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Changes to the life cycle of liver flukes: dams, roads, and ponds

Our research in Laos shows how road building and aquaculture have changed the life cycle of *Opisthorchis viverrini*, a water-borne trematode that is a major cause of cholangiocarcinoma around the lower Mekong river in southeast Asia. At least 10 million people in this region already have opisthorchiasis and many will die from cholangiocarcinoma in the coming decades.[1,2] To address the potential food security issue of reduced numbers of wild fish caught because of dam building, governmental programmes in Laos encourage the construction of home garden ponds to help rural people to produce fish more efficiently.[3-6] Fish are also being raised in soil pits that were excavated to provide substrate for road building.[7]

Surveys in six villages in Songkhone district show that 25% of households have fish ponds, many of which are stocked with fish bought from local hatcheries and nurseries that have opened to cater to the growing small-scale aquaculture industry.[8] *O viverrini* infects at least five species of commercially available fish: *Barbonymus gonionotus*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Ctenopharyngodon idellus*, and *Hypophthalmichthys molitrix* (unpublished). Furthermore, the tiny intestinal fluke *Haplorchis taichui* infects 85% of the Laos hatchery and nursery fish species—a proportion that is 39% higher than those infected with *O viverrini* (unpublished). These data suggest that infection before stocking is a likely cause of higher prevalence of *O viverrini* metacercariae found in fish from ponds in Laos than in Thailand. For example, the prevalence of *O viverrini* in *Cyclocheilichthys armatus*—a native fish that coexists with aquaculture pond species—is ten-times higher in Laos than in Thailand (40% *vs* 3%), suggesting active and ongoing transmission of the disease after stocking with infected fish.

These findings show how well-meaning developments designed to improve livelihoods in the Mekong region threaten to increase an already high prevalence of opisthorchiasis and cholangiocarcinoma. Regulation should be introduced to prevent home garden ponds being stocked with infected fish and to exclude *O viverrini* reservoir hosts such as dogs and cats from the premises of fish farms. Advances are also needed in sanitation and education about the risks of eating improperly cooked fish.[2,9] Furthermore, future development projects that affect water bodies or natural drainage patterns should be assessed holistically to establish their potential effect on transmission of human pathogens.

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