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Tsimané and Moseten peoples of lowland Bolivia demonstrate an intriguing case of epidemiological resilience

Despite widespread COVID-19 infection in the Tsimané and Moseten populations of Bolivia, the mortality rate in these remote Indigenous groups was the lowest ever recorded for any population or region.

“The fact that the fatality rate was very, very low, was a bit of a head scratcher,” said UC Santa Barbara anthropologist Michael Gurven, who has worked with these populations for decades. After all, experts and lay public alike had assumed that remote Indigenous populations, with limited access to healthcare, would be especially vulnerable to the contagion. But a total of only three people succumbed to the disease, a remarkable feat of resilience that Gurven and fellow researchers attribute to “a more vigorous and effective immune response to infection, with implications for future global pandemics.”

The researchers’ work is published in the journal Social Science & Medicine.

The coming of COVID

When the COVID pandemic began in early 2020, Gurven's mind went immediately to the Tsimané and Moseten tribes of lowland Bolivia. Still very nonindustrial, and with minimal access to healthcare, they had the odds stacked against them.

"Many people were worried about these remote groups in the Amazon that history has unfortunately shown to be highly vulnerable to novel infections," said Gurven, who co-directs the Tsimané Health and Life History Project. "We know that virgin soil epidemics can be lethal. Over the past few centuries, many introduced infections have devastated whole groups." Elsewhere in the world, the disease was indeed hitting Indigenous populations hard.

"And so there was a big concern with what might happen, especially with the minimal medical resources out there," he said.

Working collaboratively with Indigenous leaders and local health officials to stem the tide of infection, the researchers' initial efforts centered around a strategy of voluntary collective isolation, in which these largely self-sufficient groups would refrain from making contact with the outside world in an effort to leverage their remoteness.

The pandemic came anyway, and, bracing for the worst, the research team switched to surveillance mode, monitoring and recording how the disease spread, who got infected and the severity and duration of their symptoms. Once introduced, the virus indeed spread quickly, to the majority of the population: 71% of the Tsimané and 63% of the Moseten. People who were infected reported the same kinds of symptoms that were being experienced all over the world.

"COVID spread far and wide in the communities and it wasn't just a minor thing," Gurven said. "Eighty percent of positive cases experienced flu-like symptoms, headaches, loss of smell, loss of taste, just like elsewhere."

But, contrary to expectations, only three people died. "If we were using the same fatality rates we saw elsewhere, we would have expected a lot more deaths," he said. Even when taking into account the younger age profile of Tsimané and Moseten populations, their death rates were much lower than expected. What had allowed these populations to evade the worst of the COVID pandemic?

There are many factors to consider, according to Gurven, but the answer could lie in a combination of things, many of which have to do with their lifestyle and environment. The Tsimané and Moseten are mostly non-industrial forager-horticulturalists who inhabit a food-limited environment with high exposure to diverse parasites and pathogens. Compared to much of industrialized society, they have very active lifestyles, which may protect them from the comorbidities that often come with a sedentary lifestyle — such as obesity, diabetes and hypertension — conditions that could lead to severe complications when occurring alongside a COVID infection.

Meanwhile, blood tests revealed evidence of a “vigorous and effective” immune response in the high levels of COVID-specific antibodies the two Indigenous communities had — more than double the amount measured in a French cohort during the same COVID wave. While post-infection antibody levels can’t be responsible for the low mortality, the researchers propose that the high levels of antibodies could indicate a heightened immune response earlier in the disease progression, so that the COVID infection is rarely able to advance beyond the initial flu-like phase. Blood tests also revealed high levels of infection-fighting white blood cells.

“The Tsimané still experienced that first stage of COVID, but they never quite got to that second stage where it enters your lungs, when people experienced cytokine storms and sometimes needed to be hooked up to a respirator,” Gurven said, referring to the severe and sometimes fatal immune reaction that is associated with advanced COVID infections. “In fact, we had struggled to find and set up oxygen concentrators because we were worried, especially for the older adults, but there was no need to even use them.”

Underlying this upregulated immune system, the researchers hypothesize, is the persistent exposure to pathogens. Lack of sanitation and an environment of parasites, bacterial infections, and the like help to maintain what they call “immune readiness.”

“There’s a stronger, more reactive response, and the diversity of exposures could possibly speak to the regulation of responses,” Gurven said. With this enhanced ability to regulate, he added, “you can turn it up when needed and you can crank it back down when you don’t.”

In comparison, our relatively hygienic industrial society doesn't give us the same diversity of pathogen exposure, so our immune systems are not as fine-tuned. "With us, the immunity can be overly responsive, and to non-pathogens — so we see far more cases of allergies and autoimmune diseases than groups like the Tsimané," he said.

This well-regulated immune response may also confer another protective factor, particularly for the older members of the communities. "Inflammaging," or a chronic, low-level inflammation that increases with age, is notably minimal within the Tsimané and Moseten populations.

"What we observe the immune system doing as we age doesn't appear to be the case in some of these more rural contexts where there's a larger and more diverse set of infectious exposures," Gurven said.

Taken together, Gurven concludes, "There's a confluence of factors that, in interaction, shape people's risk. And so we shouldn't be looking for a single magic bullet.

"And if there are lessons to learn that might generalize to conditions that are favorable toward being protected against infectious disease, well, that's great. We need that."

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