Study shows long-term health impacts after exposure to environmental disaster

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Exposure to a large-scale disaster, such as a tsunami, impacts population

health over a decade later. A new study by an inter-disciplinary team of researchers in the United States and Indonesia has found that women who lived along the coast of Aceh, Indonesia when it was hit by waves from the 2004 tsunami have lower cortisol levels 14 years later than women who lived in other, nearby coastal communities that were not directly affected.

Cortisol is a stress hormone produced by the adrenal glands. Cortisol levels rise in response to stress as part of the fight or flight response, but consistently elevated stress can result in dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis. The study links the stresses from exposure to the tsunami to "burnout" of the HPA-axis manifest in low cortisol levels over the long-term. The findings are published in the journal *Proceedings of the National Academy of Sciences*.

"These effects are greatest for women who reported elevated levels of post-traumatic stress symptoms for two years after the tsunami," said Elizabeth Frankenberg who, with Duncan Thomas and Cecep Sumantri, leads a long-term survey project, the Study of the Tsunami Aftermath and Recovery (STAR).

They and their colleagues have been studying survivors of the Indonesian tsunami who were first interviewed before the tsunami. For this research, they collected hair samples from adults 14 years after the tsunami. "Ralph Lawton was a Duke undergraduate and Robertson Scholar when he went to Indonesia to collect the hair and establish the assay in our lab in Yogyakarta: he is incredibly impressive and the first author of the manuscript," said Duncan Thomas.

He continued, "An important finding is that people with low levels of cortisol are in worse physical and psychosocial health 14 years after the tsunami, evidence of the long reach of the stresses of the tsunami and its aftermath."

Elizabeth Frankenberg pointed out that visually, the damage wrought by the Indian Ocean tsunami on the built and natural landscape along the coast of Aceh, Indonesia, looks remarkably similar to the damage from hurricanes and intense storms along the coast of North Carolina and other parts of the U.S. "Lessons learned from following people in Aceh over 20 years provides important insights into the likely longer-term impacts of climate change on populations in the U.S. and across the globe," said Frankenberg.

STAR is a collaborative project involving investigators at the University of North Carolina at Chapel Hill, Duke University, SurveyMETER (Indonesia), Harvard University, the University of California, Los Angeles (UCLA) and the University of Southern California.

More information: Exposure to the Indian Ocean Tsunami shapes the HPA-axis resulting in HPA "burnout" 14 years later, *Proceedings of the National Academy of Sciences* (2023). DOI: 10.1073/pnas.2306497120. doi.org/10.1073/pnas.2306497120

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