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Review

A review of parasitic zoonoses in a changing Southeast Asia

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ABSTRACT

Parasitic zoonoses are common and widely distributed in the Southeast Asian region. However, the interactions between parasites, hosts and vectors are influenced by environmental, socio-cultural and livestock production changes that impact on the distribution, prevalence and severity of disease. In this review we provide an update on new knowledge in the context of ongoing changes for the food-borne pig associated zoonoses *Taenia solium* and *Trichinella* spp., the food-borne trematodes *Opisthorchis viverrini* and *Clonorchis sinensis*, the water-borne trematodes *Schistosoma* spp., the vector-borne zoonotic protozoa *Plasmodium knowlesi* and *Leishmania* spp. and the soil-borne zoonotic hookworm *Ancylostoma ceylanicum*. These various changes need to be considered when assessing or developing regional control programs or devising new research initiatives in a changing SE Asia.

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1. General introduction

The zoonotic parasites circulating in Southeast (SE) Asia are a significant burden on human health and wellbeing and there are multiple transmission pathways that place people at risk. Here we discuss the food-borne pig associated helminths *Taenia solium* and *Trichinella* spp.; the small food-borne trematodes *Opisthorchis viverrini* and *Clonorchis sinensis*; the water-borne trematodes belonging to the genus *Schistosoma*; the vector-borne protozoa *Plasmodium knowlesi* and *Leishmania* spp. and the soil-borne zoonotic hookworm *Ancylostoma ceylanicum*. All but *P. knowlesi* and trichinellosis have recently been designated neglected tropical diseases (NTDs) by the World Health Organisation (WHO, 2010). Worldwide, NTDs predominantly affect the poor with more than 40 million people infected and 750 million at risk (Keiser and Utzinger, 2005; Hotez et al., 2008), furthermore zoonotic neglected diseases make a significant contribution to the entrenchment of poverty in poor rural communities who derive income from livestock production (WHO, 2010). Vector-borne protozoan pathogens cause relatively few public health problems in SE Asia in comparison to Latin America and Africa, however, the recent discovery of a simian malaria parasite, *P. knowlesi*, infecting humans has reawakened interest, as this may have been an undetected cause of disease for many years in people who derive their living from the forest.

Southeast Asia is currently under going changes with respect to climate change, environmental degradation, deforestation and river basin management, socio-economic development and the industrialisation of livestock production. These complex ecological changes have the potential to modify the interactions between hosts, vectors and parasites and these altered interactions impact on the distribution, prevalence and severity of disease. In this review we provide an update of new knowledge in the context of ecological changes in SE Asia, and we briefly discuss the implications for the design and implementation of control programs or research initiatives.

2. Food-borne pig associated zoonotic helminthiasis

The traditional practice of consuming uncooked or partially cooked meat in some SE Asian nations places many people at risk of acquiring food-borne parasitic zoonoses, particularly *T. solium* and members of the genus *Trichinella*. Many of the changes currently taking place in SE Asia have the potential to directly impact on the transmission of these medically important parasites to pigs and by extension to people.

2.1. Taeniasis and cysticercosis lifecycle, epidemiology and distribution in the region

The *T. solium* taeniasis and cysticercosis infection complex involves two distinct disease transmission processes and requires both humans and pigs to maintain the lifecycle. Humans are the definitive host, acquiring the adult tapeworm (taeniasis) following ingestion of viable larvae (cysticerci) in contaminated pork. Eggs are shed into the environment by the adult worm via faeces; pigs become infected following ingestion of contaminated feed or water or through direct coprophagia, thus completing the lifecycle. *T. solium* has public health significance because humans can also be inadvertently infected with cysticerci following the ingestion of eggs through poor hygiene or contaminated food and water. Human cysticercosis cases are not involved in perpetuating the lifecycle but are clinically important since cysticerci may form in the brain causing neurocysticercosis, leading to seizures, epilepsy, neurological sequelae or death. Taeniasis and cysticercosis caused by *T. solium* has been the subject of a number of recently published reviews with an Asian focus (Ito et al., 2003; Rajshekhar et al., 2003; Willingham et al., 2003, 2010; Dorny et al., 2004; Wandra et al., 2007; Conlan et al., 2008, 2009). Perhaps the most consistent underlying element of these reviews is the distinct lack of high quality data from community level studies describing the epidemiology and distribution of *T. solium* in SE Asia. We will not replicate these reviews here; rather we seek to provide an update of new knowledge in the context of the changes taking place in much of SE Asia.

The distribution and epidemiology of *T. solium* in Thailand, Vietnam, Laos and Cambodia are described in detail by Willingham et al. (2010) and the distribution of *T. asiatica* in SE Asia has recently been described by Eom et al. (2009). The most recent data comes from Laos where surveys were conducted in 24 village communities in four northern provinces and among pigs at slaughter. Human cysticercosis prevalence was determined to be 2.2% by antigen capture ELISA and there was strong evidence of a focal distribution with just over half of the cases detected residing in three villages in Oudomxay province (Conlan et al., in preparation). No significant risk factors for cysticercosis were found, and although infection was rare, the highest prevalence was observed in people of the Mon-Khmer