



Risk Assessment- The Risk The Dog Meat Trade Poses to Rabies Transmission and the ASEAN Plus 3 Countries' Pledge to Eliminate Rabies by 2020.

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Aim: To describe and analyse the risk the dog meat trade poses to rabies control and elimination efforts in South-East Asia and the ASEAN countries' pledge to eliminate rabies by 2020, by reviewing existing research and using expert knowledge of rabies virus transmission and the workings of the trade.

Table of Contents

1. BACKGROUND.....	2
2. REVIEW AND ANALYSIS OF EXISTING RESEARCH.....	3
2.1 EVIDENCE AND RISKS OF RABIES TRANSMISSION TO HUMANS DURING DIFFERENT STAGES OF THE DOG MEAT INDUSTRY- DOG CAPTURE/ HANDLING, SLAUGHTER, BUTCHERY AND CONSUMPTION.....	3
2.2 EVIDENCE AND RISKS OF THE SPREAD OF RABIES ASSOCIATED WITH THE TRADE IN DOGS	5
2.2.1 <i>The spread of rabies virus in the key dog meat eating areas in Asia.....</i>	<i>6</i>
2.2.2 <i>The presence of rabies positive dogs in slaughterhouses, restaurants and markets in Asia</i>	<i>8</i>
3. RISK ASSESSMENT OF THE VARIOUS STAGES OF THE DOG MEAT TRADE AND RABIES TRANSMISSION TO HUMANS AND SPREAD OF RABIES NATIONALLY AND INTERNATIONALLY.....	9
4. RECOMMENDATIONS FOR RESEARCH TO BE CONDUCTED DURING THE FIVE YEAR MORATORIUM ON THE TRADE IN DOGS DESTINED FOR HUMAN CONSUMPTION.....	12

1. Background

Rabies is a major public health threat throughout Asia, causing substantial economic, human health and animal welfare impacts. The necessary tools and methods for control and prevention of human and canine rabies are available and the proof of the feasibility of canine rabies elimination has been demonstrated in several countries in Latin America and the Caribbean where there has been a 90% reduction of human and canine rabies¹ - and in the East and South-East Asian region (Japan, Singapore, Malaysia, Taiwan, Hong Kong and South Korea)- their success owing largely to mass dog vaccination and dog population control programs, and strict enforcement of related legislation². However, no additional Asian countries have been able to officially eliminate rabies over the past four to five decades³, with rabies remaining endemic within the dog population in other countries in the region.

Domestic dogs are the main reservoir and source of rabies in Asia, and more than 99% of all documented human rabies cases are contracted from dogs. All leading organisations committed to eliminating rabies – including the World Health Organization (WHO), the World Organisation for Animal Health (OIE), the Pan American Health Organization (PAHO) and the Food and Agriculture Organization of the United Nations (FAO) – agree that the most effective way to decrease the number of human cases of rabies is by tackling the disease within the dog population.

Rabies elimination programs focused mainly on mass vaccination of dogs are largely justified by the future savings of human rabies prevention programs, and the World Health Organization (WHO) promotes mass dog vaccination campaigns and “controlling trade in and movement of dogs” as key components for dog rabies control and eventual elimination.

In recognition of the need to tackle the enormous health burden of rabies- in the region, the Health Ministers of the ASEAN Member States and the Plus Three Countries have pledged their support for the ‘Call for Action towards the Elimination of Rabies’ in the ASEAN Member States and the Plus Three Countries by the year 2020⁴. Yet despite significant investment in national rabies prevention and control programs, canine rabies remains endemic in much of the region, including Vietnam, Thailand, Laos and Cambodia.

This paper provides an overview of existing evidence that suggests that the trade in dogs for human consumption is not compatible with rabies control and elimination efforts in the region- it is in contravention to both existing disease control laws and regulations and recommendations by leading human and animal health experts, and poses a significant risk to the ASEAN Plus 3 countries’ pledge to eliminate rabies by 2020.

¹ Vigilato, M. A. N., Cosivi, O., Knöbl, T., Clavijo, A., Silva, H. M. T.(2013) Rabies Update for Latin America and the Caribbean. *Emerging Infectious Diseases*. 19, 678-679.

² Tenzin & Ward, M. P. (2012), Review of Rabies Epidemiology and Control in South, South East and East Asia: Past, Present and Prospects for Elimination. *Zoonoses and Public Health*.

³ Tenzin & Ward, M. P. (2012), Review of Rabies Epidemiology and Control in South, South East and East Asia: Past, Present and Prospects for Elimination. *Zoonoses and Public Health*.

⁴ Association of Southeast Asian Nations [ASEAN] Plus Three (2008). Strengthening cooperation and information sharing on rabies among ASEAN Plus Three Countries. Draft Resolution, Ha Long, Viet Nam. Retrieved from <http://www.aseanplus3-eid.info/newsread.php?nid=13&gid=102>

2. Review and Analysis of Existing Research

2.1 Evidence and risks of rabies transmission to humans during different stages of the dog meat industry- dog capture/ handling, slaughter, butchery and consumption.

Review of existing evidence of reported cases of human rabies linked to activities associated with the dog meat trade, and a qualitative risk analysis of rabies transmission to humans at sequential points of the dog meat supply chain.

Existing published research outlined below reveals evidence of rabies infection to humans at the following stages of the dog meat supply chain as referenced below – dog slaughter, butchering, preparation and consumption of raw meat. Furthermore, dog capturing and handling associated with the trade also increases the risk of dog bites and scratches, given the stressful circumstances surrounding dog capture and that many of the dogs are not used to be handled. However, inadequate research has been conducted to evaluate the circumstances in which dog bite incidences occur..

Vietnam

- Outbreak of rabies in Ba Vi, 2007: The District Department of Animal Health (DAH) reported that up to 30% of human rabies deaths were linked to exposure to the virus during slaughter and butchery of dogs⁵.
- Research by the National Institute of Hygiene and Epidemiology (NIHE), 2007: Of ten laboratory confirmed cases of human rabies from northern hospitals, four did not have a history of dog bite- three of these patients had prepared dog meat from sick animals prior to onset of rabies illness, and the fourth patient had not handled or prepared a dog for consumption but had eaten dog meat⁶.
- Research by the National Institute of Hygiene and Epidemiology (NIHE), 2007- 2009: Of 23 patients with laboratory confirmed rabies between 2007 and 2009, 22% did not have any history of dog or cat bites, but they had an experience of butchering dogs or cats, or consuming their meat⁷.
- Research by the Wellcome Trust of Great Britain, 2009: Wertheim *et al.* published a case study of two men who died of laboratory confirmed rabies after killing, butchering, preparing and eating rabies infected animals⁸.

⁵ Hampson, K., 2009. Mission Report: Vietnam. WHO (unpublished)

⁶ Anh NTK, Hanh NTH, Giang NC, Dong NV, Thai NQ, et al. (2008) Rabies, a re-emerging disease in Vietnam. RITA abstract.

⁷ Nguyen, A. K. T., Nguyen, D. V., Ngo, G. C., Nguyen, T. T., Inoue, S., Yamada, A., Dinh, X. K., Nguyen, D. V., Phan, T. X., Pham, B. Q., Nguyen, H. T., Nguyen, H. T. H. (2011). Molecular epidemiology of rabies virus in Vietnam (2006–2009). *Japanese Journal of Infectious Diseases*, 64, 391-396.

⁸ Wertheim, H. F. L., Nguyen, T. Q., Nguyen, K. A. T., De Jong, M. D., Tatlor, W. R. J., Le, T. V., Nguyen, H. H., Nguyen, H. T. H., Farrar, J., Horby, P., Nguyen, H. (2009). Furious rabies after an atypical exposure. *PLoS Medicine*, 6, 1-5.

- Statement by NIHE, 2011: *'Butchering of dogs or cats for consumption is one of the routes of rabies transmission with cause of 1.6% human rabies in recent years'*⁹.

Thailand

In contrast to other commercial dog meat countries, such as Vietnam, China and the Philippines, there are no cases of human rabies cases reported in published literature associated with the dog meat trade in Thailand. However, this could be because dog meat is only consumed by a minority of Thais, and the majority of Thais involved in the dog meat trade are not involved in dog slaughtering, butchery or consumption. They are, however, involved in activities associated with dog capture and transport. It is therefore suggested that further research is conducted to analyse the circumstances surrounding dog bites, focusing in dog trading 'hot spots' in Thailand so as to evaluate the impact of dog trading on human rabies cases in Thailand.

Interestingly, research conducted in Nakhon Phanom Province (a 'hot spot' for the dog meat trade) revealed that people who did eat dog meat were significantly less likely to know about rabies and its transmission, than those who did not eat dog meat¹⁰.

Laos

Whilst there is evidence of dogs being traded and transported between provinces and internationally within and from Laos, there have been no studies in these rabies endemic countries specifically reviewing the link of rabies and the dog meat trade. Further research is required.

Cambodia

Whilst there is evidence of dogs being traded and transported between provinces and internationally within and from Cambodia, there have been no studies in these rabies endemic countries specifically reviewing the link of rabies and the dog meat trade. Further research is required.

The Philippines

- Retrospective study of all patients identified as having clinical rabies from January 1987 to June 2006 admitted to San Lazaro Hospital in Manila, 2011: Of a total of 1,839 rabies cases, 25 (1.14%) were ascribed to eating raw dog meat, representing a recognisable rabies risk¹¹.
- Statements by the City Veterinary Office, Baguio City: The City Veterinary Office (CVO) of Baguio City, where dog meat consumption remains popular

⁹ Nguyen, T.H.H. (2011). 3rd Rabies in Asia Conference. RIACON 2011, Abstract Book.

¹⁰Prakit, S., Wongplugsasoong, W., Tanprasert, S., Sithi, W., Thamiganout, J., Insea, T., Tooraoap, S., Bootrach, S., Rungreung, H. (2013). Investigation on Dog Rabies Case and Rabid Dog Meat Consumption, Nakhon Phanom Province, Thailand 2011. Outbreak, Surveillance and Investigation Reports (OSIR). 6, 6-12.

¹¹ Dimaano, E. M., Scholand, S. J., Alera, M. T. P., Belandres, D. B. (2011). Clinical and epidemiological features of human rabies cases in the Philippines: a review from 1987 to 2006. International Journal of Infectious Diseases, 15, 495-499.

despite its prohibition, has issued warnings that diseases such as rabies could be contracted through the consumption of dog meat since the dogs are often supplied from different parts of the lowlands, and the meat does not pass through the required quarantine inspections conducted by the National Meat Inspection Service (NMIS) and the CVO¹².

China

- Study of human clinical rabies cases, 1992: Of 61 human clinical rabies cases, 3 were not associated with dog bites or injury, but were associated with the handling of dog carcasses for human consumption. Of these three cases, one had a prior hand wound, one had killed a sick family dog and denied any wounds, while the last only contacted the skin, urine and saliva but denied any open wounds. It was reported in the WHO bulletin that handling and butchering the carcass of dogs was a particular risk¹³.

Concluding comments: There is increasing recognition, and evidence, of the risk all stages of the dog meat trade pose to rabies transmission to humans. Transmission of rabies through contact with the meat of an infected animal has been highlighted by several studies^{14 15}, and the slaughtering of an unvaccinated rabies reservoir species (including dogs) in endemic areas needs to be considered a category III (severe) exposure, requiring prophylaxis¹⁶.

Although the risks vary, these have not yet been quantified and require further research and consideration.

2.2 Evidence and risks of the spread of rabies associated with the trade in dogs

Review of the spread of rabies in the key dog trading countries and provinces, and the presence of rabies positive dogs in slaughterhouses, restaurants and markets.

We know that the potential to spread disease through the movement of even a small number of dogs is high- for example, rabies was introduced to the previously rabies-

¹² See, D. (2010). Dog meat sold in Baguio likely unfit to eat. The Manila Bulletin Newspaper Online.

¹³ Kureishi, A., Xu, L. Z., Wu, H., Stiver, H.G. (1992). Rabies in China: Recommendations for control. *Bulletin of the World Health Organization*, 70, 443- 450.

¹⁴ Wertheim, H.F.L., Nguyen, T. Q., Nguyen, K.A.T., de Jong, M.D., Tatlor, W.R.J., Le, T.V., Nguyen, H.H., Nguyen, H.T.H., Farrar, J., Horby, P., Nguyen, H. (2009) Furious Rabies after an Atypical Exposure. *PLoS Medicine*, 1-5.

¹⁵ Tariq, W. U., Shafi, M. S., Jamal, S., Ahmad, M. (1991). Rabies in man handling infected Calf. *Lancet*, 337, 1224.

¹⁶ Wertheim, H. F. L., Nguyen, T. Q., Nguyen, K. A. T., De Jong, M. D., Tatlor, W. R. J., Le, T. V., Nguyen, H. H., Nguyen, H. T. H., Farrar, J., Horby, P., Nguyen, H. (2009). Furious rabies after an atypical exposure. *PLoS Medicine*, 6, 1-5.

free island of Flores (Indonesia), following the introduction of just three dogs from Butung Island, a rabies endemic region, by a fisherman¹⁷.

Exact figures of the numbers of dogs exported from Thailand, Laos and Cambodia into Vietnam are impossible to ascertain; however, conservative estimates suggest that up to 80,000 dogs are exported into Vietnam from Thailand, via Laos, alone each year.

The trade is in contravention of existing disease control laws and regulations, as well as recommendations by WHO and OIE, and many of the dogs, in export vehicles which are known to carry false documents, could be incubating the virus when vaccinated or can host the virus while appearing healthy.

While the majority of dogs for meat may arguably be contained during transportation and holding from Thailand to Vietnam until slaughter, there is still potential for close contact through wire cages and fences with dogs and cats, and other species, external to this trade, or escape of infected dogs which could undermine regional rabies control efforts.

The transprovincial and trans-national spread of rabies viruses is believed to be one of the aspects responsible for exacerbating the dog rabies epizootics in Indonesia¹⁸ and China¹⁹, and, Zu (2001) confirms that trade of dogs for their meat is a risk to effective rabies control²⁰: *“Since the mid-1990s, new factors have emerged, including an increased demand for dog meat, leading to an increase in dog breeding in impoverished villages, and a decline in vaccine quality, which appears to have been the cause of a new increase in rabies incidence in several southern provinces. Traffic in dogs from villages to city markets as a meat source has become big business. As it can potentially spread rabies, it should be prohibited²¹.”*

2.2.1 The spread of rabies virus in the key dog meat eating areas in Asia

The sourcing of dogs for meat conveys risks when collecting and concentrating dogs of unknown rabies status from wide areas- for example, in the case of Vietnam, dogs are imported from Thailand, Laos, Cambodia and China to supply the dog meat industry, disrupting stable dog populations in their communities of origin, and resulting in the mixing of many dogs from various sources throughout the Asia.

Vietnam

- Molecular epidemiology studies of rabies virus present in Vietnam, 2006-2009: Rabies viruses from Thailand and Vietnam are closely related, possibly

¹⁷ Wilde, H. (2000). WHO Technical Advisory Mission on Intradermal Rabies Vaccination: Flores Island Rabies Outbreak, Indonesia.

¹⁸ Clifton, M. (2010). How not to fight a rabies epidemic: a history in Bali. *Asian Biomedicine*, 4, 663- 670.

¹⁹ Tao, X-Y., Tang, Q., Li, H., Mo, Z-J., Zhang, H., Wang, D-M., Zhang, Q., Song, M., Velasco-Villas, A., Wu, X., Rupprecht, C. E., Liand, G-D. (2009). Molecular epidemiology of rabies in Southern People’s Republic of China. *Emerging Infectious Diseases*, 15, 1192- 1198.

²⁰ Zu, S-X. (2001). Epidemiology of rabies and control of dog rabies in China. In Dodet & Meslin (Eds.), *Rabies in Asia: Proceedings of the Fourth International Symposium in Hanoi Vietnam* (pp.88-89). London, England: John Libbey and Company Ltd.

²¹ Zu, S-X. (2001). Epidemiology of rabies and control of dog rabies in China. In Dodet & Meslin (Eds.), *Rabies in Asia: Proceedings of the Fourth International Symposium in Hanoi Vietnam* (pp.88-89). London, England: John Libbey and Company Ltd.

from a common ancestor virus, indicating an endemic and cycling infection. Given the dog meat industry is associated with the main mass movement of dogs between Thailand and Vietnam, it may be responsible for this endemic cycling of rabies virus²². In addition, Northern Vietnamese rabies strains have come directly from Southern China; again implicating the live dog movement, possibly associated with the dog meat industry, as the source²³.

- Molecular epidemiology studies of rabies virus present in, Ho Chi Minh City, 2007: Rabies virus strains may have independently entered Vietnam from several countries, including China and the Philippines, and may have established and spread throughout Vietnam. The authors of this study highlight that domestic and international transportation of animals is not well-regulated in Vietnam, and the lack of control has led to the spread of rabies from one region to others, and consequently to the increase in the number of cases of human rabies²⁴.
- Recognition of risk posed by the trade in dogs in rabies transmission by the local government of Lao Cai, 2011: In June 2011, the local Government of Lao Cai Province in Northern Vietnam suspended trade in and slaughter of dogs in response to an outbreak of rabies²⁵.

Indonesia

- Introduction of rabies to Bali, 2008 (WHO): Rabies was introduced to the south of Bali, Indonesia, in 2008, when inadequate quarantine measures allowed the import of an unvaccinated rabid dog from Flores where dogs are routinely eaten. To avoid restricting the commerce in dog meat, the Flores authorities had decided not to impose effective controls on the translocation of dogs²⁶ despite the obvious human cost. Rabies has since spread from the south of the island to the north as a result of the movement of dogs to supply the demand for dog meat, and there are now no rabies-free regencies.
- The rabies burden is now increasing in Indonesia, and rabies is now present in 24 out of 33 provinces in the country, and disappointingly, even more islands have been reporting rabies outbreaks in the last decade due to movement of dogs for various reasons²⁷.
- The current outbreak of rabies in Central Java has been attributed to the trade in dogs for meat from West Java.
- The number of people seeking post-exposure treatment and human rabies cases are increasing every year in Indonesia, and are expected to continue to increase unless the geographical spread of canine rabies is controlled²⁸.

²² Nguyen, A. K. T., Nguyen, D. V., Ngo, G. C., Nguyen, T. T., Inoue, S., Yamad, A., Dinh, X. K., Nguyen, D. V., Phan, T. X., Pham, B. Q., Nguyen, H. T., Nguyen, H. T. H. (2011). Molecular epidemiology of rabies virus in Vietnam (2006–2009). *Japanese Journal of Infectious Diseases*, 64, 391-396.

²³ Nguyen, A. K. T., Nguyen, D. V., Ngo, G. C., Nguyen, T. T., Inoue, S., Yamad, A., Dinh, X. K., Nguyen, D. V., Phan, T. X., Pham, B. Q., Nguyen, H. T., Nguyen, H. T. H. (2011). Molecular epidemiology of rabies virus in Vietnam (2006–2009). *Japanese Journal of Infectious Diseases*, 64, 391-396.

²⁴ Yamagata, J., Ahmed, K., Khawplod, P., Mannen, K., Xuyen, D.K., Loi, H.H., Dung, N.V., Nishizono, A. (2007). Molecular epidemiology of rabies in Vietnam. *Microbiol. Immunol*, 51, 833- 840.

²⁵ Thanhniennews (2011). Dog days for canine meat regulation.

<http://www.thanhniennews.com/2010/pages/20110822141610.aspx>

²⁶ Clifton, M. (2010). How not to fight a rabies epidemic: a history in Bali. *Asian Biomedicine*, 4, 663- 670.

²⁷ World Health Organization (2008) Rabies country profile: Indonesia. Retrieved from http://www.searo.who.int/LinkFiles/Zoonoses_INO-rabies-cp.pdf

²⁸ World Health Organization (2008) Rabies country profile: Indonesia. Retrieved from http://www.searo.who.int/LinkFiles/Zoonoses_INO-rabies-cp.pdf

2.2.2 The presence of rabies positive dogs in slaughterhouses, restaurants and markets in Asia

There is evidence of the high incidence of rabies positive dogs destined for human consumption (in slaughterhouses, restaurants and markets) in Vietnam, China and Indonesia, posing a significant risk to human health as outlined in Part 2.1., and proving that rabies positive dogs are being transported domestically and internationally. Examples of published evidence is outlined below, however, it is likely to be an underestimate of the true situation as many countries where dog meat slaughterhouses, restaurants and markets exist, such as Thailand, Laos and Cambodia, have not reported any data on this.

Vietnam

- Slaughterhouses in Northern and Southern provinces, 2011: Brain samples from 100 dogs were collected from dogs in slaughterhouses in Northern provinces, and a further 76 samples were collected from Southern provinces- Laboratory analysis confirmed that 2.0% of samples of dog brains collected from the Northern provinces and 16.4% from the Southern provinces were infected with rabies virus²⁹.

China

- Slaughterhouses in Southern Provinces, 2008: Dog brain samples were collected from dog slaughterhouses in the southern Chinese provinces of Guangxi and Guizhou, where dogs are routinely sourced from villages to supply the slaughterhouses. Using the fluorescent antibody test, it was revealed that the positive rate of rabies virus antigen was as high as 6.4% in Guiping (Guangxi province)³⁰.
- Restaurants in Southern Provinces, 2005-2007: 2,887 dog brain samples from dog meat restaurants in fifteen cities in Guizhou, Guangxi and Hunan provinces- of all the specimens collected, 2.3% tested positive for rabies. Importantly, all the dogs from which samples were taken did not show symptoms of rabies at the time of slaughter³¹.

Indonesia

- Markets in North Sulawesi Province: The heads of dogs were collected from wet markets in 3 cities in the North Sulawesi province- The first study revealed that of 103 samples collected, 7.8% tested positive for rabies; and the second study comprising of 47 samples revealed that 10.6% of these tested positive for rabies.

²⁹ Nguyen, A. K. T., Nguyen, D. V., Ngo, G. C., Nguyen, T. T., Inoue, S., Yamada, A., Dinh, X. K., Nguyen, D. V., Phan, T. X., Pham, B. Q., Nguyen, H. T., Nguyen, H. T. H. (2011). Molecular epidemiology of rabies virus in Vietnam (2006–2009). *Japanese Journal of Infectious Diseases*, 64, 391-396.

³⁰ Hu, R. L., Fooks, A. R., Zhang, S. F., Liu, Y., Zhang, F. (2007). Inferior rabies vaccine quality and low immunisation coverage in dogs (*Canis familiaris*) in China. *Epidemiol. Infect.*, 136, 1556-1563.

³¹ Tao, X-Y., Tang, Q., Li, H., Mo, Z-J., Zhang, H., Wang, D-M., Zhang, Q., Song, M., Velasco-Villas, A., Wu, X., Rupprecht, C. E., Liand, G-D. (2009). Molecular epidemiology of rabies in Southern People's Republic of China. *Emerging Infectious Diseases*, 15, 1192- 1198.

Concluding comments: There is evidence that there is a high concentration of rabies positive dogs in slaughterhouses, restaurants and markets; posing a significant risk to human health as outlined in Part 2.1. Furthermore, evidence demonstrates that the transport of rabies infected dogs is occurring, domestically and internationally, and the lack of control has led to the spread of rabies from one region to others, and consequently to the increase in the number of cases of human rabies. The risk is further exacerbated by the fact that many dogs do not show any clinical signs of rabies due to the long incubation period of the rabies virus.

Although the majority of dogs in this trade are destined directly for slaughter, there are still risks of escape, release and contact with external dogs and other species. The collection of and trade in dogs disrupts stable dog populations which are required for effective canine vaccination programmes, and is in contravention to recommendations by leading human and animal health expert bodies- including the WHO, PAHO, OIE- who advocate restricting the movement of dogs in rabies endemic countries, mass vaccination, and mitigating the risk of disease transmission by quarantine, *proven* rabies vaccination status and international animal movement permits, as reflected in national laws and by-laws.

The evidence outlined above is what has been published; however, is likely to be an underestimate of the situation as research and data are lacking in this area.

3. Risk Assessment of the Various Stages of the Dog Meat Trade and Rabies Transmission to Humans and Spread of Rabies Nationally and Internationally.

A qualitative review of the risk various stages of the dog meat trade pose to human health and rabies transmission nationally and internationally, and the risk the ongoing trade poses to the ASEAN Plus 3 pledge to eliminate rabies by 2020.

Critical points of risk of rabies transmission associated with the dog meat trade are summarised below (Table 1), and if not controlled, will undermine the member country or the ASEAN + 3 Rabies Control Goal by 2020.

Risk is classified as High (7-9), Medium (4-6) or Low (1-3), based on expert knowledge of rabies transmission, existing evidence, and ACPA members' research and evidence of the dynamics and operations of the dog meat trade:

The risk is estimated:

- a) As a multiplication of the **probability** (score 3 assuming more than 50% chance, score 2 is 10- 50% chance, and score 1 if less than 10% chance) of a dog bite or infectious contact with rabies virus by the **impact** (High, Medium or Low as 3,2,1 respectively) on a human presuming full PEP is not administered rapidly in accordance with WHO recommendations.
- b) As in 1) a multiplication of the **probability and impact** of spread of the virus from dogs associated with the trade. This is complex as the relevant Ro

(dependent on the population of susceptible, unvaccinated dogs), reproduction rate, etc. will determine whether infection will be maintained in a population of dogs. However, in Vietnam, Thailand, Laos and Cambodia, vaccination coverage is low, roaming dog populations are high and thus the probability of spread of the rabies virus is likely high.

Table 1- Key points of risk of rabies transmission associated with the dog meat trade. Risk is classified as High (7-9), Medium (4-6) or Low (1-3).

Activity	a: Risk to humans	b: Risk to spread of dog rabies	Overall risk and Comment
Collection and mixing of dogs from their stable population and territory with other dogs.		2 x 3 = 6 2 x 1 = 3	Within group External spread
Mass movement or translocation of dogs across districts, provinces and international borders	2 x 3 = 6	1 x 3 = 3	
Catching, handling of dogs of unknown rabies and vaccination status. Many are guard dogs.	2 x 3 = 6		Depends if workers vaccinated. All would require PEP post bite.
Dog escape, contact with external dogs		1 x 3 = 3	
Dog holding, feeding including force feeding	2 x 3 = 6	2 x 2 = 4	Spread of infectious saliva to the area, other dogs.
Dog handling for slaughtering	1 x 3 = 3		Higher if the dog is showing clinical signs of rabies.
Dog butchering	3 x 3 = 9		Very high risk if skull broken, brain removed and handled.
Dog meat and offal preparation	2 x 3 = 6	1 x 3 = 3	Contact with mucous membrane, aerosol. Contamination of knife between carcasses and human injury, cut.
Dog meat or offal consumption - raw	1 x 3 = 3		

Further research is required for more robust and quantitative risk assessment and recommendations for this are outlined in *Part 4- Recommendations For Research to be Conducted During The Five Year Moratorium on the Trade in Dogs destined for Human Consumption*. However, it should be noted that quantified risk may not change the risk mitigation requirements (namely assured vaccination status and minimal quarantine periods) for regulation and maintenance of a dog meat trade that poses any risk to the ASEAN 2020 rabies control pledge.

The aforementioned arguments, based on evidence, qualified risks and precedents for disease control in ASEAN, indicate that regulation and maintenance of the dog meat trade would not be effective. The following points summarise the significant risks that maintenance of the dog meat trade in the region poses to the ASEAN Plus 3 pledge:

- The long incubation of the virus: While mass vaccination of dogs to control rabies is certainly advocated and has been effective for in-country control, the situation is more complex for translocation of dogs from and within a rabies endemic country. Vaccination without reliable confirmatory testing, certification and six months quarantine could not assure prevention of cross-border transmission of rabies.
- Apparently healthy dogs may contain the virus before, during or after vaccination: Rabies prevention is about minimising risk and dogs that are incubating the virus at the time of vaccination, during transport or even shedding virus prior to clinical onset while apparently healthy, present a known impact but as yet un-quantified risk from this trade.
- Disruption, removal for the meat trade and high turn over of dogs in many of these societies destabilises dog populations and compromises vaccination programmes seeking to reach the recommended 70% vaccination coverage required to control and eliminate canine rabies.
- Vaccination and certification cannot be assured: Currently, the vast majority of dogs for the meat trade in Vietnam are illegally transported across borders, unvaccinated and not quarantined for any period, let alone a minimum of 28 days if unvaccinated, to six months ideally. It is concluded that any suggested policy for vaccinating dogs prior to movement and slaughter to minimise rabies transmission risk would be flawed without six months quarantine and ideally serological testing to show the vaccine was effective (as per strict importation requirements to rabies free countries).
- Effective quarantine periods would make the trade unfeasible and quarantine facilities and capacity would be very costly.
- Regulatory capacity in-country and impact especially at borders, in addition to the above points, would be costly and difficult to implement.
- High risk individuals are not currently aware of exposure when handling, skinning, butchering or preparing dog carcasses nor can afford necessary pre- and post-exposure vaccination and treatment.
- The majority of the industry is not legal or officially reported and regulated. The bureaucracy, facilities and capacity to regulate safe and effective maintenance of this trade would be very costly and likely cost-prohibitive for the industry.
- Finally, there are the on going risks to the massive investment for general control of rabies both in-country and across the region. Liability of a

comparatively small industry for the member country or another member country's rabies status would appear contrary to the ASEAN collaboration required to achieve the 2020 rabies control pledge.

Based on this, maintaining and/ or regulating the dog meat trade is not a viable option if the ASEAN Rabies Control Goal is to be met. Given the dog meat trade involves the only current mass movement of known or suspected rabies-infected dogs, there is a strong argument to stop the cycle of infection by preventing entry of dogs imported for the meat trade by banning this trade entirely.

4. Recommendations For Research to be Conducted During The Five Year Moratorium on the Trade in Dogs Destined for Human Consumption

Key areas of research to be conducted during the recommended moratorium on the transport of dogs for commercial purposes from one country to another for a 5 year period to research the risk and impact on rabies transmission.

In order to reduce the many thousands of human rabies deaths that occur annually due to contact with rabid dogs, it is crucial to uncover the mechanisms governing viral dispersal across the landscape so as to direct successful control interventions. There lies great potential for advancing the effectiveness of control campaigns in areas burdened with disease by improving surveillance and modifying control strategies based on information gleaned from surveillance³².

It is recommended that during the five year moratorium on the trade in dogs destined for human consumption, the following activities are conducted so as to gain quantifiable data to assess the risk the ongoing trade in dogs for commercial reasons poses to rabies transmission in the South-East Asia region:

- 1- Collect retrospective data to evaluate the circumstances and vocation in which dog bite incidences occur, focusing in dog trading 'hot spots', including North-East Thailand, per-urban Hanoi and Ho Chi Minh city.
- 2- Collect data to evaluate the circumstances under which human rabies cases occur in dog trading (including key international or provincial border areas), slaughtering and preparation and consumption hot spots so as to gain a better understanding of risks associated with these activities.
- 3- Map all the locations where there is an existing high incidence of human and canine rabies cases against existing key dog meat trading (including dog market, restaurant, sourcing) locations in Thailand, Vietnam, Laos and Cambodia so the effect of the five year moratorium can be evaluated.

³² Bruncker, K. Hampson, K. Horton, D.L. and Biek. R, (2012). Integrating the landscape epidemiology and genetics of RNA viruses: rabies in domestic dogs as a model. *Parasitology* (2012) 139, 1899-1913

- 4- Assess public attitudes towards the dog meat trade in Thailand, Vietnam, Laos and Cambodia.
- 5- Conduct an economic assessment of the dog meat trade in Vietnam, Thailand, Laos and Cambodia, including:
 - a. How many people's livelihoods are solely dependent on the trade;
 - b. What is the value of the dog meat trade and how does this compare to other animal industries;
 - c. What are the costs associated with the trade- including risks it poses to investment by ASEAN countries to control and eliminate rabies; costs that would be associated with the infrastructure required to regulate the trade (quarantine facilities, serological testing, border controls, etc.); impact of the trade on international image.

In order to accurately assess the impact the five year moratorium on the trade in dogs destined for human consumption, evidence would need to be provided that the moratorium is being effectively implemented and enforced

So as to ensure effective enforcement of the moratorium, it is recommended that implementing bodies are established at the provincial, municipal and village level in key areas where the dog meat industry continues to thrive, and it is suggested that national legislation is reinforced through the passing of pertinent local ordinances and by-laws.

It is crucial to work with local communities to raise awareness of the risks the dog meat industry poses to both human health and animal welfare, and for local law enforcers to be equipped with the skills, knowledge and motivation to enforce existing legislation.

Many non-governmental and inter-governmental organisations, and human and animal health experts and institutions are involved in rabies control programs and it is therefore recommended that local authorities work in collaboration with these stakeholders.