

Current status of the Rabies and Prevention Strategy in Taiwan

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Abstract

Rabies is an acute viral encephalomyelitis that kills almost 100% of animals or humans. Once symptoms of the disease develop, rabies is nearly fatal. There is no effective cure, though vaccination can keep rabies at bay. An estimated 70,000 people worldwide die from rabies each year, 95% of them from a bite or scratch of dogs, and wild carnivores are crucial hosts of rabies as well.

In 2013, a ferret-badger was identified as the first confirmed case since Taiwan started rabies surveillance of wild animals, injured or dead, in 2012. As of the end of February 2020, there have been 816 positive cases of ferret-badgers, one puppy dog, one musk shrew, and nine masked palm civets. Most of them are found in the mountain areas, distributed in 89 townships of nine cities/counties.

The most efficient and economic approach to rabies prevention is vaccination of dogs and cats: a vaccination rate of over 70% can effectively break rabies transmission cycle at its source. Taiwan's current endeavors focus on raising dog/cat vaccination rate and lowering dog/cat exposure to wild animals, thus containing the disease in the wilderness. In addition, to minimize human rabies, measures are in place to offer pre-exposure prophylaxis shots for high-risk persons and prompt access to post-exposure prophylaxis for people sustaining any bite/scratch from suspected animals. Other actions include enhancing animal surveillance, management of cats/dogs, intensifying vaccine stockpiles, border control, scientific researches and international collaboration.

Taiwan's Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ) is actively engaged in this anti-rabies campaign on all fronts: working with local animal disease inspection authorities to achieve a 70% vaccination rate nationwide, active-and-passive surveillance of animals (domestic or wildlife), survey of ferret badger population and habitats, studies of rabies positive rate and cross-species transmission. Meanwhile, BAPHIQ has utilized

multi-pronged approach to contain rabies to ferret badgers only: developing oral vaccines, and routes of administration, specifically against ferret badgers rabies. BAPHIQ aspires to contain rabies in one species and to eventually eliminate the disease.

Mid- to long-term strategic plans

Measures taken by Taiwan's Rabies Central Epidemic Command Center have proven to be quite effective. Since the first confirmed rabies case in early July of 2013, there have been no dog/cat epidemic or any human case; only ferret badgers have been found to carry the virus. Now, the epidemic has subsided, thanks to prompt crucial measures like raising pet vaccination rates, setting up buffer zone, minimizing potential spread of rabies to dogs/cats, increasing accessibility to vaccines at more designated vet clinics. However, the virus is likely to co-exist with Taiwanese people for a long time to come. It is time for authorities to scale down their short-term, responsive measures and resume normal operation while formulating mid- to long-term strategic plans to prevent rabies.

1. Sustained rabies surveillance

- 1.1 Surveillance of animals: passive surveillance is initiated upon called-in tips from the public about road-kills or someone bitten by a suspected rabid wildlife; active surveillance on dogs/cats has been conducted in the ground-zero community; active surveillance on wildlife is enhanced, such as survey of ferret badger population distribution, density, life style, and rabies prevalence rate, and the likelihood of cross-species transmission. Such findings would contribute to adjustments in rabies prevention strategies.
- 1.2 Surveillance of humans: watching for potential rabies infection in humans, such as that caused by organ transplant; moreover, monitoring people's exposure to high-risk rabid animals, and management including wound treatment, vaccination and recovery status.

2 Campaign for dogs/cats vaccination

Taiwan has continued to promote over-90% vaccination rate in dogs/cats in high-risk areas like the ground-zero community and indigenous tribal lands. Also, a target of 90% vaccination rate was set for the nine cities/counties with symptom-free ferret habitats to build up a buffer zone. For other areas, the authority is working

with veterinary practitioners to strive for over-70% of dogs/cats getting rabies shots. Authorities have stepped up enforcement and fines against owners failing to vaccinate their pets.

3 Management of dogs/cats

Global experience shows rabies control campaigns go beyond vaccinating dogs/cats: the success lies in responsible owners and zero abandoned pets as well as smart ways to handle stray animals. Their management involves incorporating lessons from around the world and continued communication with local animal welfare groups to forge consensus conducive to best practices.

Long-term strategies for dogs/cats management are as follows:

- 3.1 Culling at the source: organizing neutering campaigns around rural areas to stem reproduction at the source; offering incentives for owners to come forward for pet registration and neutering.
- 3.2 Raising owner awareness: Educating owners to be more responsible; organizing volunteers to conduct frequent and in-depth audit at the community level; engaging veterinary clinics to promote pet registration.
- 3.3 Fostering animal welfare NGOs: Setting up an evaluation platform -- through consultation, support, training and assessment -- to cultivate private animal shelters that set benchmarks for animal welfare services
- 3.4 Leveraging veterinary expertise: engaging veterinary professionals through city/county vet associations to provide vaccination, chip implant, neutering, and registration and audit while educating pet owners to be more responsible. These efforts are essential to follow-up booster shots and pet status tracking.

4 Protection of humans against rabies

- 4.1 Post-exposure vaccination: Based on rabies epidemic status and MOHW's Advisory Committee on Immunization Practices (ACIP) guidelines, we updated a list of recipients for rabies shots and post-exposure prophylaxis (PEP). Post-exposure vaccination has been paid for by Taiwan's

National Health Insurance scheme. The local government could regularly designate hospitals for rabies vaccination service according to people's needs of animal biting/scratching incidents. Considerations are also required for designated hospitals to be equipped with capability to provide emergency services to handle animal biting, transportation and storage of refrigerated vaccine, and management of medical staff training.

4.2 Pre-exposure vaccination

High-risk people should get pre-exposure vaccination to minimize the probability of having rabies infection. Based on the World Health Organization (WHO) guidelines, the term "high-risk people" refers to lab staff handling rabies virus and relevant tasks, workers on bats or carnivorous wildlife (for disease prevention or survey of wildlife or forestry), long-term visitors or inhabitants engaging in outdoor activities in high-risk areas; especially children because they are likely to come in contact with animals but unable to articulate the incident after a bite, thus requiring pre-exposure shots against the peril.

During the short-term response stage, 3500 persons were identified – by central and local authorities -- for pre-exposure shots to minimize on-job risk of rabies infection. Such immunization efforts would continue in the mid- to long-term campaign stages. The Centers for Disease Control of the MOHW continues to remind high-risk groups of relevant ministries to regularly receive the pre-exposure rabies shots.

5 Upgrading Lab capacity

5.1 Animal-origin specimen

With subsidy funding, local-level initial-screening labs have been set up at university veterinary schools and research institutes. The Animal Health Research Institute (AHRI) is responsible for confirmation of animal-origin specimens after testing positive at local labs in human-victim cases, and development of rabies epidemiology and inspection/diagnosis

technology. AHRI is poised to set up -- with US CDC assistance -- animal serological surveillance scheme to gain insight into efficacy of oral vaccines. AHRI has a close collaboration with the OIE reference laboratory of ANSES-Nancy laboratory for rabies and wildlife to enhance ability of rabies diagnosis.

5.2 Human-origin specimen

Taiwan's CDC is getting support from foreign counterparts to upgrade technological expertise and staff competency. The bio materials of standard rabies virus strain and cell culture are transferred from AHRI in 2016. In 2017, CDC dispatched staff members to Japan's National Institute of Infection Disease (NIID) for personnel training and discussions on bilateral cooperation. Taiwan's CDC Laboratory also obtains higher testing throughputs with staff training abroad or locally under foreign advisors.

6 Enhancing a stockpile of vaccine

6.1 Animal vaccine

Inventory check is conducted quarterly to gauge the need for additional importation to meet domestic demand. There is a reserve of 250,000 newly purchased doses based on the quantity dispensed on dogs/cats this year (the ground-zero area, indigenous mountain lands, and the nine cities/counties where symptom-free ferret badgers are found). Safety-level to trigger the next purchase is 150,000 doses.

6.2 Human vaccine and prophylaxis

The usage amount and inventory check of Human Rabies Immune Globulin (HRIG) after rabies exposure is set quarterly to gauge the need for additional importation to meet domestic demand.

In addition, post-exposure rabies shots have been covered by the National Health Insurance scheme to ensure comprehensive protection of persons sustaining bites/scratches from high-risk animals.

7 Research and development

7.1 Animal trial

7.1.1 Research into genetic analysis results of Taiwan's rabies virus

The rabies virus strain found in Taiwan's ferret badgers has been identified as a sub-species independent from those found elsewhere. Foreign experts suggested that we promptly figure out virus pathogenicity in original hosts and rabies prevalence in Taiwan's ferret badger population. The study begins with quantitative study of lab mice's median lethal dose in order to estimate pathogenicity at various dosages on ferret badgers. Baseline data – such as symptoms and infectious material in saliva – are collected for developing their oral vaccines. Further animal trials are planned to explore the pathogenicity and symptoms on dogs infected with rabies virus from ferret badgers. Such knowledge would greatly enhance the efficacy of rabies prevention endeavor on the part of veterinarians and the public.

7.1.2 Compliance with the 3R principle

The animal trials design will adhere to the 3R principle (reduction, replacement and refinement) on animal welfare and be reviewed by the institutional animal care and use committee before announcing to the public.

7.2 Assessment of wild-animal oral vaccine

7.2.1 Extra caution required: there have been reports of successful control of wildlife rabies spreading using oral vaccine. However, such live attenuated vaccines require careful assessment for safety ensuring. Given the international experience a timeframe of 10~12 years to see the results, this approach calls for long-term government commitment of money and human resources. Therefore, extra caution is required before proceeding with this approach.

7.2.2 Adopting WHO rules: Taiwan intends to start assessment of oral vaccine while heeding WHO rules and experiences from other countries. The tasks would

incorporate active surveillance on wildlife to analyze -- specifically for ferret badgers -- oral vaccine's palatability, proper dosage, safety, and efficacy. There will be ancillary studies on safety to non-target animals and humans, total dose dispensed, locations, timing, result monitoring, and ecological impacts.

7.3 Epidemiological study

Active and passive surveillance on dogs/cats and wild animals are on-going. Cages have been deployed in three sampling areas (Taitung, Nantou and Miaoli counties). The first batch was harvested on October 7 for analysis of wildlife population distribution, density, natural behavior, rabies prevalence, and whether more animals have been affected besides ferret badgers. The findings, along with gene sequencing of rabies virus, would contribute greatly to epidemiological study.

8 Capacity building

8.1 The Council of Agriculture is to organize various conferences for expertise sharing.

8.2 The Ministry of Health and Welfare is to work with medical associations of each specialty to conduct on-job trainings.

8.3 College curriculum is to include rabies control for future health care and veterinary personnel.

9 Public awareness campaign

Campaigns to raise public awareness are incorporated into ministry-level annual plans.

10 International collaboration

We continue to follow rabies-control guidelines set by the WHO and World Organization for Animal Health, also known as OIE, when engaging in knowledge exchange -- abroad or in Taiwan -- with global experts to formulate rabies prevention strategies and assessment of oral vaccines.