**Fertility and crisis in Indonesia: 30 years of climate disasters**

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Natural disasters impose profound shocks on women's life-cycle outcomes, with fertility among the most affected dimensions. Fertility may rise through mortality replacement mechanisms or decline due to stress, increased partner mortality, higher risks of miscarriage, and reduced fecundity linked to nutritional deficiencies following disruptions in food supply. Empirical evidence to date remains inconclusive, with studies reporting mixed or contradictory findings.

This paper systematically analyses the long-term relationship between disaster exposure and fertility in Indonesia over the past five decades. Using one round of the World Fertility Survey (1976) and eight rounds of the Indonesian Demographic and Health Surveys (1987–2017), we examine the effects of high-intensity climatic disasters—including floods, cyclones, and typhoons—on completed fertility among women aged 40–49. Disaster exposure, defined as events affecting over one million people, is measured by linking DHS data to EM-DAT, the International Disaster Database, at the provincial level to capture all events experienced by women during their reproductive years.

We apply multilevel modelling techniques to account for the hierarchical structure of individuals within provinces and to assess contextual effects while controlling for socio-economic factors such as education, residence, wealth, and marital status. The results reveal a generally negative association between disaster exposure and completed fertility, with notable variations in intensity across survey years and provinces. Fertility levels remain lower among more educated and urban women. Situated within broader research on crises and demographic behaviour, this study offers a historical account of how recurrent environmental shocks shape childbearing outcomes in Indonesia.

Extended abstract

**Background and Motivation**

The relationship between environmental shocks and demographic behaviour has long been debated. While common belief suggests that disasters may lead to "baby booms" due to increased mortality or social disruptions, empirical evidence remains inconsistent. Most research to date, as summarised by Lee et al. (2023), points to an overall negative association between disasters and fertility, often mediated by physiological and behavioural mechanisms. However, this literature largely focuses on high-income countries (HICs), leaving significant knowledge gaps regarding long-term fertility responses in low- and middle-income settings such as Indonesia — a country recurrently affected by floods, droughts, cyclones, and earthquakes.

**Research Gaps**

Three main gaps motivate this study. First, the interaction between fertility and mortality transitions under recurrent shocks remains unclear. Second, there is little understanding of how repeated exposure to disasters across the reproductive lifespan affects completed fertility. Third, most prior studies assess short-term or cohort-specific impacts rather than cumulative lifetime effects. Addressing these limitations is particularly relevant for Indonesia, where the fertility transition coincided with intense environmental instability and economic transformation.

**Objectives**

This study investigates the *lifetime impact* of high-intensity climatic disasters on completed fertility among Indonesian women aged 40–49 years over the past five decades. Rather than focusing on the timing of individual disasters, we estimate the cumulative exposure to major weather-related events —defined as floods, cyclones, typhoons, and droughts—that affected at least one million people.

**Data and Methods**

We combined one round of the World Fertility Survey (1976) and eight rounds of the Indonesian Demographic and Health Surveys (DHS, 1987–2017). Disaster data were sourced from the EM-DAT International Disaster Database, linked to DHS provinces to estimate the total number of people affected during each woman's reproductive life (sum of injured, affected, and homeless).

Using a *pseudo-longitudinal synthetic cohort design*, we reconstructed individual fertility histories and employed multilevel models to account for clustering at province and household levels. The models control for individual socio-economic characteristics (education, residence, wealth, and marital status) and contextual variables capturing provincial disaster intensity.

**Findings**

Results show that fertility outcomes follow expected socio-economic gradients: completed fertility is higher among women with lower education, those living in rural areas, and those in the poorest wealth quintiles. Additionally, women who experienced child loss show higher fertility, suggesting a possible replacement or mortality counterfactual effect.

Preliminary analyses indicate that exposure to multiple or intense disasters is associated with modest but significant reductions in completed fertility. The effect appears to vary by disaster type, with stronger associations for earthquakes and weaker ones for droughts. Cohort effects are also visible, reflecting both changes in data quality and evolving coping strategies, such as urbanisation (from 32% in 1976 to 53% in 2017) and shifts in mortality perceptions (Table 1).

**Table 1 Event effect and ICC models Indonesia (1976-2017)**

| | **1976** | **1987** | **1991** | **1994** | **1997** | **2002** | **2007** | **2012** | **2017** |
|---|---|---|---|---|---|---|---|---|---|
| Affected by climate disasters at least once | 0.54* | 0.51*** | -0.17 | -0.26** | -0.55** | 0.06 | -0.11 | -0.18* | -0.23** |
| ICC province/ region level | 0.02 | 0.06 | 0.21 | 0.30 | 0.46 | 0.58 | 0.45 | 0.05 | 0.03 |

The mechanisms linking disasters to fertility appear both physiological and behavioural. Adverse impacts arise through higher miscarriage risk, stress, malnutrition, and disruption of living conditions, leading to reduced coital frequency or delayed marriage. Conversely, some events may temporarily increase fertility via earlier marriage or childbearing following disruptions in education or social structures. The overall direction of association in Indonesia, however, aligns with a *detrimental* fertility effect.

**Contribution and Limitations**

This paper offers one of the first lifetime, population-level analyses of disaster exposure and fertility in a developing-country context. By focusing on cumulative exposure rather than event timing, it provides a long-term perspective on reproductive resilience under environmental stress.

Nonetheless, the approach entails limitations: residence assumptions may obscure migration effects; disaster timing is not directly matched to fertility episodes; and reporting inconsistencies may underestimate event frequency. Future work will model fertility and poverty outcomes (PPP) at the time of disasters and explore patterns of childlessness and unwanted fertility.

**Conclusion**

Indonesia's experience illustrates how recurring climatic shocks shape reproductive trajectories across generations. The findings highlight the importance of integrating disaster risk reduction with reproductive health and social protection policies, especially as climate-related crises intensify.