

## POLICY BRIEF

# Impact of Extreme Climate Events on Early Childhood Development in Pakistan



Faisal Abbas, Akhtar Ali & Haram Saad  
NUST

Globally Pakistan is the most vulnerable country to the changing climatic conditions. Pakistan is experiencing increasing frequency and severity of extreme climate events—heatwaves, floods, droughts, erratic rainfall—that threaten the physical, cognitive, emotional, and social development of young children. In Pakistan, extreme climate change events are increasingly undermining the environmental and social conditions necessary for healthy early childhood development (ECD).

Pakistan stands among the nations most vulnerable to climate change. Despite contributing less than 1% to global greenhouse gas emissions, the country has repeatedly borne the brunt of devastating weather events in recent years, including crippling heatwaves and catastrophic floods (World Bank, 2022). These extreme events do not impact all populations equally. Children from poorer households, already marginalized by poverty, are disproportionately affected—forced into early labour or marriage as families seek coping mechanisms in crisis (Save the Children, 2023).

The consequences of these climate-driven disasters extend beyond physical health. Floods and heatwaves have disrupted education for millions of children. In Pakistan, these events have grown more frequent and intense over the past two decades. According to the Global Climate Risk Index (Germanwatch, 2021), Pakistan is among the top 10 countries most affected by climate-related disasters between 2000 and 2019. The 2022 floods, for example, directly affected 33 million people, including over 16 million children, while also destroying more than 2 million homes and thousands of schools and health facilities (UNICEF Pakistan, 2022).

Children under the age of five are particularly vulnerable: exposure to heat stress, malnutrition, infectious diseases, displacement, and disrupted education undermine developmental milestones. Early Childhood (< 5 years) is critical window for development. Damage or deprivation in that period can have irreversible effects.

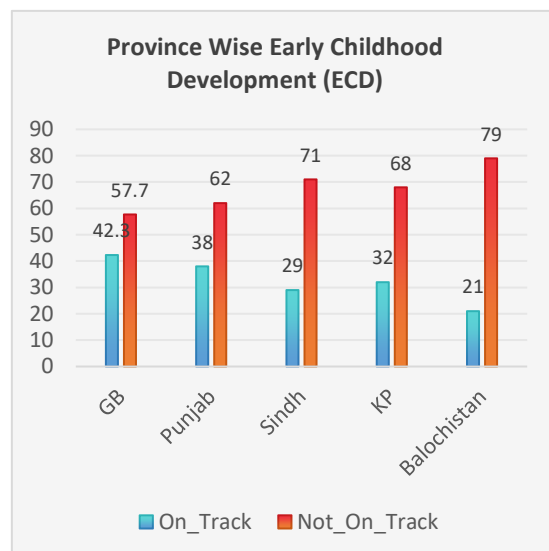
Without targeted policy interventions, these impacts will impede human capital development,

contribute to inter-generational cycles of poverty, and constrain national development.

For the current study MICS data was used, covering all major provinces of Pakistan—Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan as well as Gilgit-Baltistan. These datasets include detailed modules on child development, health, nutrition, household demographics, and environmental conditions. MICS surveys typically target children under five years of age and women aged 15–49, with sample sizes ranging from 50,000 to 80,000 households, thereby providing robust provincial and national estimates. To quantify early developmental outcomes, an Early Childhood Development (ECD) Index was constructed across multiple domains for children aged 36–59 months. The construction of the ECD index followed standardized procedures as recommended by UNICEF MICS guidelines. For extreme events calculation NASA data set was used.

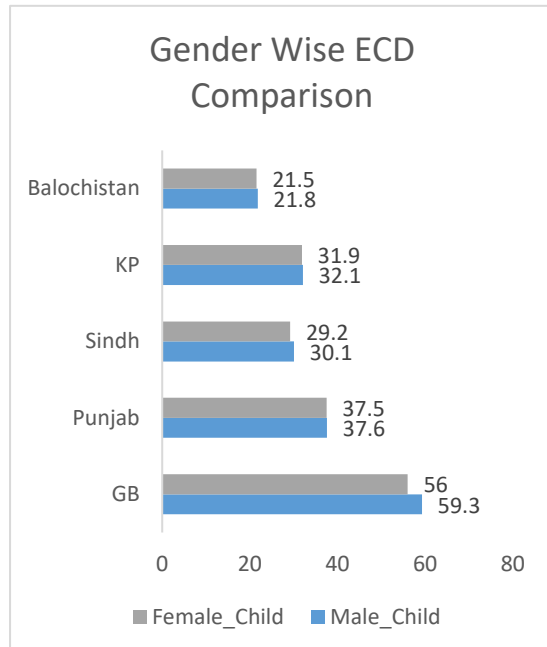
## Key Findings

### Province Wise Early Childhood Development Index



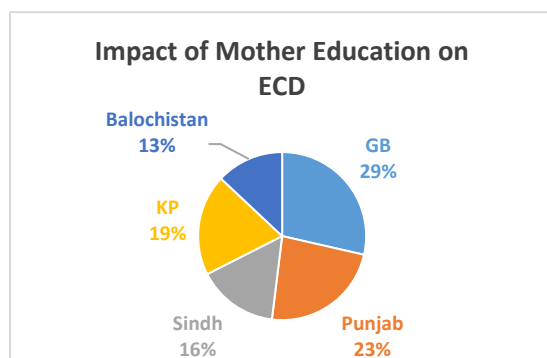
## Gender Wise Analysis

Gender wise analysis indicates that male children are marginally performing better as compared to female children across all the demographic regions/territories in Pakistan.



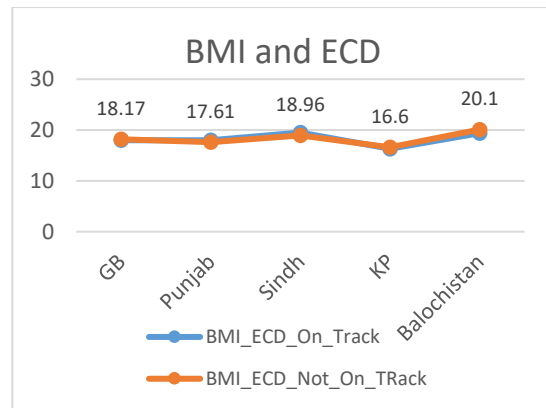
## Impact of Mother Education

The pie chart below indicates that there is positive and significant impact of mother education on early childhood development.



## Body Mass Index and ECD Relationship

There is no clear relationship between BMI and Early Childhood Development as the below graph indicates.



## Impact of Extreme Climate Change Events on Early Childhood Development

The correlation between extreme rainfall and early childhood development is strong negative i.e. -0.821 and highly significant at 1 percent level of significance. More extreme rainfall events are strongly associated with poorer early childhood development. Similarly, correlation between temperature and early childhood development is strong negative i.e. -0.673 and significant.

All climate indicators are negatively correlated with early childhood development, suggesting that as climate stress increases, child development worsens. The most impact full indicators appear to be: Extreme rainfall events (strongest negative effect). Rainfall and average temperature (also strong effects). Even moderate or weak indicators, like temperature extremes, show statistically significant negative associations. Climate change isn't just an environmental issue-it has serious implications for child well-being and development. Policymakers and stakeholders in child health and education need to consider climate resilience strategies.

Beside correlation regression results were also estimated documenting the impact of extreme climate change events on early childhood development and the results are negative and significant indicating that extreme climate change events has negative impact on early childhood development in Pakistan. All these empirical findings indicate serious implications for policy makers.

## Policy Recommendations

- **Integrate Early Childhood Development (ECD) into Climate Adaptation Policy**

Early Childhood Development (ECD) needs to be part of Pakistan Climate Adaptation Policy. This needs to be ensured that national and provincial climate adaptation frameworks explicitly include ECD domains (health, nutrition, learning, emotional well being).

- **Strengthening Health & Nutrition Services with Climate Sensitivity**

Expand maternal and child health programs with preparedness for heat, flood, waterborne diseases. Improve nutrition support programs (supplementation, food security, emergency feeding) in climate-vulnerable areas. Ensure WASH infrastructure is resilient to flooding and secure water supply in heat extremes.

- **Protect & Adapt Early Learning / Education Infrastructure**

Build and retrofit early childhood centres and primary schools to be climate resilient (flood-proofing, ventilation, shade, solar power etc.). Develop contingency plans for continuity of early education during disasters (remote learning, mobile learning centres). Ensure psychological support, trauma counseling for young children affected by disasters.

- **Strengthening Social Protection & Household Resilience**

Cash transfers, food vouchers or other safety nets targeted to households with young children to buffer income losses, food insecurity. Support livelihood diversification to reduce dependency on climate-sensitive agriculture.

- **Enhance Community & Caregiver Support**

Awareness campaigns for caregivers on climate risks (heat, hygiene, nutrition) and home-based early stimulation. Support mothers & pregnant women especially in vulnerable zones (nutrition, antenatal care, safe spaces). Launch campaigns to

educate families about climate risks and child safety during extreme events.

- **Improve Data, Monitoring, and Research**

Collect disaggregated data (by age, gender, locality) on children's health, growth, development outcomes in face of climate risks. Conduct longitudinal studies to map long-term effects of exposure to climate stressors.

- **Strengthening Institutional Coordination & Financing**

Ensure relevant ministries (climate change, health, education, social welfare) coordinate planning and response for ECD. Mobilize dedicated funding (national budget as well as international climate finance) for child-focused climate resilience.

- **Prioritize High-Risk, Low-ECD Regions**

Use geospatial and developmental indicators to target provinces like Balochistan, Sindh, and AJK for priority interventions. Allocate additional resources for infrastructure, health, and education in these areas.

Climate change is already compromising the development potential of Pakistan's youngest citizens. Without swift and coordinated policy action, these impacts are likely to worsen, deepening inequality and undermining human capital for generations to come. A proactive, climate-informed, and child-centered policy response is not optional-it is essential.

The evidence presented above demonstrates a clear and statistically significant negative relationship between extreme climate events-particularly rainfall and temperature fluctuations-and early childhood development (ECD) outcomes across Pakistan. Over the past 15 years, Pakistan has experienced a notable increase in climate-related disasters, including floods, heatwaves, and snowstorms, with significant impact on young children's health, learning, and development.