

EMERGENCY PUBLIC HEALTH EFFORTS OF INSTITUT PASTEUR DU LAOS FOR COVID-19 DIAGNOSTICS

Opinion Column by
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Due to an unprecedented workload with numerous samples arriving at Institut Pasteur du Laos and the various public health duties, the Administration and Virology team have not been able to answer numerous requests for interviews and journalistic solicitations as we need to prioritize the urgent public health mission.

The Institut Pasteur du Laos has been solicited by the Lao Ministry of Health (MOH) as a front-line laboratory for COVID-19 diagnostics using RT-PCR as the method of detection. Institut Pasteur du Laos has been assigned by the Lao MOH a surveillance network of 10 hospitals from North to South for COVID-19 detection:

Civilian Hospitals in Vientiane Capital

Setthathirat Hospital

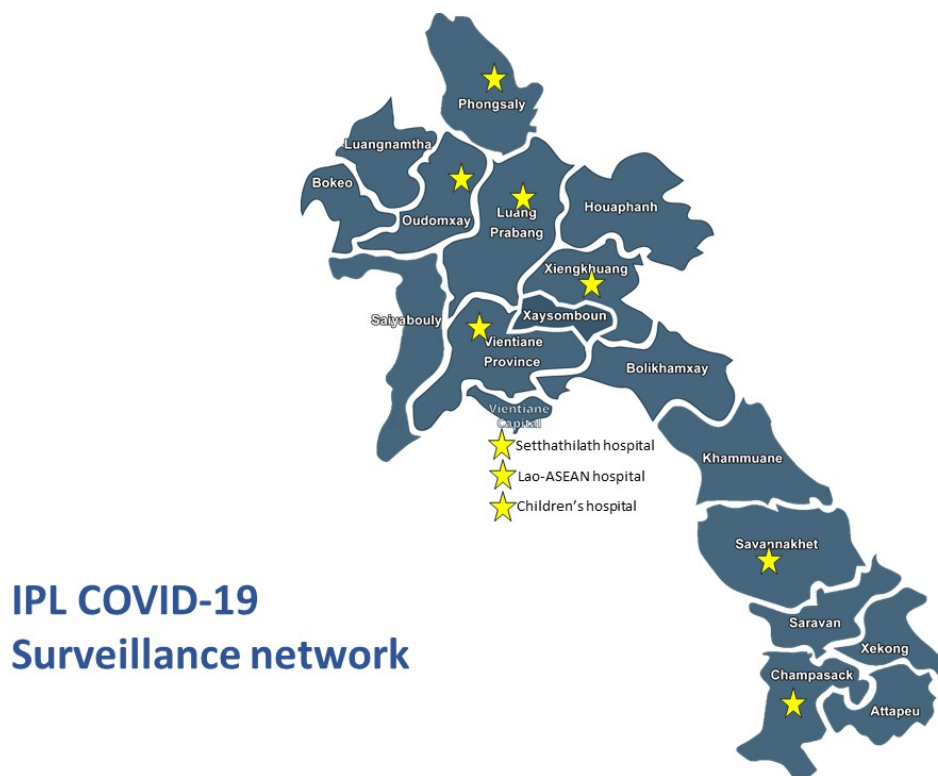
Lao – ASEAN Hospital

Children's Hospital

Military Hospitals:

Phongsaly, Oudomxay, Vang Vieng (Vientiane Province),
Xeingkuang, Luangprabang, Savannakhet, Champassak

MAP of COVID-19 HOSPITAL SURVEILLANCE NETWORK FOR INSTITUT PASTEUR DU LAOS



Samples are received from the hospital network arrive at IPL and are analyzed under adequate biosafety / biosecurity conditions within the Institut Pasteur Laos BSL-Plus laboratory the highest biosafety level laboratory in Laos.

INSTITUT PASTEUR DU LAOS VIROLOGY TEAM WORKING BSL3-PLUS LABORATORY PREPARING COVID-19 SAMPLE FOR TESTING

The testing of suspected case samples takes around 4 hours in order to extract the SARS-CoV-2 nucleic acids and to amplify the viral genomic material using Real-Time PCR. Positive and negative results are reported to the Lao Ministry of Health – International Health Regulations contact person who then relays the result to the clinician/patient and to the World Health Organization.

Each test has a relatively high cost of \$15 US dollars and the equipment for sample preparation and analyses is also expensive. Patients sample testing is done free of charge.

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RESEARCH ON SARS-CoV-2 AT INSTITUT PASTEUR DU LAOS

In addition to Public Health diagnostic work on suspected COVID-19 cases, Institut Pasteur du Laos is also working on: **Tracking the origin and transmission/spillover of the new coronavirus SARS-CoV-2**

Summary of Research Program

In their article on the *Global Epidemiology of Bat Coronaviruses*, Wong and colleagues (*Viruses* 2019 11,174) made a strikingly predicted the emergence of SARS-CoV-2! They wrote in their article, "the presence of live bats in wildlife wet markets and restaurants in Southern China, are important for interspecies transmission of CoVs and may lead to devastating global outbreaks". As their words went to press, their prediction materialized in a wet market in Wuhan, China where bats, and other species of wildlife were for sale in anticipation for the up-coming Year of the Rat Spring Festival.

Before the original SARS epidemic (SARS-CoV-1), bats were not known to be hosts to coronaviruses (CoVs). However, in the past 15 years bats have been found to be hosts to >30 CoVs with complete genome sequences (Wong *et al.*, *Viruses* 2019 11,174). As a result of their unique mechanism of viral replication, CoVs have a high frequency of recombination and mutation rates, which allows them to rapidly adapt to new hosts and ecological niches (Graham *et al.*, *J. Virol.* 2010 84, 3134). Given the numbers of alphaCoVs and betaCoVs already found in a plethora of bats species, it is obvious that these viruses have found a suitable host reservoir in *Chiroptera*.

Bats are the only group of mammals capable of sustained flight, which allows them to disseminate the viruses they harbor and enhance the chance of interspecies transmission (Wong *et al. Viruses* 2019 11,174). That said, this is certainly not the only avenue of viral dissemination by bats; human capture of bats for food, and hematophagous arthropods, via mechanical transmission, may also play important roles in CoVs viral propagation in and around bats. It is common knowledge that Laos, Vietnam and Cambodia are the epicenter for illegal wildlife trade in Southeast Asia, where a vast variety of lucrative wildlife including bats are clandestinely shipped to wet markets of China.

Institut Pasteur of Laos (IP Laos) and National Institute of Hygiene and Epidemiology (NIHE) in Vietnam, as well as Chinese partners, lead by Institut Pasteur de Shanghai – Chinese Academy of Sciences (IPS-CAS) and Institut Pasteur of Cambodia (IPC) are strategically positioned as an interactive One-Health Research Network to investigate the origins and transmission mechanisms of SARS-CoV-2. Their field and laboratory experience provide this network with a unique opportunity to explore the origin and spillover events of SARS-CoV-2 and other SARS-like-CoVs.

More specifically, Phongsaly and Oudomsay provinces in Lao PDR and Dien Bien, Lai Chau, Lào Cai, Hà Giang provinces in Vietnam all share a direct border with Yunnan province in China. Whereas, Cao Bang, Lang Son and Quang Ninh provinces of Vietnam share a direct border with Guangxi Province in China. This entire Sino-Lao-Vietnamese region shares common limestone karstic formations containing an unlimited number of bat caves. Furthermore, numerous official and non-official border crossings make it easy to transport bats and wildlife from Lao PDR Vietnam and Cambodia to China. All three countries, and especially Lao PDR, have extremely high biodiversity and abundance of wildlife and represent the “breadbasket” of live wild animals (bats, civet cats, pangolins, squirrels, raccoon

dogs, wild boar, deer, etc) sent to China (laos.wcs.org). Furthermore, with the arrival of the China-Lao high-speed train from Vientiane, Lao PDR to Kunming, China (to open 2021) wildlife trafficking could increase in the future. Despite strict bans on wildlife trafficking and reinforced enforcement at border crossings, wildlife trafficking will certainly continue because of the deep Chinese cultural beliefs that wild animal consumption for food and medicine brings the body strength, stamina and medicinal cures. Furthermore, the lucrative nature of trafficking and the traditional idea that “animals live for man” strongly indicate that China’s appetite for wildlife is likely to survive the COVID-19 epidemic (Master and Yu *Reuters News Agency*, 17 Feb. 2020)!

Hence, a better scientific understanding of the origin, natural history and dispersal of SARS-CoV-2 and SARS-like-CoVs in their natural environment, as well as the mechanisms leading to their interactions and interspecies jumping: Bat-Bat; Bat-Animal and Bat-Human are paramount to mitigate future spillover events that result in devastating epidemics like the one we are witnessing today with SARS-CoV-2 in China and around the world.

At present the Lao PDR is in full lockdown due to the COVID-19 epidemic in-country and around the world, but when the epidemic in Laos subsides our research teams will return to the field to investigate the presence of SARS-CoV-2 in bats and other wild animals (catch- sample- and release) suspected as being possible reservoirs or recipient intermediate animal hosts (e.g. pangolins, snakes).