

Reaching the zero by 30 dog-mediated human rabies goal



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It is unacceptable that as we advance into the 21st century rabies is still a threat to humans and animals alike. Given public health interventions that focus solely on disease prevention in humans have no effect on the reduction of infection in the reservoir hosts, the most effective way to combat human rabies infection is to control the disease transmission by mass vaccination of the animal source, e.g. dogs and wildlife¹. This short communication focuses on the global strategic target to end human deaths from dog-mediated rabies by 2030² in line with the Sustainable Development Goals by providing recent updates on World Health Organization (WHO) and OIE guidelines³⁻⁵ and recommendations as well as highlighting Australian rabies research activities to prevent an incursion of rabies into the country.

Dog-mediated rabies and the regional situation

Dog-mediated rabies is the cause of ninety-nine percent of the 59 000 human rabies deaths annually with the greatest burden being in India and across Africa⁶. Australia has been free of the dog rabies virus variant, although Australian Bat Lyssavirus is maintained in native bats, and has spilled over to horses and people⁷⁻⁹. Travellers to endemic dog-mediated rabies countries should consider the risk of being exposed to the deadly virus and if necessary seek medical advice about pre-exposure prophylaxis rabies vaccination^{10,11}. This risk was sadly evident last year when a 24-year-old Norwegian woman died from rabies having been infected by a puppy she rescued while holidaying in the Philippines. This tragic case highlights the importance of rabies awareness for travellers and communication of preventative measures to reduce

the risk of being bitten or scratched by infected animals especially dogs, and appropriate treatment to follow if exposed³.

Dog-mediated rabies is an ancient, neurotropic viral disease that should already have been eliminated globally given the tools to control and prevent the disease have been available for decades¹². More recently, following the development of the global framework to eliminate dog-mediated human rabies and leadership by the tripartite alliance (WHO, OIE and FAO) and Global Alliance for Rabies Control (GARC), many countries are implementing a multi-sector approach to progress rabies control and elimination. Practical inter-sectoral linking has been successful in the Philippines with 15 island and localities becoming rabies free zones¹³. Additionally, multi-stakeholder national rabies prevention and control committees have supported implementation of national programs.

Only Singapore remains rabies free within the ASEAN region following the reintroduction of dog-mediated rabies to Malaysia during 2015 and 2017 from neighbouring endemic countries. Bali (incursion 2008) continues to progress control of dog-mediated rabies despite challenges in maintaining high dog vaccination coverage across the island^{14,15}. Responsible dog ownership has been highlighted as a key element of National Rabies Elimination programmes in the OIE terrestrial code for rabies although the contribution the control of dog populations plays in dog-mediated rabies elimination remains unknown.⁵

International organisations and updates to rabies guidelines

The WHO Technical Report Series on Rabies No. 1012 released in April 2018, provides new recommendations for pre- and post-exposure prophylaxis, with reduced doses and timing in immunocompetent people^{3,16}. Updates on rabies surveillance are included and cross matched with the revised OIE code on infection with rabies virus⁵. Integrated bite case management is promoted with communication processes developed between human and animal health sectors leading to rapid responses and tracing of infected animals and exposed people. Strengthening of human and animal health systems is necessary to deliver activities of national rabies elimination programs, although often these become less prioritised given competing health emergencies. The WHO and OIE are supporting countries to assess and strengthen their One Health

capacity to deliver zoonotic control programs through Joint External Evaluations (JEE) and IHR–PVS (International Health Regulations–Performance of Veterinary Services) National Bridging Workshops.

The newly introduced progression of countries from endemic rabies to elimination of dog-mediated rabies by implementation of sustained mass dog vaccination programmes and validation and verification of the absence of human deaths from rabies for 24 months was included to support countries reaching zero human deaths. Mexico recently obtained WHO recognition for eliminating dog-transmitted human rabies as a public health issue, adding to evidence that virus transmission can be stopped through mass dog vaccination campaigns.

The OIE Terrestrial Code and Manual for Rabies have recently been through cycles of revisions with the primary tests for rabies diagnosis being direct fluorescent antibody test, direct rapid immunohistochemistry test (dRIT) or lyssavirus polymerase chain reaction assays (PCR) from appropriate brain samples of suspect rabid animals^{4,5}. This testing currently occurs at the Australian Animal Health Laboratories (AAHL) in Geelong for any suspect cases in Australia. Rapid tests (lateral flow devices) are being used in the field to assist in diagnosis although these have variable sensitivity and specificity^{17–19}. Additionally, oral vaccination of dogs is now considered a useful supplementary measure to increase vaccination coverage in the dog population

where necessary²⁰. The requirements for inactivated and oral rabies vaccines have been revised and updated to be in line with WHO, EMA and FDA provisions. The code chapter on rabies now distinguishes between a country and zone free from infection with rabies virus and from dog-mediated rabies. There is also a new Article on OIE-endorsed official control program for dog-mediated rabies (Article 8.14.11) and for surveillance (Article 8.14.12)⁵.

Given no clinical signs or gross post mortem lesions are pathognomonic for rabies, laboratory diagnosis is necessary for suspect case confirmation²¹. To assist neighbouring countries to improve the diagnosis of animal rabies the Australian government supported the development of an immunoperoxidase antigen detection test that could be used in provincial laboratories without the need for expensive fluorescent microscopes²². The AAHL has also been building capacity regionally in phylogenetic analysis of rabies viruses to better understand the molecular epidemiology of rabies outbreaks which is especially important during the final stages of dog-mediated rabies elimination. Figure 1 illustrates the different wildlife associated lyssaviruses that may also be circulating in some countries and that can spill over into humans²³.

Australian rabies research building surveillance capacity

With dog rabies spreading into eastern Indonesian islands, and only 300 km from northern Australia shores, pre-border biosecurity and

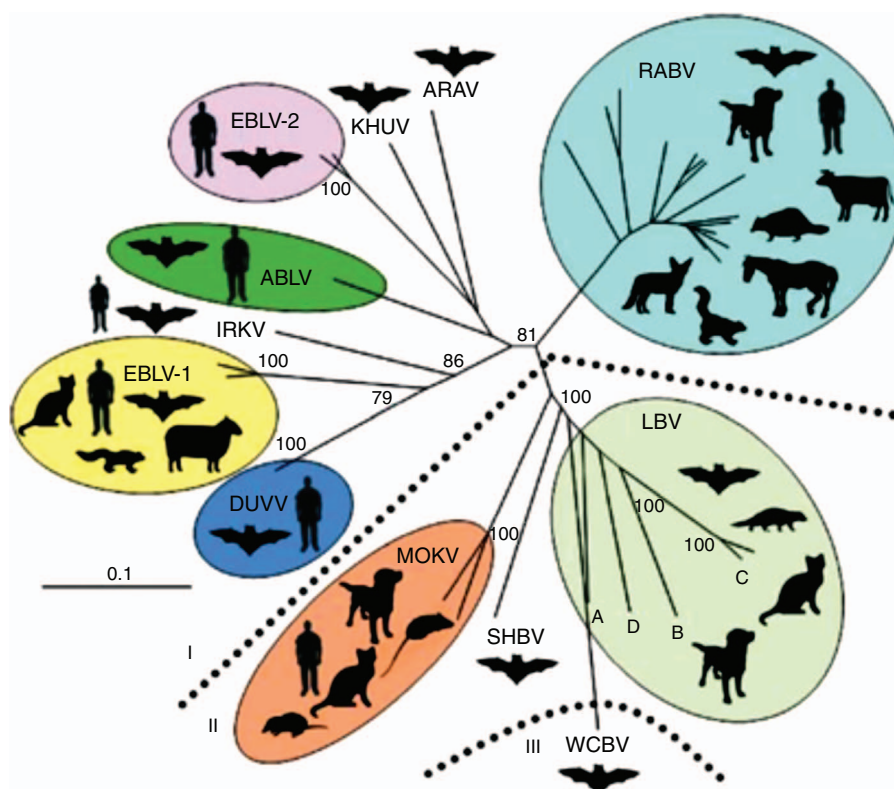


Figure 1. Phylogenetic analysis of lyssavirus isolates with animals found naturally infected circled. Roman numerals refer to antigenic phylogroups²³.

active surveillance programs are essential to prevent or rapidly identify an incursion²⁴. Risk assessments have focused on estimating the probability of a rabies-infected dog on fishing or recreational boats entering illegally into northern Australian remote indigenous communities and Papua New Guinea^{25,26}. Large numbers of owned dogs are free-roaming in these remote communities therefore research has investigated the roaming behaviour of these domestic dogs (using GPS tracking collars) to better understand interactions to enable modelling of a rabies incursion and interventions^{27–29}. More recent modelling assessed targeted rabies vaccination strategies in different dog populations associated with roaming behaviour³⁰. Currently, the optimal rabies population vaccination coverage is seventy percent to achieve herd immunity and prevent virus transmission. The modelling of targeted rabies vaccination strategies based on the roaming behaviour of the dogs (directly associated with risk of rabies transmission) has indicated that lower vaccination coverage may be feasible which is beneficial when rabies vaccines are in limited supply as well as being more cost-effective³⁰.

AUSVETPLAN rabies and Australian bat lyssavirus

Australia's national rabies and Australian bat lyssavirus (ABLV) preparedness and emergency response plan (AUSVETPLAN)³¹ are currently under review with a joint technical workshop recommending the updated manuals be combined. This is because an emergency response following an outbreak would be strategically similar and require a coordinated response between the public human and animal health agencies. Given the risk of a rabies incursion in northern Australian indigenous communities and the cultural and social importance of dogs and dingo hybrids in these communities, it is recommended that community appropriate strategies for biosecurity responses to an incursion be developed and incorporated into these manuals³².

Reporting of potential rabies cases in these remote indigenous communities requires awareness of the disease and participation in this surveillance, which in-turn requires communities to perceive a need for this surveillance³³. Qualitative studies have explored sustainable community-based surveillance for rabies in these communities and noted the importance of traditional communication channels and direct conversation with valued animal-management services. To communicate rabies risk pathways awareness the Northern Australia Quarantine Strategy (NAQS) have produced an animated video (white paper funded project)³⁴ for use in community health clinics and schools in northern Australia. Figure 2 shows a diagram from the video illustrating the possible entry points of



Figure 2. Diagram from Northern Australia Quarantine Strategy rabies risk pathways awareness video showing possible entry points of infected rabid dogs on illegal fishing or recreational boats³⁴.

infected rabid dogs on illegal fishing or recreational boats. The video also promotes awareness about telling a ranger or biosecurity officer about any dogs from boats that are behaving strangely (hypersalivation, paralysis, lethargy, abnormal aggression, abnormal vocalisation). Data on the incidence of dog bites is also important to monitor.

Conclusion

The correlating updates on rabies guidelines by WHO and OIE will greatly support the zero by 30 goal and prevention of rabies incursion. Australia's pre-border biosecurity has successfully facilitated continued freedom from dog-mediated rabies. Ongoing research has built capacity in rabies surveillance and risk assessment and in additional has supported our neighbours in dog-mediated rabies control and, hopefully, eventual elimination.

Conflicts of interest

The author declares no conflicts of interest.

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Biography

Dr Andrea Britton is an experienced One Health professional with a strong background in epidemiology, public health and emergency disease preparedness and response. She has global experience with dog-mediated rabies control and eradication as Non-Executive Director for Vets Beyond Borders an Australia non-government organisation and as program officer for OIE (World Organisation for Animal Health) in the southern African region. As a veterinarian with a Master of Public Health degree majoring in Epidemiology, she has a keen interest in developing programs for the prevention and control of zoonotic diseases using a One Health approach. Andrea participated in the revision of WHO Expert Consultation in Rabies (third edition) and the development of the global dog-mediated human rabies elimination framework for ZERO human deaths by 2030. She has presented internationally in India, Argentina, Canada and South Africa on rabies control and elimination.

Did you know?

Point of care testing in Australia began during the first outbreaks of plague in Sydney (1900 and 1902) and Brisbane (1902).

Medical officers called to visit suspected patients equipped with a kit containing syringes, platinum wire loops, culture tubes, spirit lamp and glass slides so that cultures and smears of pus and blood could be made at the bedside.

Sydney's waterfront, wharves, buildings and nearby houses were filthy and rat infested. Large areas were quarantined, rat catchers set to work and buildings were demolished. Infected persons and healthy people living in the same house were transferred to the Quarantine Station at North Head, now known as Q station and well worth a visit if you are visiting Sydney.