

RABIES

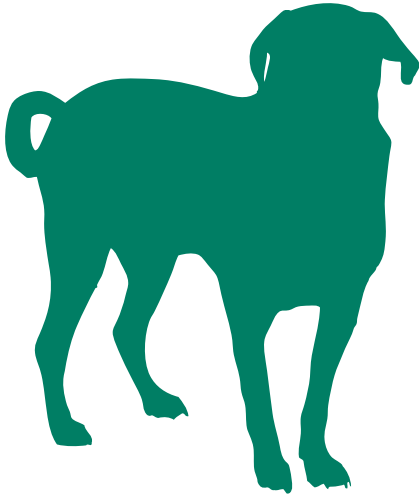


RATIONALE FOR INVESTING IN THE GLOBAL ELIMINATION OF DOG-MEDIATED HUMAN RABIES

RATIONALE FOR INVESTING IN THE GLOBAL ELIMINATION OF DOG-MEDIATED HUMAN RABIES



**FREEDOM
FROM DOG-MEDIATED
HUMAN RABIES IS A
GLOBAL PUBLIC
GOOD.**



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Why investment is needed: key rationale

FREEDOM FROM DOG-MEDIATED HUMAN RABIES IS A GLOBAL PUBLIC GOOD.

Rationale 1: Rabies is a major public health problem that disproportionately burdens poor rural communities

Dog-mediated rabies kills tens of thousands of people every year, many of whom are children (WHO, 2012). The vast majority (99%) of human deaths occur in Africa and Asia where dog rabies is poorly controlled and disproportionately affects poor rural communities where access to appropriate post-exposure prophylaxis (PEP) is limited or non-existent (Knobel DL et al., 2005; WHO, 2013a; Hampson K et al., 2015; Sambo M et al., 2013).

Rationale 2: Rabies is preventable yet continues to kill

Human rabies is a 100% vaccine-preventable disease yet continues to kill. While deaths can be averted by PEP, this intervention alone will never eliminate the disease and costs will only escalate over time (Kasempimolporn S, Jitapunkul S, Sitprija V, 2008; Zinsstag J et al., 2009).

Rationale 3: Dog-mediated human rabies can be eliminated by vaccinating dogs

Rabies is preventable at its source by vaccinating dogs. Elimination of human rabies deaths is achievable by eliminating rabies in dogs through mass dog vaccination campaigns, supported by improved access to PEP (WHO, 2013a). The decline in human rabies deaths closely mirrors the decline in dog rabies cases, and has been shown throughout Latin America and in rabies elimination demonstration projects in Africa and Asia.

Rationale 4: Rabies elimination is feasible

Global elimination of dog-mediated rabies is feasible. Throughout the world, most domestic dogs are accessible for mass vaccination campaigns (Lembo et al., 2010; Davlin S, VonVille H, 2012). Practical guidance is available online and adaptable for different contexts through a stepwise approach framework (FAO, 2012) and training packages (Lembo et al., 2012; GARC, 2015a; GARC, 2015b). While human health services need to take a key role in avoiding rabies deaths, the role of veterinary services is critical in eliminating canine rabies at its source. Control of rabies is an effective showcase for 'One Health'¹ in action requiring effective collaboration between the human and animal health sectors (WHO, 2015a; Lankester F et al., 2014; Bank W, 2012).

¹ Addressing health risks at the interface of humans, animals and the environment that they share through cross-sectoral and multidisciplinary collaboration.

Rationale 1: Rabies is a major public health problem that disproportionately burdens poor rural communities

FOR THE FIRST TIME EVER, COMPREHENSIVE ESTIMATES ARE AVAILABLE ON THE GLOBAL BURDEN AND FINANCIAL COSTS OF RABIES. COSTS TO THE BITE VICTIM ASSOCIATED WITH POST-EXPOSURE TREATMENT ARE VERY HIGH, OFTEN EQUIVALENT TO SEVERAL MONTHS OF LIVING EXPENSES.

Dog-mediated human rabies disproportionately affects poor rural communities, and particularly children (WHO, 2012; Knobel DL et al., 2005; WHO, 2013a; Hampson K et al., 2015). Most human rabies deaths occur in poor rural communities of Asia and Africa where canine rabies remains uncontrolled, and access to life-saving post-exposure prophylaxis (PEP) is limited or non-existent (Hampson K et al.,

2015). Even where PEP is available, animal bite victims from low socioeconomic groups in rural areas commonly experience delays in seeking and receiving PEP at health facilities, which can result in fatal outcomes (Sambo M et al., 2013; Hampson K et al., 2008).

Costs due to livestock losses. Livestock deaths to canine rabies are still poorly quantified but are likely an important loss to impoverished livestock-dependent communities, particularly in Africa (Hampson K et al., 2015).

Rabies PEP imposes a heavy economic burden on bite victims and on the already stretched public health budgets of national governments. The global costs of PEP for prevention of canine-mediated rabies are high, with US\$ 1.7 billion spent annually on direct PEP costs and a further US\$ 1.4 billion incurred through indirect patient costs (travel and lost income) (Hampson K et al., 2015). Costs to the bite victim for receiving a full course of PEP can be substantial, often equivalent to several months of living expenses (Knobel DL et al., 2005). PEP use is highest in Asia, with 27 million courses of PEP administered each year at an annual cost of US\$ 1.3 billion (Hampson K et al., 2015).

Rationale 2: Rabies is preventable yet continues to kill

INVESTMENT IN ELIMINATING RABIES AT ITS SOURCE IS THE MOST COST-EFFECTIVE AND EQUITABLE APPROACH TO HUMAN RABIES PREVENTION.

The toll of rabies is high. The World Health Organization (WHO) estimates 35 000 annual rabies deaths globally for 2000–2012 (WHO, 2015b) and a recent estimate amounts to 59 000 annual deaths (Hampson K et al., 2015). The Global Burden of Disease Study estimated that rabies killed 23 500 humans in 2013 (Naghavi M et al., 2015).

Human rabies prevention should not rely only on PEP. While PEP is effective at preventing human rabies deaths, the approach is costly and can only protect individuals who have prompt access to health facilities with appropriate PEP provision. Even with large expenditure on PEP, tens of thousands of people from impoverished communities are still dying every year in Asia and Africa (WHO, 2012; Knobel DL et al., 2005; WHO, 2013a; Hampson K et al., 2015).

Without investment to control rabies at its source, the costs of rabies will continue to escalate. With increases in human and dog populations across Asia and Africa, the number of people exposed to rabies and the demand for PEP will continue to escalate if canine rabies is not controlled at its source (in domestic dogs) (Kasempimolporn S, Jitapunkul S, Sitprija V, 2008; Zinsstag J et al., 2009).

Vaccination of dogs against rabies is highly effective in preventing human rabies deaths. (Zinsstag J et al., 2009; Fitzpatrick MC et al., 2014). Vaccination of dogs reduces human exposure to rabies. In countries where canine rabies is endemic, the number of human rabies deaths closely mirrors the number of dog rabies cases. Dog rabies cases decline directly in line with increasing levels of dog vaccination coverage (WHO/Bill & Melinda Gates Foundation, 2014a; Vigilato M et al., 2013).

Costs and cost-effectiveness of dog vaccination. While costs vary across different settings and with different delivery models, the potential economic benefits of dog vaccination are far-reaching (Shwiff S, Hampson K, Anderson A, 2013). For example, in Latin America, significant declines in dog-mediated human rabies have resulted from investing 20% of the total costs of prevention into mass dog vaccination at a cost of US\$ 0.11 per person (Hampson K et al., 2015). In Asia, PEP costs are high. Little is invested in dog vaccination and the incidence of human rabies deaths is much higher than in Latin America (Hampson et al., 2015; Shwiff S, Hampson K, Anderson A, 2013). Rabies control through PEP alone was estimated to cost US\$ 46 per DALY (Zinsstag J et al., 2009) averted in Chad. However, a theoretical model suggested that a combined strategy of PEP provision and mass dog vaccination campaigns capable of interrupting transmission of the disease could enhance cost effectiveness to US\$ 32 per DALY averted after 6 years of implementation (Zinsstag J et al., 2009).

Rationale 3: Dog-mediated human rabies can be eliminated by vaccinating dogs

RABIES CAN BE ELIMINATED AT ITS SOURCE THROUGH MASS VACCINATION OF DOMESTIC DOGS.

The benefits of rabies elimination justify investment in rabies control. Prevention of human rabies and control of canine rabies have been successful in champion countries in North America, Western Europe, and parts of Asia and Latin America (WHO, 2013a). The potential economic benefits of rabies elimination through dog vaccination have been demonstrated in several countries, for example in Bhutan (Fishbein DB et al., 1991), Chad (Sambo M et al., 2013), Indonesia (Hampson K et al., 2009) and the Philippines (Morters MK et al., 2013), and justify the investment in rabies control programmes.

Vaccinating 70% of the dog population is sufficient to eliminate canine rabies. Substantial evidence from modelling studies and empirical data indicates that vaccination of 70% of dogs will be sufficient to eliminate canine rabies (WHO, 2013a; Hampson K et al., 2009). This target threshold applies to dog populations across a wide range of settings in Asia and Africa regardless of dog density or ownership patterns (Hampson K et al., 2009; Morters MK et al., 2013; Townsend SE et al., 2013; Rupprecht C et al., 2007; Lapiz SMD et al., 2012).

Comprehensive vaccination across large areas is the most effective approach to achieve elimination. While substantial declines in dog rabies can be achieved rapidly through even small-scale dog vaccination campaigns, rabies elimination requires well-coordinated campaigns that achieve high contiguous coverage across large areas annually. Even small patches of low coverage can delay time to elimination and incur substantial costs (Townsend SE et al., 2013).

Early discontinuation of rabies control programmes can lead to costly re-emergence of the disease. Genetic analyses of the rabies virus have demonstrated several cross-border and long-distance introductions of rabies through human-mediated transport (Hayman D et al., 2011). Continued surveillance and emergency planning are therefore required after rabies has been eliminated from an area.

Regional and global strategies are needed to bolster countries' efforts to eliminate dog-mediated human rabies. The establishment of coordinated networks that work effectively across national boundaries has been critical to the successes demonstrated in Latin America (Lankester F et al., 2014; Vigilato M et al., 2013). Coordinated regional and global strategies are supported by the Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (OIE) and WHO, which have reiterated their shared commitment to eliminating rabies (FAO/OIE/WHO, 2010; FAO et al., 2008; FAO, 2013).

Rationale 4: Rabies elimination is feasible

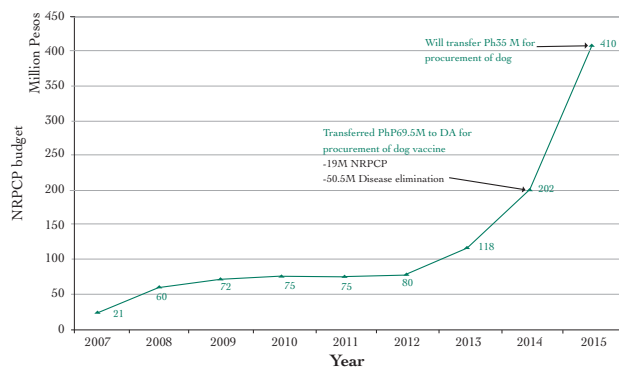
ALL OF THE TOOLS
REQUIRED TO PREVENT AND
ELIMINATE DOG-MEDIATED
RABIES ARE AVAILABLE BUT
NOT IMPLEMENTED WIDELY.

Global elimination of human deaths from canine mediated rabies is possible. The global elimination of human deaths from canine-mediated rabies is achievable by integrating effective strategies of mass dog vaccination with improved accessibility to human preventive measures (dog bite management and PEP). Recent successful outcomes from rabies programmes implemented in the Philippines, South Africa, the United Republic of Tanzania and Bangladesh provide proof of principle that rabies can indeed be controlled and eliminated with currently available tools (WHO/Bill & Melinda Gates Foundation, 2014a; WHO/Bill & Melinda Gates Foundation, 2014b; Director General of Health Services, 2013; Republic of the Philippines Department of Health, 2012).

Applying the One Health strategy is successful and manageable. Elimination of canine rabies is epidemiologically and operationally feasible through mass vaccination of domestic dogs (Lembo T et al., 2010; Hampson K et al., 2009). An integrated One Health approach applied in rabies programmes fills the responsibility gap between health sectors (Lankester F et al., 2014; Nel LH, 2013; WHO, 2015c; WHO, 2015d). Reduction of rabies deaths in Bangladesh (Director General of Health Services, 2013) and elimination of human rabies in KwaZulu-Natal province of South Africa (WHO/Bill & Melinda Gates Foundation, 2014a) were supported by national cross-sectoral committees.

Achieving high vaccination coverage and outreach awareness is possible only by engaging communities and fostering the participation of local leaders. Freedom from rabies has been achieved in nine islands of the Philippines. Success was attributed to the partnership between national agencies (departments of agriculture, health and education) that provide high-level support for rabies vaccination and prevention. The Department of Health has invested in scaling up dog vaccination campaigns (*Figure 1*) and supporting community outreach campaigns implemented by local government units (Republic of the Philippines Department of Health, 2012).

Figure 1 An example of One Health in action (Philippines), 2007–2015. The Department of Health is now providing resources to the Ministry of Agriculture to scale up dog vaccination campaigns within the National Rabies Prevention and Control Program (NRPCP)



Engaging local and political leaders with communities to raise awareness of rabies prevention measures and to change risky behaviour is critical for successful interventions. (FAO et al., 2012; Lembo T et al., 2010; GARC, 2015a; GARC, 2015b; WHO/Bill & Melinda Gates Foundation, 2014b). Paradigm shifts in rabies elimination in KwaZulu-Natal and Bangladesh resulted in efforts focusing on mass dog vaccination instead of reductions in dog population, to effectively interrupt disease transmission and prevent human rabies (Lembo T et al., 2010; Director General of Health Services, 2013). Investment in community engagement supported the efforts of community-based rabies action groups in KwaZulu-Natal and in the large-scale mobilization of communities to implement dog vaccination campaigns in the Philippines (GARC, 2015a; WHO/Bill & Melinda Gates Foundation, 2014b).

Training and participation of local agency personnel and fostering cross-sectoral partnerships to outreach regions are fundamental to generating champions, advancing campaigns and sustaining freedom from rabies. The commitment and engagement of rabies champions has been a critical factor in successful demonstration projects. New champions must be generated to bring campaigns to new areas and to sustain rabies-free status in areas where the disease has been eliminated.



Investment purpose: global elimination of rabies

THE TOOLS, VACCINES AND EVIDENCE ARE AVAILABLE: INVESTMENT FUNDS CAN GO DIRECTLY TOWARDS RABIES CONTROL AND ELIMINATION.

Global freedom from the threat of dog-mediated human rabies is feasible within our lifetime. Many tools and mechanisms are already available to help support countries in their efforts towards rabies elimination and to coordinate regional and global planning. An integrated investment strategy is needed to make this vision a reality. This strategy would combine the expertise of FAO, OIE and WHO as well as other major stakeholders including the Global Alliance for Rabies Control (GARC) with the aims of gaining support from countries and funding agencies worldwide to act through existing international health mechanisms including rabies vaccine banks, reporting systems, control tools, regional frameworks and resources, and of collaborating between the animal and human health sectors (FAO/OIE/WHO, 2010).

Regional rabies vaccine banks have begun to support countries in their control efforts. Support to countries from rabies vaccines banks provides an incentive to engage in and leverage investments, generates economies of scale, limits the need for physical storage of vaccines and provides efficient procurement mechanisms that can speed up delivery to countries in need. The OIE has set up a vaccine bank for dog vaccination, initially in Asia (WHO, 2015d), with funding from the European Union and additional financial support from the Government of Australia. Other funds from the governments of France and Germany have been provided for the procurement of dog vaccines in Africa. WHO now uses this vaccine

bank to procure rabies vaccines for dog vaccination in Southern Africa and the Philippines (Anderson A, Shwiff S, 2013). Some 11.6 million doses of vaccines have been ordered between 2012–2016, of which 7.85 million doses by WHO through the OIE Vaccine Bank.

Coordinated partnerships. Expansion of a coordinated approach among partners for access by all endemic regions to dog and human vaccines and rabies immunoglobulins would facilitate access by pooling bulk purchasing, forecasting of needs, transparency in pricing, and options to involve multiple quality-assured suppliers including public sector suppliers for both dog vaccines and human PEP.

STIMULUS PACKAGES. PROVIDING STIMULUS PACKAGES TO START-UP RABIES CONTROL AND ELIMINATION PILOT PROGRAMMES CAN DEMONSTRATE SUCCESS AND TRIGGER INTEREST AND FURTHER LOCAL OR FOREIGN INVESTMENT.

Stimulus packages would contain provision not only for vaccine but also for capacity building, initiation and planning of local/regional/national programmes and procedures, animal handling equipment, and material for communication and awareness. This stimulus generates demonstration of success and evidence through better data.

Effective reporting and surveillance systems are critical. Surveillance data is critical for evaluating the progress of control and elimination campaigns, but is limited by weak surveillance systems and poor intersectoral communication. Data on human rabies needs to be better captured and presented on the WHO Global Health Observatory (Fitzpatrick MC et al., 2012). OIE Member countries need to commit to reporting animal rabies data through the OIE World Animal Health Information System. Surveillance systems used in Europe could be applied to lower-income settings using appropriate innovations. For example, mobile phone surveillance systems in the United Republic of Tanzania and integrated databases in KwaZulu-Natal have collated information across all sectors (on human and dog rabies cases, human rabies exposures, administration of PEP and dog vaccination campaign data), providing accurate data to track trends and target high-risk areas, while monitoring progress and cost-effectiveness of interventions (Lembo T et al., 2010; GARC, 2015a; GARC, 2015b). OIE Member countries are committed to reporting animal rabies data through the global online OIE World Animal Health Information System. Specific reporting databases in Latin America (Cleaveland S et al., 2006) and Europe (WHO, 2015b) can be expanded to include more countries and serve as a model to replicate in other regions. To measure progress towards the goal of the elimination strategy – zero rabies deaths – reporting systems to record such data are needed and must be included in future implementation strategies.

Rabies control tools. The Rabies Blueprint (GARC, 2015a), Rabies Stakeholder Consultations, health economic models and the Stepwise Approach towards Rabies Elimination (SARE) (Lembo T, others, 2012) are recently developed tools to assist countries with designing sustainable rabies control programmes.

Regional frameworks and resources. Steps towards elimination of dog-mediated human rabies have already been taken by Member countries and by regional groupings such as the Pan American Health

Organization (PAHO), the Association of Southeast Asian Nations (ASEAN) Plus Three, and WHO's South-East Asia and Western Pacific regional offices (WHO, 2013a).

Collaboration between animal and human health sectors. As reiterated in writing in April 2010, FAO, OIE and WHO have formally shared responsibilities and coordinated global activities to address health risks at the human–animal–ecosystem interface under the auspices of the One Health concept. In collaboration with FAO and OIE, WHO's South-East Asia and Western Pacific regional offices have published guidance for establishing functional, sustainable collaboration between animal and human health sectors in countries, focusing on surveillance and information-sharing, coordinated response, risk reduction and collaborative research (GARC, 2014).

Regional organizations, networks, nongovernmental organizations and the private sector. The ASEAN, the South Asian Association for Regional Cooperation, the Southern Africa Development Community and PAHO sustain political commitment for prevention of human rabies in these regions. A number of specialized international agencies and private sector organizations are also contributing to the control and elimination of dog rabies (FAO/OIE/WHO, 2010).

The political landscape supports integrated control. The world's focus has been expanded from poverty alleviation to shared prosperity and from disease-specific goals to universal health coverage (WHO, 2015d). The Sustainable Development Goals recognize more explicitly than ever before the need to tackle inequity and provide health for all (OIE, 2013). The political landscape supports integrated control. For long-term financial investments, the synergy of rabies control and prevention with other health services – such as primary care linked with veterinary delivery systems for prevention – has a great political momentum and potential for optimizing resources to achieve global elimination of rabies.

THE THREE MAJOR INTERNATIONAL ORGANIZATIONS INVOLVED IN RABIES (WHO, FAO AND OIE) AS WELL AS NONGOVERNMENTAL ORGANIZATIONS, ANIMAL WELFARE ORGANIZATIONS AND OTHER PUBLIC AND PRIVATE STAKEHOLDERS ARE UNITING TO REDUCE THE GLOBAL BURDEN OF RABIES.

Role of WHO, FAO, OIE and GARC. To offer a coordinated mechanism to better consolidate fragmented efforts at global, regional and subnational levels, WHO, FAO, OIE and GARC are involved in collating and disseminating expertise and building technical capacity in countries. Recognizing the importance of their collaboration in the fight against rabies (WHO, 2013b, WHO, 2015e, PAHO, 2015) during a high-level technical meeting (Mexico City, Mexico, November 2011), the two UN agencies (WHO, FAO) organizations and the World Organisation for Animal Health (OIE) identified rabies as a priority disease and as a model where the benefits of intersectoral approaches are evident (FAO et al., 2008).

World Health Organization (WHO). To meet the needs of disadvantaged and vulnerable groups, WHO provides leadership for public health development and coordination on rabies elimination programmes to governments, host agencies, NGOs, the private sector and civil society. The Organization also provides technical support to countries, catalyses the building of institutional capacity, sets norms and standards, assesses health trends and works closely with designated collaborating centres in support of its programmes.¹

World Organisation for Animal Health (OIE). The OIE develops standards, guidelines and recommendations for control of animal rabies and stray dog population management based on scientific evidence. The OIE World Animal Health Information System is the global online web-based notification system for reporting rabies in animals. The OIE's Performance of Veterinary Services Pathway, Laboratory Twinning Programme,² Reference Laboratories³ and Collaborating Centres (endorsed by the World Assembly of National Delegates to the OIE) help countries to ensure strengthening of veterinary services, laboratories and surveillance, all of which are key to the successful elimination of rabies.⁴

Food and Agriculture Organization of the United Nations (FAO). The FAO provides technical support for control of animal rabies in numerous countries and supports interministerial, multi-stakeholder country workshops and awareness-raising campaigns. The organization is working with partners on the SARE tool. FAO reference centres for animal health are institutions designated by the Director-General to provide field and technical support to its Member countries for disease prevention or control.⁵

Global Alliance for Rabies Control (GARC). The GARC was established to eliminate rabies by building political commitment through raising community awareness (such as the World Rabies Day initiative); demonstrating and promoting effective practices for reducing rabies deaths; and conducting applied research to address critical gaps in knowledge and resources. GARC also established the Partners for Rabies Prevention in 2008, as a widely representative group of rabies stakeholders and experts who endeavour to support leading public-private rabies control activities across the world (FAO/OIE/WHO, 2010). The 'Rabies Blueprint' conceived by GARC and partners provides standard operating procedures and consolidated information for all aspects of dog-mediated human rabies control and prevention.⁶

1 <http://www.who.int/rabies/en/>

2 <http://www.oie.int/en/support-to-oie-members/laboratory-twinning/>

3 <http://www.oie.int/en/our-scientific-expertise/reference-laboratories/list-of-laboratories/>

4 <http://www.oie.int/en/animal-health-in-the-world/rabies-portal/>

5 <http://www.fao.org/home/en/>

6 <http://www.rabiesalliance.org/>

SUMMARY:

WHY INVESTMENT IS NEEDED



- Rabies is a global public health problem with important socioeconomic impacts.
- Rabies is a poverty-related disease that affects disadvantaged populations.
- Human rabies is preventable; almost all cases are transmitted through the bite of a rabid dog.
- Elimination of dog-mediated rabies reduces cases of human rabies.
- Elimination of human rabies is possible.
- Technical support and tools are available.
- Freedom from dog rabies should be considered a public good, worthy of the investment required for global elimination and a significant contribution towards realizing the Sustainable Development Goals.
- Evidence-based strategies in champion countries have demonstrated the feasibility of rabies elimination by controlling the canine source.
- Improving and maintaining data on important indicators, such as human rabies deaths, dog bites and dog rabies cases is essential to monitor and evaluate progress towards elimination and prevent re-emergence.



How Investment Has Worked: Four Case Examples

The WHO Department of Control of Neglected Tropical Diseases coordinated a proof-of-concept project 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 domestic dogs. Demonstration pilot programmes provide essential strategies for programme implementation and lessons learned to inform the rabies elimination global investment strategy.

WHO demonstration projects: Philippines, KwaZulu-Natal province of South Africa, the United Republic of Tanzania and Bangladesh

THE PHILIPPINES

Introduction

The project included the Visayas islands in the Philippines, which consistently had the highest number of patients with animal bites including the following three regions:

- Eastern region with a human population of 4 101 322 and a dog population of almost 350 075 as well as some of the highest number of human rabies cases in the country.
- Central region has a human population of 6 398 628 and a dog population of 443 596.

- Western Region has a human population of about 6 843 643 and a dog population of 805 378.

Programme goals

- Decrease the number of all rabies cases (human and animal) by 50% by 2016 with the eventual outcome of declaring the Philippines rabies free by 2020.
- Achieve a paradigm shift in strategic planning and implementation of activities in order to generate additional information on the rate of success and to eliminate rabies through dog rabies control.

Programme objectives

- Implement a coordinated rabies elimination programme plan (2012–2016) through mass vaccination of dogs and dog population management in order to:
 - improve surveillance and diagnostics in human and animal populations;
 - control and eliminate rabies in domestic dogs while respecting nature;
 - ensure access to post-exposure prophylaxis to improve targeted delivery of the intervention to exposed patients;
 - foster community engagement through education and training to increase awareness for dog vaccination and responsible dog ownership; and
 - build a strategy to ensure the sustainability of rabies-free status.

Programme implementation activities

The measurable objectives of the project were accomplished through several key activities that include:

- **Data collection, surveillance and diagnostics** on human and dog populations and cases of animal rabies; establishment of a central database system for registered and vaccinated dogs to impound unregistered, stray and unvaccinated dogs; linked the National Rabies Information System (NaRIS) with the Philippines Animal Health Information System (PhilAHIS) to capture dog rabies data in order to maintain a One Health approach.
- **Mass dog vaccination** as the most cost-effective means of preventing and cutting the transmission of rabies.
- **Human vaccination:** Access to PEP vaccine to provide post-exposure treatment to animal bite victims.
- **Education and training** to foster community awareness; conduct information and education campaigns on the prevention and control of rabies; provide opportunities for education of pupils and students on rabies, its prevention and control focusing on Responsible Pet Ownership and early consultation for dog bites and training of doctors and nurses on how to manage rabies exposures.
- **Develop a sustainable rabies-free status** strategy including dog movement and border controls and improved management of dog populations; coordination, implementation, monitoring and evaluation, closely coordinated between project areas.
- **New policies and guidelines** to guide future programme implementers and in expansion sites. Increase in budget support to ensure sustainability of the accomplishments of the project.

Box 2

The Philippines - lessons learned

1. **A strong legal framework is considered as one of the strengths of the programme.** Legal support facilitated implementation of the rabies programme.
2. **Availability of logistics,** personnel and existence of facilities such as Animal Bite Treatment Centres contributed to the increase in the PEP completion rate among animal bite victims. The availability of dog vaccines during summer months ensured better dog vaccination coverage.
3. **Data management is vital to the smooth operation of a project, as well as for rapid responses to new outbreaks.** Requesting and receiving raw data from each region took weeks to reach the project leader. In response to this challenge, a new data management system (NaRIS, National Rabies Information System) for entering human rabies cases and exposures was developed and piloted in the project site.
4. **Politics influence projects and programmes in a variety of ways and need to be considered at every stage.** The programme was affected by the suspension of dog vaccination activities in most project sites during local government elections (the usual vaccination months).

Box 3**Visayas Islands, the Philippines – key programme outcomes****3.1 Increased dog vaccination coverage in all project regions (comparing year 2008 to year 2013)**

Region	2009		2010		2011		2012		2013	
	Number	%	Number	%	Number	%	Number	%	Number	%
Western Visayas	126383	15.75	600942	79.85	640171	78.45	541668	72.88	186180	24
Central Visayas	87655	19.76	112935	28.15	428740	85.99	481993	81.60	178548	29.33
Eastern Visayas	52582	15.02	59818	20.47	140943	52.64	131582	49.15	77797	15

3.2 Decrease number of positive canine rabies cases in all project regions (comparing year 2008 to year 2013)

Region	2008	2009	2010	2011	2012	2013
Western Visayas	108	85	82	32	5	3
Central Visayas	88	55	34	47	35	43
Eastern Visayas	No data	14	4	7	1	3

3.3 Decrease in the number of human rabies deaths in all project regions (comparing year 2008 to year 2013)

Region	2008	2009	2010	2011	2012	2013
Western Visayas	14	14	15	8	3	1
Central Visayas	14	12	13	10	7	2
Eastern Visayas	23	17	12	11	6	1

KWAZULU-NATAL

Introduction

Kwa-Zulu Natal is one of the smallest but most populated of South Africa's nine provinces, with a human to dog ratio of 6.5 humans for every dog in the tribal and unofficial territories. During the past 45 years, this province on the eastern seaboard of South Africa has been battling enzootic canine rabies. Even with appropriate regulations, mass vaccination campaigns, strenuous surveillance and sound veterinary infrastructure, elimination of the disease did not appear to be feasible. This area has therefore been targeted for the implementation of activities to control dog rabies.

Programme goals

- Eliminate human rabies in KwaZulu-Natal
- Decrease the incidence of dog rabies in KwaZulu-Natal
- Achieve a paradigm shift in strategic planning and implementation of activities in order to generate additional information on the rate of success and eliminate rabies through dog rabies control.

Programme objectives

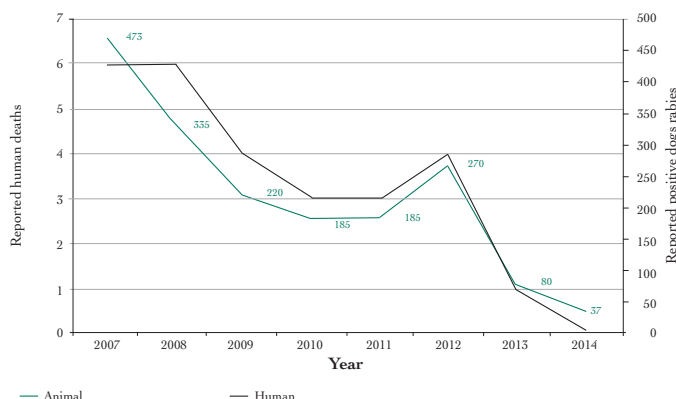
- Improve surveillance and diagnosis in human and animal populations
- Control and eliminate rabies in domestic dogs while respecting nature
- Ensure access to PEP to improve targeted delivery of the intervention to exposed patients
- Foster community participation through education and training to increase awareness for dog vaccination, responsible dog ownership and methods to prevent rabies exposure and infection
- Build a strategy to ensure sustainable rabies-free status.

Programme implementation activities

The measurable objectives of the project were accomplished through several key activities that include:

- **Data collection, surveillance and diagnostics** to centrally store, manage and analyse data on human and dog populations and cases of animal rabies.
- **Mass dog vaccination campaigns** were carried out throughout 2012 and 2013 to reduce the number of rabies cases. A new strategy to follow up unvaccinated dogs was implemented to increase coverage.
- **Human vaccine and management** to provide PEP access to exposed patients.
- **Education and training** to foster community awareness. Rabies action groups established to train and assist in the development, printing and distribution of new educational posters.
- **Training courses** for personnel were developed.
- **Design of a long-term sustainable strategy** for maintaining freedom from canine and human rabies included identification of zones for continued vaccination and control including dog movement and border controls and improved management of dog populations; coordination, implementation, monitoring and evaluation, closely coordinated between the three project areas.

Figure 2 KwaZulu-Natal success in preventing human rabies deaths with the implementation of dog vaccination campaigns, 2007–2014



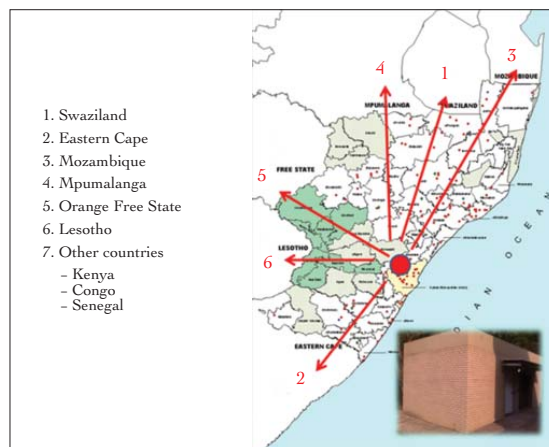
Key programme outcomes

- Human rabies has been eliminated in KwaZulu-Natal (zero cases reported for more than 24 months) (*Figure 2*)
- Databases implementation has increased the availability and quality of human case information, vaccine costs and distribution.
- Data collection estimated the dog population in the province to be approximately 1.2 million.
- Surveillance data collection capacity has increased.
- Strategies are in place to respond to outbreaks.

The project was designed to include neighbouring regions and countries in order to incorporate the southern African subcontinent and as part of a coherent effort to eliminate canine rabies (*Figure 5*). Stronger commitments from provincial authorities have alleviated many of the logistic, financial and managerial

difficulties in implementing and maintaining successful dog vaccination strategies. KwaZulu-Natal has, through the influence of the project, become self-sustaining in its elimination efforts.

Figure 3 Expansion and sustainability of the KwaZulu-Natal rabies elimination project in order of implementation



Box 4

Kwa-Zulu Natal, South Africa programme – lessons learned

1. **Champions are key to initiating and sustaining successful projects.** Once the project is established it needs to be built into the regional programme and become self-sustaining.
2. **Networks of international support (not necessarily financial) play a huge role in influencing local support for such a project.** The names of the Bill & Melinda Gates Foundation as well as WHO have opened up opportunities and influenced decisions at levels previously unavailable to local control efforts.
3. **Successful campaigns require cooperation from all sectors as well as areas of a project site; otherwise gaps can easily lead to outbreaks of re-incursions of the disease.** The no buy-in for mass vaccination campaigns in a few localities resulted in an explosion of cases in those areas. Once vaccination teams were able to reach dogs in the area, the disease was under control within 4 months.
4. **Success resulted from the funding of a small project, showing success and promise uniquely designed for local conditions.** KwaZulu-Natal is now working with all bordering provinces and countries to expand activities and ensure a rabies-free area. This momentum and expansion have created opportunities for future research and improved political support.
5. **Critical resources and attention may be diverted from the project to another disease outbreak if the project is run by a unit with multiple disease responsibilities such as Veterinary Services.** Resources were diverted away from the rabies campaign to manage an outbreak of foot-and-mouth disease.
6. **Securing the transfer and management of funds in developing countries can be complicated and can easily hamper success.** Bureaucracy is one of the biggest challenges to the success of programmes.

UNITED REPUBLIC OF TANZANIA

Introduction

The demonstration programme was implemented in 28 districts in five regions in south-east Tanzania, 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 geographical dog to human ratios (Knobel DL et al., 2005; GARC, 2015a).

The programme was coordinated by the WHO country office, the lead Ministries of Livestock and Fisheries Development, and the Ministries of Health and Social Welfare, and executed in partnership with local government agencies.

Programme goals

- Eliminate human rabies and decrease the incidence of dog rabies in south-east Tanzania
- Prevent rabies transmission by implementing mass dog vaccination

Programme objectives

- Generate data on dog vaccination and rabies surveillance measures in different communities
- Collect incidence of animal bites and human rabies
- Improve the availability and delivery of human anti-rabies PEP
- Raise public awareness on rabies health risks and prevention measures
- Understand the dynamics of canine rabies elimination in island and inland settings.

Programme implementation activities

The measurable objectives of the project were accomplished through several key activities that include:

- **Data collection, surveillance and diagnostics** through a mobile phone-based surveillance system operated across the project area, used by more than 300 health workers and livestock field officers (WHO, 2014a). It generated data on rabies surveillance measures (bite incidence, human rabies deaths, use of PEP and dog vaccination coverage) and identified key indicators for programme evaluation. The system enabled nearly real-time reporting, and monitoring of progress of interventions.
- **Mass dog vaccination** was carried out in all districts under the project during the 5-year period. With sufficient resources, district veterinary officers were able to organize comprehensive campaigns that reached all villages and achieved high levels of coverage, showing the feasibility of achieving good vaccination coverage in areas without previous experience of dog vaccination.
- **Human vaccination** to improve delivery of PEP services in 110 selected health facilities thereby providing free access in remote communities (WHO, 2014b).
- **Education and training** to foster community and public awareness. District and regional officers were trained on handling Standard Operating Procedures, administration protocol for anti-rabies vaccines and rabies immunoglobulin. Selected health facilities participated on supportive supervision, on-site training and feedback-sharing meetings.

Key programme outcomes (Lembo T et al., 2010; GARC, 2015a).

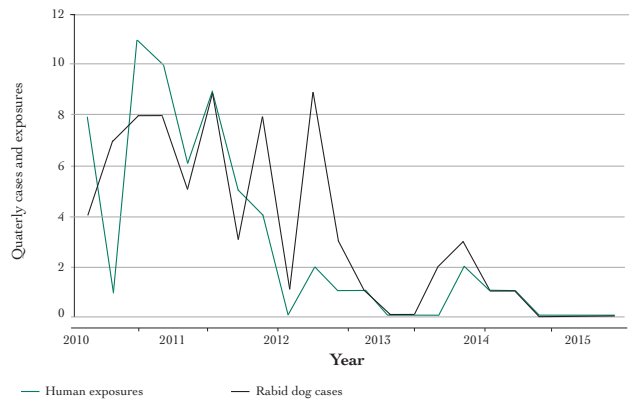
- Elimination of human and dog rabies in Pemba, with zero cases of dog rabies reported since 2014 (*Figure 4*).
- After an initial rise in the reporting of dog bites and treatment-seeking behaviour, the incidence of animal bites decreased notably in those that achieved high levels of vaccination coverage in dogs (> 70%).
- Use of mobile phone-based surveillance with increased availability of data on human rabies

deaths, human exposures, PEP use, and dog vaccination campaign indicators.

- Increased accessibility of PEP, with a much higher proportion of people exposed to rabies now receiving PEP and with a switch to more cost-effective intradermal administration regimens.
- Demonstration of the feasibility of achieving 70% dog vaccination coverage even in remote areas with little infrastructure or previous experience in dog rabies control.
- Development of rabies control activities in adjacent regions beyond the study areas.

The case study provides an example of how a rabies control strategy can be implemented in urban and remote rural areas of sub-Saharan Africa that have relatively weak infrastructure and little experience in rabies control and prevention. The project has demonstrated the feasibility of reaching high levels of dog vaccination coverage and has eliminated canine and human rabies in the island site (Pemba). In most areas, demand for human PEP has reduced as dog vaccination campaigns have progressively improved

Figure 4 Cases of dog rabies and human rabies exposures in Pemba Island, United Republic of Tanzania, 2010–2015; dog vaccination campaigns were first implemented in 2011



and are controlling dog rabies. The project has also identified key indicators for programme evaluation and developed new methods to measure these indicators.

Dog bites are the main source of rabies virus infections for human rabies cases. Therefore, continued mass dogs vaccinations are planned to continue to reduce the spread of rabies.

Box 5

United Republic of Tanzania – lessons learned

1. Enthusiastic and committed local leadership is key to success. 20 out of 25 districts successfully increased the number of dogs vaccinated, and at least 9 districts exceeded 60% of dog vaccination coverage. In those areas, committed district veterinary officers have been able to mobilize, organize and implement routine dog vaccination campaigns in their communities.
2. Successful implementation of dog vaccination campaigns generates new champions. It is widely perceived that achieving high levels of vaccination coverage is difficult or impossible in African communities. However, the feasibility of successful implementation becomes apparent once practitioners and communities become engaged, with success generating new champions to perpetuate campaigns.
3. Catalytic funding is critical to overcome initial barriers to implementation. Once in place, success can breed success. A National Rabies Control and Elimination Strategy (NARCES) has been developed to catalyze elimination plans and efforts in neighboring regions throughout the United Republic of Tanzania.
4. Dog vaccination campaigns need to cover all communities. Gaps in dog vaccination can lead to costly delays in disease control and elimination. In Pemba Island, as soon as mass vaccination was adopted across villages, the number of rabies cases rapidly declined. Effective organization and advertising of campaigns is critical, with re-evaluation of requirements (such as dog vaccine doses) as programmes progress.
5. Centralized administration and implementation of dog vaccination campaigns can be costly. Careful planning and budgeting of campaigns is needed, particularly in relation to staff time and travel expenses in the field. Campaigns involving high levels of community participation and/or NGO partnerships are likely to be the most cost-effective.
6. Implementing rabies control measures is likely to improve rabies surveillance. Poor levels of rabies surveillance have often been considered a hindrance to national control programs and act as a barrier to implementation. However, through this project, an innovative mobile phone-based system to support the national surveillance system was found to stimulate reporting of rabies cases and rabies exposures in a cycle of positive reinforcement.
7. Rabies elimination can occur quickly. As shown in Pemba, rabies elimination can be achieved rapidly through effective dog vaccination campaigns, but measures need to be in place to prevent the re-introduction of new cases.

BANGLADESH

Introduction

Rabies occurs throughout Bangladesh, placing the entire human population at risk. Rabies predominantly affects the rural poor and marginalized populations. Given the lack of awareness of rabies and the high cost of medical treatment, victims of animal bites often seek ineffective treatments, and access to PEP is inequitable. In 2010, around 2000 human deaths were due to rabies. In response, Bangladesh launched a canine rabies elimination programme, which aims to reduce human deaths and eliminate the disease, and adopted a national strategic plan for the elimination of rabies by 2020.

Programme goals

The programme uses dog bite management and mass dog vaccination to reduce the incidence of human rabies deaths.

Programme objectives

To implement a coordinated human rabies elimination programme through mass vaccination of dogs and dog population management thereby reducing human deaths by 90% by 2015 and eliminating the disease by 2020.

Programme implementation activities

The measurable objectives of the project were accomplished through several key activities that include:

- **National Rabies Survey.** A survey was implemented in 600 cluster areas, with 300 households in each for a total household sample of 180 000 to determine dog population numbers, bites and cases.

- **Mass dog vaccination.** Mass dog vaccination was initiated in 2011 in combination with local capacity building and knowledge transfer, with the aim of completing three rounds of vaccination in a phased manner to interrupt the dog transmission cycle, eliminate rabies and remove the need for human rabies prophylaxis. Mass dog vaccination was carried out in 58 of the 64 districts over the subsequent 2.5 years.
- **Prevention control centres.** National Rabies Prevention and Control Centre national dog-bite management centre in Mohakhali, Dhaka where 350–450 daily dog-bite patients receive anti-rabies vaccine free of charge; District Rabies prevention Control Centres – 65 centres established in 64 districts providing dog bite management facilities that provide free anti-rabies vaccine and rabies immunoglobulin.

Key programme outcomes

- Rabies deaths have decreased by around 50% between 2010 and 2013.
- Increased availability of free vaccines and rabies immunoglobulin at centres in all 64 districts of the country.

Box 6

Bangladesh rabies elimination case example - lessons learned

1. Elimination of rabies through mass dog vaccination is more cost effective than indefinite dog bite management and provision of PEP. There are an estimated 1.2 million dogs in Bangladesh, resulting in an estimated cost of US\$ 3.6 million to complete three rounds of vaccination per year. It is expected that the cost of PEP will continue to rise unless rabies is controlled at source. If rabies is not eliminated through mass dog vaccination, the cost for dog bite management will be incurred indefinitely.
2. Impactful changes are accomplished by rabies champions in endemic countries. Funding for rabies control has been provided by the Ministry of Health and Family Welfare (MoHFW) and the Ministry of Local Governance. MoHFW allocated US\$ 0.1 million for mass dog vaccination in 2013–2014. Of note are the local champions in Bangladesh who convince political leaders, policy-makers and stakeholders for political commitment and technical leadership and partnership for this mission. Previously, the MoHFW funded human rabies prophylaxis and ownership for dog rabies control was lacking. In the current elimination programme, the MoHFW has played a crucial role in promoting mass dog vaccination and dog population management.
3. Revised recommendations for PEP increased the overall long-term cost-effectiveness of rabies vaccines. Before the launch of the rabies elimination programme in 2010, Bangladesh produced 60 000–70 000 courses of nerve tissue vaccine (NTV) annually at a cost of around US\$ 120 000 (no longer recommended by WHO). Subsequently, PEP recommendations in Bangladesh were revised to indicate the use of intradermal vaccine in combination with rabies immunoglobulin in line with WHO position¹, and PEP is provided for over 200 000 people annually. This change resulted in annual costs for human treatment of US\$ 2.1–2.6 million. While the cost of vaccination has subsequently increased, there is an acknowledgement of the high indirect cost of the administration of NTV due to lost working days and additional costs incurred from visiting the clinic for treatment for 10 consecutive days. In addition, many people abandon NTV treatment due to the length of treatment and the side-effects including pain. NTV can only be stored for 6 months, compared to the 2 years for the vaccines now administered. This increases the overall long-term cost-effectiveness of the intradermal rabies vaccine.

In addition, the Ministry of Local Governance and Rural Development has been funding activities, and there is mobilization of domestic resources for the rabies elimination programme.

¹ WHO position papers are available at : <http://www.who.int/immunization/documents/positionpapers/en/> accessed September 2015.





#rabies

Summary results of case examples

PROGRAMME SIMILARITIES AND DIFFERENCES

All programmes had similar health impact goals that included:

Decreased number of human and dog rabies cases

All programmes had focused implementation activities in almost all of the following implementation activity areas:

- Data collection, surveillance and diagnostics
- Dog vaccination and management
- Human vaccine provision and bite management
- Education and training
- Long-term rabies elimination sustainable surveillance strategy.

Box 7 shows successful programme outcomes:

Box 7

Four case examples – Results Flow Logic (HKIS, 2015)

(P) – Philippines, (KZN) – KwaZulu-Natal, South Africa, (T) – United Republic of Tanzania and (B) – Bangladesh

Health impact

Behavioural change, e.g. increased access to health services or reduced risk factors

- Positive dog rabies cases reduced (KZN), (P), (T)
- Dog bite victims seeking PEP for dog bites decreased (T)
- Dog vaccination coverage increased (B),(P), (KZN), (T)
- Use of more cost-effective intradermal administration regimens increased (T)

Long-term outcomes

- Data collection, surveillance and diagnostics
- Dog vaccination and management

Intermediate outcomes

Knowledge, attitudes and skills change

- Community awareness of human and dog rabies and dog ownership improved (KZN)
- Dog bite reporting increased (KZN), (P)
- Human PEP delivery improved (KZN), (P), (T)
- Human and dog surveillance data collection capacity increased (KZN), (T)

Short-term outcomes

Reach, engagement and relationship building

- Collaboration maintenance strategies with neighbouring provinces in place (KZN), (P), (T)
- Community engagement through education and training increased (KZN), (T)
- Data and database implementation access and quality increased (KZN), (T)

HEALTH IMPACT SUCCESS STORIES FROM CASE EXAMPLES

PHILIPPINES

HUMAN RABIES DEATHS HAVE DECREASED IN ALL PROJECT REGIONS

- Long-term, intermediate and short-term rabies outcomes were reported.
- Programme objectives and activities focused on all implementation activity areas, including data collection and surveillance, dog and human vaccine and management, education and training, and long-term rabies-free sustainable strategy.

KWAZULU-NATAL

HUMAN RABIES HAS BEEN ELIMINATED WITH ZERO CASES FOR MORE THAN 24 MONTHS

- Short-term, intermediate and long-term outcomes were reported at all levels of influence and in all implementation activity areas (data collection and surveillance, dog and human vaccine and management, education and training and long-term rabies free sustainable strategy). This programme had the most comprehensive amount of activities, outputs and outcomes of the four case examples; perhaps because the apparent broad and nimble coverage of all key activity implementation areas and levels of influence provided the necessary outcome linkages to achieve the elimination of human rabies for more than 20 months.

UNITED REPUBLIC OF TANZANIA

HUMAN AND DOG RABIES HAS BEEN ELIMINATED IN PEMBA WITH ZERO CASES OF DOG RABIES SINCE 2014

- Long-term, intermediate and short-term rabies control and prevention outcomes were reported.
- Programme objectives and activities focused on all implementation activity areas, including data collection and surveillance, dog and human vaccine and management, and education and training. No human and dog rabies cases have been detected in Pemba for more than a year highlighting the feasibility of eliminating rabies entirely. The considerable reductions in bite incidence shows how well implemented dog vaccination campaigns can reduce the public health burden of disease. Moreover this programme has highlighted how 70% dog vaccination coverage can be achieved even in remote areas with little infrastructure or previous experience in dog rabies control, and the potential for improving rabies surveillance by implementing rabies control activities.

BANGLADESH

HUMAN RABIES DEATHS DECREASED BY AROUND 50% BETWEEN 2010 AND 2013

- Programme objectives focused mainly on mass dog vaccination and dog population management to reduce deaths and eliminate rabies.
- Comparatively, although its objectives focused on two main areas, Bangladesh implemented broader activities relating to data collection, human management, education and training, although activities relating to long-term rabies free sustainable strategy were not reported.

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RABIES: THE FACTS



VIRUS TRANSMISSION



Saliva of infected animals



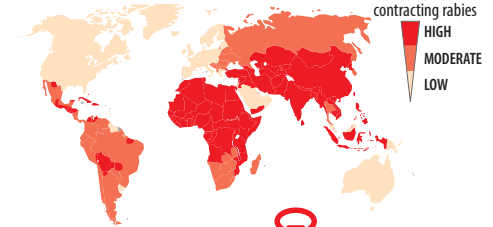
99% of human cases are caused by **dog bites**

The virus attacks the brain
Rabies is **fatal** once symptoms appear



FATALITIES

Rabies affects **poor rural communities** mostly in Asia and Africa



About **One death** every **15 mins**



40% of the victims are children younger than 15



TREATMENT



Thorough washing of the wound with soap, and, vaccine injections can avoid symptoms and **save lives**.
Seek immediate medical care if bitten.



HOW TO PREVENT RABIES TRANSMISSION FROM DOGS?



Raise public **awareness**

Learn **dog body language**



NO DOG BITE = NO RABIES

VACCINATING DOGS SAVES HUMAN LIVES

Rabies is 100% preventable



Vaccinating **70%** of dogs **breaks rabies transmission cycle** in an area at risk

Every dog owner is concerned



28 September

• World Rabies Day •

#rabies



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