Areas where the next pandemic could emerge are revealed

AT A GLANCE…

■ Almost half the world's most connected cities straddle animal-human spillover hotspots;

■ 14–20 per cent of these cities are in areas with poor health infrastructure, meaning infections resulting from spillovers are likely to go unreported;

■ South and southeast Asia and Sub-Saharan Africa have the most cities at greatest risk; and,

■ The new methodology builds on understanding sources of pathogen transmission at wildlife-human interfaces by locating the most connected airports adjacent to these interfaces, where infections can spread quickly globally.

AN international team of researchers has taken a holistic approach to reveal for the first time where wildlife-human interfaces intersect with areas of poor human health outcomes and highly globalised cities, which could give rise to the next pandemic unless preventative measures are taken.

Areas exhibiting a high degree of human pressure on wildlife also had more than 40 per cent of the world's most connected cities in or adjacent to areas of likely spillover, and 14–20 per cent of the world's most connected cities at risk of such spillovers likely to go undetected because of poor health infrastructure (predominantly in South and South East Asia and Sub-Saharan Africa). As with Covid-19, the impact of such spillovers could be global.

Led by the University of Sydney and with academics spanning the United Kingdom, India and Ethiopia, the open-access paper shows the cities worldwide that are at risk. Last month, an IPBES report highlighted the role biodiversity destruction plays in pandemics and provided recommendations. This Sydney-led research pinpoints the geographical areas that require greatest attention.

The paper, "Whence the next pandemic? The intersecting global geography of the animal-human interface, poor health systems and air transit centrality reveals conduits for high-impact spillover", has published in the leading Elsevier journal, One Health. City lists for yellow, orange and red alert zones are available in open access.

Lead author Dr Michael Walsh, who co-leads the One Health Node at Sydney's Marie Bashir Institute for Infectious Diseases and Biosecurity, said that previously, much has been done to identify human-animal-environmental hotspots.

"Our new research integrates the wildlife-human interface with human health systems and globalisation to show where spillovers might go unidentified and lead to dissemination worldwide and new pandemics," said Michael, from the University of Sydney's School of Public Health, Faculty of Medicine and Health.

Michael said that although low- and middle-income countries had the most cities in zones classified at highest risk for spillover and subsequent onward global dissemination, it should be noted that the high risk in these areas was very much a consequence of diminished health systems. Moreover, while not

A study looking at where connected cities straddle animal–human spillover hotspots reveal areas where the next pandemic could emerge.

THE UNIVERSITY OF SYDNEY

Illustrative map of 'red-alert zone' Dr Michael Walsh, The University of Sydney
Walsh et al. One Health (2020) doi.org/10.1016/j.onehlt.2020.1001777
Circles represent approximate location of risk. Size of circle indicates level of risk.

as extensively represented in the zone of highest risk because of better health infrastructure, high-income countries still had many cities represented in the next two tiers of risk because of the extreme pressures the affluent countries exert on wildlife via unsustainable development.

Identifying areas at risk

The researchers took a three-staged approach:

1. First, identify where the sharing of space between wildlife and humans is greatest, and therefore where spillover events would be expected to be most common. The researchers refer to this as the 'yellow' and 'orange' alert zones of two- and three-way interactions between humans, domesticated animals and wildlife.

2. Next, identify where areas of high wildlife-human interface coincide with areas of poor health system performance, which would comprise areas expected to miss ongoing chains of transmission following a spillover event ('red-alert' zone – see graphic).

3. Finally, identify cities within or adjacent to these areas of spillover risk that are highly connected to the network of global air travel, and therefore may serve as conduits for future pandemics.

"This is the first time this three-staged geography has been identified and mapped, and we want this to be able to inform the development of multi-tiered surveillance of infections in humans and animals to help prevent the next pandemic," the paper reads.

Of those cities that were in the top quartile of network centrality, approximately 43 per cent were found to be within 50 km of the spillover zones and therefore warrant attention (both yellow and orange alert zones). A lesser but still significant proportion of these cities were within 50 km of the red alert zone at 14.2 per cent (for spillover associated with mammal wildlife) and 19.6 per cent (wild bird-associated spillover).

Michael said although it would be a big job to improve habitat conservation and health systems, as well as surveillance at airports as a last line of defence, the benefit in terms of safeguarding against debilitating pandemics would outweigh the costs.

"Locally-directed efforts can apply these results to identify vulnerable points. With this new information, people can develop systems that incorporate human health infrastructure, animal husbandry, wildlife habitat conservation, and movement through transportation hubs to prevent the next pandemic," Michael said.

"Given the overwhelming risk absorbed by so many of the world's communities and the concurrent high-risk exposure of so many of our most connected cities, this is something that requires our collective prompt attention."

The authors of this research, Michael Walsh, Shailendra Sawleshwarkar, Shah Hossain and Siobhan Mor, are all associated with the University of Sydney. Additionally their various affiliations comprise The Westmead Institute for Medical Research (Australia), Manipal Academy of Higher Education (India), University of Liverpool (UK) and the International Livestock Research Institute (Addis Ababa, Ethiopia campus).

It's a sh*t of a job but thank god someone's doing it

SUDHI Payyappat admits his is not the most glamorous of jobs. The microbiologist spends his working days in a small scientific lab, surrounded by little bottles of wastewater – the stuff we flush down the toilet.

But what the role lacks in glamour, it makes up for in importance.

Sudhi and his small team of four have been national leaders in what medical experts say is a critical part of the nation's coronavirus response: testing our sewage for Covid-19.

Sudhi Payyappat spends his days analysing wastewater, looking for Covid traces. (PHOTO: ABS News, Brendan Esposito)

The wastewater testing has been described as public health 'surveillance'.