - Some limited data are available on dog movements and location of zoo-sanitary checkpoints.



Objective 2: Improved targeted delivery of PEP

- Standard operating procedures (SOPs) have been prepared and accepted by the Ministry of Health;
- Intradermal regimens have been identified and approved;
- High-risk individuals and groups have been identified for pres-exposure prophylaxis;
- Training has been provided in PEP administration (including ID);
- Biologicals have been procured and distributed.

Objective 3: Implement dog rabies control programmes

- Vaccines have been procured, and data are collected on the dog population, the number of vaccinated dogs, vaccination campaign management and vaccine use;
- The campaign SOPs have been adapted from the protocols developed in the KwaZulu-Natal pilot project. They include the principles, planning, equipment check list, procedures during campaigns (advertising, vaccine storage, transportation, data recording, restraint/handling of dogs and cats, vaccination site/route, age of dogs for vaccination, marking dogs; post vaccination surveys and euthanasia);
- Workshop and training sessions have been held, in vaccination, animal handling, blood sampling, post-mortem sample collection;
- Community awareness was raised through film shows to school children, discussions with district executive directors and events at the community-level;
- Dog vaccination campaigns are starting in high-density urban centres (Dar es Salaam, Morogoro):
 - Epidemiological, logistic and political rationale have been established;
 - Small scale trial campaigns have been carried out (last September, in relation with WRD);
 - Larger campaigns are underway.
- Vaccination campaigns is being rolled out to rural districts (early 2010):
 - Mobile teams are supervised by District Veterinary Officers;
 - Vaccination is in progress in some districts, but it has to face with general problems in planning, budgeting and logistics.

Objective 4: Improve dog rabies surveillance and diagnostic systems

- Equipment needs have been identified; SOPs have been defined and adopted;
- Field and laboratory technician training in diagnostics (FAT and dRIT) is supported by CDC, Atlanta, a private Swiss Foundation, and SOPs are under development; training in molecular methodology is supported by the VLA for senior virologists, with a funding from the Glasgow University;
- Two centers are in place in the area, but still with a huge problem of sample submission, which remains to be increased.

b. Challenges

This project is facing major challenges:



- The One Health Vision and inter-sectorial collaborations are difficult due to political and logistical barriers; personnel from the human and veterinary health sector should build on knowing each other and mutual respect and trust;
- Funding mechanisms and procurement procedures have to be improved, especially at the provincial/district level;
- Key personnel have insufficient experience in implementing dog vaccination campaigns (loss of 'champions');
- Planning with District Vaccination officers (DVOs) is an issue; campaigns were over-budgeted, inappropriate or insufficient equipment was ordered;
- Government resources and commitment are insufficient.

6.8. The Marwar Trust Project - Alexander Wandeler

The Marwar Trust, located in Jodhpur, is an Indian public registered Trust recognized by the Animal Welfare Board of India. It is dedicated to the control of stray dog populations and canine rabies in Jodhpur in order to reduce rabies mortality and improve animal welfare. Since 2004, the Trust has undertaken a high-intensity animal birth control and rabies vaccination program. Teams of dog catchers capture street dogs and bring them to the Marwar Trust shelter, located in the outskirts of the city. Here they are spayed or neutered, vaccinated against rabies, and then receive a distinctive notch in the left ear. After a few days of recovery after surgery, they are released in the location where they were captured. Alongside this programme, the Trust organizes dog-bite prevention and rabies awareness lessons in the local schools. For children that do not go to school, the information is provided on the streets through puppet shows.

To date, 53,100 dogs have passed through the shelter; between 62% and 87% of the street dogs show ear notches. Over 90% of the Jodhpur population knows about PEP, and 10,500 students have been instructed.

However, in spite of the high vaccination coverage, rabies is still present in dogs in the city, and cases of human rabies still occur, though the true incidence is hardly known.

Furthermore, the project is probably not sustainable: problems are funds, missing data (human and animal rabies), and the fact that rabies is still present in spite of high vaccination coverage. This may come from a rapidly growing population, high animal influx and restricted availability of proper PEP.

6.9. Sustaining canine-rabies free zones - Alex Wandeler

Numerous rabies prevention and control projects are time limited and stop when goals are met or funds are used. Sponsors approve a plan that is limited in time, has achievable milestones, and success is usually measured according to achievements of milestones rather than assuring the sustainability and translation into routine disease control activity.

Goals of the projects may vary, including:

- proof of feasibility



- pure research
- operational research
- dog rabies elimination

Projects do generally not foresee a maintenance phase, but rabies control activities need to be sustained, i.e. herd immunity has to be maintained at a level appropriate to the risk of contracting rabies, surveillance and vigilance have to be sustained even when rabies cases go down, development of and compliance with appropriate regulations are still to be ensured, and when successful, rabies efforts are to be exported to neighbouring countries.

Discussion: *Continuous lobbying efforts at government level are needed to create the political will that is required to make dog rabies control programmes sustainable. The barriers in governments and resistance to working together between agricultural and health sectors are still very high and require trans-sectional collaborations, scientific involvement and leadership. Mobilization of resources at community level is equally important to support public and assure control logistics.*

The Bohol project provides a good example of integration of sustainability in the planning. Dog owners have to register their dogs, and the registration fees serve as revolving funding for maintenance of the programme.

It was also noted that projects can be stopped once animal rabies is eliminated, provided the maintenance of a surveillance system. In case of re-introduction of rabies, the project can be re-activated.



Deliverables from Banna 2010

ACTION ITEM	WHO	DATE
Blueprint		
Testing of the Blueprint in various countries <ul style="list-style-type: none"> ○ Ethiopia, Mozambique, Sierra Leone, Kenya ○ Bolivia ○ Israel ○ Philippines ○ Bali ○ Sri Lanka and Asia ○ MEEREB countries (Eastern Europe and Middle East: Croatia, Egypt, Georgia, Iran, Serbia, Turkey, Ukraine) ○ Togo and other AfroREB countries –when French version is available 	LN FL NT BM EH LK BD+PC MW	June 15
Workshops to be held in Haiti/Dominican Republic. Letter of support of the concept from PRP to be sent to PAHO and CDC		
Development of a slide-set for presentation of the Blueprint at meetings	TL, KdB, PC	
Preparation of an evaluation form for workshops and Google analytics and Survey Monkey for feedback on website	PC	
Checking of sustainability section	AW, TM	
Launch on website (English version)		June 15-30, 2010
Translation of blueprint into French to be completed	FAO Bamako	June 30 2010
Translation of <i>"Blueprint"</i> into French = <i>Livre Blanc</i>	BD	
Translation of blueprint into Spanish / Portuguese / Arabic?	KD to talk to EU	
Request for translation of blueprint into Farsi and Turkish [added after the Banna meeting]	(MEEREB/BD)	



Blueprint availability on website to be announced <ul style="list-style-type: none">○ onto ProMed○ onto Wikipedia	DB, KdB LT	