

Indigenous knowledge, community resilience, and health emergency preparedness



The COVID-19 pandemic and the climate change emergency are among the greatest socioenvironmental crises of our time. These crises have exacerbated health inequalities,¹ revealing substantial weaknesses in health systems and community preparedness.² Indigenous peoples globally face some of the greatest risks associated with pandemics and global environmental changes. In the past 3 years (since Nov 16, 2020), we have collaborated with Indigenous communities as part of the COVID Observatories Project, to document their lived experiences, perceptions, and responses to the COVID-19 pandemic in the context of climatic stresses. In this Commentary, we reflect on the commonalities of Indigenous actions across multiple settings, recently synthesised at a COVID Observatories workshop at the Keystone Foundation in Kotagiri, India (March 19–21, 2023). We also provide examples of the use of Indigenous knowledge and practices that aligned with public health responses and underpinned community resilience in response to the COVID-19 pandemic.

In real-time, we observed and documented Indigenous peoples' holistic vision and responses to the pandemic and climate stressors. Some of the strategies used by Indigenous peoples are based on lived experiences of previous pandemics and the use of ancestral knowledge about food generation and health protection. These responses include use of natural resources (eg from forests), family farms, identifying medicinal plants, implementing collective efforts to protect their food security, and use of their communication systems in Indigenous languages to translate and transmit knowledge about food security and the COVID-19 vaccination within their communities.

In the Peruvian Amazon, the elders from the Shawi and Ashaninka Peoples have shared how measles killed many of them, and to protect themselves, they would temporarily live in the forest. During the first 4 months of the COVID-19 pandemic, the Shawi people closed their borders, and some families went to live in the forest, built new houses and relied on forest food, while others who had access to fish farms, home-grown foods, and food from small farms stayed

in their communities. Similarly, during the first wave of COVID-19, Indigenous communities in the Nilgiris district in Tamil Nadu, India, moved far into the forest. In India, Peru, and Sri Lanka, communities revived traditional agricultural practices and reflected on the importance of their territory and food sovereignty in responding to global emergencies and climate change. For the Irula and Kurumba communities in Tamil Nadu, the revival of millet, a weather-adaptable crop, allowed Indigenous farmers to become self-sufficient during the pandemic when food chains were disrupted and prices increased.³ In the case of older Ashaninka women in the central Peruvian Amazon, during the pandemic they transferred Indigenous knowledge to young women about producing and generating nutritious foods in accordance with Indigenous diets, and about how to use medicinal plants to promote and support health within their communities (which we have described previously⁴). In Sri Lanka, Coastal Vedda families spent more time on home gardening and chena cultivation. In the Eastern Cape province of South Africa, Xhosa communities returned to home gardens that had been forgotten due to drought and focused on resilient crops.

Indigenous leadership and community cohesion have been crucial in building resilience during ongoing climate disasters and the COVID-19 pandemic. Coastal Vedda Peoples took early action in Sri Lanka before cyclone Burevi in December, 2020, to maintain pandemic precautions. They organised to take COVID-19 preventive measures despite an absence of government interventions for COVID-19 awareness. In the South African town of Makhanda, Xhosa communities have been experiencing severe droughts for several years, exacerbating food insecurity during the pandemic and reducing agricultural production. By collaborating with civil society organisations and establishing community kitchens, the Xhosa people showed resilience, facing the consequences of the pandemic and the droughts. In Nilgiris, community health workers were instrumental in providing awareness and demystifying the complications of COVID-19 vaccination. They also supported the dissemination of information on dietary practices that include wild foods, and the revival of traditional recipes. Ashaninka women

For the COVID Observatories Project see <https://sites.google.com/upch.pe/covid-observatories/covid-observatories?authuser=0>

For more on the COVID Observatories workshop see <https://keystone-foundation.org/keystone-hosts-the-covid-observatories-team-for-a-workshop/>

	Indigenous knowledge	Public health approaches	Commonalities
Epidemiological triangle	When diseases, environmental crises, or disasters happen, many Indigenous peoples understand the event as being a consequence of an imbalance in the relationship between humans, mother nature, and spiritual influences ⁷	This concept is closely related to the epidemiological triangle to understand causes of infectious diseases: ⁸ host (eg, humans), agent (eg, other species in nature), and environment in which the disease is transmitted (eg, land and weather conditions)	There are relationships in the socioecological dimensions that need to be balanced to prevent diseases; for example, changes in the global climate system might affect human behaviours and other species' behaviours, implying that humans and non-humans are part of the same collective (eg, the concept of mother nature taking care of everything and everyone)
One Health	Indigenous knowledge has a strong health–nature nexus, similar to the One Health framework	In the One Health framework, when a virus jumps the species barrier is when imbalance among species is present and there is a risk of a new disease emerging ⁹	Indigenous knowledge about imbalance among species causing disease in the past aligns with the fact that health systems have faced multiple pandemics; previous learning processes enable Indigenous communities to produce responses informed by empirical data, communicated in Indigenous languages (an example of community resilience)
Planetary health	In the Indigenous worldview, imbalance has repercussions on human health and reflects the Indigenous concept of holistic linkages between humans, other species, and the land where Indigenous peoples live	From a planetary health perspective, the long-term, unwise behaviours of human populations are changing our planetary system and are creating unprecedented challenges to sustain healthy life on Earth ¹⁰	The notion of a planet is closely related to the land, community, or space where Indigenous peoples and families live; even when we do not see the whole Earth, the reality of a space that needs to be healthy, to produce a healthy life, implies that we are part of a major whole system, and all people need to respect it

Table: Commonalities between Indigenous knowledge and public health approaches to understand the health–disease process

leaders in the Peruvian Amazon have recovered medicinal plants and protected natural water sources to adapt to changes in seasonal patterns affecting water availability. These actions demonstrate the innovative thinking and self-organisation within communities that help to overcome challenges and create solutions when resources and support are limited.

In other regions, however, we documented how structural socioeconomic inequities reduced Indigenous peoples' community capacity to respond to the COVID-19 pandemic and increased their vulnerability to multiple stresses. In Ghana and Namibia, our work with the Dagaaba, Ovatjimba, and San Peoples showed how inadequate economic resources, unemployment, illiteracy in the dominant language, and weak social networks increased vulnerability. Government attempts to address these challenges have mainly focused on emergency relief, which fails to address the root causes of inequality and creates dependency on the government, and often does not meet community needs. Similar challenges with governmental aid were noted by Ashaninka communities in Peru.⁴ In Uganda, three decades ago, the Batwa, who are known as Keepers of the Forest, lost access to their ancestral lands—the source of their typical foods, forest resources, and herbal medicines. Reduced access to these Indigenous lands has increased vulnerability among the Batwa communities to the impacts of climate change and recently COVID-19, as we have described previously.⁵ Livelihoods such as making and selling crafts, dancing for tourists, and manual labour

for money and food came to a halt due to the pandemic and lockdown restrictions.⁶ However, our work has shown how Batwa resilience to COVID-19 was based on long-standing knowledge of traditional herbal medicines and well established community support systems like sharing food.

There are commonalities between Indigenous worldviews and public health approaches around the health–disease process and how communities respond to health emergencies. Both acknowledge the interconnected relationship between humans and the socioecological system and the need for balance in this relationship. These commonalities indicate synergies that could be used to strengthen health system responses to current and future health risks (table).

The knowledge of Indigenous peoples is central to community resilience, and their holistic vision of population health aligns with public health approaches. As efforts develop to build health emergency preparedness, support climate adaptation, and promote sustainable development, we conclude it is imperative that Indigenous knowledge, practices, and worldviews underpin policy development and decision-making processes.

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*Carol Zavaleta-Cortijo, James D Ford, Eranga K Galappaththi, Didacus B Namanya, Nosipho Nkwinti, Bhavya George, Cecil Togarepi, Francis A Akugre, Ingrid Arotoma-Rojas, Kerrie Pickering, Chrishma D Perera, Indunil P Dharmasiri, Victoria Chicmana-Zapata, Joana Bezerra, Richard Nuwagira, Olivia Nakwafila, Hans Amukugo, Martha Hangula, Jyotsna Krishnakumar, Ketty Marcelo†, Jaime Miranda, COVID Observatories Team‡
 Carol.zavaleta.c@upch.pe

†Ketty Marcelo is a woman leader of the Ashaninka Indigenous Peoples from the central Amazon, Peru.

Intercultural Citizenship and Indigenous Health Unit, School of Public Health and Administration, Cayetano Heredia University, Lima, 15102, Peru (CZ-C, VC-Z); Priestley Centre for Climate Futures, University of Leeds, Leeds, UK (JF, IA-R); Department of Geography, Virginia Tech, Blacksburg, VA, USA (EKG, CDP, IPD); Ministry of Health, Uganda National Health Research Organisation, Entebbe, Uganda (DBN, RN); Rhodes University Community Engagement, Makhanda, South Africa (NN, JB); Keystone Foundation, Kotagiri, India (BG, JK); Department of Animal Production, Agribusiness and Economics (CT, MH), Department of Epidemiology and Biostatistics (ON), and School of Nursing and Public Health (HA), University of Namibia, Windhoek, Namibia; Institute for Environment and Sanitation Studies, University of Ghana, Accra, Ghana (FAA); Environmental Sustainability Research Centre, Brock University, St Catharines, ON, Canada (KP); Junin, Peru (KM); CRONICAS Center of Excellence in Chronic Diseases, Universidad Peruana Cayetano Heredia, Lima, Peru (JJM)

‡Team members listed in the appendix.

See Online for appendix

- 1 Appleby J. The public finance cost of COVID-19. *BMJ* 2022; **376**: e0490.
- 2 Shroff ZC, Marten R, Vega J, Peters DH, Patcharanarumol W, Ghaffar A. Time to reconceptualise health systems. *Lancet* 2021; **397**: 2145.
- 3 Guleria S, Paithankar P, Prakash A, Mohan K. Ensuring food and nutrition security in climate fragilities and disasters: the 31 inspiring practices. Delhi, India: National Institute of Disaster Management, 2021.
- 4 Arotoma-Rojas I, Chicmana V, Anza-Ramírez C, et al. Policy recommendations from the COVID-19 Observatories in Indigenous peoples for Peruvian stake holders. March 30, 2023 (in Spanish). <https://doi.org/10.6084/m9.figshare.22357822.v1> (accessed July 20, 2023).
- 5 Zavaleta-Cortijo C, Ford JD, Arotoma-Rojas I, et al. Climate change and COVID-19: reinforcing Indigenous food systems. *Lancet Planet Health* 2020; **4**: e381–82.
- 6 Namanya D, Nuwagira R, Ainembabazi T, et al. Prevention, impacts, and response to COVID-19 among the Batwa Indigenous Peoples in Uganda: a policy brief. 2022. https://figshare.com/articles/online_resource/Prevention_Impacts_and_Response_to_COVID-19_among_the_Batwa_Indigenous_Peoples_in_Uganda_A_Policy_Brief/21394974/2 (accessed July 6, 2023).
- 7 Arotoma-Rojas I, Berrang-Ford L, Zavaleta-Cortijo C, Ford JD, Cooke P. Indigenous peoples' perceptions of their food system in the context of climate change: a case study of Shawi men in the Peruvian Amazon. *Sustainability (Basel)* 2022; **14**: 16502.
- 8 Smith E. The effect of potential climate change on infectious disease presentation. *J Nurse Pract* 2019; **15**: 405–09.
- 9 Leifels M, Khalilur Rahman O, Sam IC, et al. The One Health perspective to improve environmental surveillance of zoonotic viruses: lessons from COVID-19 and outlook beyond. *ISME Comm* 2022; **2**: 107.
- 10 Horton R, Lo S. Planetary health: a new science for exceptional action. *Lancet* 2015; **386**: 1921–22.