Study links stress to chromosomal damage

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Snodgrass, upper left, his research team, and Sahariya villagers oversee a local doctor administering a malaria test in the village Behruda.

A new wildlife preserve in India recently became a laboratory for Colorado State University researchers who studied not endangered animals but villagers displaced by the preserve. They found that such stress takes a measurable toll on people's health.

Jeffrey Snodgrass, an anthropology professor, and Sammy Zahran, associate professor of economics, led an interdisciplinary CSU team that measured residents' stress using tools that ranged from interviews to saliva tests for elevated levels of certain hormones. The group also took samples of cells from inside villagers' cheeks to analyze how stress

affected their chromosomes' protective caps, or telomeres.

The research involved two villages in India: one that was relocated from its river valley to nearby plains to create room for a new preserve for endangered Asiatic lions, and another on the edge of the preserve that wasn't moved. The CSU team found that the relocated villagers demonstrated higher stress levels than the ones who were allowed to remain in their homes, and discovered evidence that the stress was harming their health and even potentially accelerating their aging at a deep, cellular level.

"We don't usually think about conservation displacing people," Snodgrass said. "In this case, we asked whether stress could actually injure people deeply and shave off years of their life. Our findings support the idea that stress is linked to cellular damage."

The results of the study, titled "Stress and telomere shortening among central Indian conservation refugees," were published Feb. 17 in the *Proceedings of the National Academy of Sciences.*

Snodgrass said the project is believed to be the first such stress study conducted outside of Western, educated, industrialized, rich and democratic societies, which tend to have lower stress levels and longer life expectancies.

Snodgrass, who has worked with the indigenous Sahariya people in India since 2008, spent four years on the current project, interviewing subjects from both villages and ranking their answers on the Bradford Somatic Index, a scale created specifically for South Asia to measure one's psychological state.

Snodgrass' main research assistant, Ghanshyam Sharma, left, and the headman of the village Behruda, near the fence marking the wildlife sanctuary's ecological core, which they're now forbidden to enter.

His team also collected saliva and used toothbrushes to swab inside subjects' cheeks, sending those samples back to his research partners for the hormone and telomere tests.

"It was a challenging field situation," Snodgrass said. "We preserved samples in a refrigerator powered by a generator."

Zahran handled the data analysis, while Susan Bailey of CSU's Department of Environmental and Radiological Health Sciences and postdoctoral student David Maranon did the telomere studies.

"I'm kind of in awe of their lab over there," Snodgrass said.

Bailey's work includes one of the upcoming NASA studies being done on the twin astronauts Scott and Mark Kelly while Scott spends a year on the International Space Station.

Each chromosome has a protective end-cap called a telomere, which Bailey compares to the plastic tip on a shoelace that keeps the lace from unraveling. As cells divide and replicate normally throughout life, the chromosomes divide as well, and as they do, the ends—the telomeres—gradually erode, eventually leading to the natural death of cells.

Snodgrass spent four years in India studying members of the two villages for signs of stress.

Bailey says the erosion rate of telomeres reveals a lot about a person's aging process and health. For instance, studies have shown that nonsmokers who get regular exercise typically have longer telomeres than those who have unhealthy lifestyles.

In this case, the researchers found that during the study period, the telomeres of individuals in the displaced population were shorter than those of the villagers who were allowed to remain in their ancestral homes.

Those results were consistent with findings in the study of two stress hormones, cortisol and alpha-amylase, by Douglas Granger of Arizona State University and Johns Hopkins University. Their analysis found the hormone levels were elevated in the displaced villagers as well. Another co-author on the paper was Chakrapani Upadhyay, a sociologist at the Government Postgraduate College in Pratapgarth, India.

Snodgrass said that, aside from the groundbreaking findings, the project was distinctive because it involved a variety of researchers from seemingly disparate fields: sociology, biology, economics, anthropology and endocrinology.

"I think the hard sciences need the social sciences, and vice versa," he said. "I think that together, we can come up with interesting—and important—findings not possible any other way."

More information: *PNAS*, Sammy Zahran, E928–E936, DOI: 10.1073/pnas.1411902112

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