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# 2015 Outbreak of Canine Rabies in Malaysia: Review, Analysis and Perspectives

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## Abstract

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Rabies is an acute fatal zoonotic encephalitis caused by a Lyssavirus belonging to the family rhabdoviridae responsible for about 69000 deaths annually. In July, 2015 Malaysia lost its rabies free status due to an outbreak of canine rabies that started from Perlis state and later moved to Kedah and Pulau Pinang states of Malaysia. This study was carried out to review available data on rabies and determine the incidence of rabies during the outbreak, the susceptible population of dogs, the number of dogs culled, the number of dogs vaccinated and lessons that can be learned from the outbreak using data principally from the OIE and other public domain sources. Statistical calculations employed chi square analysis at 95% confidence level using SPSS version 22. The incidence of rabies was 0.10% (CI= 0.05%, 0.18%). There was significant difference ( $P<0.0001$ ) between the number of cases, number of susceptible dogs, number of dogs destroyed and number of dogs vaccinated between the 3 states in Malaysia with Perlis having the highest number of cases, Kedah having the highest number of susceptible dogs, Pulau Pinang having the highest number of culled dogs but with the least number of vaccinated dogs and Kedah having the highest number of vaccinated dogs. Perlis had the highest number of cases followed by Pulau Pinang. Kedah with the highest number of vaccinations recorded only 1 case of rabies. There was no case of human rabies despite numerous dog bite cases during the outbreak. The proximity of the 3 states especially Perlis to a rabies endemic country must have led to the outbreak of the infection. Mass vaccination of dogs along with short term targeted culling is important in stopping rabies outbreaks. Territories within close proximity to endemic locations must maintain more surveillance against transboundary diseases like rabies. Post exposure prophylaxis is necessary immediately after exposure to rabies to prevent human infection.

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**Keywords:** Rabies, outbreak, public health, canine, human, Malaysia.

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## Introduction

About 75% of infectious emerging diseases affecting man today are of animal origin and 60% of these diseases are considered zoonotic in nature (Bueno-Marí *et al.*, 2015). Rabies is a highly fatal old (at least 4000 years old) zoonotic disease caused by a bullet-shaped Lyssavirus capable of affecting all warm blooded (mammals) animals with mortality reaching almost 100% after onset of clinical signs or symptoms (Sparkes *et al.*, 2014; Taylor and Nel, 2015; Lankester *et al.*, 2014). This disease now kills more than 69,000 people every year most of whom are in Asia and Africa (Mähl *et al.*, 2014; Lankester *et al.*, 2014; Taylor and Nel, 2015). Previously uncorroborated anecdotal reports of rabies in birds over 50 years ago (Paarmann, 1955; Nikolitsch, 1956) have now been supported by clear evidence of natural occurrence of rabies in a chicken in India (Baby *et al.*, 2015) adding a new dimension to the epidemiology and public health implications of the disease.

Rabies has been known to occur in Malaysia since 1884 but there were no records until 1924 when records started to be kept of rabies cases in Malaysia. The first major outbreak of rabies in Malaysia in recorded history was in the former Province of Wellesly (now Seberang Perai in Pulau Pinang state) and Perak in 1945 (Ganesan and Sinniah, 1993). During the major outbreak of 1945 a large number of allied forces brought with them dogs from endemic Burma (Myanmar) into Peninsula Malaysia and introduced the disease to the local dog population and for the first time Selangor was also infected in 1952 (Lim, 1998). Rabies was eradicated from Malaysia in 1999 after the last human case in 1998 and last dog case in 1999 prompting the World Association for Animal Health to declare Malaysia rabies free in 2012 (Ganesan and Sinniah, 1993; Lim, 1998) and since then there was no major outbreak until the recent outbreak.

“The Animal Act 1953” of “The Laws of Malaysia Act 647” which has now been amended with “The Laws of Malaysia Act A1452 Animals Amendment Act 2013” makes provision, *inter alia*, for the coverage of special issues relating to dog

rabies including (a) licensing (section 38) (b) handling of rabies-infected areas (section 39) (c) culling or detention of any animal suspected to be infected with rabies (section 40) (d) detention of any dogs that have bitten a person (section 41) (e) administering of anti-rabies vaccines in dogs (section 42) (Parliament-Malaysia, 2013). This usually becomes very important in the face of an outbreak like the recent.

The recent outbreak of rabies in Malaysia that started in July, 2015 and was resolved by November, 2015 after a lot of mass vaccination of dogs and culling of stray dogs has a lot to teach the scientific community and policy makers. This study was conducted to elucidate from the author’s perspective what happened during the course of the outbreak, the number of rabies cases in dogs, the control strategies employed and what lessons can be learned from the outbreak using reliable data from public domains.

## Materials and Methods

The secondary data in this paper are from the Office International des Epizooties (OIE) via the WAHID interface (Jebara *et al.*, 2012) and other publicly available verifiable sources. Based on the available information in the public domain tables were created to tabulate the information. The information and data from the news media were not as detailed as the one from the OIE. Because of the dearth of scientific literature on rabies in Malaysia, the author would also be citing credible news sources and online sources from within and outside Malaysia. There were wide variations in the exact number of cases of rabies in Malaysia during the outbreak with the news media giving statistically significantly higher numbers with some news outlets putting the number to be at least 42 positive cases as of 09/10/2015 (Naidu, 2015; Mok, 2015) compared to the 10 cases submitted to the OIE in the final report dated 28/10/2015. But the author has chosen to use the lowest figures which are the official figures submitted by the Department of Veterinary Services of Malaysia (DVS) to the OIE and available on the public domain and compare them with the figures given by the media to the world. The OIE figures are considered more

scientifically valid because they are reported by scientists who have an obligation to notify the OIE about disease outbreaks involving animals and who were in the forefront of containing the rabies outbreak.

### Statistical Analysis

Some publicly available data was considered for chi square statistical analysis at 95% confidence level using SPSS version 22 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.).

### Results

Figure 1 shows the states in Malaysia with an emphasis on the proximity of the rabies infected states to Thailand. The summary of data from the rabies outbreak as presented to the OIE is shown in the table (Table 1). The summary of the data as

presented in most media outlets is shown by 2 representative media company data available on public domain (Table 2). There was statistical difference between the number of susceptible dogs, cases, number of dogs destroyed and vaccinations between the different states in Malaysia affected by the outbreak based on the data presented to the OIE, with Kedah having the highest number of susceptible dogs, Perlis having the highest number of cases, Pulau Pinang (Penang) having the highest number of destroyed dogs and Kedah having the highest number of vaccinations. There was significant statistical difference between the number of cases and number of dogs destroyed based on the data given by the media. The total number of cases and number of dogs destroyed as presented to the OIE and the ones supplied by the media were statistically different when compared: with the number of cases higher as given by the media and number of dogs destroyed lower as given by media.

**Table 1:** Summary of outbreak information for the 3 states as obtained from OIE.

Location	Susceptible	Cases	Destroyed	Vaccinations
Perlis	1838	6	302	1838
Pulau Pinang	3946	3	2224	1722
Kedah	4567	1	2047	4597
<b>Total</b>	<b>10351</b>	<b>10</b>	<b>4573</b>	<b>8157</b>

Data source (OIE, 2015a);  $P < 0.00001$ .

**Table 2:** Summary of outbreak information for the 3 states as given by the media.

Location	Cases	Destroyed
Perlis	20	299
Pulau Pinang	4	1711
Kedah	18	1693
<b>Total</b>	<b>42</b>	<b>3703</b>

Data source: ChannelNewsAsia and The Malay Mail Online (Naidu, 2015; Mok, 2015),  $P < 0.00001$ .

### *Geographical Trends of Rabies in Malaysia*

Throughout Malaysian rabies history almost all cases of rabies outbreaks in Malaysia have been confined to the East coast and West coast of Peninsular Malaysia. In the 2015 outbreak three

states were declared rabies infected and they included Perlis, Kedah and Pulau Pinang states which are all on the northern region of the west coast of Peninsular Malaysia and not too far from Thailand which is endemic for rabies.



Fig. 1: Map of Peninsula Malaysia.  
source: www.wikipedia.org

### *Weekly Trend of Outbreak*

The Department of Veterinary Services of Malaysia (DVS) on 3<sup>rd</sup> November, 2015 declared that the outbreak which started on 27<sup>th</sup> July, 2015 and was confirmed on 4<sup>th</sup> August, 2015 had been resolved and was now over but Malaysia would have to wait another two years to get a rabies free status from the World Association for Animal Health (OIE). The outbreak was declared over in the three affected states considering the expiration of three times the considered 14 days incubation period of the virus in dogs. It was reported that from the day the infection was confirmed to 31<sup>st</sup> October, 2015 a total of 11, 298 dogs had been vaccinated with 32, 319 awareness campaigns carried including house to house visits (Bernama, 2015c). The cases were diagnosed using Direct Fluorescent Antibody Test (FAT) and Reverse Transcription PCR (RT-PCR) at the Veterinary Research Institute (VRI) Ipoh, Perak, Malaysia. The following measures were applied in response to the outbreak by the DVS: Movement control inside the country, Screening, Vaccination in response to the outbreak (s), Disinfection / Disinfestation, Traceability, Quarantine, Surveillance outside, containment

and/or protection zone, Official disposal of carcasses, by-products and waste, Surveillance within containment and/or protection zone, No treatment of affected animals (OIE, 2015b). Perlis outbreak started on the 27<sup>th</sup> July, 2015 with 1 case and 1 death dog owned by an owner and was resolved by 18/09/2015 after a total of 6 cases involving stray dogs. Pulau Pinang case started on 09/09/2015 and was resolved by 17/09/2015 involving all 3 cases of stray dogs. The outbreak in Kedah started and was resolved on 12/09/2015 involving a case of a stray dog. The apparent morbidity was 0.10% and proportion of susceptible dogs lost through death and culling was 44.18% from the final report submitted to OIE on 28/10/2015 (OIE, 2015a). From this it is clear that the incidence of rabies in Malaysia is less than 0.10%, making eradication easy with concerted efforts at mass vaccination of all dogs (stray and owned).

### *Outbreak Hypothesis*

Malaysia has an immune belt zone around the border territories with Thailand covering 50 to 80 Km from the Thailand border. The outbreak in

Perlis and Kedah were hypothesized to have originated from neighbouring Thailand by land movement. But the outbreak in Pulau Pinang was hypothesized to have originated by sea through fishermen boats and sea vessels (OIE, 2015a). Considering that there were no outbreaks of rabies in East Malaysia (Sabah and Sarawak) and other states not bordering the immune belt zone it may be justified to consider this hypothesis to hold true. This is supported by a previous report in another state on the 1996 outbreak which suggested that infection was brought into the state of Terengganu, which had never had rabies before then, from Thailand via dog on fishing boat into coastal villages between November 1995 to June 1996 (Loke *et al.*, 1998; Townsend *et al.*, 2013).

### ***Awareness Campaigns***

These campaigns helped a lot in creating awareness about the disease and encouraging the public to vaccinate their dogs against rabies. The campaigns were carried out in public and private institutions, communities, house to house, radio, TV, internet, handbills, posters and various other means of disseminating information to the people not only in the three affected states but all over Malaysia including East Malaysia (Sabah and Sarawak). These campaigns sensitized the public to the outbreak of the disease and encouraged them to take necessary steps for their protection and that of their pets. In some cities hundreds of pet owners lined up at Veterinary centers with their pets to receive the anti-rabies vaccine which was made freely available in the face of the emergency outbreak.

### ***Control and Prevention Tactics and Controversies***

The drastic steps to control the outbreak of rabies in Malaysia involved culling of stray dogs as much as possible. This strategy though effective in the short term but in the long term mass vaccination to achieve at least 70% herd immunity would be a more humane and effective control strategy (Coleman and Dye, 1996; Putra *et al.*, 2013; Clifton, 2010). The culling of stray dogs generated controversy and mass protests by animal lovers and welfare activists around the country especially in

Pulau Pinang state. The main concern of the activists was what they perceived as the indiscriminate culling of stray dogs instead of a mass vaccination of all dogs against rabies. The rabies-infected order 2015 which was given on 15/09/2015 was lifted on 09/10/2015 about a month after the first outbreak was reported (Sue-Chern, 2015).

### ***Human Rabies in Malaysia***

About 131 years ago a little known Louis Pasteur came to limelight as a national hero in France when he implemented a protocol that saved the life of a child, Meister, who had been severely mauled by a rabid dog which in those days was a death sentence (Lankester *et al.*, 2014). This protocol was later used and modified over the years to save many lives and now rabies is a preventable human infection if postexposure prophylaxis is administered as soon as possible after exposure to the bite or saliva of a rabid dog before any onset of symptoms of rabies which may include fever, hydrophobia, pruritus and pain at site of bite involving itching, headaches and other non specific symptoms (Jackson, 2013). The Milwaukee protocol developed by Rodney Willoughby in 2004 and successfully used to treat a case of clinical rabies has witnessed more failures than success after it was developed but may still be worthy of trial as a last resort in dying patients (Aramburo *et al.*, 2011; Mohan *et al.*, 2014; Report, 2012).

One of the earliest reports of human exposure to the rabies virus in this outbreak were 8 people bitten by 4 suspected rabid dogs in July, 2015, of which 2 dogs were later confirmed to have rabies by August, 2015 and victims were treated as outpatients (Promedmail, 2015). By 11/09/2015 a 53 year old woman in Kedah state was bitten by her own dog which tested positive for rabies triggering alarm about possible transmission of rabies but she was treated with anti-rabies human vaccine and was scheduled for 4 doses of the vaccine which is a common standard medical procedure in Malaysia for such cases (ProMED-mail, 2015). By the 09/10/2015 the Kedah state health department had reported 70 dog bite cases of exposure to humans (Chow, 2015). In the latest outbreak there was no case of human rabies as prompt drastic control measures undertaken and post-exposure prophylaxis

(PEP) averted any human infection in the population in spite of many cases of bites by suspected rabid dogs reported. A total of 409 cases of people bitten by dogs in the affected states during the outbreak was recorded (Anon, 2015).

### ***General Discussion and Recommendation***

The total number of cases in the present outbreak was similar to the one in 1996 and 1997 where there were 12 and 10 cases of rabies in dogs in Malaysia respectively (Lim, 1998). The outbreak was restricted to states around the Thailand border like in most previous outbreaks (Lim, 1998; Ganesan and Sinniah, 1993). This is so because bordering an endemic country is a risk factor for rabies due to the propensity to move animals from across the border without adequate precaution or illegal transportation of dogs across the border (Taylor and Nel, 2015; Ganesan and Sinniah, 1993; Keling, 1975). Logically Kedah which had the highest number of susceptible dogs also had the highest number of vaccinations going beyond the susceptible dog population. This was the last state to report an outbreak of rabies and resources were mobilized from within and beyond the state to stop the outbreak including mass vaccinations and culling of stray dogs. This also explains why there was only 1 official case reported to the OIE from this state. The experience garnered from controlling the first set of outbreaks in Perlis and Pulau Pinang came into positive play in Kedah state. However, there is a discrepancy with the figure from the media which showed Kedah worse affected with cases than Penang. The figure from the DVS submitted to OIE appears to be more reliable considering the antecedents of the media to be highly sensational and alarmist in their reporting of deadly disease outbreaks such as rabies and ebola in many other countries (Fritz, 2015).

Perlis was the first state to be hit by the rabies virus and had the highest number of cases because of the initial delay in reporting cases and in taking action against the disease. The initial public health response was said to have been slow in coming (Promedmail, 2015). The initial delay may be multifactorial as the re-emergence of the rabies virus after a period of rest in Malaysia took almost everyone by surprise. Perlis is the smallest state in

Malaysia and probably the closest, considering its size, to Thailand which is highly endemic for rabies and this may explain why it was the route of entry for the virus into Malaysia and had the bulk of the cases before it spread to other states. This is further confirmed from studies of another transboundary disease of brucellosis, where Perlis was found to also have the highest prevalence (Bamaiyi *et al.*, 2015). The speed with which the infection spread from Perlis into other states of Kedah and especially Penang almost simultaneously suggests there must have been more than one source of the infection considering the geographical distance between the 3 states of almost 200km and the short duration required for spread. It is also possible that a dog incubating the virus may have been inadvertently transported across state boundaries. However, the DVS suggests the Penang outbreak was through a dog via a sea boat from the neighbouring country of Thailand (OIE, 2015a).

Having been rabies free for a while the DVS and private clinics had only limited stock piles of rabies vaccines for dogs. The immediate massive reaction against the outbreak of rabies in Penang coupled with the limited stock may have made highly cosmopolitan Penang with about 25,000 stray dogs (Baker, 2015) to run out of vaccines thereby making it have the lowest number of vaccinations (Bernama, 2015b).

This may have disenchanted pet owners against vaccinating their dogs against rabies that even after new stocks were brought, still Penang had the lowest vaccinations among the states (Bernama, 2015a). Yet it destroyed significantly more dogs than the other states perhaps due to the frenzy created by the rabies outbreak and the need to quickly regain control of the health emergency in the state. This kind of approach has been criticized in other studies and some have suggested that culling dogs is not a solution to the threat of rabies but rather concerted mass vaccination of dogs and adequate management of strays (Clifton, 2010). The best approach to handling rabies outbreak may be culling of some stray dogs around the foci of infection and then mass vaccination of all kinds of dogs in order to build an immune “firewall” against introduction of infection into the community. This may seem expensive to many developing countries



but in the long run it is actually a cheaper option to invest in rather than culling of dogs alone (Smith and Wilkinson, 2003; Shwiff *et al.*, 2013). This study showed that Kedah state which promptly launched more massive vaccination and had the highest number of vaccinations in addition to culling reported only 1 case, emphasizing the importance of mass vaccination of dogs.

The 2015 outbreak of rabies in Malaysia has brought with it a lot of lessons learnt which include the following: Immune belt zone surveillance: The Malaysian immune belt zone which is also referred to as the rabies buffer zone are all the areas that are within a radius of 50 Km to 80 Km of the border with Thailand.

This buffer zone is important because Thailand is highly endemic for rabies and a porous border allows the free movement of humans and animals between the 2 countries. This free movement of people and animals also comes with the burden of transboundary diseases such as rabies which imported or smuggled animals may be incubating.

The communities located within this immune belt should be monitored more strictly and active comprehensive surveillance for rabies in the dog population must be ensured to forestall any failure of surveillance that could lead to future outbreaks. Routinely blood samples should be collected on monthly basis from high dog population density communities for serologic surveys using tests like the Rapid Fluorescent Foci Inhibition Test (RFFIT) which is a serum neutralizing test that uses neutralizing antibodies against the rabies virus following the World Health Organization (WHO) guideline and other tests like the Fluorescent Antibody Virus Neutralization Test (FAVNT) and the Enzyme Linked Immunosorbent Assay (ELISA) (Dyer *et al.*, 2014; Ondrejková *et al.*, 2015).

Vaccine preparedness: At the peak of the Pulau Pinang state outbreak and vaccination efforts, the state run out of vaccines for the dogs while there were still enough vaccines and Immunoglobulins for human cases of bites from suspected rabid dogs. The threat of rabies is so serious that adequate preparedness must be ensured in all the states of Malaysia at all times to ensure that such incidence does not repeat itself. Developing nations and nations that have obtained a rabies free status must

learn from this incident the lesson of preparedness for emergencies even after obtaining a rabies-free status especially nations surrounded by endemic countries.

### *Animal Welfare*

There is an increasing awareness of the welfare of animals around the world and Malaysia is not behind in this development. The authorities and corporate bodies along with public spirited individuals need to invest more in providing dog shelters to minimize, if not, eliminate completely the threat to public health posed by numerous stray dogs and stray cats on the streets (Molento *et al.*, 2014).

Another way of catering for animal welfare as well as public is by incorporating dogs as part of a public health and animal welfare program such as the dogs called “community dogs” in Brazil and some parts of the USA (Molento *et al.*, 2014). To earn the trust and respect of animal activists and dog lovers, in the face of outbreaks, stray dogs should be culled as humanely as possible, minimizing every form of appearance of cruelty to animals.

If possible the culling should not be done in full view of the public because there were reports of strangling of dogs and all forms of cruelty that made the headlines during the outbreak including videos uploaded to youtube showing very cruel treatments of dogs (WAD, 2015). An animal activist was said to have even attempted suicide because of the killing of stray dogs (Lakshiny, 2015) and another fainted while pleading with authorities to stop culling dogs in a forum tagged “Stop Killing Start Vaccinating” (Lim, 2015).

This was the dark side of the rabies control measures that were put in place by the authorities. The task of preventing future rabies outbreaks would certainly not be an easy one considering that a state like Penang is estimated to have some 25000 stray dogs (Baker, 2015) but it can be done by continuous vaccination of dogs, responsible pet ownership and ethical management of movement of animals from one location to the other in addition to humanely controlling the number of strays by neutering them and providing shelters.

### ***One Health Approach***

The one world, one health approach to confronting medical challenges is pivotal to any success in the fight against zoonotic diseases that have plagued man and animals for many generations. In the Malaysian experience of the rabies outbreak hundreds of veterinary, paraveterinary, medical, paramedical and environmental health officers were mobilized to nip the outbreak in the bud before it became a national health tragedy. Officers had to work over time and even beyond normal working days (Bernama, 2015a). Increasingly the world is realizing the need to combat diseases from all angles and in recent years we have what is known as the FAO/OIE/WHO tripartite concept note 2010 that brings together the 3 giant bodies fighting against diseases and other health challenges confronting the world (Lee and Brumme, 2013; FAO-OIE-WHO, 2010).

### ***Public Awareness***

creating good public awareness can lead to timely ends to outbreaks as in this case. The outbreak was effectively contained within 2 months of its onset through massive public awareness that gave the public enough information to safe guard public health. Strategic public awareness using well informed workers will improve prevention efforts against rabies (Mutembei *et al.*, 2015; Nguyen *et al.*, 2015).

### ***Economic Impact***

There is an economic price to pay when outbreaks of deadly diseases like rabies occur in a nation. This is exemplified by Singapore suspending commercial imports of dogs, cats from Malaysia (AsiaOne, 2015). The annual global cost of rabies excluding deaths is about \$530 million, which is a great burden to developing countries of Asia and Africa where the prevalence is highest (Shwiff *et al.*, 2013).

The world is watching and can help: No country is an island in today's world. The rabies outbreak became news around the world that reminds scientists and authorities that whatever happens in one country comes under the searchlight of the global village the world has become. Other

countries and organizations had to be contacted to help with vaccines when there were no more vaccines available in Penang to vaccinate dogs. Human vaccines were also imported from overseas and rabies immunoglobulins for postexposure prophylaxis. Cross border approaches and regional collaborative groups can help nations learn from each others experiences and coordinate efforts to control and possibly eliminate the threat of rabies across small and wide geographical boundaries (Taylor and Nel, 2015).

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