

Three decades of data in Bangladesh show elevated risk of infant mortality in flood-prone areas

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A new study from researchers at UC San Diego's Scripps Institution of Oceanography and UC San Francisco estimates 152,753 excess infant

deaths were attributable to living in flood-prone areas in Bangladesh over the past 30 years. Additionally, across the study period, children born during rainy months faced a higher risk of death than those born in dry months.

The paper is [published](#) in the *Proceedings of the National Academy of Sciences*.

The findings begin to unspool the long-term public health impacts of recurring environmental hazards such as flooding, wildfires, or [extreme heat](#), many of which are [becoming more common or more severe under climate change](#), said study co-author Tarik Benmarhnia, an associate professor at Scripps Oceanography who studies climate change and health.

Benmarhnia and his co-authors were motivated to undertake the study as a way to move beyond cataloging the acute public health impacts of natural hazards linked to climate change.

"We wanted to document what happens when year after year some communities are exposed to these climate hazards," said Benmarhnia.

Benmarhnia and his co-authors wanted to find a way to look at the long-term public health burden of living in flood prone-areas on [child mortality](#) and Bangladesh seemed to offer an opportunity to quantify that burden over a long time period.

"Child mortality is a proxy for easily avoidable negative health outcomes," said Benmarhnia. "If we can't avoid child mortality there are also likely to be issues with malnutrition, [mental health](#), and communicable diseases—from a public health perspective infant mortality is only the tip of the iceberg."

Bangladesh sits in the [Ganges-Brahmaputra-Meghna river basin](#), which also runs through Tibet, Nepal, Bhutan, and northern India and is home to more than 618 million people. Every year, [monsoon season](#) brings extensive flooding to Bangladesh, and those floods are [predicted to become more frequent and extreme due to climate change](#).

To look at the long-term health implications of repeated exposure to flooding, the study combined a well-established spatially-resolved flood-zone mapping tool and [health data](#) from 58,945 mothers and 150,081 births collected by [U.S. AID's Demographic and Health Surveys](#) (DHS) program between 1988 and 2017. The study matched mothers that were nearly identical across other measurable characteristics that might impact infant mortality, such as wealth and education, and differed only in the flood-risk of their birthing location.

"We wanted to isolate as much as possible the effect of living in flood-prone areas from other factors that could alter the risk of child mortality," said Benmarhnia.

The study estimated that living in flood-prone areas was associated with an excess risk of infant mortality of 5.3 additional deaths per 1,000 births compared to living in non-flood-prone areas over the 30-year period between 1988 and 2017, with children born during rainy months at higher risk of death than those born in dry months.

The researchers then used national population data, weighted [statistical analysis](#), and the same flood-zone mapping tools to extrapolate their findings with this initial group to the entire country of Bangladesh. This national-scale analysis estimated that 152,753 excess infant deaths were attributable to living in flood-prone areas in Bangladesh over the past 30 years.

The study's results don't point to any particular mechanism for how flood

exposure might drive increased infant mortality, and Benmarhnia said investigating potential causes will be a necessary step in developing effective interventions. That said, he suggested that flooding can impact [food security](#) and financial stability, especially for agricultural communities.

Benmarhnia said the findings suggest that focusing only on the immediate effects of flooding may underestimate their impact on population health and that effects on infant [mortality](#), in particular, appear to manifest over a longer time scale. The study also provides a template for measuring longer-term health impacts from floods and a generalizable example of how to study the long-term health effects of climate-related environmental hazards.

The role of climate change was not explicitly included in the analysis, said Benmarhnia, but he said there was a continuous increase in the overall risk of [infant mortality](#) across the study's three decades.

"We didn't quantify the role of climate change, but it's the elephant in the room," said Benmarhnia. "While our data can't explicitly link our findings to climate change, they're compatible with the notion that [climate change](#) is making flooding and the public [health](#) impacts that flow from it worse."

In light of their findings, the study authors are now studying the potential of seasonally-timed nutritional interventions that can bolster food security when communities are at the greatest risk from flooding and other climate-sensitive exposures.

"We need to be thinking about and dealing with the long-term consequences of other [climate](#) hazards and instances of so-called extreme weather," said Benmarhnia. "We may also need to redefine our concept of extreme. The intensity is extreme but these [environmental](#)

[hazards](#) like flooding are less and less rare. We may need to reframe these issues as recurring problems and not just emergency situations."

In addition to Benmarhnia, the study was co-authored by Francois Rerolle, who is a postdoctoral researcher at UC San Francisco and Scripps Oceanography, and Benjamin Arnold of UC San Francisco.

More information: Francois Rerolle et al, Excess risk in infant mortality among populations living in flood-prone areas in Bangladesh: A cluster-matched cohort study over three decades, 1988 to 2017, *Proceedings of the National Academy of Sciences* (2023). [DOI: 10.1073/pnas.2218789120](https://doi.org/10.1073/pnas.2218789120). www.pnas.org/doi/10.1073/pnas.2218789120. On *Reseach Square*: [DOI: 10.21203/rs.3.rs-2231972/v1](https://doi.org/10.21203/rs.3.rs-2231972/v1)

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