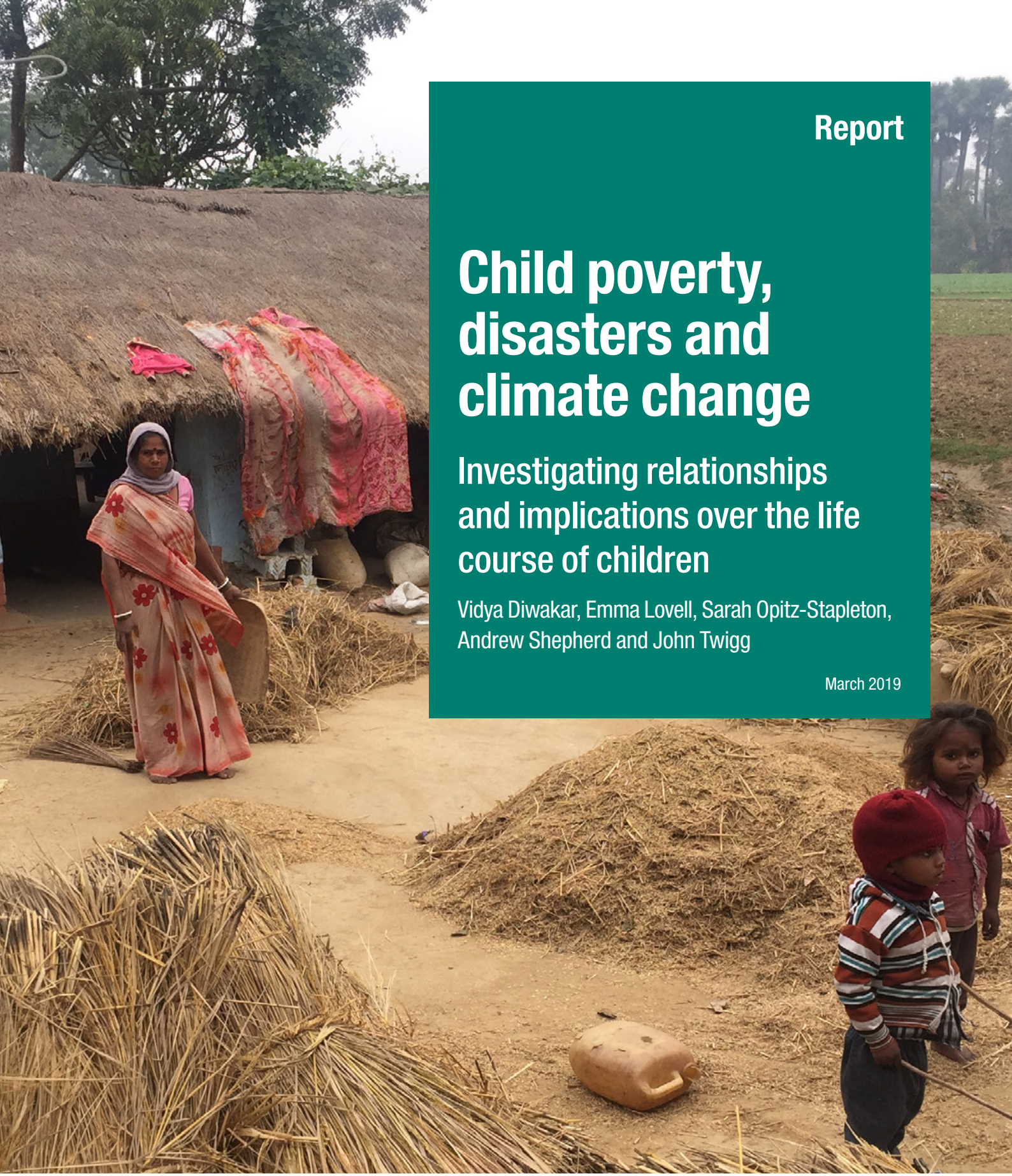


Report

Child poverty, disasters and climate change

Investigating relationships and implications over the life course of children

Vidya Diwakar, Emma Lovell, Sarah Opitz-Stapleton, Andrew Shepherd and John Twigg

March 2019

Chronic Poverty Advisory Network

Readers are encouraged to reproduce material for their own publications, as long as they are not being sold commercially. ODI requests due acknowledgement and a copy of the publication. For online use, we ask readers to link to the original resource on the ODI website. The views presented in this paper are those of the author(s) and do not necessarily represent the views of ODI or our partners.

This work is licensed under CC BY-NC-ND 4.0.

Cover photo: Laugain, Bihar. © ADM Institute for the Prevention of Postharvest Loss

Acknowledgements

This paper is the work of two programmes at the Overseas Development Institute (ODI), the Risk and Resilience Programme and the Chronic Poverty Advisory Network (CPAN), bringing together a range of expertise to ensure that we deliver the highest-quality research. We would like to thank UNICEF for financing the research.

We are grateful to the following for their inputs to this report: Pandora Batra, Sophie Bridonneau and Alice Caravani of ODI for their help with the case studies and data. We would also like to thank our reviewers: Hannah Caddick, Elizabeth Carabine, Rebecca Nadin and Thomas Tanner (ODI), Amanda Lenhardt (Save the Children UK) and Antony Spalton, Hamish Young, Lars Bernd, Sarbjit Singh Sahota and Banku Bihari Sarkar (UNICEF). Thanks to Hannah Caddick, Anna Hickman, Katherine Shaw and Sean Willmott for their help with communications; to Steven Percy and Matthew Foley for copyediting the two papers; to Nicholas Martin and Sean Wilmott for their help with the design; and to Hannah Bass for proofreading.

This report is accompanied by a briefing note and infographic, available at **www.odi.org/publications/11281-child-poverty-disasters-and-climate-change-investigating-relationships-and-implications-over-life**.

Contents

Acknowledgements 3

List of boxes, tables and figures 5

Acronyms 7

Terminology 8

Executive summary 10

1 Introduction 18

1.1 Understanding disasters, poverty and child wellbeing 18

1.2 Direct impacts of disasters and climate change on child wellbeing 20

1.3 Indirect impacts of disasters and climate change on child wellbeing 21

1.4 Building roads out of poverty amid environmental shocks and stresses 21

1.5 Scope and purpose of the report 22

2 Methodology 24

3 Country overviews: child poverty and disasters in India and Kenya 27

3.1 India 27

3.2 Kenya 32

4 Linking disasters to children's lifecycles 37

4.1 The relationship between disasters and household poverty 37

4.2 Children living in disaster-prone areas 41

5 Child poverty and disasters: spotlight on Bihar and Turkana 47

5.1 Bihar, India 47

5.2 Turkana, Kenya 52

6 Implications and recommendations for policy and programming 56

6.1 Recommendations: the wider context 59

7 Conclusions and looking forward 63

References 65

Annex 1 Policy frameworks 74

Annex 2 Data sources and their limitations 78

Annex 3 Methods of empirical analysis 81

Annex 4 Empirical results 84

List of boxes, tables and figures

Boxes

Box 1 Links to international policy frameworks **20**

Box 2 Spotlight: child wellbeing and floods in India **45**

Box 3 Disaster risk management and climate change policy in Bihar **75**

Box 4 Disaster risk management and climate change policy in Turkana **77**

Tables

Table 1 The relationships between natural/climate hazard-related disasters and child and adolescent wellbeing at different life course stages in India and Kenya **13**

Table 2 Data sources **26**

Table 3 Total number of deaths, affected people and total damage by disaster type in India, 2000–2014 **29**

Table 4 Total number of deaths, affected people and damage by disaster type in Kenya, 2000–2014 **34**

Table 5 Kenyan counties' exposure to flood and drought **35**

Table 6 INFORM results for Turkana, Kenya, 2015 **52**

Table 7 Key findings and associated policy implications for different stages of life course in India and Kenya **57**

Table 8 Associations between disasters and household poverty status: Kenya, logistic regression **84**

Table 9 Associations between disasters and household poverty status: India, logistic regression, fixed effects **85**

Table 10 Associations between disasters and household poverty trajectories: India, multinomial logistic regression effects **86**

Table 11 Results of t-tests: child and adolescent wellbeing in disaster-prone areas vs others **87**

Figures

Figure 1 The links between natural/climate hazard-related disasters and children's wellbeing at different stages of their life course **12**

Figure 2 Incidence of disaster types in India, 2000–2014 **28**

Figure 3 Incidence of disasters caused by natural hazards by state **29**

Figure 4 Poverty trajectories in India by household, 2005–2011 **31**

Figure 5 Household poverty trajectories by disaster prevalence, 2011 **31**

Figure 6 Chronic poverty by socio-religious group, 2005–2011 **31**

Figure 7 Poverty descenders by social group, 2005–2011 **32**

Figure 8 Incidence of disaster types in Kenya, 2000–2014 **32**

Figure 9 Map of arid and semi-arid counties in Kenya **33**

Figure 10 Poverty rate across Kenyan counties, 2009 **36**

Figure 11 Female headship by poverty and disaster prevalence, Kenyan counties, 2013–14 **36**

Figure 12 Housing and demographics among chronically poor households in India, 2011 **40**

Figure 13 Housing and demographics overall, Kenyan counties, 2014 **40**

Figure 14 Health services for pregnant mothers, India, 2011 **42**

Figure 15 Health services for pregnant mothers, Kenya, 2014 **42**

Figure 16 Secondary enrolment rates, India, 2011, and Kenya, 2014 **44**

Figure 17 Incidence of disaster types in Bihar, 2000–2014 **48**

Figure 18 Multi-hazard map of Bihar **49**

Figure 19 District-level increasing mean November minimum temperatures, 1971–2015 **50**

Figure 20 Turkana, mean monthly maximum temperatures, 1971–2015 **53**

Figure 21 Turkana, mean monthly precipitation, 1981–2015 **53**

Figure 22 Precipitation trends for Turkana during the short rainy season, 1981–2015 **54**

Figure 23 Child farm labour among adolescents, Turkana, 2014 **55**

Acronyms

APFM	Associated Programme on Flood Management
ARC	Africa Risk Capacity
ASALs	Arid and semi-arid lands
CCA	Climate change adaptation
CHIRPS	Climate Hazards Group InfraRed Precipitation
CPAN	Chronic Poverty Advisory Network
CRU	Climate Research Unit of the University of East Anglia
DRM	Disaster risk management
DRR	Disaster risk reduction
EDE	End Drought Emergency
GDP	Gross domestic product
ICDS	Integrated Child Development Services
IHDS	India Human Development Survey
INFORM	Index for Risk Management
IMD	India Meteorological Department
IMF	International Monetary Fund
JDU	Janta Dal United
INDCs	Intended Nationally Determined Contribution
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MICS	Multiple Indicator Cluster Survey
NDMA	National Drought Management Authority
NDMP	National Disaster Management Plan
SDMA	State Disaster Management Authority
SDGs	Sustainable Development Goals
SDMP	State Disaster Management Plans
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UNISDR	United Nations International Strategy on Disaster Reduction
WASH	Water, sanitation and hygiene
WHO	World Health Organization

Terminology

Adolescents	Individuals defined generally, according to WHO, UNICEF and others, as those aged between 10 and 19 years.
Adivasi	A collective term to refer to the various ethnic groups of India. People belonging to the 'Scheduled Tribes' in India are generally considered to be Adivasis, though the two terms are not interchangeable.
Affected	'People who are affected, either directly or indirectly, by a hazardous event. Directly affected are those who have suffered injury, illness or other health effects; who were evacuated, displaced, relocated or have suffered direct damage to their livelihoods, economic, physical, social, cultural and environmental assets. Indirectly affected are people who have suffered consequences, other than or in addition to direct effects, over time, due to disruption or changes in economy, critical infrastructure, basic services, commerce or work, or social, health and psychological consequences' (UNISDR, 2016: 11).
Capacity	'The combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience' (UNISDR, 2016).
Child life course/ lifecycle	The process of a child's life through a sequence of age categories. In this study, we categorise life course into the following: in utero and birth, children under five, young children 6–14 years old, and adolescents 10–19 years old. While the latter two groups do have overlaps, we feel this approach is a step towards understanding how needs and wellbeing outcomes vary by a child's stage of life.
Children	In this paper, we define children as those aged 0–14 years, following definitions used by agencies such as UNICEF and WHO.
Chronic poverty	'Extreme poverty that persists over years or a lifetime, and that is often transmitted intergenerationally' (Shepherd et al., 2014: 3).
Climate hazard	A climate-related event or trend that may cause loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, etc. This includes rapid-onset events such as heavy rain and flash floods, and slow-onset events such as drought, sea level rise and gradual shifts in seasons (adapted from IPCC, 2014).
Deprivation	The lack of something considered to be a necessity. It is often the result of a lack of income and other resources. While one deprivation alone is not necessarily a cause for concern, overlapping deprivations may indicate a state of poverty (adapted from OPHI, n.d.).
Disaster	'A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts' (UNISDR, 2016: 13).
Disaster-prone	In this study, we define 'disaster-prone' areas as those areas which have experienced more disasters than the country-wide mean (based on EM-DAT data, which covers a range of disaster types – for which our study included biological, climatological, geophysical, hydrological and meteorological). In some instances, where explicitly noted, we also define it as areas that have experienced a longer average duration of disasters than the country-wide mean. Note: where we refer to 'flood-prone' (or 'drought-prone'), the same method is used. We refer to areas that have experienced more floods (or droughts) than the country-wide mean (based on EM-DAT data for the respective disaster type).

Disaster risk management (DRM)	'Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses' (UNISDR, 2016: 15).
Disaster risk reduction (DRR)	'Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development' (UNISDR, 2016: 16).
Exposure	'The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas' (UNISDR, 2016: 18).
Hazard	'A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation' (UNISDR, 2016: 18).
Impoverishment	'The descent into extreme poverty' (Shepherd et al., 2014). Also referred to in this paper as 'poverty descents'.
Multidimensional wellbeing	This study deals with outcome indicators such as schooling, health and labour, which are indicative of child wellbeing in a conceptualisation that is much wider than monetary or per capita income or expenditure measures alone. We refer to this as multidimensional wellbeing.
Panel data	Longitudinal datasets that track the same households over time; ideally, panel datasets comprise more than two waves of data collection. In this way, households that are chronically poor (poor in each period) can be identified, as well as those that move in and out of poverty (the transitory poor – poor in at least one period, but not in all periods).
Poverty escapes	An ascent out of or escape from extreme poverty. In other words, starting below the poverty line and thereafter moving above it, in the case of two-wave panel data as per this study.
Recovery	'The restoring or improving of livelihoods and health, as well as economic, physical, social, cultural and environmental assets, systems and activities, of a disaster-affected community or society, aligning with the principles of sustainable development and "build back better", to avoid or reduce future disaster risk' (UNISDR, 2016: 21).
Rehabilitation	'The restoration of basic services and facilities for the functioning of a community or a society affected by a disaster' (UNISDR, 2016: 22).
Resilience	'The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management' (UNISDR, 2016: 22).
Response	'Actions taken directly before, during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected' (UNISDR, 2016: 22).
Risk	'Risk is often represented as the probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard' (IPCC, 2014: 5).
Scheduled Castes and Tribes	Terms used to administer constitutional privileges and protection for specific groups of people in India who have been historically disadvantaged.
Slow-onset disaster	'A slow-onset disaster is defined as one that emerges gradually over time. Slow-onset disasters could be associated with, e.g., drought, desertification, sea-level rise, epidemic disease' (UNISDR, 2016: 14).
Sudden-onset disaster	'A sudden-onset disaster is one triggered by a hazardous event that emerges quickly or unexpectedly. Sudden-onset disasters could be associated with, e.g., earthquake, volcanic eruption, flash flood, chemical explosion, critical infrastructure failure, transport accident' (UNISDR, 2016: 14).
Vulnerability	'The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards' (UNISDR, 2016: 24).

Executive summary

This study examines the relationship between natural hazard-related disasters, including those influenced by climate change, and child and adolescent poverty. It brings together new ways of looking at this nexus through a lifecycle approach, which focuses both on the incidence of child poverty and longer-term poverty and wellbeing. The lifecycle approach adopted in this study stems from a recognition that disasters affect different stages of a child's life course in different ways, and that different policies are accordingly needed at each stage. Analysis is carried out both directly (through the effects of disasters on household poverty trajectories and individual deprivation, injury and death), and indirectly (through the effects of disasters and climate change on services and systems central to child wellbeing and long-term development, including health, nutrition, water, sanitation and hygiene (WASH) and education). The analysis is new and unique, combining a range of different datasets and studies around household and child poverty, disasters and local climatology, brought together for the first time.

The study focuses on the links between natural hazard- and climate-related disasters and child wellbeing in India and Kenya (focusing on three counties: Bungoma, Kakamega and Turkana – which we will refer to as Kenya) between 2000 and 2014.[1] The report also undertook case studies in the State of Bihar, India, and Turkana County in Kenya.

Members of an association of HIV-positive men in Bungoma, Kenya breed fish to supplement their diet and sell in the local market. © STARS/ Kristian Buus

1 The choice of study locations was partly determined by the availability of data, but it is a very limited sample and it should be stressed that it is difficult to draw general findings for other countries and contexts from these examples.

Key messages

Part 1: A focus on child wellbeing

1 Key message

The need to adopt a lifecycle approach to support longer-term development outcomes. Disasters and climate change impact children and adolescents in different ways: directly (for instance through the effects of disasters on household poverty trajectories and individual deprivation, injuries and death), and indirectly (through the effects of disasters and climate change on services and systems central to children's wellbeing and long-term development, including health, nutrition, WASH and education). Research tends to focus on the short-term, direct impacts, not the indirect and longer-term effects that disasters may have on a child's multidimensional wellbeing and longer-term development.

Key finding

See Table 1 for a summary of key findings.

Recommendation

The whole of a child's life course needs to be considered in relation to climate and disaster risk, not just static points in time, because impacts will vary in the immediate, short and longer term. *See Table 1 for policy recommendations.*

2 Key message

The need to ensure continuity of services and systems central to child wellbeing and resilience. The research found significant differences in access to services (health, education) and infrastructure (WASH, electricity and roads) between disaster-prone areas and other areas; these gaps often particularly affect chronically poor children or marginal groups. Access to and continuity of these systems and services are critical to reducing child poverty and, ultimately, eradicating extreme poverty.

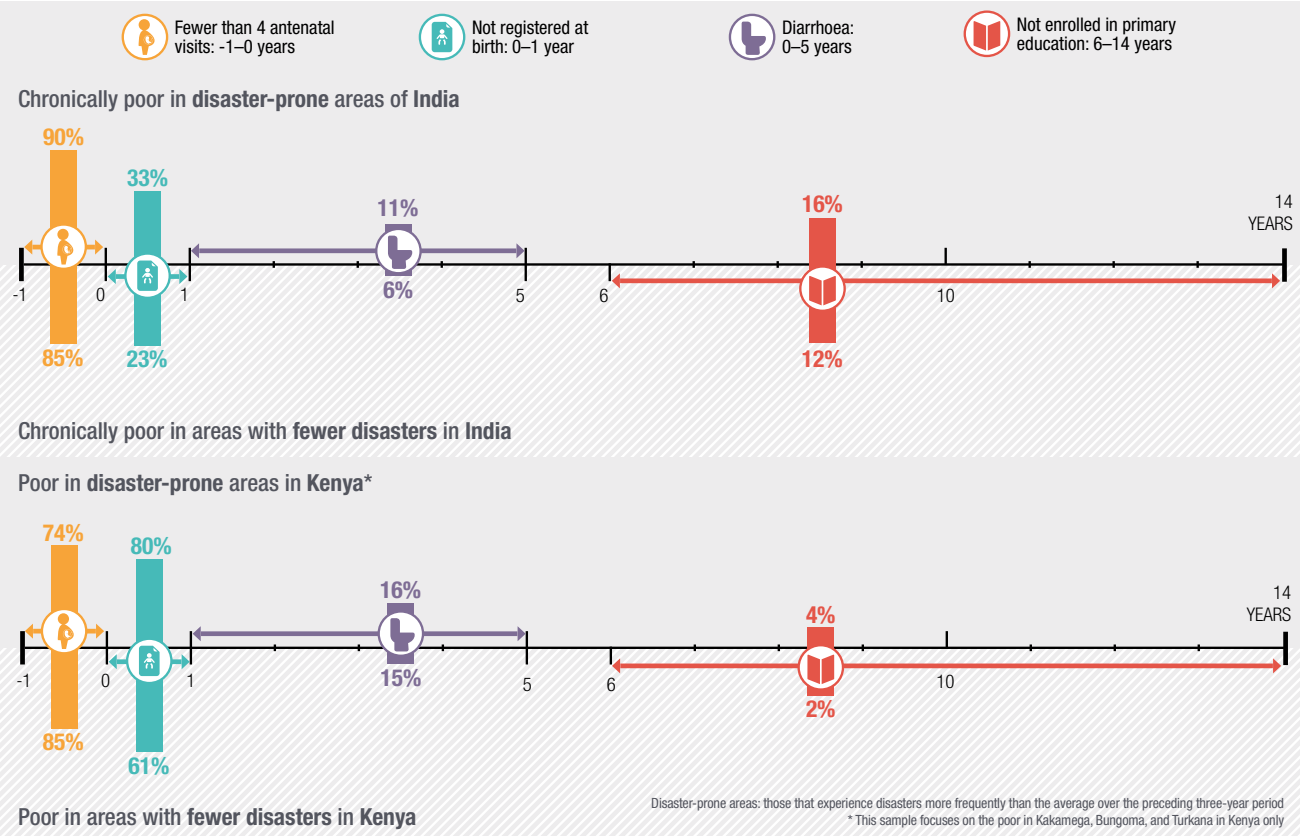
Recommendation

Key services for children and infrastructure in disaster-prone areas need to be tailored and strengthened to reach the most marginalised, and access for all needs to be sustained despite environmental shocks and stresses. Development and planning need to be risk-informed across sectors to prepare for current and emerging risks, including contingency planning to avoid disruption to basic services and infrastructure. Simultaneously, sustained efforts to support *response and recovery* after a disaster strikes can help ensure access to, and continuity of, services and systems, despite environmental shocks and stresses. Greater attention should be given to equity and inclusion in sectoral policies and programming, as well as policies and programming aiming to build resilience and promote longer-term wellbeing before, during and after a disaster. Programming and service delivery should be designed to support different livelihood systems in different socioeconomic and cultural contexts. A disaster can be a political opportunity to develop a national commitment to social transfers (such as cash transfers, but also other forms of government investment in rebuilding services and infrastructure in a more resilient manner) which may have been missing prior to the disaster, and which could help prevent impoverishment and close some of these service gaps.

3 Key message

The need to understand underlying vulnerabilities and intersecting inequalities. Children are not a homogenous group. Socially, economically, culturally, politically and/or environmentally marginalised children are often the most vulnerable to harm from environmental shocks and stresses due to the contexts in which they live – which may constrain or enable their ability to prepare for, cope with and respond to climate change and natural hazards (Lovell and Le Masson, 2014). Our results highlight that specific poor and marginalised groups such as the tribal Adivasis ('Scheduled Tribes') of India, and the nomadic pastoralists who make up the majority of the population of Turkana in Kenya, are

Figure 1 The links between natural/climate hazard-related disasters and children's wellbeing at different stages of their life course



Note: This timeline depicts selected key findings of the study in terms of the wellbeing of children and adolescents in disaster-prone areas of India and Kenya, compared to areas with fewer disasters in these countries. In Kenya, the school statistic refers to whether the child attended school during the school year, whereas in India, the question more restrictively asks whether the child is currently enrolled at the time of the survey.

particularly vulnerable to environmental shocks and stresses, including those influenced by climate change.

Key finding

Almost 20% of the Adivasi population in India fell into poverty in disaster-prone areas between 2005 and 2011, compared to 12% among other groups. Kenya's drought-prone Turkana County has a higher prevalence of poor people living in rural areas (55%) compared to urban areas (6%).

Recommendation

Intersecting inequalities need greater consideration in policy and planning. The intersecting inequalities certain groups face (for example poverty, ethnicity, gender, disability, caste or age) mean that targeted interventions are required to reduce chronic and extreme poverty among people most vulnerable to natural hazard-related disasters, including those influenced by climate change. Targeted and strengthened approaches in policy and planning are needed to reach the most marginalised, for instance through the provision of mobile services in Turkana.

Table 1 The relationships between natural/climate hazard-related disasters and child and adolescent wellbeing at different life course stages in India and Kenya

The table below provides a selection of recommendations from the research study over different stages of a child's life course. For the full set, and explanations of what in some instances may appear to be counter-intuitive findings, please refer to the main report. The sample is of chronically poor across states in India, and the poor in Kakamega, Bungoma and Turkana.

Stage of life course	Key study findings for India and Kenya	Policy implications: national and local governments should…
In utero and birth		
Fewer than four antenatal visits (%)	**India:** 90% of chronically poor mothers had fewer than four antenatal visits in disaster-prone areas, compared with 85% elsewhere.* **Kenya:** 74% of poor mothers had fewer than four antenatal visits in disaster-prone areas, compared with 85% elsewhere.*	• Increase access to healthcare and promote context-specific child and maternal health interventions which are functional and accessible at all times. For instance, provide mobile health service delivery in areas where the population are (semi-) nomadic, such as in Turkana. This should include a basket of everyday healthcare provision to reduce health risks, including maternal health (through *both* antenatal visits and delivery care), immunisation against disease, regular treatment facilities and emergency response to disasters and climate change. • Ensure that public health programmes in emergency interventions are risk-informed, and that community health systems are strengthened. • Systematically strengthen systems of birth registration, especially for marginalised groups such as the Adivasis in India, which will open up access to social and other services. This requires tackling the bottlenecks (including administrative, access, demand and awareness) which limit the provision of adequate birth registration for people in disaster-prone or marginalised areas/groups.
Access to formal delivery care (%)	**India:** 20% of chronically poor mothers accessed formal delivery care in disaster-prone areas, compared with 22% elsewhere. **Kenya:** 27% of poor mothers accessed formal delivery care in disaster-prone areas, compared with 43% elsewhere.	
Birth registration (%)	**India:** 67% of babies in chronically poor households were registered in disaster-prone areas, compared with 77% elsewhere.* **Kenya:** 20% of poor babies were registered in disaster-prone areas, compared with 39% elsewhere.*	
Children under five		
Diarrhoea (%)	**India:** 11% of chronically poor children had diarrhoea in the two weeks preceding the survey in disaster-prone areas, compared with 6% elsewhere.* **Kenya:** 16% of poor children had diarrhoea in disaster-prone areas, compared with 15% elsewhere.	• Ensure policies and programming are risk-informed to reduce disruption to systems and services that support safe WASH, which will help reduce the risk of diarrhoea and other vector-borne diseases and illnesses. • Learn from existing WASH programmes to understand and replicate success factors and enhance access, especially among the poorest or most marginalised. For example, Anganwadi Centres in villages and settlements constitute the backbone of the Integrated Child Development Services (ICDS) programme, providing a network dedicated to improving child wellbeing outcomes (Andrew et al., 2015). Community nutrition programmes in Kenya were also undertaken alongside sectoral actions (LINKAGES, 2002).

Stage of life course	Key study findings for India and Kenya	Policy implications: national and local governments should…
Young children		
School enrolment (%), 6–14 years	**India:** 84% of chronically poor children were enrolled at the time of the survey in disaster-prone areas, compared with 88% elsewhere.* **Kenya:** 96% of poor children were enrolled in disaster-prone areas, compared with 98% elsewhere.	• Promote comprehensive school safety, including safe learning facilities that protect children and teachers from the impacts of disaster; raise awareness about environmental shocks and stresses; and promote contingency and preparedness plans, including ensuring education continuity after a disaster. • Provide extra salary, housing and help with children's schooling for teachers, to encourage them to work and live in disaster-prone areas, and so that they suffer less stress and provide better-quality teaching. • In Kenya, provide mobile primary schooling so that pastoralist children and adolescents, especially girls from nomadic families, can access education. • If appropriate, adjust the school year and day to seasonal livelihood patterns to improve attendance.
Years of education, 6–14 years	**India:** Chronically poor children had on average 2.5 years of education in disaster-prone areas, compared with 2.4 years elsewhere.* **Kenya:** Poor children had on average 1.5 years of education in disaster-prone areas, compared with 2.6 years elsewhere.*	
Adolescents		
School enrolment (%), 15–18 years	**India:** 43% of chronically poor adolescents were enrolled at the time of the survey in disaster-prone areas, compared with 51% elsewhere.* **Kenya:** 89% of poor adolescents were enrolled at any point during the school year in disaster-prone areas, compared with 84% elsewhere.*	• In India, expand scholarship and other education programmes for low-income groups. Providing bicycles to children, particularly girls, can encourage children to stay in secondary education. • Limit the use of schools as evacuation or relief centres in order to avoid education disruption, or find mechanisms to continue classes when schools must be used. • Reintegrate children and adolescents who have been removed from the school system, paying attention to gender, age and other socioeconomic markers, through: (i) local education authorities identifying children withdrawn from school; and (ii) developing and providing information about measures for reintegration: school feeding, cash transfers and migrant support programmes, including a focus on children and others left behind in migrant households. • Reduce child labour. Measures could include extended and optimised social protection to ensure livelihood safety, with cash transfers tied to school attendance, nutrition programmes and extra-nutritious meals in schools during disasters.
Years of education, 15–18 years	**India:** Chronically poor adolescents had on average 2.7 years of education in disaster-prone areas, compared with 2.9 years elsewhere.* **Kenya:** Data quality inadequate to draw conclusions.	
Labour (%), 10–19 years	**India:** 39% of chronically poor adolescents were engaged in some form of labour in disaster-prone areas, compared with 44% elsewhere.* **Kenya:** 31% of poor adolescents were engaged in some form of labour in disaster-prone areas, compared with 65% elsewhere.*	

Note: Text in green denotes difference is statistically significant (table of significance provided in Annex 3). This table provides differences between disaster-prone and other areas, but does not speak of causation – these outcomes are as much due to increasing vulnerabilities related to changing demographics and socioeconomic conditions, unplanned urbanisation, development within high exposure zones and environmental degradation as they are due to the hazard (climate-related, geological, epidemics and pandemics).

Part 2: A focus on disasters and poverty dynamics

4 Key message

The need to understand types of disasters, risks and how these influence poverty pathways.

4A Disasters can be slow- or rapid-onset, frequent or infrequent, and children will be affected in different ways, in different contexts and over different time periods

While children and adolescents are at risk of sudden-onset, high-impact events, such as flooding or earthquakes, they are also subject to risks related to slow-onset hazards, including shifts in seasons and temperatures, which may contribute to chronic, low-frequency impacts on multidimensional wellbeing.

Key finding

In India and Kenya, floods were the most common type of disaster between 2000 and 2014, and were responsible for the highest number of deaths (more than 22,000 in India, and more than 850 in Kenya). Droughts are also significant in both countries. In India, areas with a high prevalence of floods also saw high numbers of households falling into poverty, in part reflecting their vulnerability to rapid-onset disasters.

4B Natural hazard-related disasters, including those influenced by climate change, affect household poverty pathways, which can impact child wellbeing over the longer term

Examination of long-term poverty dynamics, or changes in wellbeing over time, brings the focus on the chronically poor. These are people who have been poor for many years, whose poverty is often transmitted to future generations, and who often lack the skills, education and other assets to escape poverty. Where they do manage to escape, these groups are often especially vulnerable to falling back into poverty – particularly when shocks (including disasters) strike. Disasters have the potential to reverse years of development gains. Reaching 'zero poverty'[2] means tackling chronic poverty: preventing people from falling into it, and ensuring that escapes from poverty are sustained.

4C Disasters and climate change affect households' poverty status

Key finding

In India, our analysis[3] reveals the likelihood of a household being in poverty was 53% lower in areas that saw an increase in disasters over time. In Kenya, the likelihood of a household being in poverty was 47% higher when the number of disasters increased.

At first sight, the India finding appears strange. In fact, improved outcomes for some people despite high hazard exposure seems to be in part a result of pro-poor political settlements and improved governance in certain areas, reducing vulnerability and improving resilience (Shepherd et al., 2013). India developed and implemented its first Disaster Management Act in 2005, the National Action Plan on Climate Change in 2008 and the National Policy on Disaster Management in 2009. Although there is still more emphasis on disaster response and relief as opposed to long-term disaster risk management (DRM) (Bahadur et al., 2016), some progress is being made with regard to child wellbeing and more integrated DRM across socioeconomic development planning in some states. Nevertheless, many state-level plans and policies have only recently been established, including Bihar's Disaster Risk Reduction (DRR) Roadmap (adopted in 2016), and therefore these are yet to have a measurable effect beyond some pockets of resilience programming.

In Kenya, the finding suggests that policies and programming aimed at building resilience are yet to make a considerable difference to poverty reduction. This is partly because many policies and supporting authorities aiming to end drought emergencies and build resilience have only recently been established, and the country has

2 Zero poverty is measured by the World Bank not in its literal sense, but rather refers to a target to lower the global poverty rate to 3%.

3 See our methodology for this regression analysis in Annex 3.

only recently begun to adopt a more anticipatory and holistic approach to climate and disaster risk. The complex nature of drought emergencies, pastoral livelihood dimensions and low investment and political backing have all made progress challenging, as has the high incidence of severe and repeated drought since 2009. While drought management appears to have become more established in recent years, flood and disease preparedness remain less coordinated (Development Initiatives, 2017).

4D Disasters and climate change also affect households' poverty pathways

Key finding

In rural Kenya between 2000 and 2007, drought was a driver of reduced household income (Muyanga and Musyoka, 2014). In India, our analysis revealed that households in disaster-prone districts are twice as likely to be chronically poor than to escape poverty, and three times as likely to become impoverished.

In India, while policies and programming which aim to build resilience to climate and disaster risks may help support escapes out of poverty overall, they do not prevent chronic poverty. The factors that are linked to lower development outcomes, such as a lack of medical services, are the same factors influencing vulnerabilities and capacities to prepare for, cope with and recover from hazards. Lack of services, poor governance and other lower development outcomes simultaneously place households and children at higher disaster risk.

Our regression analysis in India also reveals that disasters of longer duration are associated with a lower risk of chronic poverty and impoverishment, possibly because relief programmes last longer, and so have time to extend their reach to more marginalised people, including children.

Recommendation: the wider context

Climate and disaster risk should have a stronger focus in socioeconomic development policy. While both countries have national and sub-national policies and plans to reduce climate/disaster risk, building resilience to environmental shocks and stresses requires that other sectors and line ministries have the requisite incentive, mandate, capacity and finances and services. This is still a challenge.

The institutional and policy separation between development, poverty reduction and climate/disaster risk is not helping secure the outcomes that these institutions and plans target individually. Despite work by India's Planning Commission, and Sustainable Development Goal (SDG) cells[4] in some states, there remains a need to increase the 'integration of interventions across sectors and to foster strong governance and institutional arrangements for resilience across scales' in both countries (Carabine et al., 2015: 4). The 2030 Development Agenda offers an opportunity for countries to thoroughly integrate DRR and risk-informed programming across sectors and ministries. This should include tracking impact and results in resilience-building through the SDGs and Sendai monitoring and reporting.

Achieving longer-term development outcomes, despite environmental shocks and stresses, requires an understanding of the causal links between disasters and development outcomes, and adequate delivery of the services and systems central to child wellbeing and long-term development. This will help to build people's capacity to adapt, anticipate and absorb climate and disaster risks (Bahadur et al., 2015a), and reduce the risk of impoverishment in the wake of a disaster.

Response and recovery programmes need more time. In line with the recommendation for Key Message 2, the research suggests that there are many situations where response programmes should continue long after they are normally terminated, so that the poorest and most marginalised people, including children, receive support to recover and rebuild their lives

4 For example, according to Mishra and Tavares (2015), 57 government ministries and/or departments have set up Gender Budgeting Cells to ensure that budgets include adequate provision for schemes intended to benefit women.

after a disaster. This in turn can help them strengthen their capacity to adapt, anticipate and absorb future climate/disaster risks, and ensure continued access to, and continuity of, services and systems central to child wellbeing and longer-term development outcomes. Efforts to 'build back better' and safer after a disaster need to be integrated within recovery, rehabilitation, reconstruction and development planning. This will help support safer and more resilient infrastructure, which will help households and sectors mitigate future disaster risk and prevent the disruption of critical basic services in the face of environmental shocks and stresses.

Part 3: Bridging data gaps

Key message

The above key findings all indicate data gaps that need to be filled. Addressing global data issues and improving our understanding of key services and wellbeing in disaster-prone areas is a step towards improving the long-term trajectories of children and adolescents in the face of environmental shocks and stresses, including climate change. A better data bank would help local and national governments and practitioners to increase the resilience of children and adolescents over their life course more effectively and equitably, for generations to come. This includes the need to disaggregate by: a) child wellbeing – disaggregated for girls and boys – and other markers of identity; b) direct and indirect impacts of disasters; c) by type of disaster and exposure to different hazards; d) over the life course; e) by type of data source; and f) cross-sectoral data.

Recommendation

Data needs to be disaggregated by various markers (a–f) to develop a stronger understanding of the relationship between disasters, climate change and child poverty. This can support policies and practices that promote children's long-term wellbeing in the face of disasters and climate change.

Conclusion

An all-hazards approach to policies and programming that aim to build resilience is needed across spatial (including national, county/state, district and local) and temporal (in the immediate, short and long term) scales. Such an approach should consider multiple types of hazards, including those emerging due to climate change. Risk-informed interventions need to be integrated across services and systems (including health, nutrition, WASH, education, child protection and social protection). Such an approach would help to support children and adolescents' longer-term development outcomes and adaptive capacities in the context of environmental shocks, stresses and change.

1 Introduction

This study examines the relationship between natural hazard-related disasters, including those influenced by climate change, and child and adolescent poverty. It brings together new ways of looking at this nexus through a lifecycle approach focusing both on the incidence of child poverty and longer-term poverty and wellbeing. This focus stems from a recognition that disasters affect wellbeing – and services such as health and education systems – in different ways during different periods of child and adolescent development, and that different policies and responses are accordingly needed at each stage. The study focuses on the links between natural hazard- and climate-related disasters and child wellbeing in India and Kenyaia and Kenya (focusing on three counties: Bungoma, Kakamega and Turkana) between 2000 and 2014,[5] with case studies in the State of Bihar, India, and Turkana County in Kenya. The analysis is new and unique, combining a range of different datasets and studies around household and child poverty, disasters and local climatology, brought together for the first time. Considering these inter-related aspects will help promote a better understanding of how policy-makers, local and national governments and practitioners can strengthen the resilience of children and adolescents.

1.1 Understanding disasters, poverty and child wellbeing

Changes in the socioeconomic, political, cultural and environmental contexts within which people live are creating different hazard risks, including for children and adolescents (Opitz-Stapleton,

Girl in Bihar, India. © Jack Wickes

5 The choice of study locations was partly determined by the availability of data, but it is a very limited sample, making it difficult to draw out general findings for other countries/contexts from these examples.

2014). One ODI report finds that up to '325 million extremely poor people will be living in the 49 most hazard-prone countries in 2030, the majority in South Asia and sub-Saharan Africa' (Shepherd et al., 2013: vii). Children and adolescents are disproportionately at risk; in the 2000s, nearly 175 million children were affected by disasters annually (Save the Children, 2007). While disasters and climate change affect people, including children and adolescents, in different ways,[6] those who are socially, economically, culturally, politically or environmentally marginalised are often the most vulnerable to environmental shocks and stresses. This is due to the context in which they live, which may constrain or enable their ability to prepare for, cope with and respond to climate- and natural hazard-related disasters (Lovell and Le Masson, 2014).

Climate change is changing the strength and frequency of climate-related hazards, and increasing seasonal and annual variability. These shifts, coupled with the changing contexts in which children and adolescents live, are increasing their vulnerability and undermining their capacity to prepare for and recover from natural hazard-related disasters. At the same time, exposure to climate change and disasters is intensifying as more people and assets are located in hazard-prone locations (Mitchell et al., 2012). This is partly due to underlying risk drivers, including changing demographics, unplanned and rapid urbanisation, poor land management, environmental degradation and loss of natural ecosystems (Lovell and Le Masson, 2014; IPCC, 2012; UNISDR, 2015).

Increased vulnerability and exposure to disasters, including those influenced by climate change, poses serious challenges for tackling poverty and disaster risk. For instance, poverty status and dynamics can influence a household's capacity to adapt to, anticipate and absorb climate and disaster impacts (Bahadur et al., 2015a). Concurrently, natural hazard-related disasters, including those influenced by climate change, can have detrimental effects on household poverty, and can affect a child's wellbeing and longer-term development outcomes. Such shocks and stresses can reverse years of development gains, threatening international efforts to meet the 2030 sustainable development agenda (Shepherd et al., 2013). They also erode gains for new generations of children.

A child's wellbeing is influenced even before they are born, and determined in part by household factors such as the physical characteristics of the home, access to water supply, food security, maternal health, nutrition and savings and indebtedness. Natural hazard-related disasters can in turn affect local communities, households and individuals in different ways. Yet there are stark gaps in examining the diversity of vulnerability and capacity across different groups of children and adolescents according to age, gender, disability, ethnicity, social class, religion, family structure, access to resources, power and status differences and how these influence differentiated disaster impacts. Children and adolescents are not a homogenous group, and it is critical that research, policies and programming consider how different forms of exclusion and marginalisation intersect for children and adolescents, and how these different factors shape vulnerabilities over a child's life course. Research tends to focus on the short-term, direct impacts,[7] not the indirect and longer-term effects that disasters may have on a

6 The causality runs both ways. Natural hazard (including climate) risks are as much due to increasing vulnerabilities related to changing demographics and socioeconomic conditions, unplanned urbanisation, development within high-exposure zones and environmental degradation as they are due to the hazard – climate-related, geological, epidemics and pandemics. Risk – the potential for impacts – results from the interaction of vulnerability, exposure and the hazard. Moreover, in India, there exists a conflict–climate nexus, where hazards such as floods, coupled with other drivers of impoverishment like contention over natural resources and sociopolitical inequality, have high occurrence in areas of armed conflict (Diwakar et al., 2017a). Together, these can work to exacerbate poverty.

7 The distinction between direct and indirect effects varies in the literature. Many of the individual deprivation dimensions, such as schooling and short-term morbidity, are here explored in the following section so as to be better linked to access to services and other such indirect impacts.

Box 1 Links to international policy frameworks

Several international policy frameworks consider climate, disasters, sustainable development and child rights. The Paris Climate Agreement provides a path for mitigating emissions and supporting countries to move forward with adaptation. The Sendai Framework for Disaster Risk Reduction 2015–2030 recognises the need to manage disaster risk in all its dimensions, including exposure, vulnerability and hazards. It also recognises that children and young people should be given the 'space and modalities to contribute to disaster risk reduction, in accordance with legislation, national practice and educational curricula' (UNISDR, 2015: 23). The SDGs set ambitious targets to reduce poverty among children in all its dimensions (Goal 1.2), while the Convention on the Rights of the Child seeks to advance children's rights in key socioeconomic, political and civic areas related to survival, development, protection and participation (Children's Rights Alliance, 2010). Greater coherence is needed across these frameworks to build children and adolescents' resilience to climate and disasters, eradicate child poverty and ensure that no one is left behind.

child's wellbeing and longer-term development outcomes. All too often the focus is on sudden-onset, high-impact events such as flooding and earthquakes. While these hazards tend to demonstrate the most immediate and dramatic impact in terms of deaths and economic losses, children and adolescents are also subject to risks related to slow-onset hazards, including shifts in seasons and temperatures and drought, which can have major impoverishing consequences over the longer term. For instance, drought coupled with overuse of water resources can cause water stress and food insecurity, which can lead to malnutrition and can widen existing inequalities in the long term. This is concerning given that nearly 160 million children live in areas of high or extremely high drought severity (UNICEF, 2015; Peek, 2008). Yet analysis of these hazards' impacts over time is often limited, perhaps due to the lack of longitudinal datasets on longer-term childhood poverty, health, wellbeing and other dynamics.

This study examines both short- and long-term impacts on childhood poverty and wellbeing that result through a combination of natural hazards and underlying vulnerabilities. It also considers both sudden- and slow-onset hazard impacts and their implications for the contextual services and systems central to child wellbeing, as both are critical for long-term child poverty and, ultimately, eradicating extreme poverty.

1.2 Direct impacts of disasters and climate change on child wellbeing

Disasters can have a direct impact on a household's poverty status and dynamics, through physical and material damage to their lives and assets. For instance, homes may be partially or totally destroyed, resulting in a lack of safe shelter. This can inhibit a child's ability to recover, while jeopardising their physical security (UNICEF, 2015). Damage to ecosystems that provide a buffer for certain natural hazards, such as mangroves in relation to flooding, can also have direct effects on livelihoods, or can trigger secondary hazards such as landslides. Damage to cultural heritage or religious sites can have important symbolic and material significance for children and adolescents' identity, 'beliefs, practices and knowledge' (IFRC, 2014: 122), which can influence their recovery.

Children also often experience high mortality and morbidity, injury and illness during and after a disaster, depending on socio-cultural restrictions and their physical ability to move to a safer location. They may also be at greater risk given their dependence on adults, who may themselves suffer illness or death. Older children may experience direct behavioural, psychological and emotional impacts after a disaster (Peek, 2008: 3). Different age groups therefore require different forms of physical, social, mental and emotional support (Peek, 2008: 4; Lovell and Le Masson, 2014).

1.3 Indirect impacts of disasters and climate change on child wellbeing

Disasters can also have indirect impacts on households and children. Damaged infrastructure and poor housing conditions can increase exposure to future climate or disaster risks, or can disrupt households' water, electricity/energy supplies and communications, hindering recovery (Lovell and Mitchell, 2015). Households may reduce spending on education, healthcare and food, which can affect nutrition and longer-term development outcomes. Families may also pull their children out of school to support short-term household welfare, including domestic work and paid labour (Silbert and Usche, 2012; Arouri et al., 2015; Mottaleb et al., 2013). Over the long term, this may prevent children, particularly girls, from developing a pathway out of poverty through education (Lovell and Le Masson, 2014).

Child wellbeing may also suffer because of disruptions to services and systems. Disasters can destroy school buildings and transport infrastructure, school books and equipment and displace students and teachers (Peek, 2008; Mudavanhu, 2014). They can also disrupt health services and healthcare, including access to vaccinations and immunisation coverage (Datar et al., 2011). Care for pregnant mothers can be reduced, threatening the wellbeing of babies in utero, and for children injured during the disaster or dealing with chronic health issues. Hazards can also contribute to secondary health impacts such as the spread of disease (Mudavanhu, 2014; Bartlett, 2008). During flooding or heavy or prolonged rains, blocked drains and flooded latrines can contaminate water supplies, encouraging the spread of water- and vector-borne diseases and respiratory illnesses among children (Ahmed, 2004; Dickin and Schuster-Wallace, 2014).

Child malnutrition after a disaster is also a grave concern. The World Health Organization (WHO) estimates that, between 2030 and 2050, climate change may contribute to approximately 95,000 deaths due to childhood undernutrition through damage to crops and food insecurity (WHO, 2017). This can lead to stunting and cerebral impairment (Aguilar and Vicarelli, 2011; Bartlett, 2008; Opitz-Stapleton, 2014). The impact of malnutrition and inadequate food consumption on in-utero development and maternal health can also affect birth weight and overall health (Aguilar and Vicarelli, 2011). Finally, disasters can also lead to longer-term physical and psychological impacts, including delayed mental development, being orphaned, post-traumatic stress disorder, family separation and sexual and psychological abuse (Ridsel and McCormick, 2013; Silverman and La Greca, 2002; Peek, 2008).

1.4 Building roads out of poverty amid environmental shocks and stresses

The road to zero poverty requires a shift in the way the term 'poverty' is conceptualised and assessed. The chronically poor, or those who have been poor for many years, often 'transmit' their poverty to future generations, and often lack the skills, education and other assets to escape its clutches. In instances where they do escape, these groups are often especially vulnerable to falling back into poverty – particularly when shocks (including disasters) strike.

Policies aimed at tackling poverty need to have a stronger emphasis on preventing impoverishment, or the process in which households fall into poverty, as well as boosting socioeconomic development to help lift households out of poverty. At the moment, poverty reduction efforts tend to focus on those near the poverty line rather than the poorest of the poor. In a similar vein, responses to disasters are likely to focus on preventing impoverishment and death (which may contribute to impoverishment). However, reaching 'zero poverty' means tackling chronic poverty, preventing people from falling into poverty, and ensuring that escapes from poverty are sustained. To this end, a concurrent focus on relief and recovery can contribute to a sustained escape from poverty.

Policies and programming aimed at building resilience can help to reduce hazard risk through reducing vulnerability and people's exposure to environmental shocks and stresses, and can help build people's capacity to anticipate and prepare for future events. Stronger DRR programmes coordinated with poverty reduction efforts can

reduce the vulnerability of the impoverished and families at risk of falling into poverty, thereby reducing the risk of impoverishment post-disaster. Efforts to support *response and recovery* after a disaster strikes can help households and different sectors and services central to a child's wellbeing (such as health or education) to build back in a way that helps to tackle chronic poverty, prevent impoverishment and help sustain poverty escapes, while enhancing an individual or sector's resilience to future hazards.

These themes are crucial for achieving the 2030 agenda for sustainable development, and are central to the Sendai Framework for Disaster Risk Reduction (2015–2030), which promotes the need to understand disaster risk (Priority 1), strengthen disaster risk governance (Priority 2), invest in DRR for resilience (Priority 3) and enhance 'disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction' (Priority 4) (UNISDR, 2015). It is the combination of risk-informed development and response and recovery that provides opportunities to improve childhood wellbeing and reduce poverty.

1.5 Scope and purpose of the report

This report addresses the following research questions:

1. What are the implications of disasters for child and adolescent poverty and wellbeing?
2. What can analysis of relevant datasets (particularly panel data) tell us about child and adolescent poverty and wellbeing in climate- and disaster-affected situations at the national and subnational level, and the causes of these dynamics?
3. Having identified relationships between natural hazard-related disasters, climate change and child and adolescent poverty over the life course, what policy and programming implications may be drawn?

To do this, we consider two case studies, India and Kenya, a choice guided by:

- High numbers of **poor people and a high risk of natural hazard-related disasters**. Kenya has experienced extensive drought and food insecurity over recent years. India has the highest number of people likely to be living in poverty in 2030. It is also exposed to a range of hazards, and has a government with the capacity to deal with climate and natural hazard-related risks, at least in some states (Shepherd et al., 2013). Around a third of children living in poverty globally are in India (Newhouse et al., 2016). These two countries also have large marginalised groups – for example the Adivasis ('Scheduled Tribes') in India, and pastoralists, especially in the arid and semi-arid lands (ASALs) of Kenya. These populations are often heavily reliant on the environment for their livelihoods, and are most at risk from environmental shocks and stresses, including those influenced by climate change.
- The **variety of climate/disaster typology**: recognising that disasters can be slow- or rapid-onset, frequent or infrequent, various risk typologies are considered to examine the different vulnerability factors that lead to particular impacts for different hazards. It is important to consider how children are affected by both slow- and rapid-onset disasters, including climate change and variability, to recognise the range of hazards and risks that different people or groups experience within different contexts, and over different time periods. As such, the paper investigates the impacts of both rapid-onset disasters, such as flooding in Bihar State, India, as well as drought, a slow-onset disaster, in Turkana, Kenya.
- **Policies and programming that aim to build resilience**, and the associated adaptive capacity of countries at the national and subnational level to deal with natural-hazard related disasters and climate change. We seek to understand the policies that aim to promote more resilient systems and services in the face of environmental shocks and stresses, as well as the response capacity of these countries, which can significantly affect the longer-term impacts of a disaster, and the recovery of people, assets, systems and services in the aftermath.
- **Data availability** on child outcomes and disasters, especially at the subnational level (see Table 2). The Indian Human Development

Survey (IHDS) is a nationally representative panel dataset which covers a variety of child wellbeing outcomes across the life course and across Indian states. Panel data is important as it allows individuals and households to be tracked over time and poverty dynamics to be assessed – important components for achieving zero poverty. The Multiple Indicator Cluster Survey (MICS) in Kenya covers Turkana, Bungoma and Kakamega counties in 2013–14, and focuses on child and adolescent wellbeing across a range of indicators (see Figure 8 for a map of Kenya). We present these outcomes across the lifecycle of children. In addition, for both countries climate and disaster data is available at the subnational level, which can be paired with wellbeing outcomes in subnational areas.

The following section introduces the methodology used for the study, which brings together a unique pairing of data sources for the first time. Section 3 provides background context for India and Kenya, in terms of the most prevalent types of disasters, and poverty profiles derived from the datasets. We then examine poverty and wellbeing across children and adolescents' life courses in disaster-prone areas of India and Kenya, relative to other areas, with a focus on climate, disasters and child outcomes in Bihar and Turkana. The final section draws out the policy implications of our findings, and presents initial recommendations for ensuring that children are at the forefront of national poverty reduction efforts, and that policies and programming that aim to build resilience to climate and disasters are risk-informed.

2 Methodology

Our analysis of child wellbeing is structured around a child's life course, recognising that disasters affect different stages in different ways, and that different policies and responses are accordingly needed at each stage. While the results understandably vary by gender, and often by caste or social group, we do not systematically present these identity-disaggregated results, choosing instead to focus on instances where sample sizes are sufficiently large and statistical gender differences are particularly visible in the data. In the analysis, we focus on a set of factors with data readily available across our surveys, though we recognise that these constitute only a small subset of child wellbeing indicators:[8]

- **In utero and children under five**: access to health services for the mother, formal delivery care for the mother, antenatal visits for the mother, birth registration of the baby and diarrhoea prevalence in children under five.
- **Children**: access to primary schools, primary school enrolment (6–14 years) and years of education (6–14 years).
- **Adolescents**: secondary school enrolment (15–18 years), years of education (15–18 years), engagement in farm labour and other forms of child labour (10–19 years).

The study examines the relationship between natural/climate hazard-related disasters and child and adolescent[9] wellbeing in India (with a case study in the State of Bihar) and Kenya (focusing on three counties: Bungoma, Kakamega and Turkana) between 2000 and 2014.[10] The analysis combines a range of different datasets and studies around household and child poverty, disasters and local climatology, brought together for the first time (Table 2).

We have used a combination of robust empirical methods to analyse the relationship between child poverty and disasters. In particular, associations between disasters and poverty incidence and trajectories were assessed using logistic regressions, controlling for factors other than disaster incidence or prevalence that may affect poverty dynamics at the household level. Statistical t-tests were also employed to investigate differences in means between population subgroups, including gender and other socioeconomic profiles.

This was carried out in disaster-prone areas compared with other areas of India, and in Turkana, Bungoma and Kakamega, the three counties investigated in Kenya (based on available MICS data). This was complemented with more sophisticated difference-in-difference estimations for robustness, to examine the extent to which the presence of disasters may have affected schooling outcomes. We also conducted Mann-Kendall trend analysis of rainfall and temperature changes over the last 30 to 40 years in case study locations and hypothesised the impacts of these climate shifts for children and adolescents based on known impacts on livelihoods, health and sanitation.

While merging datasets and analysis over the life course is an innovative approach, there are limitations. In particular, while regression-based analysis was adopted to investigate the drivers of household poverty trajectories in Section 4.1, the following section examining a child's life course investigates differences in disaster-prone areas

8 For further discussion of data limitations, see Annex 2.

9 Children and adolescents are defined as individuals aged 0–14 years, and 10–19 years respectively, following age groups common in the literature and policy settings.

10 The choice of study locations was partly determined by the availability of data, but this is a very limited sample, and it is difficult to draw out general findings for other countries/contexts from these examples.

compared with other areas of the country, and does not empirically control for other variables that may affect child outcomes. To overcome this, we have relied on secondary data to support the hypotheses drawn, and as noted in the preceding paragraph have also adopted complementary statistical tests to ensure the robustness of the findings. More detail on the data sources employed for analysis in this study can be found in Annex 2. More details on the tools and approaches used in this study, as well as further data limitations, are in Annex 3.

Complementing this empirical analysis, the study presents an overview of some existing policies and programming that aim to build resilience to disasters and climate change in Kenya and India at the national level, as well as in the case study areas of Turkana county and the State of Bihar (see Section 4.3 and Annex 1). A review of the wider literature on the extent and nature of household and child poverty following disasters was also undertaken. In the study, we use this rapid policy review to evaluate the potential impact of such policies on overall child wellbeing and poverty, particularly in disaster-prone locations.

In our analysis, we measure poverty status and dynamics, and also examine multidimensional wellbeing in terms of individual deprivation, for example in health, schooling and living standards. We define 'disaster-prone' areas[11] as areas which have experienced more frequent disasters than the country-wide mean (based on EM-DAT data, which covers a range of disaster types – for which our study included biological, climatological, geophysical, hydrological and meteorological factors) in the years preceding the survey. In some instances, where explicitly noted, we also refer to areas which have experienced a longer average duration of disasters than the country-wide mean. Accordingly, by developing our understanding of the effect of slow- and rapid-onset hazards on poverty incidence and dynamics, we attempt to provide a sound basis to inform policy and programming, aiming to reduce poverty and build resilience to climate and disaster risk (Section 5). Methods of empirical analysis are outlined in more detail in Annex 3.

In **India**, our measure of poverty status is constructed through comparing household per

Children in Bungoma, Kenya. © Lukas Bergstrom

11 Note: where we refer to flood-prone (or drought-prone), the same method is used. These terms refer to areas that have experienced a more frequent number of floods (or droughts) than the country-wide mean (based on EM-DAT data for the respective disaster type) in the years preceding the survey.

Table 2 Data sources

Data source	Brief description
India Human Development Survey (IHDS)	National panel dataset from 2005 and 2011 covering 41,554 households across the country (IHDS, n.d.)
Kenya Multiple Indicator Cluster Survey (MICS)	Household-level survey data for Turkana, Bungoma and Kakamega counties over 2013–14 (MICS, n.d.)
EM-DAT	Datasets on types, frequency and intensity of disasters on a subnational level. We investigate datasets for India and Kenya for three years leading up to the year of the household dataset (http://www.emdat.be)
Index for Risk Management (INFORM, 2017)	Index for Risk Management based on hazard and exposure, vulnerability and coping capacity (http://www.inform-index.org)
Climatic Research Unit Time Series 4 (CRU TS4.0 – Harris et al., 2014).	Gridded precipitation and other meteorological variables (https://crudata.uea.ac.uk/cru/data/hrg)
Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS – Funk et al., 2015)	The area-averaged nearest-neighbour CHIRPS pentad was used to interpolate missing precipitation data for Bihar, and as precipitation data for Kenya (http://chg.geog.ucsb.edu/data/chirps)
India Water Portal (2017)	India-specific district-wise monthly precipitation and minimum and maximum temperature for the period 1970–2002 (http://www.indiawaterportal.org/met_data)
All India District-Wise Rainfall Data (India Meteorological Department (IMD), 2017)	India-specific district-wise monthly precipitation data for 2004–2015 (http://hydro.imd.gov.in/hydrometweb/(S(urzg0q2qhgiu3iybivktld55))/DistrictRaifall.aspx)

capita expenditure to a national poverty line. Since national-level panel data on child and human development is available in India, our measure of wellbeing is employed in a dynamic way through the exploration of poverty trajectories. This exploration of the changes in wellbeing that individuals experience over time is important because falling into poverty, escaping poverty and getting trapped in poverty (being chronically poor) are each based on combinations of structural and idiosyncratic factors from the individual and household to the global level. Examining these factors using panel data allows stronger claims to be made about causality between climate-related and other natural hazards on the one hand, and child wellbeing dynamics over time, on the other. This is important because the policies required to promote and sustain escapes from poverty are different from those required to prevent descents into poverty (Shepherd et al., 2014).

In **Kenya**, where recent panel data covering child wellbeing was not available, we instead rely on cross-section MICS data. This is a limitation in the analysis as it does not allow us to examine the poverty trajectories of children and households, but only a point-in-time poverty status. In fact, the choice of study locations was partly determined by the availability of data, but this is a very limited sample and so it is difficult to draw out general findings for other countries or contexts. Nevertheless, the Kenyan cross-section dataset presents a useful contrast to the longitudinal analysis undertaken in India, and relies on a dataset (MICS) focused on child and maternal wellbeing. In our analysis in Kenya, we classify the poor as those at a wealth score percentile below the poverty rate.[12] We analyse child wellbeing in Kenya in three counties where data was available in the MICS for the latest survey year (2013/14). As such, though we refer to Kenya for simplicity in Sections 4.1 and 4.2, the analysis is restricted to the western counties of Turkana, Bungoma and Kakamega. In our case study in Section 4.3, we then focus on Turkana. Our decision to employ MICS is guided by the purpose of the dataset, which provides a tool by which to monitor the situation of children and women in these counties.

12 Specifically, we extrapolate poverty incidence rates per county provided by census surveys using the national poverty line to the respective percentiles of a wealth score provided in each county dataset. We do this given that the wealth score is calculated per dataset, and thus not comparable across the counties when merged. We thus standardise our measure of poverty by creating a proxy with this poverty incidence rate equivalence.

3 Country overviews: child poverty and disasters in India and Kenya

3.1 India

Key messages

- Flooding was the most common disaster type in India between 2000 and 2014, and was also responsible for the most deaths. The states most exposed to natural hazards in terms of total number of disasters in this period were Bihar, Uttar Pradesh and Andhra Pradesh. Areas with a high prevalence of floods also saw a high proportion of households falling into poverty.
- Areas affected by drought, a slow-onset disaster, were more economically dynamic and subsequently saw more poverty escapes. Improved outcomes for the poor, generally and in drought-prone areas, may in part be a result of pro-poor political settlements and good governance, leading to reduced corruption and expanded basic services.

3.1.1 Disaster profile

India is a vast country, with multiple climate regimes and ecosystems that shape poverty and its dynamics among different population

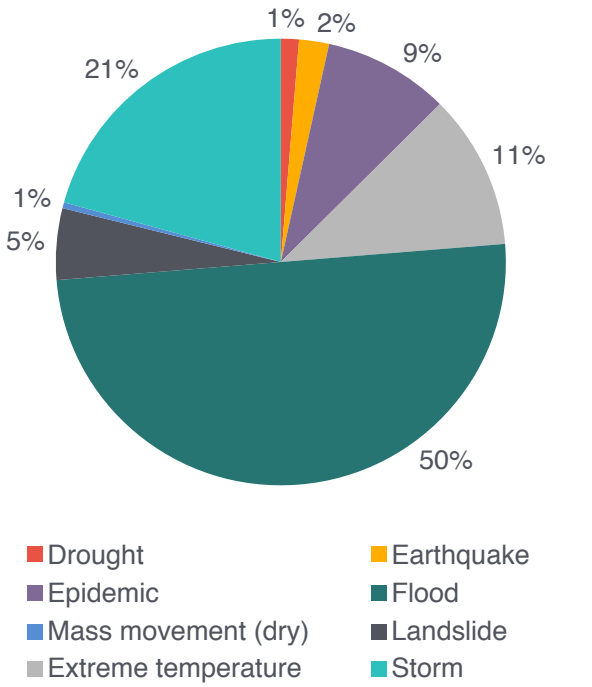
A child eats a sachet of therapeutic food at a health clinic in Turkana County. © Russell Watkins/DFID

groups, as well as livelihoods, cultures and the natural hazards to which people and their assets are exposed. The INFORM database[13] (INFORM, 2017) puts India in the high disaster risk category, with an overall risk value of 5.7 (hazard exposure 7.3, vulnerability 5.4, lack of coping capacity 4.8).[14]

Between 2000 and 2014, India experienced on average around 18 disasters per year (EM-DAT, 2017); the most prevalent disaster type was flooding (50%), followed by storms (21%), extreme temperatures (11%), epidemics (9%) and landslides (5%) – see Figure 2.[15] Reporting of drought incidence is lower in the EM-DAT database, although drought occurs almost every year in a few regions throughout the country. Reporting differences are related to how the National Commission on Agriculture and the India Meteorological Department classify droughts – agricultural, meteorological and hydrological – and recent (2013) changes in reporting standards, difficulties in defining drought onset and end and spatial impacts (Rathore et al., 2014).

Between 2000 and 2014, natural hazards in India, including climate-related hazards, are estimated to have affected about 655 million people, leaving 71,000 dead and resulting in almost $54 billion in economic damage (EM-DAT, 2017) – see Table 3. Drought affected the largest number of people (350 million), but floods resulted in the highest number of deaths and the most economic damage in the 14 years between 2000 and 2014 (more than 22,000 deaths and economic damage of almost $38.5 million) (see Table 3). These figures should however be treated with caution as a lack of data means that the real impacts are being severely underestimated.

Figure 2 Incidence of disaster types in India, 2000–2014



Note: EM-DAT recognises the challenge of recording the start and end date for slow-onset disasters such as drought, and therefore the result for drought in this figure may not be fully accurate.
Source: Authors' compilation using Tableau Public and EM-DAT data, 2017.

3.1.2 Policies aimed at building resilience: governance of climate and disaster risk in India

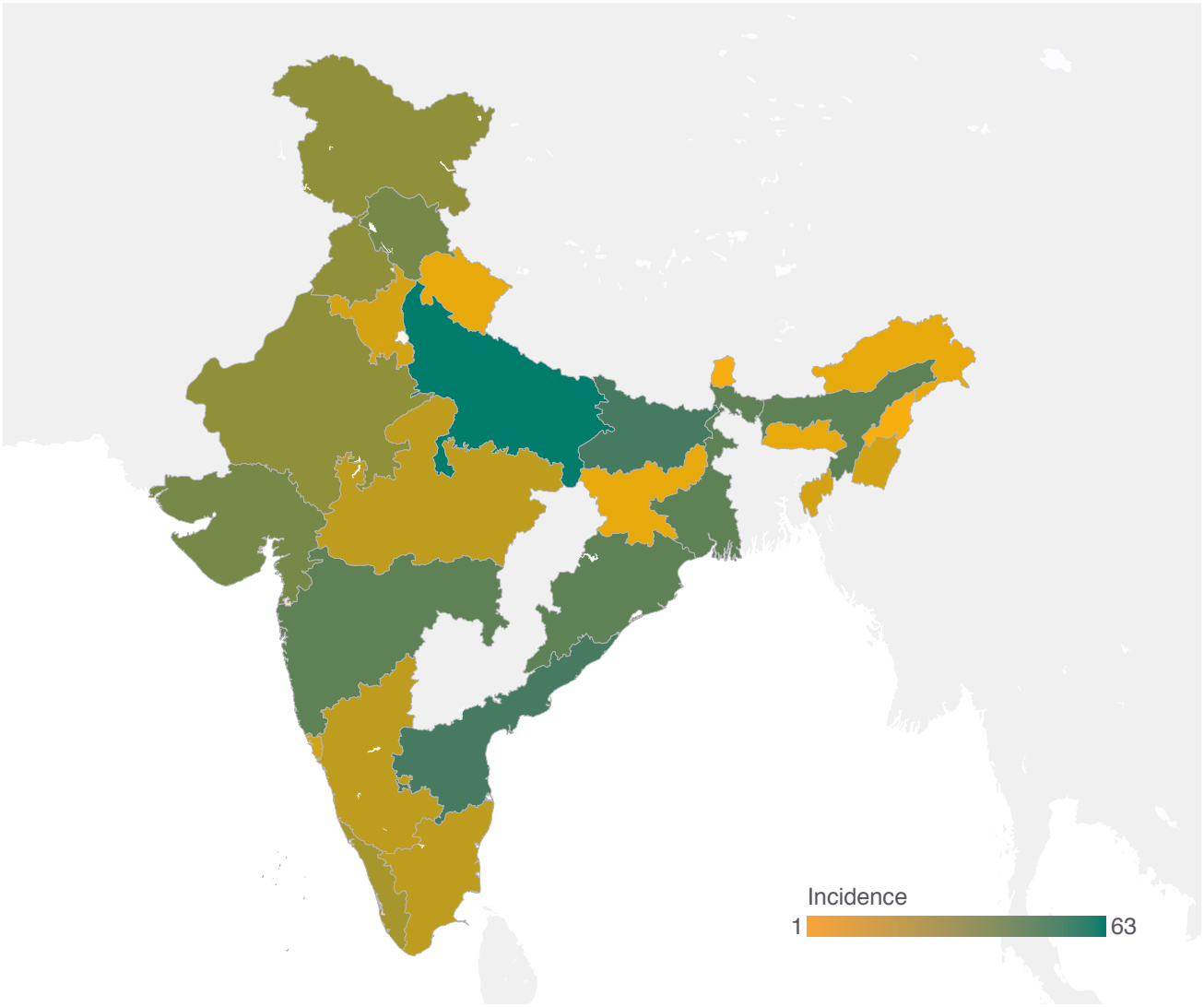
Disaster risk response and management policy and practice has been evolving in India since

13 INFORM is a global, open-source risk assessment for humanitarian crises and disasters. The model is 'based on risk concepts published in scientific literature and envisages three dimensions of risk: hazards & exposure, vulnerability and lack of coping capacity dimensions' (INFORM, 2016).

14 The INFORM model provides a risk profile, which 'consists of a value between 0–10 for the INFORM Risk Index and all of its underlying dimensions, categories, components and indicators … a lower value (closer to 0) always represents a lower risk and a higher value (closer to 10) always represents a higher risk … The results of the INFORM Risk Index and its dimensions are divided into five groups (very high, high, medium, low and very low). The thresholds of these groups are fixed and are based on cluster analysis of 5 years of INFORM results' (INFORM, 2016).

15 EM-DAT classifies only drought as a 'climatological' disaster. Floods and landslides are classified as 'hydrological' disasters, while storms and extreme temperatures are classified as 'meteorological' disasters. The difference between a meteorological and climatological disaster is related to duration, with climatological disasters being slower-onset and of longer duration. All of these hazards are shifting in frequency, intensity, duration and location due to climate change (IPCC, 2014). Moreover, EM-DAT is likely to underestimate the impact of hazards overall given that it does not capture slow-onset disasters well. For example, it has very little wildfire data, even though other research shows the significance of wildfire deaths and injuries in India.

Figure 3 Incidence of disasters caused by natural hazards by state



Source: Authors' compilation using Tableau Public and EM-DAT data, 2017.

Table 3 Total number of deaths, affected people and total damage by disaster type in India, 2000–2014

Disaster type	Total affected (millions)*	Total deaths	Total damage (US$m)
Drought	350	20	1,498.72
Earthquake	8	37,820	4,765.80
Epidemic	<1	1,528	<1
Extreme temperature	<1	6,489	400.00
Flood	276	22,318	38,473.35
Landslide	<1	832	50.00
Mass movement (dry)**	<1	16	<1
Storm	21	1,658	8,640.51
Grand total	**655**	**70,681**	**53,828.38**

**These figures have been rounded up.*
*** This describes a quantity of debris/land/snow or ice that slides down a mountainside under the force of gravity. It often gathers material that is underneath the snowpack, such as soil and rock (debris avalanche) (IFRC, n.d.).*
Source: Authors' calculation based on EM-DAT data, 2017.

2000. The Disaster Management Act of 2005, which led to the establishment of the National Disaster Management Authority, required states to develop their own disaster management authorities, and began articulating the roles and responsibilities of various ministries in DRM (Government of India, 2005). The 2009 National Policy on Disaster Management laid the foundation for further efforts to move to a more proactive disaster management paradigm from what was historically a reactionary approach (Government of India, 2009). Experiences in moving towards implementation of the two acts, including gaps and challenges, along with recognition of shifting global perspectives (e.g. the Sendai Framework, the Paris Climate Agreement and the Sustainable Development Goals), led to the development and release of the National Disaster Management Plan 2016, which marks a first step in the provision of long-term (15 years) DRM (Government of India, 2016). DRM is decentralised, and states and union territories have developed their own disaster management plans (SDMPs), as have 80% of the country's districts (Bahadur et al., 2016). While these plans recognise different vulnerable and marginalised groups, including women, children and people with disability, and in some cases castes, this tends to be in terms of needs and vulnerabilities in the context of disaster response, as opposed to their participation in DRM decision-making and implementation (Bahadur et al., 2016).

Policies on mitigation and adaptation are outlined in the country's National Action Plan on Climate Change (Government of India, 2008a). This focuses on eight mission areas related to energy efficiency, water, agriculture, forestry, habitat conservation and urban planning that are simultaneously intended to reduce poverty, promote sustainable development and enhance resilience (Pandve, 2009; Government of India, 2008a). See Annex 1 for more details on these policies.

3.1.3 Poverty among India's marginalised people

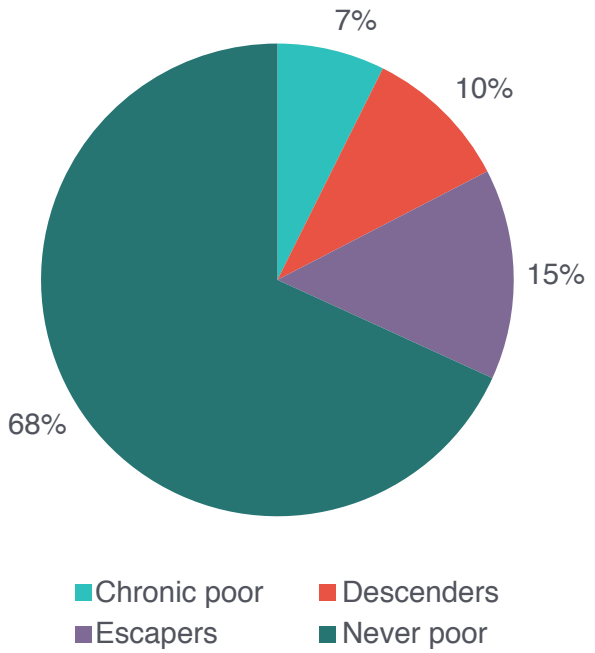
India is now classified as a lower-middle-income country, and recent disasters in the country have taken place at a time of strong economic growth. Between 2005 and 2011, the country's annual gross domestic product (GDP) rose by 8.5% on average, largely due to trade liberalisation, a strong demographic dividend and improved literacy rates contributing to a more productive labour force (Chandrasekhar, 2011; Raghbendra Jha, 2011; Anand, 2014). More than 50% of the population is involved in agriculture-related activities, although this sector contributed only about 14% of national GDP in 2011 (Dhar, 2012); over a third of child labour in the country is in agriculture (Acharya, 2015).

In tandem with growth, the country has also achieved considerable poverty reduction. Some 138 million people were lifted out of poverty between 2004–05 and 2011–12 (Aiyar, 2013). This has been helped by the implementation of initiatives including the ICDS programme, which provides food, education and healthcare to children under six years and their mother, and the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), which aims to guarantee 100 days of waged employment a year for rural households.

While levels of child poverty are high in each survey year, rates of chronic poverty are lower over the two years combined.[16] Chronic poverty has long-term effects on children as they often suffer interlocking deprivations (such as bad health or inadequate access to education) which limit their ability to escape poverty later in life, and often require targeted measures to address. In the Indian panel dataset (IHDS), approximately 7% of households across the country were living in chronic poverty between 2005 and 2011 (Figure 4). Rates did not differ much by disaster prevalence (Figure 5). This suggests that, while policies and programming that aim to build resilience may have been successful in helping some to escape poverty, they have not been as effective in preventing

16 However, it is worth noting that the descriptive disaggregation provided here does not control for other factors which may affect household poverty trajectories (we do this in the regression analysis presented in Section 4.1).

Figure 4 Poverty trajectories in India by household, 2005–2011



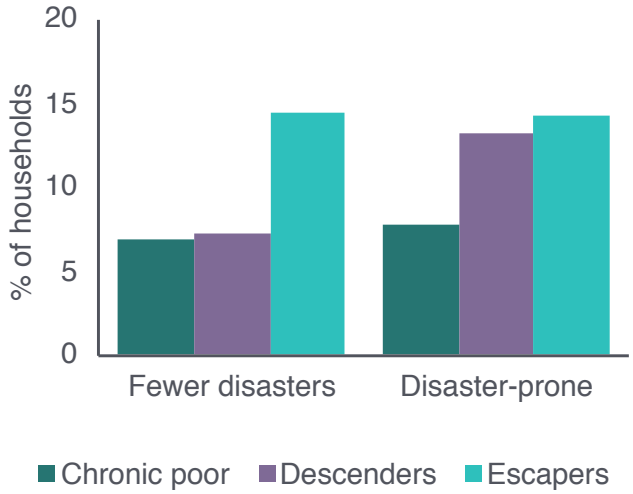
Source: Authors' calculation based on IHDS data from 2005 and 2011 (IHDS, n.d.) and therefore the result for drought in this figure may not be fully accurate.

impoverishment (poverty descents) and reducing chronic poverty.

Household poverty descents were concentrated in disaster-prone areas.[17] Disaggregating by type of disaster, poverty descents were particularly common in areas with more floods. However, for regions prone to climatological disasters recorded in EM-DAT, namely drought, we observe fewer poverty descents and more poverty escapes. This could reflect stronger growth, as well as other factors. For instance, since the 1990s ground-water systems have been developed for farmers in dryland regions, though not in flood-prone regions, which are seen as having better agronomic potential (Mehta and Shah, 2001). Pro-poor political settlements and good governance in certain areas, evidenced by reduced corruption and expanded basic services (Mcloughlin, 2014), have also played a part.

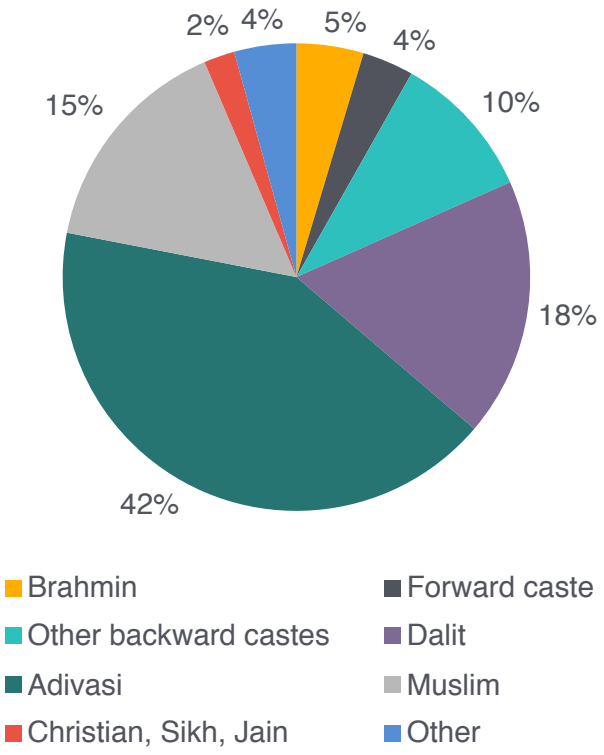
Poverty affects different households to different degrees, and affects different groups, frequently along religious and caste lines (Thorat et al., 2016). The Scheduled Castes and Tribes, in particular the Adivasis, have been marginalised

Figure 5 Household poverty trajectories by disaster prevalence, 2011



Source: Authors' calculation based on IHDS data from 2005 and 2011 (IHDS, n.d.) and therefore the result for drought in this figure may not be fully accurate.

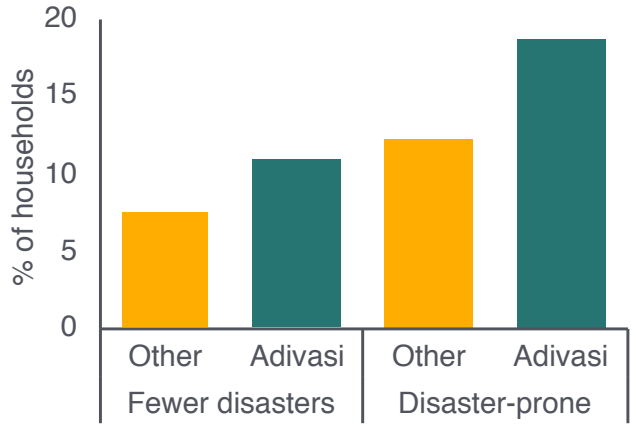
Figure 6 Chronic poverty by socio-religious group, 2005–2011



Source: Authors' calculation based on IHDS data.

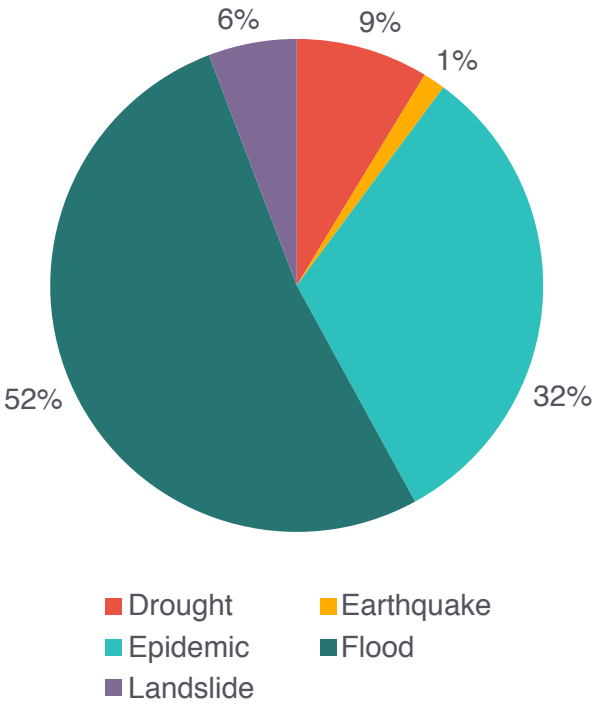
17 22% of districts were 'disaster-prone' in the latest survey year, according to this definition. Moreover, the average number of disasters per year leading up to 2005 was 1.7, and 1.8 leading up to 2011.

Figure 7 Poverty descenders by social group, 2005–2011



Source: Authors' calculation based on IHDS data.

Figure 8 Incidence of disaster types in Kenya, 2000–2014



Source: Authors' calculation based on EM-DAT data, 2017.

for generations. Between 2005 and 2011, Adivasis accounted for over two in five chronically poor households (Figure 6). Almost a fifth of the Adivasi population fell into poverty in disaster-prone areas, compared with just 12% amongst other groups (Figure 7).

3.2 Kenya

Key messages

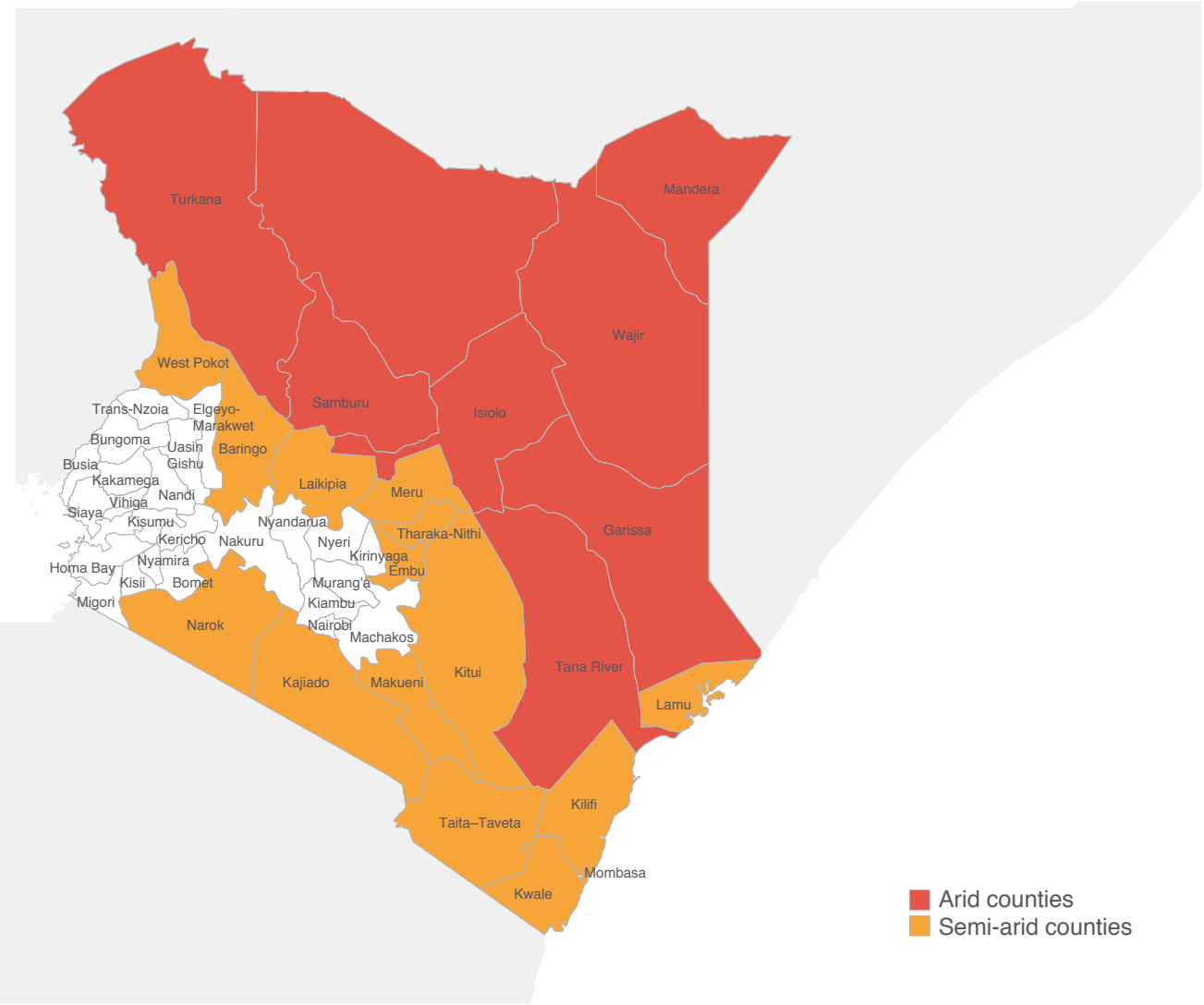
- Our analysis reveals that, as in India, flooding was the most common type of disaster in Kenya between 2000 and 2014, and resulted in the most deaths.
- Drought has affected the largest number of people, and is a particular concern in the ASALs.
- The years 2010–2014 were particularly devastating: more than 10 million people were affected by natural hazards, particularly drought, more than half the total number affected in the 14 years between 2000 and 2014.

3.2.1 Disaster profile

The INFORM database (INFORM, 2017) puts Kenya in the high disaster risk category, with an overall risk value of 6.1 (hazard exposure 6.1, vulnerability 5.9, lack of coping capacity 6.4). The country experiences a range of hazards, including droughts, floods, earthquakes, volcanic eruptions, landslides, cyclones and storms. ASALs cover about 89% of the country's territory (as shown in Figure 8), and contain 36% of the population and 70% of the national livestock herd (Ministry of Devolution and Planning, 2015). These areas are affected by droughts, which result in food insecurity and malnutrition-related illnesses, deaths and disruption of livelihoods (Development Initiatives, 2017). Other areas, such as the western lowlands around Lake Victoria, the coastal lowlands bordering the Indian Ocean and other areas with poor surface water drainage, are prone to flooding, as well as water-borne human and animal diseases, including cholera and Rift Valley fever (Development Initiatives, 2017).

Floods (52%) were the most frequent hazard between 2000 and 2014, followed by epidemics

Figure 9 Map of arid and semi-arid counties in Kenya



Source: ASF, 2015.

(32%), bacterial diseases such as cholera and meningococcal disease and viral diseases, including measles, drought (9%)[18] and landslides (6%) (Figure 9). During this period, natural hazard-related disasters are estimated to have affected almost 20 million Kenyans, killing over 1,700 and resulting in over $200 million in economic damage (EM-DAT, 2017). Drought was responsible for the highest number of people affected (about 18 million); floods resulted in the highest number of deaths (over 850) and over $100 million in economic damage between 2000 and 2014 (see Table 4).

More than half of the people affected by natural hazard-related disasters between 2000 and 2014 were impacted during the last four years of the period (a total of over 10 million). Recurrent, intense and widespread droughts between 2010 and 2014, coupled with locust plagues, restrictions on pastoral mobility and desperate pastoralists cutting trees and grass for their herds, led to an environmental crisis that undermined livelihoods and threatened lives through food insecurity and conflict over natural resources (Masih et al., 2014; Wanyama, 2014; Cherono et al., 2017; Omolo, 2010).

18 Again, the low incidence of drought in the database is likely related to challenges in defining onset, conflicting reporting statements by different agencies and reporting standards around whether a drought is considered meteorological, hydrological or agricultural.

In these four years, there were at least 500 deaths, a third of the total between 2000 and 2014; the damage caused, at $136 million, represented almost 70% of the total registered over the same period. However, it is important to highlight that these figures are still likely to be an underestimate, due in part to the complexity of recording data on drought (see Annex 1 for a discussion on the limitations of data sources).

3.2.2 Policies aimed at building resilience: governance of climate and disaster risk in Kenya

Many policies and authorities that aim to end drought emergencies and build resilience have only been formed recently. The National Drought Management Authority (NDMA) was set up in 2011, and the country has only recently begun to adopt a more anticipatory and holistic approach to climate and disaster risk, with the National Climate Change Response Strategy developed in 2010. Both the Sector Plan for Drought Risk Management and Ending Drought Emergencies and the National Climate Change Action Plan were developed in 2013, and the National Adaptation Plan was established in 2016.

These policies and plans all feed into the Kenya Vision 2030 (Government of the Republic of Kenya, 2007), which commits to ending drought emergencies by 2022. The NDMA has a mandate to establish 'mechanisms which ensure that drought does not result in emergencies and that the impacts of climate change are sufficiently mitigated' (NDMA, 2017a). However, as outlined in Kenya's Sector Plan for Drought Risk Management and Ending Drought Emergencies (2013–2017), 'drought management in Kenya has continued to take a reactive, crisis management approach rather than an anticipatory and preventive risk management approach', which in turn has led to an overreliance on emergency food aid (Government of the Republic of Kenya, 2013a: 20–21). Moreover, there is no central DRM agency or law, and disaster preparedness is piecemeal and fragmented across the country, with little corresponding action, allocation of resources, policy or preparedness for disasters other than drought (Development Initiatives, 2017). See Annex 1 for more details on the relevant policies.

Table 4 Total number of deaths, affected people and damage by disaster type in Kenya, 2000–2014

Disaster type	Total affected (millions)*	Total deaths	Total damage (US$m)
Drought	18	111	<1
Earthquake	<1	1	100.00
Epidemic	<1	685	<1
Flood	2	851	100.54
Landslide	<1	56	<1
Grand total	20	1,704	200.54

** These figures have been rounded up.*
Source: Authors' calculation based on EM-DAT data, 2017.

3.2.3 Bungoma, Kakamega and Turkana counties in western Kenya

While Kenya, as a whole, is at high risk of suffering negative impacts from floods and epidemics, there are regional variations. We focus on Bungoma, Kakamega and Turkana counties in western Kenya. This selection is data-driven. In particular, these are the areas covered in our child wellbeing dataset in the latest survey year. It is important to highlight, however, that there are significant differences between Turkana, an ASAL and a large county in terms of area, compared with the other two counties, Bungoma and Kakamega, which have comparatively wet climates and are much smaller.

The natural hazards they experience are also very different: Turkana is classified as an arid county prone to droughts and floods (ASF, 2015), while Bungoma and Kakamega experience dry spells, but are also flood-prone (see Table 5 for a distinction between physical exposure to floods and drought between the three counties). Focusing on three counties obviously limits the generalisations we can make regarding Kenya at large. However, our aim is to control for influencing drivers of poverty within these counties, and so tease out the impact of disasters.

While the three counties have different hazard profiles, Bungoma, Kakamega and Turkana share striking socioeconomic similarities, including

significant rural populations predominantly engaged in agriculturally based livelihoods. Livestock production, agriculture and oil extraction are the dominant economic activities in Turkana County (The Economist, 2015; Opiyo et al., 2015a; 2015b), with livestock and agriculture particularly sensitive to drought, climate variability and change (Parry et al., 2012). The economies of Bungoma and Kakamega are dominated by agriculture. Vector-borne disease burdens are also sensitive to rainfall patterns and habitat suitable for vectors, such as forest and wetland cover. While accessible information on malaria prevalence was lacking for Bungoma and Kakamega, lowlands and some forest and wetland areas in neighbouring Nandi County have higher risk of malaria outbreaks post the rainy season (Ernst et al., 2006). Bungoma and Kakemaga have some similar land areas to Nandi, and it is possible that these also have higher malaria risks following the long rains. In all three counties, reliance on climate-sensitive livelihoods and exposure to different climate-related hazards influence child wellbeing, nutrition and access to safe water differently (as discussed in Section 2); as such, interventions and policy recommendations also need to vary (see Section 5).

3.2.4 Poverty among Kenya's population subgroups

In contrast to India, disasters in Kenya have not occurred against a backdrop of strong growth. Between 2005 and 2016, GDP growth averaged just 1.3%, with agriculture contributing almost a third of the country's GDP (World Bank, 2017). Over a similar period, poverty in Kenya fell marginally, to 25.1% in 2013 from around 30.4% of the population in 2005, according to the $1.90 international poverty line (World Bank, 2017). This slow pace is indicative of the country's weak poverty eradication policies and poor monitoring (Shepherd et al., 2018), as well as high vulnerability and disaster risk. In 2015, the country was ranked sixth in terms of sub-Saharan African countries with large populations living in extreme poverty (Karanja, 2015). What poverty reduction was achieved during this period was driven by positive, albeit low, economic growth, particularly in Nairobi, and a structural shift from agriculture to services, aided by improved safety nets and rural-to-urban migration (IMF, 2014; Nyamboga et al., 2014).

Table 5 Kenyan counties' exposure to flood and drought

District	Exposure to flood	Exposure to drought	Overall exposure to natural hazards
	(Scale of 0–10)	(Scale of 0–10)	(Scale of 0–10)
Bungoma	8.9	1.0	6.4
Kakamega	9.0	1.5	6.6
Turkana	6.9	7.4	7.1

Source: INFORM, 2015.

In addition to persistent poverty, Kenya also has a legacy of HIV, which in 2012 affected 1.6 million people and 200,000 children (UNICEF, 2013). Around 1 million Kenyan children were orphaned by AIDS as of 2012, exacerbating child labour rates across the country and contributing to low education outcomes (UNICEF, 2013). A study of Kenya, India, Cambodia, Ethiopia and Tanzania found that one in seven orphaned and abandoned children engage in child labour (Whetten et al., 2011). Child labour often comes at the cost of education (IRIN, 2002). The common practice of early marriage also contributes to low rates of secondary or higher degrees of education: 23% of girls are married before they turn 18 (UNICEF, 2014).

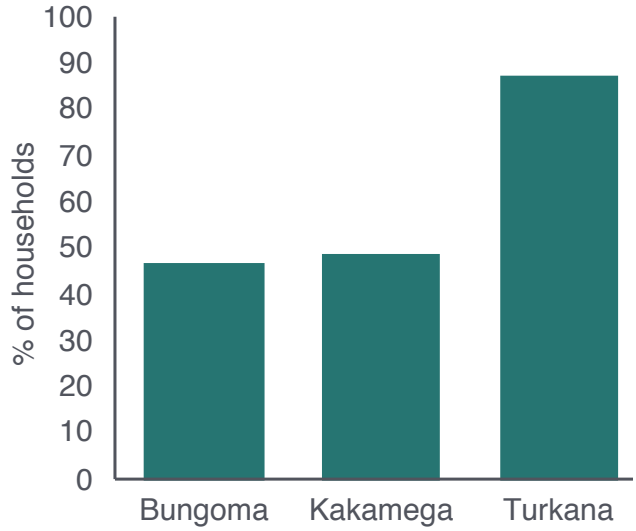
3.2.5 Poverty among Turkana, Bungoma and Kakamega subgroups

As our measure[19] of disasters demonstrates, Turkana is classified as more disaster-prone than Bungoma and Kakamega, with more droughts and epidemics, as reflected in Table 5.[20] Turkana also had the highest poverty rates, according

19 As with India, disaster-prone regions are defined as those with a prevalence and duration of disasters higher than the mean in the years preceding the survey.

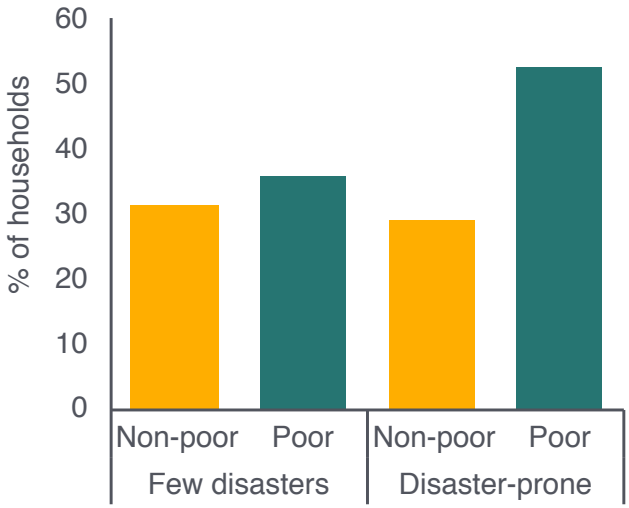
20 It is also worth noting that the average duration of disasters in Turkana (8.75 days) was considerably higher than either Bungoma (1.25 days) or Kakamega (2 days), further substantiating our disaster classification.

Figure 10 Poverty rate across Kenyan counties, 2009



Source: 2009 Census, Kenya (in Daily Nation, 2014).

Figure 11 Female headship by poverty and disaster prevalence, Kenyan counties, 2013–14



Source: Authors' calculations, based on MICS data.

to the 2009 census (Figure 10), and a higher prevalence of poor people living in rural areas (55%) relative to other areas of the county (6%). (More information on Turkana's socioeconomic profile is provided in Section 4.3.)

Household demographics also vary among the poor in disaster-prone areas of Turkana, Kakamega and Bungoma. Over half of poor households in Turkana are female-headed (Figure 11), a higher proportion than in the other two counties. Women-headed households in pastoral areas are more vulnerable to poverty and to the negative impacts of droughts or floods due to a combination of factors, including poor customary rights to land for women; inadequate water wells and livestock; difficulty in retaining livestock without a male family member due to patriarchal cultural norms; reduced or non-existent assistance from the husband's clan after his death; and difficulties fleeing during cattle raids in pastoral areas of Turkana because they must care for their children (Omolo, 2010). These households also have more members on average than their counterparts in less disaster-prone areas.

4 Linking disasters to children's lifecycles

The following sections explore the links between disasters and poverty incidence and trajectory, before examining wellbeing over the life course of children in disaster-prone areas of India and Kenya.[21] In the following analysis, it is important to recognise that factors linked to lower development outcomes, such as lack of medical services, are the same factors influencing people's vulnerabilities and capacities to prepare for, cope with and recover from hazards. Lack of services, poor governance and other factors in lower development outcomes simultaneously place households and children at higher climate and disaster risk. As such, greater cross-sectoral consideration needs to be given to the causal links between disasters and development outcomes.

4.1 The relationship between disasters and household poverty

This section examines the relationship between disasters and poverty in India and Kenya. An overview of the methods of analysis is given in the methodology section at the start of the paper, and described in more detail in Annex 3.

James, an 18-month-old boy, has his arm circumference measured as part of a Save the Children/UNICEF malnutrition screening programme supported by UK aid in Turkana, northern Kenya. © Russell Watkins/DFID

21 As a reminder, analysis of child wellbeing in Kenya is based on three counties where data was available in the MICS for the latest survey year. As such, although we refer to Kenya for simplicity in Sections 4.1 and 4.2, it is worth emphasising that the analysis is restricted to the western counties of Turkana, Bungoma, and Kakamega. In our case study in Section 4.3, we then focus on Turkana.

Key findings

- An increase in the average number of disasters over the three-year period leading up to the survey is associated with lower poverty incidence in India, possibly because of recent policy changes aimed at building resilience.
- However, a higher average *number* of disasters is associated with a higher risk of a household being chronically poor or becoming impoverished, while a longer *duration* of disasters is associated with a lower risk of chronic poverty and impoverishment. The latter may be because response and recovery programmes last longer, and so have time to extend their reach to more marginalised people.
- In Kenya, a higher average number of disasters is associated with higher poverty incidence. This partly reflects the weakness of policies and programming aimed at building resilience in the country. In rural Kenya, drought is a driver of reduced household income.

4.1.1 India

In India, households in areas experiencing one more disaster compared with the preceding survey round are half as likely to be in poverty.[22] The relationship is stronger for drought than floods. This finding at first appears counter-intuitive. However, it could be a result of policies and programmes in disaster-affected areas that have reduced vulnerability and improved capacities, and in doing so helped households better prepare for hazards and support their escape from poverty. This is similar to the Bangladesh 'model', where household engagement in relief programmes in response to floods has helped improve wellbeing and resilience to natural hazard-related disasters and climate change (Shepherd et al., 2013). Similarly in India, policy and programming which aim to build resilience mean that there is a 'good chance of minimising long-term disaster impacts' (ibid.).[23]

When we explore the relationship between disasters and poverty *trajectory*, as against *incidence*, however, we observe that an increase in the average number of disasters is associated with a higher risk of a household being chronically poor. Households in disaster-prone districts, those that experience disasters more frequently than the average over the preceding three-year period, are twice as likely to be chronically poor relative to escaping poverty, and three times as likely to become impoverished. Interestingly, a greater average duration of disasters is associated with a slightly lower risk of chronic poverty and impoverishment. This may be because response and recovery programmes last longer, and so have time to extend their reach to more marginalised people relative to humanitarian responses in short-term disasters, which may bring a large transfer of resources but not be adequately targeted to reach the poorest of the poor, or may not last long enough. Nevertheless, households which experience longer-lasting disasters and simultaneously experience a household shock[24] such as a job loss or death are 1.5 times as likely to be at risk of chronic poverty. This suggests that, even though policies and programming aimed at building resilience may help people escape poverty in areas where there has been an increase in disaster prevalence, these programmes are still not enough to help households across disaster-prone areas escape chronic poverty or prevent impoverishment.

We also analyse differences in housing conditions between households in disaster-prone

22 In technical terms, an increase in the average number of disasters by one over the three-year period leading up to the survey is associated with lower poverty incidence by around 50%. The same association holds when we examine disasters as a binary wherein disaster-prone areas are defined as those with an average number of disasters higher than the mean. We also use a more severe threshold, defining disaster-prone areas as those with an average number of disasters in the 90th percentile, but our direction of association does not change.

23 However, as our analysis for Bihar in Section 4.3 would suggest, these capacities may be better tailored to situations of drought relative to floods.

24 The data does not provide information on whether these shocks are related to disasters.

areas compared with other areas.[25] In India (Figure 12, left), only three in five chronically poor households in disaster-prone areas tend to have access to electricity, compared with four in five households elsewhere. This could be because many disaster-prone areas are remote and less well connected, which can impede access to electricity and other infrastructure services (Risk to Resilience Study Team, 2009). It may also be because natural hazard-related disasters have disrupted electricity generation, supply or provision (Urban and Mitchell, 2011), or damaged other critical infrastructure, such as roads and railways, that households with agricultural livelihoods depend on to bring their crops to market and access supplies and credit (Risk to Resilience Study Team, 2009; The Desakota Study Team, 2008). This highlights the links between drivers of vulnerability (e.g. unequal access to infrastructure and services, particularly for the poor) and the vulnerability of services to which people *do* have access to disruption and potentially slower repairs given conflicting government priorities after a disaster. The factors contributing to poverty in disaster-prone areas overlap significantly with those that make such households more vulnerable to suffering disproportionate harm during and after the occurrence of a hazard. Low connectivity and poor infrastructure also limit livelihood opportunities and result in migration for wage labour. In fact, seasonal or short-term migration of at least one member of the household was slightly higher among the chronically poor in disaster-prone areas (16%) than elsewhere (12%). According to IHDS data, chronically poor people tend to migrate to another state or within the same state, and rarely (less than 3%) abroad. Limited opportunities for local labour in drought-prone or other disaster-affected areas, where natural resources may be scarce, can have a negative impact on child wellbeing, including education, and many children may be forced to relocate due to climate stresses or nomadic livelihood practices (Doshi, 2016).

Chronically poor households in disaster-prone areas have one more child on average, and these children constitute a larger proportion (37%) of household members than in chronically poor households elsewhere (33%) (Figure 12). This could be a coping strategy through the provision of more members to contribute to agricultural labour and to offset the increased morbidity and mortality stemming from environmental shocks and stresses. The higher number of children in disaster-prone districts could also in part be due to limited or inadequate family planning and health services – the inadequacy of such services also leads to wider health risks, including infectious diseases (Mason et al., 2005; Harris, 2012). Increasing population size, without local development planning, could result in more households being exposed to natural hazards as they are forced to live on marginal land or pursue unsustainable livelihood practices; for example, increased cultivation in wetlands could increase the risk of flooding (Resilient Africa Network, 2016).

4.1.2 Kenya

In Kenya, disasters in the three counties analysed are associated with an increased likelihood of poverty, suggesting that policies and programming aimed at building resilience are yet to make a considerable difference in poverty reduction.[26] Secondary research of longitudinal data in rural Kenya between 2000 and 2007 indicates that reductions in rural household incomes are driven by reduced and increasingly erratic rainfall during the short- and long-rain seasons, leading to drought (Muyanga and Musyoka, 2014). A legacy of reactive policy and programming approaches, poor integration of risk management into socioeconomic planning and socio-cultural practices have all influenced the dynamics of household poverty and child

25 As mentioned earlier, we analyse difference in means here. This method of statistical analysis does not control for other factors which could affect child wellbeing outcomes. Indeed, disaster-prone areas may often reflect general socioeconomic trends, so observations may not always be disaster-specific. However, we disaggregate by number and average duration of disasters as a robustness check and findings remain largely consistent. See Annex 3 for more details on methodology.

26 We are unable to test interactions with other household shocks due to data limitations.

wellbeing. The complex nature of drought emergencies, and low investment and political support for poverty reduction, particularly around marginalised groups such as pastoralists, has made progress challenging, as has the high incidence of severe and repeated drought in Kenya since 2009.

In terms of household demographics in disaster-prone areas, poor households across our three counties again tend to have more children, and the share of children in a household is again slightly higher (45%) than elsewhere (43%) (see Figure 13). This could reflect the common practice of polygamy in Turkana, where pastoralists tend to have more children in general, partly as a coping mechanism, compared with the agricultural households characterising Bungoma and Kakamega (IRIN, 2006).

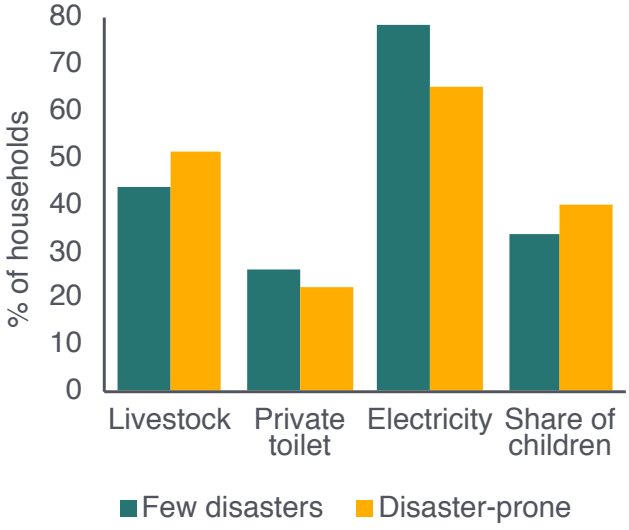
School closures have been a common response to drought, limiting girls' enrolment in particular. Droughts have led to increased population movements among already nomadic pastoralists, increasing the risk of children becoming separated from their families (Macharia, 2017).

Households in disaster-prone areas in the three counties fare much worse in terms of housing conditions. They are less likely to have private toilets, adequate sources of cooking fuel and electricity: 65% of households in areas with fewer disasters have private toilets, compared with just 8% in disaster-prone areas. However, given that Turkana people tend to be mobile pastoralists, and mobility is the most important way to manage drought risk, the lack of a toilet or electricity in a household is understandable.

Households in these areas also own less livestock. Livestock has long been an important element in ensuring food security and economic stability among poor households (Food Security Portal, 2012). Repeated droughts and floods have resulted in widespread livestock losses through death, raiding and forced sales (Mude et al., 2010; Huho et al., 2011). Although families try to purchase fodder, water and other resources to maintain their herds as best they can during and after a disaster, depleted household capital and savings make it difficult for some families to restock their herds after a disaster (Ouma et al., 2012).

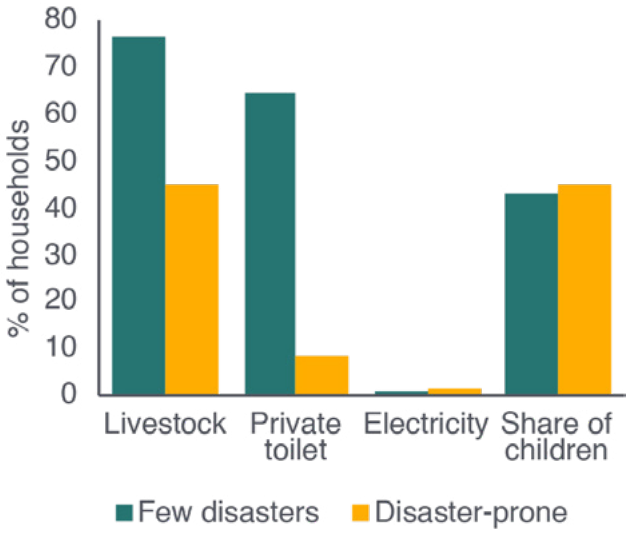
Recognising the vulnerability of pastoral areas, the Kenyan government produced the Ending Drought Emergencies: Common Programme Framework for Drought Risk Management (2014–2018) in 2014. The framework, which focuses on the ASALs, has three main components: drought risk and vulnerability reduction; drought early warning and response; and institutional capacity for drought and climate resilience (Government of the Republic of Kenya, 2014). If drought management in

Figure 12 Housing and demographics among chronically poor households in India, 2011



Source: Authors' calculations based on IHDS and MICS survey data.

Figure 13 Housing and demographics overall, Kenyan counties, 2014



Source: Authors' calculations based on IHDS and MICS survey data.

the ASALs can help to improve anticipatory and preventive risk approaches through this framework, and programmes backed by the framework specifically target poor children and other vulnerable groups, there is scope for improving the wellbeing of pastoralists in the ASALs. Kenya's National Adaptation Plan (2016) makes explicit mention of the rights of children, and the need to improve access to food, education, livelihood diversification and social protection for children and youth, as well as other vulnerable groups (e.g. women, orphans, the elderly and those with disabilities); these targeted approaches should help contribute to people's capacity to cope with environmental shocks and stresses.

4.2 Children living in disaster-prone areas

While the poverty trajectories of households and housing conditions following a disaster influence child wellbeing, other important indicators need to be explored, as outlined at the start of Section 4. The next section examines wellbeing through the various stages of a child's life course. (A summary of results is presented in Annex D, with policy recommendations in Section 5.)

4.2.1 In utero and birth

Key findings

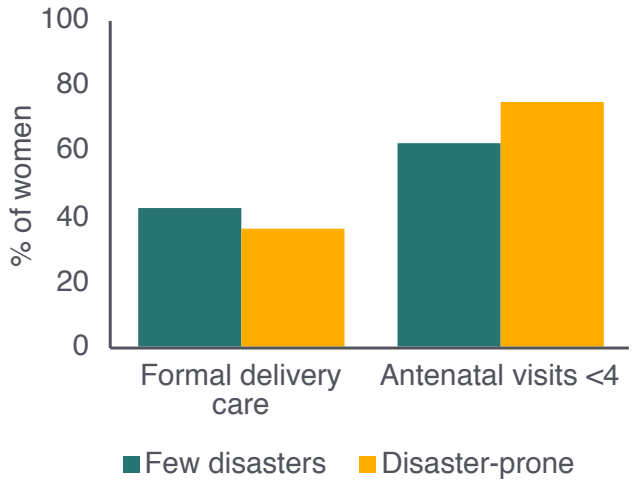
- Chronically poor women in disaster-prone areas of India and Kenya are less likely to access formal delivery care for the birth of a child compared with other areas.
- In India, chronically poor women in disaster-prone areas are less likely to make the recommended four antenatal care visits, reflecting the greater distance to government maternity centres in these areas relative to others. Results are reversed in Kenya, reflecting targeted development initiatives in recent years.

The health and wellbeing trajectories of children start long before they are born, and are shaped by a mother's health while the baby is in utero, as well as socioeconomic contexts which affect the medical care, nutrition and other services mothers receive during pregnancy. Optimistically, we note that health services in India are more likely to be located within half a kilometre of chronically poor households in disaster-prone areas compared with other areas of the country. This reflects the government's longstanding development programmes in certain disaster-prone areas, particularly areas susceptible to drought (Mehta and Shah, 2001). Even so, chronically poor Indian women in disaster-prone areas are less likely to access formal delivery care[27] (36% in disaster-prone areas, compared with 42% elsewhere) or make the recommended four antenatal care visits prior to the birth of a child (Figure 14). This may reflect the increased distances (two kilometres on average) required to travel to government maternity centres in disaster-prone areas compared with other areas of the country. Birth registration is also much less common in disaster-prone areas (69%, compared with 84% elsewhere). Birth registration is a potential development 'accelerator', and can lay the foundation for pro-poor and other development interventions for target groups. By giving identity to children, it officially provides them with rights ranging from healthcare to schooling and formal employment. It is also an important tool for national planning and for monitoring progress towards development goals.

As in India, birth registration is much less common in disaster-prone counties of Kenya, accounting for just 20% of births compared with almost twice that elsewhere. In Turkana, this is partly on account of the sheer distance to registration centres, as well as pastoralists' remoteness and mobility. Also similar to India, poor women in disaster-prone areas of Kenya are much less likely to be provided with formal delivery care (27% compared to 43%) (Figure 15). Again, this is probably because of the long distances involved in accessing health facilities, as well as low education

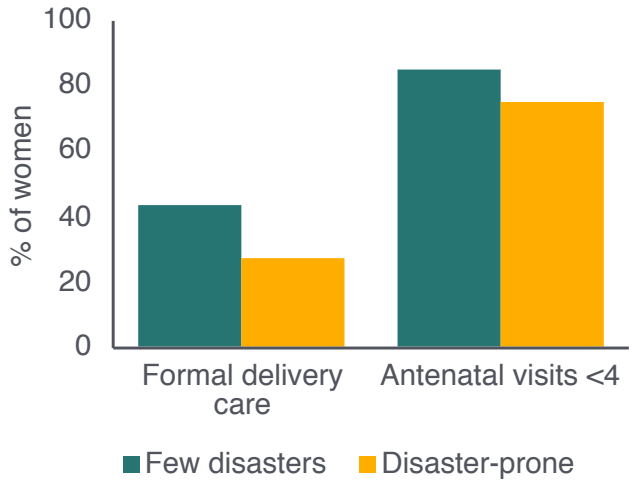
27 Defined as delivery by a doctor or nurse (as opposed to informal care as provided through, for example, a traditional birth attendant or friend).

Figure 14 Health services for pregnant mothers, India, 2011



Source: Authors' calculations based on IHDS and MICS data.

Figure 15 Health services for pregnant mothers, Kenya, 2014



Source: Authors' calculations based on IHDS and MICS data.

levels, cultural preferences and limited social mobility, a perceived lack of quality in service provision and high service charges. Although the government decided to abolish maternity charges in public health facilities in mid-2013, cultural norms need to shift away from traditional providers in order for the policy change to have the desired effect of encouraging pregnant women to go to public facilities (Eijk van et al., 2006; USAID, 2013). Interestingly, women in disaster-prone areas of Kenya are more likely to make the recommended four antenatal care visits, compared to women in areas less affected by disasters. This could be a result of recent initiatives to provide mobile healthcare units in more remote areas of Turkana, which can support pastoral groups with 'antenatal care, family planning, nutrition, child growth monitoring, and health education' (EEAS, 2013).

4.2.2 Children under five

Key findings

- In India and Kenya, chronically poor children under the age of five are more likely to have diarrhoea, reflecting poorer access to water and sanitation in disaster-prone areas.

Once a child is born, a host of illnesses and conditions could affect their wellbeing and long-term poverty trajectories. In India and Kenya, malnutrition is a chronic problem. In Turkana, for example, vitamin intake is low due to low consumption of fruit and vegetables. In Bihar, the National Rural Health Mission 2012–13 report found that 80% of children under the age of five were malnourished. These conditions and related aspects of morbidity could in turn be affected by the presence or prevalence of a disaster. Poor children living in disaster-prone areas are more likely to suffer from diarrhoea. In 2005 in India, chronically poor children aged 0–5 were almost twice as likely to have diarrhoea in such areas. This is a severe problem in a country where two million children die each year from preventable conditions including diarrhoea, malaria and malnutrition. A fifth of under-five deaths stem from diarrhoea (Bhowmick, 2010). The increased likelihood of diarrhoea is partly a reflection of poor water access and sanitation practices in disaster-prone areas. Only 4% of chronically poor households in disaster-prone areas in India had indoor piped drinking water, compared with 13% elsewhere. On sanitation practices, 55% of chronically poor respondents in disaster-prone areas of India used mud and ash in handwashing, compared with 43% elsewhere.

Kenyan households in disaster-prone areas are also less likely to have access to improved drinking water sources. Only 17% of poor

households have any bar or liquid soap in their households for handwashing, compared with 65% elsewhere. Differences across counties bear a relation to differing rates of diarrhoea.

4.2.3 Education of children and adolescents

Key findings

- Primary school enrolment rates for poor children are lower in disaster-prone areas across India and the three counties in Kenya.
- In India, Adivasi adolescents are less likely to be enrolled due to remoteness and a history of social marginalisation. The gap with other groups widens in disaster-prone areas.
- Secondary school enrolment rates are higher in disaster-prone areas of Kenya on average for boys. This may reflect gendered norms and responsibilities which promote the education of boys over girls, or it may be due to limited income-generating activities for boys during drought.

Education over the course of childhood is important to wellbeing, and can support a sustained pathway out of poverty (Scott and Diwakar, 2016). Provision of primary schools in India is high regardless of disaster prevalence, but this does not imply that access to these schools is the same before and after a disaster, or for girls and boys. For example, following the 2004 Indian Ocean tsunami, student dropout rates increased in many communities where temporary shelters were built far from schools (Oxfam, 2008). The quality of education also suffers in disaster-prone areas. Persistently poor children in disaster-prone areas are slightly more likely to have teachers who are often absent (6%), relative to elsewhere (4%). These children are also much more likely to be beaten (44%) or scolded (48%) by teachers compared with other areas of the country (27% and 39% of persistently poor children, respectively).

Across our years of analysis, we observe that persistently poor children of primary-school age in disaster-prone districts of India are five percentage points less likely to enroll for school, compared with children in other areas (Figure 16).[28] Within this group, Adivasi adolescents are less likely to be enrolled in disaster-prone and other areas of the country compared with adolescents from other social groups. Moreover, the gap between enrolment rates for Adivasis compared with other groups widens in disaster-prone areas. For example, while 47% of persistently poor Adivasis and 53% of other persistently poor children were enrolled in areas with few disasters in 2011, these figures reduce to 24% and 44%, respectively, in disaster-prone districts. More generally, persistently poor indigenous youth in India remain deprived in terms of access to education, and have consistently higher dropout rates than other social groups (Joshi, 2010). This is especially problematic given that education in India over the survey period was also associated with a higher likelihood of escaping from poverty (Diwakar et al., 2017b).

Girls are much less likely to be enrolled in secondary education in disaster-prone areas (40%) compared with boys (47%), though, surprisingly, girls have almost half a year more of schooling. This could reflect the greater income-generating opportunities available to boys, which means they may leave or be taken out of school to supplement household income. This situation may be aggravated following disasters, when incomes are generally reduced, but without adequate surveys it is difficult to accurately describe what is likely to be a complex situation, dependent on socio-cultural dynamics within individual households.

In Kenya, education trends in disaster-prone areas are similar to those in India. Poor, primary school-age children in disaster-prone areas have almost a year's less teaching. Girls are less likely to be enrolled in secondary education than boys. For boys, however, in contrast with India, secondary enrolment rates are higher in disaster-prone areas (94%, compared to 81% elsewhere). This may reflect limited income-generation activities during periods of drought and other climate and

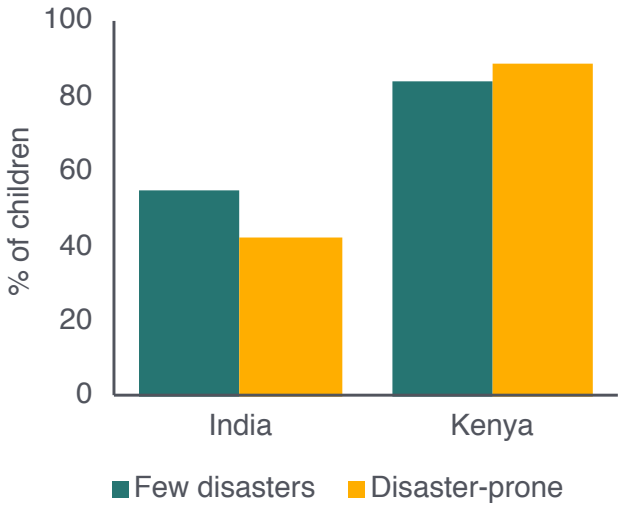
28 For robustness, we also employ a difference-in-difference estimation, and find that the presence of disasters is associated with fewer years of schooling in primary and secondary education, although the likelihood of enrolment reduces as the level of education increases.

disaster hazards, especially in areas characterised by agricultural labour. Higher male enrolment rates could also signal a growing recognition in policy of the particular impacts of climate-related hazards on children's education.[29] For example, Kenya's National Adaptation Plan 2015–2030 notes that 'drought … can contribute to children being taken out of school. Similarly, climate impacts can lead households to divert financial resources from education to food' (Government of the Republic of Kenya, 2016: 29). The *Sector Plan for Drought Risk Management and Ending Drought Emergencies* (2013–2017) also reaffirms the need to 'ensure equitable access to education for all children in arid [and] … pastoral areas, including the disadvantaged [and] … vulnerable groups' (Government of the Republic of Kenya, 2013a: 51). In this setting, the government has developed initiatives for short- and long-term actions to include information on climate change in school curricula and expand educational opportunities in the ASALs, including Turkana, for instance through mobile schools.

Targeted expansion within the education sector has not translated into improved schooling outcomes for girls. School closures are common in periods of drought, meaning that children have to travel further to attend school. This affects girls more than boys because of their reduced freedom of movement. Even where mobile schools exist, cultural values and practices constrain girls' enrolment (Rotich and Koros, 2015).

In 2013, there were 61 mobile schools in Turkana County, although these faced a number of challenges including 'inadequate number of teachers; lack of teacher motivation; lack of community awareness and sensitization on importance of schooling' (from the Turkana County education office, 2013, in Ngugi, 2016). Our results suggest that the expansion of educational opportunities does appear to be providing dividends for boys in disaster-prone areas, but this is inadequate to incentivise families to continue to educate girls.

Figure 16 Secondary enrolment rates, India, 2011, and Kenya, 2014



Note: Enrolment in India is derived from a question in the IHDS asking whether an individual is currently enrolled. In Kenya, the MICS dataset asks whether the individual attended school at any time during the current school year, and thus is likely to overstate the level of enrolment.
Source: Authors' calculations, based on IHDS and MICS data.

4.2.4 Adolescent labour

Key findings

- Poor adolescents in both countries are less likely to be engaged in economic activities in disaster-prone areas than elsewhere.
- In India, this is driven by trends among chronically poor Adivasi adolescents, who significantly reduce their engagement in farm labour during disasters. This reduction is offset by increased engagement in industry-related employment.
- In Kenya, disasters may increase the burden of labour for poor adolescent girls, who may be forced to withdraw from school to complement household welfare, particularly through domestic, livestock, farming and unpaid labour.

Insecurity and uncertainty following disasters influence decisions around income generation,

29 Additional key pieces of legislation related to Kenya's commitments to the UN Framework Convention on Climate Change (UNFCCC) are the *2010 National Climate Change Response Strategy* (Government of the Republic of Kenya, 2010), the *National Climate Change Action Plan 2013–2017* (Government of the Republic of Kenya, 2013b) and the *National Adaptation Plan 2015–2030* (Government of the Republic of Kenya, 2016). These are reconciled within its long-term socioeconomic development plan, *Kenya Vision 2030* (Government of the Republic of Kenya, 2007).

especially as children grow older. In **India**, employment among adolescents is lower in disaster-prone areas (10%) compared with elsewhere (16%), and is around 7% lower each for boys and girls. Looking at farm labour specifically, we note that chronically poor adolescents (excluding Adivasis), primarily boys, are more likely to engage in farm labour in disaster-prone areas. While the rate of farm labour among chronically poor non-Adivasi adolescent girls remains constant (38%) regardless of disasters, among boys there is notably higher participation (43% of chronically poor, non-Adivasi adolescent boys engage in farm labour in disaster-prone areas, compared with 35% in other areas of the country).

For Adivasi labour the opposite is true: while chronically poor Adivasi adolescents are more

Box 2 Spotlight: child wellbeing and floods in India

Key findings

- Flood-prone districts have similar outcomes to disaster-prone districts in India at large. However, there are certain areas of child wellbeing, especially around health outcomes for expectant mothers and babies, that perform better in flood-prone districts.
- Compared with drought, flood-prone districts also perform better on health wellbeing, though worse on education outcomes. Both areas, however, display worse education outcomes relative to areas with fewer disasters.

We also examine child wellbeing in flood-prone districts of **India**, given that floods constitute the most prevalent disaster type over the period of analysis.[1] Comparing flood-prone districts with other areas in India indicates similar trends to the overall relationship between disasters and wellbeing in the country. Chronically poor households have fewer livestock in flood-prone areas. Specifically, in 2011 42% of these households had more livestock than the mean, compared to 47% elsewhere. Livestock ownership is much lower in flood-prone areas than the average across disaster-prone areas.

Poor mothers are more likely to have access to formal delivery care in flood-prone areas, reflecting the proximity of health services in areas of higher population density. Children are more likely to have diarrhoea, partly because of contaminated water sources stemming from disasters and more generally through inadequate sanitation and poor land use planning (Nandan, 2012). For poor children of primary- and secondary-school age, we observe a reduction in enrolment in flood-prone areas at the time of the survey, some of which may be attributable to students dropping out. This difference is especially notable for secondary schooling, where 44% of poor children are enrolled, compared with 53% elsewhere. This is despite improved access to secondary schools and lower rates of teacher absenteeism more generally.

Overall, both flood- and drought-prone areas display worse outcomes relative to areas with fewer disasters. However, there are certain differences in disaster-prone areas in general compared with flood-prone areas specifically. Even compared to drought areas, flood-prone districts perform worse on education, though better on health wellbeing. These differences partly reflect the time-differentiated effects of the disasters, where for example floods may wash away learning equipment and infrastructure, and could lead to the use of school buildings as relief camps. It also partly reflects differentiated relief efforts, where flood-prone areas receive substantial health assistance to prevent the spread of disease (ReliefWeb, 2006; Varma, 2017). In contrast, drought-prone areas tend to receive more economic relief and investments such as irrigation (World Bank, 2011) and education, with less attention to short-term impacts such as reduced water quality and quantity.

1 Data limitations prevented us from undertaking a similar exercise in the Kenyan counties of analysis.

likely than other groups to support household farm labour in areas with fewer disasters (55% among chronically poor Adivasis compared with 36% among other groups), their engagement drastically reduces in disaster-prone areas (31%, compared with 40% among other groups). This reduced participation is offset by industry work, potentially reflecting the need for low-skilled repair or reconstruction work in the aftermath of a disaster. Such livelihood diversification could improve future wellbeing; indeed, while limited job opportunities may have previously made it difficult to diversify income sources (Skillshare International India, 2014), disasters may provide jobs that offer a way out of poverty.

In **Kenya**, like India, adolescent labour among the poor is marginally less common in disaster-prone areas, though certain types of adolescent labour, specifically in family businesses and clothing, is more prevalent (18% and 11%, respectively, in disaster-prone areas, compared with 8% and 6% elsewhere). It is likely that these family businesses are predominantly informal microenterprises. Micro- and small-scale enterprises in Turkana, for example, are an important mode of economic activity and livelihood generation (Ochieng, 2015). Adolsecent labour, both in family businesses and clothing, is female-dominated. Children, especially girls, are largely responsible for household chores, including water collection. This is a significant issue in ASALs including Turkana, where distances between homes and drinking water sources can often be very large. Disasters could increase the effective and actual distance to reliable water sources, for example by destroying roads or decreasing the quantity and quality of water sources, thereby creating additional burdens for adolescent girls.

Children in Turkana are on average twice as likely to engage in household chores, and are five percentage points more likely to be care-givers for old or sick members of their household. Gender differences are also evident in care duties in disasters: while around 8% of poor boys and girls are involved in caretaking in areas with few disasters, only 6% of boys but 18% of girls are engaged in these activities in disaster-prone areas. This could directly reflect household needs following a disaster, but may also affirm gender stereotypes. This could limit girls' ability to participate in school or employment, as well as their ability to evacuate during a disaster if they are responsible for old or sick members who may require more assistance to leave.

Ultimately, while a comparison of child wellbeing between disaster-prone and other areas of India and Kenya is a useful step towards understanding the needs of children in situations of uncertainty, these needs are bound to vary by subnational context. We explore this next.

5 Child poverty and disasters: spotlight on Bihar and Turkana

This section examines the links between child wellbeing and disasters in Bihar and Turkana. The absence of geographic identifiers within counties in the MICS Kenya dataset prevents us from analysing sub-county variations in disasters. As such, we examine climate trends, disasters and child wellbeing across Turkana as a whole for our case study, given that the county saw the largest incidence of disasters on average across the three counties studied. Our choice of Bihar is guided by several factors, which we turn to next.

5.1 Bihar, India

Key findings

- Flooding is common in northern Bihar, earthquakes dominate its central belt and drought features more extensively in southern districts.
- Child wellbeing outcomes are better in disaster-prone areas of Bihar, in part a reflection of policy changes over the past decade.
- The flood-prone districts of the north suffer from low human development, highlighting the need for wider and more inclusive policy interventions.

A market in Bihar, India. © Chandan Singh

5.1.1 Socioeconomic profile

Bihar is the third-largest state in India (104 million people, according to the 2011 census, 46% of whom are children, the highest in the country (Government of Bihar, 2016a)) and its most densely populated. It is also one of the poorest states in the country. Almost a fifth of the population belongs to Scheduled Castes and Tribes (Government of Bihar, 2016a). Nearly 90% of the rural population is directly or indirectly employed in sectors related to agriculture and animal husbandry (Government of Bihar, 2016a; Salam et al., 2013). A large proportion of rural (34.1%) and urban (31.2%) households in Bihar were living in poverty in 2012 (Government of Bihar, 2016a). In 2000, Bihar lost much of its mineral resources to the newly-formed state of Jharkhand, reducing the state government's capacity to finance poverty alleviation, development and disaster relief (Kumari, 2014). More recently, the government has emphasised infrastructure development and improving social delivery systems to promote economic growth.

5.1.2 Disaster profile

Bihar is exposed to earthquakes, severe storms and wildfires; over 70% of the state is flood-prone and 30% prone to drought (Government of Bihar, 2014). There were 23 floods (50% of total disasters in the state) between 2000 and 2014, 11 periods of extreme temperatures (24%) and seven storms (15%) (Figure 17). The earthquake in Nepal in 2015 killed 59 people and caused widespread damage in rural parts of northern Bihar. Figure 18 shows areas particularly exposed to hazards across the state's 38 districts.

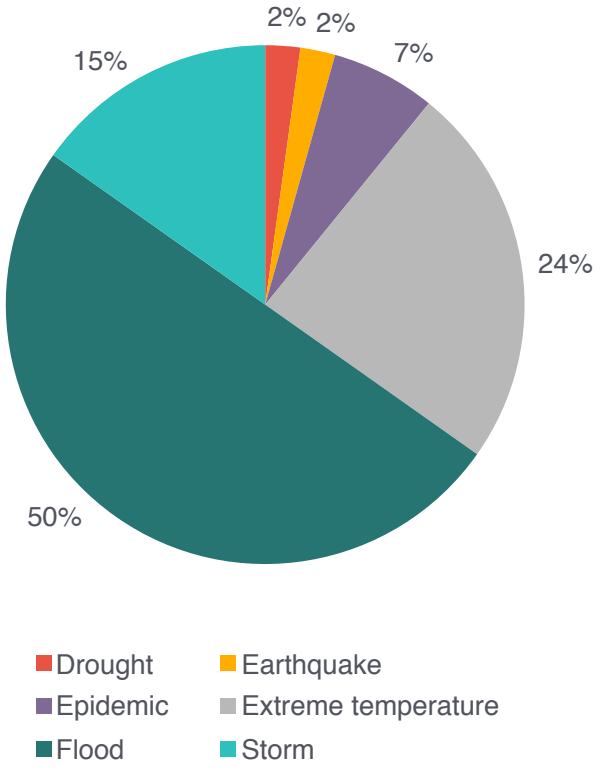
Weather and climate-related hazards in Bihar are strongly influenced by seasonality. Cold snaps cause numerous deaths (EM-DAT), while heat waves during the summer and monsoon seasons can lead to higher morbidity and mortality (EM-DAT). Strong thunderstorms (cyclones) bringing strong winds, intense rainfall, lightning and sometimes hail form across much of the state during April and May, and contribute to widespread agricultural losses and infrastructure damage (Government of Bihar, 2015). Forest fires are also a hazard.

Widespread flooding and waterlogging plague Bihar during the monsoon season (around June to late September–early October). Of Bihar's 38 districts, 28 are flood-prone; over the period of analysis, there were major floods in 2004, 2007, 2008 and 2011. An earlier flood in 2002 displaced 16.5 million people, destroying almost 400,000 homes and leaving over 400 people dead (ReliefWeb, 2002). The 2008 Kosi Floods affected nearly 4.3 million people, with over 2 million evacuated across eight inundated districts (Government of India, 2008b). Over 500 people died, 19,000 livestock perished and 223,000 houses were damaged (NDMA, 2008).

Monsoon variability is also increasing, with Bihar experiencing both floods and droughts in the same year, and sometimes even in the same district. Bihar and neighbouring Uttar Pradesh suffer a drought on average every five years (Chand and Raju, 2009). These hazards contribute to widespread crop losses and poverty (Bansil, 2011; Risk to Resilience Study Team, 2009).

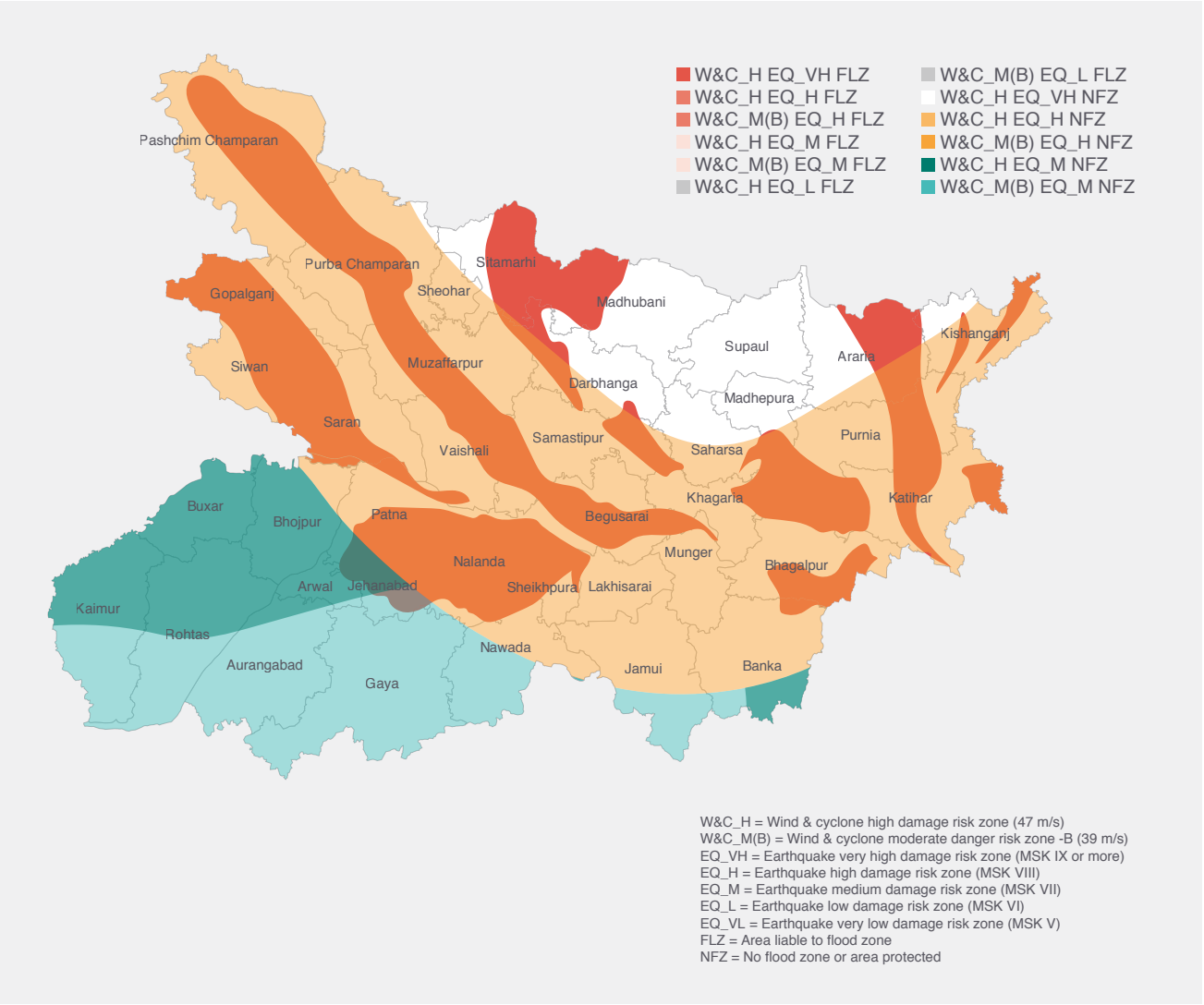
Bihar's climate is shifting, changing precipitation patterns and temperatures. Our trend analysis of historical climate data over the period 1970–2015 reveals statistically significant declines in monsoon precipitation

Figure 17 Incidence of disaster types in Bihar, 2000–2014



Source: Authors' calculation, based on EM-DAT data, 2017.

Figure 18 Multi-hazard map of Bihar



Source: BMTPC India (n.d.).

over the summer for 34 of the state's 38 districts. Minimum (night-time) and maximum (day-time) temperatures are also increasing in most districts during the second half of the year (Figure 19). Due to time limitations, it was not possible to conduct statistical downscaling to project potential climate change trends and shifts in hazards into the future (e.g. 2040s to 2060s), but previous research by one of the authors for the Nepal Terai region in north India indicates that temperatures are likely to continue to rise and precipitation to become more variable, with the potential for more floods and droughts (Risk to Resilience Team, 2009). Observed trends will continue into the future and may be exacerbated by climate change.

Warming night-time temperatures can contribute to greater physiological stress, especially during monsoon heat waves, and particularly for young children, who have greater difficulty regulating their body temperature than adults. A warming climate also potentially extends the season for epidemics such as dengue and malaria into the start of winter, as temperatures remain ideal for vector breeding and survival longer than in the past. Annual outbreaks of encephalitis and dengue in both Bihar and Uttar Pradesh cause significant child mortality and morbidity (Bagacchi, 2014; Shrivastava et al., 2015; Rajshekhar, 2017). Warmer temperatures and less precipitation can also exacerbate water quality issues and further concentrate pollutants in shallow groundwater sources. Arsenic- and fluoride-contaminated water causes serious deformities and health issues for children (Ghosh, 2010; Nandan, 2012).

Figure 19 District-level increasing mean November minimum temperatures, 1971–2015

Source: Authors' calculation, based on Mann-Kendall trend analysis of IMD and CRU TS4.0 datasets.

5.1.3 Governance of climate and disaster risk and implications for child wellbeing

Disaster governance in India is decentralised to the states. Bihar's State Disaster Management Authority (SDMA) was established in 2007, in line with the National Disaster Management Act of 2005 (Government of Bihar, 2014). The SDMA has two elements: DRM and disaster crisis management (Government of Bihar, 2014). While there is still more of an emphasis on response and relief after a disaster (Bahadur et al., 2016), progress is being made with regard to child wellbeing and more integrated DRM across socioeconomic development planning. Twenty-six out of 44 government departments in Bihar play a role in supporting disaster management (Government of Bihar, 2014). Bihar has established a State Disaster Mitigation Fund (Bahadur et al., 2016), and its Annual Development Plan includes a 'section dedicated to disaster management'; Bihar is also attempting to make DRM 'central to the operation of all offices across the state' (Bahadur et al., 2016: 19). The SDMP highlights the important role of the ICDS for young children and expectant/nursing mothers, in terms of supporting 'long term improvement in childcare, health and nutrition, water and environmental sanitation' (Government of Bihar, 2014: 40). Implementation of these policies, and progress on the ground, is not always evident.

Since the study period, and following the adoption of the Sendai Framework, Bihar has also produced a Roadmap for Disaster Risk Reduction (2015–2030) and adopted the Patna Declaration (see Annex 1 for more information). In the climate sphere, Bihar's State Action Plan on Climate Change (2015) acknowledges the prevalence of undernourished and underweight children under the age of five, and notes that climate change is likely to disproportionately affect the poor, women and children – particularly those dependent on climate-sensitive livelihoods (see Annex 1 for more details).

5.1.4 Child poverty and wellbeing in the face of disasters and climate change

Both climate-related hazards and the presence and prevalence of disasters caused by other natural hazards have affected child poverty in Bihar. Levels of inequality are high, with northern districts often disadvantaged on account of low agricultural productivity, poor irrigation and high exposure to flooding. Disaster-prone areas of Bihar had fewer livestock in 2011 compared with districts with fewer disasters, often as a result of livestock deaths after major floods (Government of Bihar and World Bank, 2010; Mubayiwa et al., 2008). Chronic poverty, often overlapping with high hazard exposure, is characterised by landlessness, low wages, agricultural dependence and systemic social discrimination, including practices such as bonded labour (Shepherd et al., 2013). All of this affects child poverty directly within the household, but also indirectly, for example through reduced expenditure on health, education and other aspects of child development.

The types of disaster prevalent across Bihar's districts may also influence child wellbeing outcomes. Across Bihar:

- **Northern** districts are highly exposed to floods and earthquakes, and are also some of the poorest-performing in terms of human development. For example, Madhepura and Araria have the highest prevalence of underweight children in the country. The area in general also scores lower than average for secondary school attendance, with the district of Kishanganj having the lowest literacy rate in the state (Government of Bihar, 2016a). Our analysis also finds lower rates of primary school enrolment and fewer years of schooling for chronically poor children of school-going age in flood-prone districts.[30] The districts of Purbi Champaran and Saharsa have the highest prevalence of diarrhoea for chronically poor children under five in our sample. Chronically poor households in these districts also tend to have more children on average. Levels of livestock ownership are also lower relative to other districts in the state. Finally, there is large variation in poverty descents within these districts. The highest rate of descents in the state is found in Purbi Champaran (driven by descents among Scheduled Castes, Dalits in particular), and the lowest is in Supaul.
- In the **central** districts human development indices improve, but some districts remain below average. Patna, the largest city and the state capital, performs relatively well, but it is also a high-risk, densely populated urban area (Government of Bihar, 2016a). On average, the city suffered more than four disasters a year in the lead-up to 2011, the year of the latest IHDS. While MGNREGA coverage is highest in flood-prone districts of the north, such as Saharsa and Purbi Champaran, it covers a higher share of chronically poor in Banka and Nalanda, both central districts, according to analysis in the latest IHDS survey.[31] The MGNREGA work opportunities available to chronically poor households could potentially strengthen their disaster resilience and promote child wellbeing outcomes.
- In drought-prone areas in the **south**, many districts have better than average development indices, including underweight children and secondary school attendance (Government of Bihar, 2016a). Subsistence farming is common, and successive years of drought have had a detrimental impact on poor livelihoods (UNICEF, 2016a).

While Bihar has a long history of violence and armed conflict (Borooah, 2008), the situation began to improve in 2005 with the coming to power of the centre-left Janata Dal United (JDU)

30 While the IHDS is a nationally representative survey, at the state level 'cautious inference may be made … for large states' (IHDS, n.d.). The analysis here is at the district level, and as such is illustrative but not statistically representative.

31 Note that this data on MGNREGA coverage is not statistically representative below the state level, but provided for illustrative purposes only.

government. Although corruption and poor governance have not been completely eradicated, the JDU's coalition of upper and lower castes, women and politicians from different ethno-religious backgrounds saw bureaucrats convicted and corruption reduced, alongside improved law and order and governance (Bhagat, 2011). The state's capacity to deal with climate and disaster risk was also strengthened. Between 1997 and 2004, 21 disasters were recorded in Bihar, with 372 disaster-related deaths recorded per year. Over the eight years between 2005 and 2012, the number of recorded disasters increased to 26, while the death toll fell to 254 per year (Government of Bihar, n.d.). Annual economic losses due to climate and disaster hazards halved over the same period (Shepherd et al., 2013).

5.2 Turkana, Kenya

Key findings

- Turkana has experienced widespread and recurrent drought, followed at times by periods of localised flash flooding, which together pose significant challenges for pastoralist communities in the county.
- Prolonged drought has contributed to widespread malnutrition and extreme poverty. The poorest children have lower wellbeing outcomes relative to richer segments of the population.

5.2.1 Socioeconomic profile

Turkana County, located in Kenya's Rift Valley, is populated predominantly by pastoralists, with up to 90% of employment related to the pastoral economy (Opiyo et al., 2015a). The majority of rural dwellers rely on farming and pastoralism for their livelihoods. Given that natural hazards and shifts in seasons and temperatures can have severe effects on land, farming, crop growth and quality, livestock health and the spread of disease and pests, these groups are often disproportionately affected by changing weather patterns, floods and drought. Severe water shortages, rapid population growth, increasing food insecurity and lack of grazing land have contributed to conflict (Human Rights Watch, 2015).

5.2.2 Disaster profile

The INFORM Greater Horn of Africa model (INFORM, 2015) puts Turkana in the very high risk category,[32] with an overall risk value of 7.2 (hazard exposure 7.8, vulnerability 7.2, lack of coping capacity 6.7) – see Table 6. Water quality is reduced during drought, creating conditions favourable to recurrent cholera outbreaks (Njeri, 2010). Malnourished children are particularly susceptible (Mbogoril and Murimi, 2017).

Turkana County covers three climate zones: hot and arid with dry summers, equatorial steppe and equatorial dry winter (Kottek et al., 2006). Turkana county was divided into five

Table 6 INFORM results for Turkana, Kenya, 2015

Kenya District	Physical exposure to flood	Physical exposure to drought	Natural	Political violence	Conflict probability	Human	Hazard	Development & deprivation	Inequality	Socio-economic vulnerability	Vulnerability	DRR	Governance	Institutional
Turkana (score: 0–10)	6.9	7.4	7.1	8.0	8.4	8.0	7.6	7.2	4.2	6.2	7.2	8.1	6.7	7.4

Source: INFORM, 2015.

32 While the county is in a very high risk category, the value for DRR is 8.1 out of 10.

rain zones for climate trend analysis: south, central-east, central-west, north-east and north-west (Figure 21). Trend analysis indicates that minimum and maximum temperatures have increased in all months over the period 1971–2015, between 0.9°C and 1.6°C. Rainfall is highly erratic in both the long rainy season (roughly April through July) and the short rainy season (roughly October through November/ December). Rainfall during the short rains has experienced a statistically significant increase over the period 1981–2015 (Figure 22). Similarly to the time limitations in the Bihar climate analysis, projections of future climate change could not be conducted. It is likely however, that mean annual temperatures over much of Africa could be 2°C to 6°C warmer by the 2080s compared with the late twentieth century mean, with arid regions particularly hard hit. The rate of minimum (night-time) temperature increases is likely to exceed that of maximum (day-time) temperatures, though both will be increasing. Changes in precipitation patterns by the end of the twenty-first century are less clear for Kenya as a whole (Niang et al., 2014).

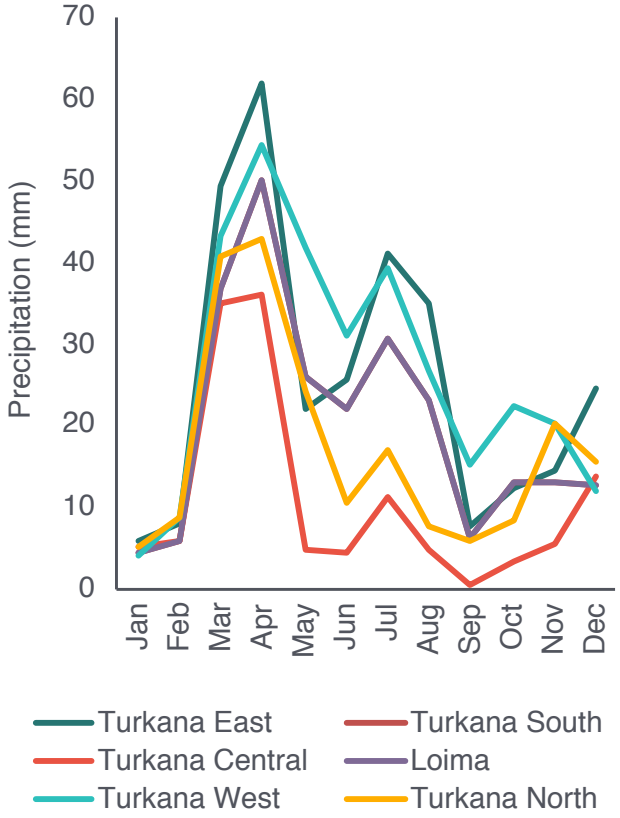
Shifting temperatures and potentially increasing precipitation variability will have a number of implications for climate-sensitive livelihoods in Turkana, and thus child wellbeing. While increasing rain prior to or at the start of the short rain season (if the trend continues into the future) might be beneficial for some crops, vegetation and water supplies for livestock, any potential increases might be offset by the greater evapotranspiration caused by increased temperatures. Warmer temperatures can also compromise water quality by concentrating pollutants in water supplies.

Only half of Turkana has access to clean water (Government of Turkana County, 2017), and the 'average distance to water in the five largest arid counties (Turkana, Marsabit, Wajir, Garissa and Mandera) is 23km' (Carabine et al., 2015: 18).

Figure 20 Turkana, mean monthly maximum temperatures, 1971–2015

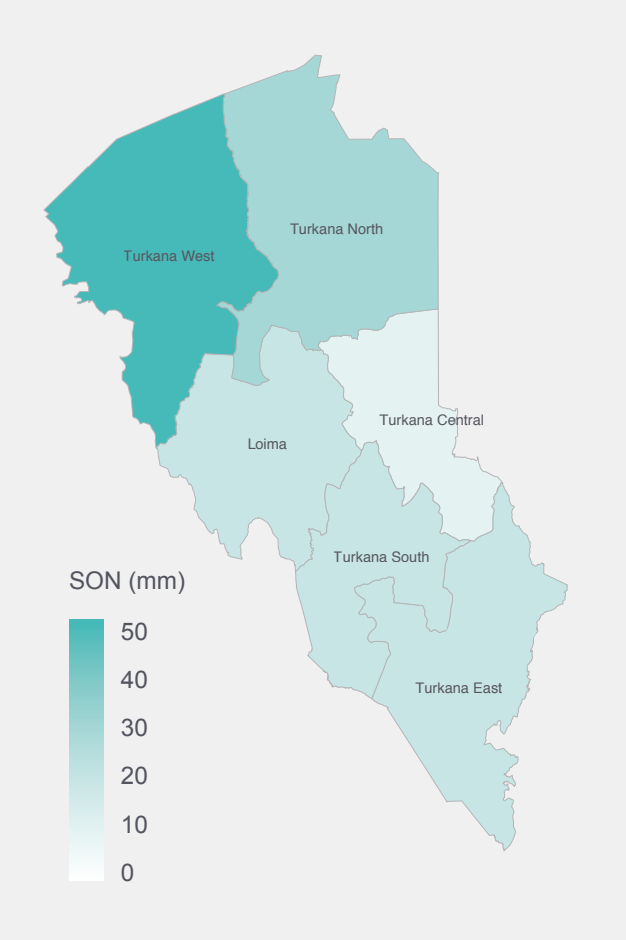
Source: Authors' calculation based on CRU TS4.0 and CHIRPS data.

Figure 21 Turkana, mean monthly precipitation, 1981–2015



Source: Authors' calculation based on CRU TS4.0 and CHIRPS data.

Figure 22 Precipitation trends for Turkana during the short rainy season, 1981–2015



Source: Authors' Mann-Kendall trend analysis for September–November, using CHIRPS precipitation data.

In a recent ODI study, water availability was seen to be the primary constraint to development and resilience in Turkana, with respondents expressing a 'strong desire to increase capacity for irrigation to support agricultural activity at household and community levels, but also at county level, in an effort to improve food security' (Carabine et al., 2015: 25). Food insecurity is high, with little dietary diversity and a reliance on cereal grains as primary food sources (Mbogori and Murimi, 2017). Such grains are sensitive to shifts in temperature and precipitation, suggesting that current and future climate trends do not bode well for child poverty and wellbeing.

5.2.3 Governance of climate and disaster risk in Turkana and implications for child wellbeing

Governance of disasters in Kenya takes place at the county level. Local bodies draft a County Integrated Development Plan, which includes policies and plans for disaster management. The process of devolution to the county level since 2013 has provided an opportunity to enhance climate and disaster resilience policies and implementation at the local level, with design and implementation hazard- and context-appropriate (Carabine et al., 2015).

While drought management appears to be more established, flood and disease preparedness seem to be less coordinated (Development Initiatives, 2017) (see Annex 1 for more details). Although Turkana government officials have acknowledged the serious risks posed by climate-related hazards and climate change, coordination issues remain around disaster risk, natural resources, the environment and development management between the national and county level. Research by Human Rights Watch (2015) has found that county government officials have no central coordination mechanism for addressing climate-related insecurities, and no plans for conducting a risk assessment or developing an adaptation plan.

5.2.4 Child poverty and wellbeing in the face of disasters and climate change

Mirroring the governance of disasters, national government services more generally, such as education, healthcare and transport infrastructure, are less developed in Turkana than other Kenyan counties. In combination with frequent droughts and heat waves, this has contributed to widespread malnutrition (over 30%) and extreme poverty (over 75% of the county's population live below the national poverty line – UNDAF, 2015). In addition, almost 6,000 children in Turkana are living with HIV, with many displaced and located in the Kakuma Refugee Camp (UNICEF, 2016b).

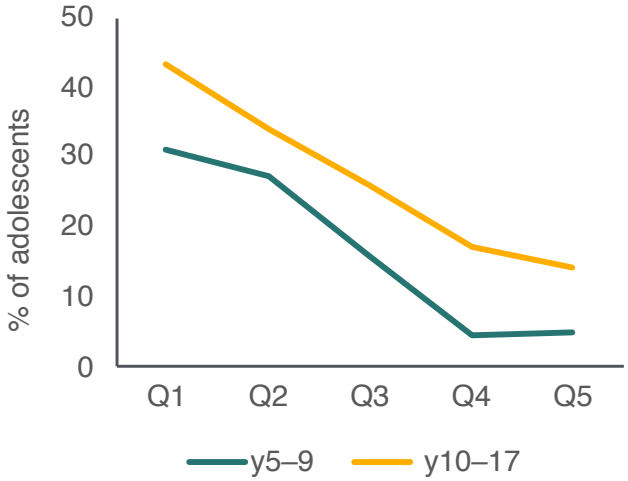
Given widespread poverty in the county, Turkana has in recent years received a large proportion of End Drought Emergency (EDE)-related donor funding. Over $220 million have been invested in projects the region since

2011. The Turkana County 2014/2015 budget 'allocates the largest share to healthcare and education, in line with EDE commitments' (Carabine et al., 2015: 10). These commitments, and the continued expansion of education in the region, are helping to change the landscape of government service provision, and are partly responsible for higher rates of male secondary enrolment in Turkana relative to Bungoma and Kakamega.

Nevertheless, significant challenges remain. Less than 2% of the county's 2013/14 budget was allocated to the pastoral economy, in which the great majority of its people make their living (Carabine et al., 2015: 10). Despite an increasing budget for the health sector overall, malaria and cholera remain common childhood illnesses. The morbidity and mortality outcomes of both illnesses are strongly influenced by high rates of child malnutrition, household poverty and poor-quality water supplies (Mbogori and Murimi, 2017; Kariuki et al., 2012; Njeri, 2010). In some parts of Turkana over a third of children under five are at risk of malnutrition, an increase from a five-year average of 21% (Jones, 2014).

As noted in Section 4.2, school closures are common during droughts, limiting enrolment, particularly for girls. Droughts also lead to increased population movements among already nomadic pastoralists, increasing the risk of children being separated from their families (Macharia, 2017). As wealth increases, the number of children per family falls and youth engagement in income-generating activities declines. Farm labour is more common among adolescents than younger children (Figure 23), reflecting their ability to engage more productively and provide more effective help to complement household incomes.

Figure 23 Child farm labour among adolescents, Turkana, 2014



Source: Authors' calculations based on MICS data.

The case studies of Bihar and Turkana reveal further nuances to the preceding national analysis. Bihar has fared relatively well in protecting the wellbeing of poor children in disaster-prone areas, in part through pro-poor political settlements and stronger policies aimed at building resilience. Drought-prone Turkana experiences a host of water-related illnesses which are not adequately addressed in current policies or programmes. Both case studies reveal a need to develop child-centric responses to climate and disaster risks, disaggregated by disaster type.

6 Implications and recommendations for policy and programming

A better and more robust understanding at national and subnational levels of how poor children are affected by various types of hazard, including those influenced by climate change and variability, and in what contexts, is vitally needed. This will help support the implementation and monitoring of Agenda 2030, reflect the Convention on the Rights of the Child and help in working towards a more child-centred approach to climate change, disasters and sustainable development. An improved understanding of the connections between child poverty, disasters and climate change is particularly pertinent as governments and national statistics offices implement and collect data to help monitor progress on different international policy agendas (as outlined in Section 1).

The table below provides key policy implications emerging from the study's findings to improve the situation of chronically poor children and adolescents over their life course in disaster-prone areas (Table 7). The sample is of the chronically poor across states in India, and the poor in Kakamega, Bungoma and Turkana.

Women using a mechanical thresher in Laugain, Bihar. © ADM Institute for the Prevention of Postharvest Loss

Table 7 Key findings and associated policy implications for different stages of life course in India and Kenya

Stage of life course	Key study findings in India and Kenya	Policy implications: national and local governments should…
In utero and birth		
Antenatal visits by pregnant women (%)	**India:** 90% of chronically poor mothers made fewer than four antenatal visits in disaster-prone areas compared with 85% elsewhere. **Kenya:** 74% of poor mothers made fewer than four antenatal visits compared with 85% elsewhere.	• Strengthen policies and programmes to meet the needs of different people and contexts. In Kenya, this requires improved data to assess household's access to health services as well as an understanding of who is being left behind. • Increase access to healthcare, and promote context-specific child and maternal health interventions which are functional and accessible at all times. For instance, provide mobile health service delivery where appropriate in Turkana (where 70% of the population are nomadic pastoralists). Motorcycle ambulances can be used to access remote areas (Oyaro, 2016). This should also include a basket of every day healthcare provision, including maternal health (through *both* antenatal visits and delivery care), immunisation, treatment facilities and emergency response to disasters and climate change. • Ensure that public health services in emergency interventions are risk-informed, and that community health systems are strengthened. • Systematically strengthen systems of birth registration, especially for marginalised groups such as the Adivasi in India, which will open up access to social and other services. This requires tackling the various bottlenecks (including administrative, access, demand and awareness) which limit the provision of adequate birth registration for disaster-prone or marginalised areas/groups.
Pregnant women's access to formal delivery care (%)	**India:** 20% of chronically poor mothers accessed formal delivery care in disaster-prone areas compared with 22% elsewhere. **Kenya:** 27% of poor mothers accessed formal delivery care compared with 43% elsewhere.	
Birth registration (%)	**India:** 67% of babies in chronically poor households in disaster-prone areas were registered compared with 77% elsewhere. **Kenya:** 20% of poor babies were registered compared with 39% elsewhere	
Children under five		
Diarrhoea (%)	**India:** 11% of chronically poor children in disaster-prone areas had diarrhoea in the two weeks preceding the survey, compared with 6% elsewhere.A 2012–13 report found that around 80% of children under five in Bihar were malnourished. **Kenya:** 16% of poor children had diarrhoea compared with 15% elsewhere. In Turkana, malnutrition is a chronic problem with low vitamin intake due to low consumption of fruit and vegetables.	• Ensure policies and programming are risk-informed to reduce disruption to systems and services supporting safe WASH, which will help reduce the risk of diarrhoea and other vector-borne diseases and illnesses. • Sanitation and nutrition programmes need to be expanded given that malnourished children are more at risk of death from diarrhoea. • Learn from good WASH programmes to understood and replicate success factors and enhance access, especially among the poorest or most marginalised. For example, Anganwadi Centres in villages and settlements constitute the backbone of the ICDS programme, providing a network dedicated to improving child wellbeing outcomes (Andrew et al., 2015). Community nutrition programmes in Kenya were also undertaken alongside supportive sectoral actions (LINKAGES, 2002). Recognise that ill-health is a major source of impoverishment. Relevant measures to prevent impoverishment could include universal health coverage or health insurance for the most marginalised. • Help promote education around healthcare risks, prevention and cure so that poor populations understand the health risks they face, and take steps to improve sanitation and reduce the risk of diarrhoea and malnutrition.

Stage of life course	Key study findings in India and Kenya	Policy implications: national and local governments should…
Young children		
School enrolment (%), 6–14 years	**India:** 84% of chronically poor children in disaster-prone areas were enrolled at the time of the survey, compared with 88% elsewhere. **Kenya:** 96% of poor children were enrolled compared with 98% elsewhere.	Promote comprehensive school safety, including safe learning facilities that protect children and teachers from the impacts of disaster; raise awareness about environmental shocks and stresses; and promote contingency and preparedness plans, including ensuring education continuity after a disaster. Eliminate gaps in education for children and adolescents, and monitor school attendance rates throughout the year, disaggregated by age, sex and other socio-cultural-economic factors, to help promote a better understanding of who is not attending school when, and why. If there are seasonal variations due to livelihood patterns around agriculture or pastoralism, adjust the school year and day to improve attendance: adjust dates and times of opening/closing schools, seeking necessary permissions; provide a mobile education component for periods of the year when pastoralists are on the move, possibly through community-based teachers travelling with them. Provide extra salary, housing and help with their own children's schooling for teachers, to encourage them to work in disaster-prone areas and so that they suffer less stress and deliver better-quality teaching. Ensure schools reopen as soon as possible following a disaster. Where evacuation centres are based in schools, these need to be recognised as purely short-term measures and other facilities found quickly. In the meantime teachers can help families with temporary home-based schooling. In Kenya, provide mobile primary schooling to ensure that children and adolescents from nomadic families, especially girls, can access education. Promote school nutrition programmes to reduce malnutrition rates and provide partial economic relief to families.
Years of education, 6–14 age group	**India:** Chronically poor children had on average 2.5 years of education compared with 2.4 years elsewhere. **Kenya:** Poor children had on average 1.5 years of education compared with 2.6 years elsewhere.	
Adolescents		
School enrolment (%), 15–18 years	**India:** 43% of chronically poor adolescents in disaster-prone areas were enrolled at the time of the survey compared with 51% elsewhere. **Kenya:** 89% of poor adolescents were enrolled at any point during the school year compared with 84% elsewhere.	Ensure comprehensive school safety immediately after disasters, including safe learning facilities, school DRM and DRR and resilience education. Eliminate gaps in education for children and adolescents, and monitor school attendance rates, disaggregated by age, sex and other socio-cultural-economic factors, to help promote a better understanding of who is not attending school and when and why, for instance if there are any seasonal variations. Adjust systems to seasonal livelihood patterns. Limit the use of schools as evacuation or relief centres. In India, expand scholarship and other education programmes to pay for school uniforms and textbooks, particularly for low-income and socially disadvantaged groups. Providing bicycles to children, particularly girls, can encourage children to stay in secondary education. Reintegrate children and adolescents who have been removed from school, paying attention to gender, age and other socioeconomic markers, through: local education authorities identifying children withdrawn from school, and developing and providing information about measures for reintegration: school feeding, cash transfers and migrant support programmes, including a focus on children. These may be shorter- or longer-term depending on the nature of the withdrawal and the availability of regular development or emergency support for such measures. Reduce child labour. Measures could include extended and optimised social protection to ensure livelihood safety, with cash transfers tied to school attendance, nutrition programmes and extra-nutritious meals in schools during disasters. Help support additional training and skilled labour to strengthen alternative livelihoods opportunities through diversification and improved access to markets.
Years of education, 15–18 age group	**India:** Chronically poor adolescents had on average 2.7 years of education compared with 2.9 years elsewhere.* **Kenya:** Data quality inadequate to draw conclusions.	
Labour (%), 10–19 years	**India:** 39% of chronically poor adolescents were engaged in some form of labour compared with 44% elsewhere. **Kenya:** 31% of poor adolescents in disaster-prone areas were engaged in some form of labour, compared with 65% elsewhere.	

Note: Text in green denotes difference is statistically significant (table of significance provided in Annex 3).

6.1 Recommendations: the wider context

Guided by a review of relevant issues in the context of natural hazard-related disasters, including those influenced by climate change, as well as practical considerations around data availability, this study makes several broader recommendations.

Climate and disaster risk management should have a stronger focus in socioeconomic development policy

Our research found that disasters impact both the immediate poverty status of households and longer-term poverty pathways. Achieving longer-term development outcomes despite environmental shocks and stresses requires an understanding of the causal links between disasters and development outcomes, and adequate delivery of the services and systems central to child wellbeing and long-term development. This will help to build people's capacity to adapt, anticipate and absorb climate and natural hazard-related disasters (Bahadur et al., 2015a), and reduce the risk of impoverishment in the wake of a disaster.

Risk-informed development **needs to be firmly embedded in the polices and programming of development agencies and governments and in sector plans**, such that their work contributes to reducing climate and disaster risk, ensuring access to and continuity of services and systems after a disaster and supporting households and sectors/services to **'build back better' and more resiliently after a disaster**. Some specific areas of policy and programming where the research results indicate collaboration is necessary include education, health, family planning and WASH. Greater attention should also be given to equity and inclusion in sectoral policies and programming, as well as policies and programmes that aim to build resilience and promote longer-term wellbeing before, during and after a disaster.

While both countries have national and subnational policies and plans to reduce climate/disaster risk, building resilience to environmental shocks and stresses requires that other sectors and line ministries have the incentive, mandate, capacity and finances to deliver risk-informed development policies, programming and services. This is still a challenge. The institutional and policy separation between development, poverty reduction and climate/disaster risk is not helping in achieving the outcomes that these institutions and plans target individually. Despite India's Planning Commission's work, and SDG cells[33] in some states, there remains a need to increase the 'integration of interventions across sectors and to foster strong governance and institutional arrangements for resilience across scales' in both countries (Carabine et al., 2015: 4). The 2030 Agenda offers an opportunity for countries to thoroughly integrate DRR and risk-informed programming across sectors and ministries. This should include respective tracking of impact and results in resilience-building through the SDG and Sendai monitoring and reporting.

Response and recovery programmes should go on longer than they often do

Disasters need to be treated as a structural feature of the development landscape in policy and programming, just as they are structural features of life in disaster-prone areas. Our research findings from India indicate that the longer disasters last the better the poverty outcomes are. This could possibly be because response programmes last longer, and so have time to extend their reach to more marginalised people. The research suggests that there are many situations where response programmes should continue long after they are normally terminated, so that the poorest and most marginalised, including children, have support to recover and rebuild their lives. This in turn can help them strengthen their capacity to adapt, anticipate and absorb future climate/disaster risks, and ensure continued access to and continuity of the services and systems central to child wellbeing and longer-term development outcomes (see recommendation below).

33 For example, according to Mishra and Tavares (2015), 57 government ministries and/or departments in the country have set up Gender Budgeting Cells to ensure that the budget gives adequate provisions for schemes meant to benefit women.

There is also a lack of distinction between where these programmes stop and where the subsequent recovery and rehabilitation stages start (UNISDR, 2016: 21). These different stages are often run by different agencies, with limited coordination: this needs to be addressed. Efforts to 'build back better' and safer after a disaster need to be integrated within recovery, rehabilitation, reconstruction and ongoing development planning. This will help support safer and more resilient infrastructure, which will in turn help households and sectors mitigate against future disaster risk and prevent the disruption of critical basic services in the face of environmental shocks and stresses.

Findings from our study also show that there has been less impoverishment from drought than flooding, suggesting **longer-term response initiatives have helped to support systems and services which in turn supports longer-term wellbeing outcomes.** This area needs further exploration and reflection on how to address particular hazard-related impoverishment and recovery processes.

Key services for children and infrastructure in disaster-prone areas need to be tailored and strengthened so that they reach the most marginalised

The research found significant gaps between disaster-prone areas and others in terms of access to services (health, education) and infrastructure (WASH, electricity and roads). Some of these gaps especially affect chronically poor children or marginalised groups in disaster-prone areas, highlighting that greater attention should be given to equity and inclusion in policies and programming aiming to build resilience and promote longer-term wellbeing. Programming and service delivery should be tailored to different livelihood systems and socioeconomic and cultural contexts, for instance through the provision of mobile services in Turkana, where the majority of the population are pastoralists.

Our study found that access to health and education services was lower in disaster-prone areas of India. In terms of health, geographical access in disaster-prone areas may be better in India, but actual use and quality may be worse than other areas. The **policy challenge lies in how to equalise the quality of, and information available about, health services to help support children, adolescents and families to overcome barriers to access to local health services.** This almost certainly means spending more on certain sectors in disaster-prone areas than elsewhere – for example on delivery care in Kenya, or providing incentives to health workers to move to and stay in disaster-prone areas. Another specific area of public policy which will have significant consequences for the way households manage disasters is family planning. The research found a larger family size among chronically poor households in India and poor households in the Kenyan counties analysed, suggesting that **special attention to the availability and reach of family planning services is needed, with adjustments to achieve greater reach, affordability, knowledge and information.**

In India, Adivasis in disaster-prone areas had particularly large deficits in education. There was also a significant gender gap. Gaps in WASH infrastructure had especially damaging consequences for chronically poor people. **From an equity point of view, it is important to narrow and close these gaps.** However, where achieving equity involves additional public expenditure, as it is likely to, the gaps may be politically harder to close. Economic policy-makers may argue that additional expenditure would produce low returns, and would be better made elsewhere, and may argue, implicitly or explicitly, that people should migrate out of such areas to other, more economically productive areas. **The economic cost of disasters – which would be mitigated by higher levels of services and infrastructure – provides a strong counter-argument, as does the need for conflict avoidance.** The International Monetary Fund (IMF) has made this argument for small disaster-prone states (Allum et al., 2016). At the national level, greater contextual evidence is needed. This is often a challenge.

Finally, in situations where there is as yet no universal social welfare system, **the end of a disaster period can be a political opportunity to develop a national commitment to social transfers, which could help prevent impoverishment and close some of these service**

gaps. Through increasing the spending power of poor households directly, and bolstering human capital indirectly, social transfers could help mitigate the effects of poverty experienced by households during shocks such as disasters, and even help prevent descents into poverty. Other supportive interventions, such as investments in human capital and economic development, will be needed alongside social transfers to tackle chronic poverty and prevent impoverishment in the context of disasters.

Intersecting inequalities need greater consideration in policy and planning

Greater attention should be given to equity and inclusion in policies and programming that aim to build resilience, including how socially marginalised groups are coping with natural hazard-related disasters, including those influenced by climate change, and how well they are embedded in the decision-making and implementation of these policies and programmes. This has been addressed widely in the literature, not least by ODI: Lovell and Le Masson (2014: 12) argue that polices and programming that aim to build resilience to climate change and disasters must 'promote and monitor the activities and outcomes that are based on context-specific and comparative analyses of the differential needs, vulnerabilities, expectations and existing capacities of all groups'.

Bridging data gaps

This report strongly recommends the disaggregation of data by various markers to develop a stronger understanding of the relationship between disasters, climate change and child poverty. This can support policies and the implementation of programmes that promote children's long-term wellbeing and adaptive capacities, and help to build their resilience to environmental shocks and stresses. Data should be disaggregated in the following ways:

By child wellbeing and other markers of identity

Ensuring data is disaggregated by sex, age, disability, ethnicity, caste and socioeconomic and poverty status will help identify context-specific and differential needs, vulnerabilities, expectations and capacities (Lovell and Le Masson, 2015). It will also highlight that children are not a homogenous group, and that many of the most vulnerable face intersecting inequalities which constrain their ability to escape poverty in a sustainable way.

Data is already disaggregated to an extent in household surveys, but certain marginalised groups, including displaced children or street children, are still a blind-spot, even in household surveys. Nevertheless, it is these groups that are often especially vulnerable, and without adequate data on their location, characteristics or the direct or indirect impacts on them of a disaster, their needs are likely to be overlooked. Disaggregated data remains virtually absent in nationwide disaster data sources such as EM-DAT. This makes it difficult to identify who has been affected by natural hazard-related disasters and where. This is vital information to inform policy, practice and the allocation of resources (PreventionWeb, n.d.). Disaster data sources should ideally provide more information on the socioeconomic characteristics of casualties, for example according to poverty or age. Data on livelihood types is also needed to ensure that interventions are targeted appropriately – for instance the need for mobile services in Turkana – and moreover be real-time and public.

By impact: direct and indirect

Children and adolescents can be directly and indirectly impacted by disasters in the immediate, short and longer term, and also through impacts on the services and systems which support child wellbeing. Data should consider the social, economic, cultural, political and environmental context of countries and subnational areas. For example, datasets should ensure coverage of community-level factors such as access to services and their quality, to then merge with disaster data and assess impacts on the wider context in which children live. Where the quantitative data may contradict existing evidence, as in the case of early marriage noted below, further exploration and a mixed methods approach is necessary to tease out causal channels. Such evidence can

strengthen long-term development solutions compared with short-term humanitarian responses in disaster-prone areas.

By type of disaster and exposure to different hazards

Collecting baseline information on the number of people exposed to natural hazards, disaggregated by age and socioeconomic status, will help governments monitor who is affected by disasters within a multi-hazard context. Baselines should include 'data on levels of infrastructure resilience, as well as monitoring changes to the risk of infrastructure losses, thereby giving an insight into the potential for a hazard to translate into a disaster' (Lovell and Mitchell, 2015: 2). Enhanced technical capacity and investment in defining and measuring slow-onset disasters is needed in order to adequately support people affected by these hazards, including drought and seasonal variability. This is important as different types of hazard will have different impacts on people's health, livelihoods and poverty projections. It would also help promote policies and plans which support contextual risk and poverty reduction. For example, our study confirmed that drought-prone areas of India tend to be more dynamic relative to those experiencing severe flooding.

Over the life course

Our results reinforce the importance of disaggregating results over time. Children's wellbeing in times of disaster varies by the stage of life they have reached. Disaggregation over time is also important since poverty is dynamic. To this end, additional longitudinal investigations of child-specific disaster impacts on wellbeing and longer-term development outcomes are needed. This study analysed existing longitudinal data for India (recent panel data was not available for Kenya). As such, we were not able to definitively assess the impact of disasters on poverty trajectories or long-term outcomes, limiting the policy implications that could be drawn in Kenya. Household surveys also need to be strengthened to address neglected areas, such as the psychological impacts of a disaster on children and adolescents.

By type of data source

Regular qualitative research alongside open-access panel data would strengthen analysis, allowing for stronger conclusions about the causes of what is observed; government data is also key, through developing a cutting-edge system responsive to SDG and Sendai reporting requirements, and using government efforts to improve online infrastructure and increase connectivity[34] to improve disaggregated disaster impact tracking and risk assessments. Such evidence will help provide a better understanding of the indicators needed to measure a child's resilience and long-term wellbeing and development outcomes. For example, our analysis of the Indian dataset revealed that early marriage was virtually absent (less than 2% among children between ten and 17 years of age), but other evidence indicates that India has the highest number of child brides in the world, with 47% of girls married before they turn 18 (UNICEF, 2014).

Cross-sectoral data

Incorporating climate and disaster information within sectoral plans will help ministries manage climate and disaster risks, thereby minimising cascading disruptions to services and systems. Many countries, including India and Kenya, have national and subnational programmes and policies designed to improve child poverty and wellbeing. Sharing data on education, health and social protection, for instance, will help ensure cross-sectoral development planning. Working with national statistics offices to incorporate this data would be a useful step towards building a 'cross-sectoral, multi-dimensional and dynamic' understanding of resilience, which considers both direct and indirect effects (Bahadur et al., 2015b).

An all-hazard approach to policies and programming that aim to build resilience is needed across spatial (including national, county/state, district and local) and temporal (in the immediate, short and long term) scales. Risk-informed interventions need to be integrated across services and systems central to child wellbeing and long-term development (including health, nutrition, WASH, education, child protection and social protection).

34 Such as through aspirations towards 'Digital India': see http://digitalindia.gov.in.

7 Conclusions and looking forward

This paper illustrates the varied impacts of climate and natural hazard-related disasters, including those triggered by sudden- and slow-onset hazards, on poor children and adolescents in India and three counties in Kenya. This is shown through the direct impacts of disasters on poverty incidence and trajectories, and through the indirect impacts on the services and systems central to child wellbeing and long-term development. The study finds that there is a significant relationship between disasters and poverty in Kenya and chronic poverty in India, the effects of which can lead to numerous negative wellbeing outcomes for children and adolescents. Case studies on Turkana County in Kenya and Bihar State in India demonstrate the importance of analysing different types of hazard (for instance drought and flooding) alongside their different implications for longer-term development outcomes for children and adolescents.

Our results also highlight that specific marginalised groups, such as the Adivasis in India and nomadic pastoralists in Turkana, are particularly vulnerable to disasters, adding to our understanding of the factors affecting their marginalisation. The intersecting inequalities that these groups face are an important issue in vulnerability, and mean that targeted interventions are required to reduce chronic and extreme poverty among groups at particular risk.

This report provides an initial evidence base from which to develop sound policies

Students after IT class at Mabanga Primary School, Bungoma, Kenya. © STARS/Kristian Buus

targeting poor children and adolescents affected by natural hazard-related disasters, including those exacerbated by climate change. Additional longitudinal and disaggregated investigations should focus on child-specific impacts of natural hazards and climate change on wellbeing and longer-term development outcomes at the subnational level, taking into account the different socioeconomic, cultural, political and environmental factors that turn hazards into disasters. While this study has combined data on disasters with climate and household panel data, measuring the impact of slow-onset disaster hazards is a challenge. As such, greater clarity on what type of drought is being declared (meteorological, hydrological or agricultural) and by whom is needed, alongside a more nuanced metric for projected drought and famine risk 'given the complex interactions between lower than average rainfall, production, food access and the wider context' (Shepherd et al., 2013: 68). Clear agency roles and responsibilities for measuring risks and impacts, and the financial and governance mechanisms for responding to these, are critical to reduce risk and support longer-term development outcomes.

The Kenyan government responded to drought throughout 2017, including in Turkana County (UNICEF Kenya, 2017), and the government in India responded to severe flooding in Bihar (PGVS and Christian Aid, 2017). At the same time, both countries are preparing for and responding to various other climate and disaster shocks and stresses. In both countries, poor households, and within them vulnerable children, are affected on a daily basis; many fall into poverty, while others remain trapped in chronic poverty. Understanding the implications of disasters and climate change for child and adolescent poverty in these settings is therefore indispensable. Considering these different inter-related aspects will help promote a better understanding of how policy-makers, local and national governments and practitioners can enhance the resilience of children and adolescents over their life course more effectively and equitably, for generations to come.

References

Acharya, N. (2015) 'New child labour norms leave many dissatisfied', *Business Standard*, 24 May (www.business-standard.com/article/opinion/new-child-labour-norms-leave-many-dissatisfied-115052400736_1.html)

APFM (The Associated Programme on Flood Management) (2004) *Strategy for flood management for Lake Victoria Basin, Kenya*. Nairobi: The Associated Programme on Flood Management (APFM), World Meteorological Organisation (WMO) and the Ministry of Water Resources Management and Development (MWRMD)

Aguilar, A. and Vicarelli, M. (2011) El Niño *and Mexican children: medium-term effects on early-life weather shocks on cognitive and health outcomes*. Yale University and Harvard University (www.aguilaresteva.com/wp-content/uploads/2012/09/El_Nino_Effects_Child_Dev_v17Nov11.pdf)

Ahmed, S. (2004) *The gendered context of vulnerability: coping/adapting to floods in Eastern India*. Gender Equality and Disaster Risk Reduction Workshop

Aiyar, S. (2013) 'Why no applause for 138 million exiting poverty?', Economic Times, 28 July (http://articles.economictimes.indiatimes.com/2013-07-28/news/40848763_1_poverty-line-poverty-ratio-extreme-poverty)

Allum, P., Atolia, M., Tumbarello, P., Allum, P., Farid, M., Maret, X., Acevedo, S., Bonato, L. and Laframboise, N. (2016) *Small states' resilience to natural disasters and climate change – role for the IMF* (https://www.imf.org/external/np/pp/eng/2016/110416.pdf)

Anand, R., Tulin, V. and Kumar, N. (2014) *India: defining and explaining inclusive growth and poverty reduction*. IMF working paper WP/14/63

Andrew, A., Attanasio, O., Augsburg, B., Grantham-McGreggor, S., Pahwa, S., Meghir, C. and Rubio-Codina, M. (2015) *Early childhood development in the slums of Cuttack, Odisha, India*. Cemmap, ESRC (https://www.ifs.org.uk/uploads/publications/comms/ECD%20India%20-%20Cuttack%20-%20Baseline%20Report_FINAL_noappendix-1.pdf)

Arouri, M., Nguyen, C. and Youssef, A. (2015) 'Natural disasters, household welfare and resilience: evidence from rural Vietnam', *World Development* 70

ASF (ASAL Stakeholders Forum) (2015) *Where we work* (http://www.asalforum.or.ke/)

Bagacchi, S. (2014) 'India intensifies Japanese encephalitis immunisation', *The Lancet* 14

Bahadur, A., Peters, K., Wilkinson, E., Pichon, F., Gray, K. and Tanner, T. (2015a) *The 3As: tracking resilience across BRACED*. London: BRACED

Bahadur, A., Lovell, E., Wilkinson, E. and Tanner, T. (2015b) *Resilience in the SDGs: developing an indicator for Target 1.5 that is fit for purpose*. London: ODI

Bahadur, A., Lovell, E. and Pichon, F. (2016). *Strengthening disaster risk management in India: a review of five State Disaster Management Plans*. London: CDKN and ODI

Bansil, P. (2011) *Bihar agriculture: a perspective*. New Delhi: Concept Publishing Company

Bartlett, S. (2008) *Climate change and urban children: impacts and implications for adaptation in low- and middle-income countries*. London: Human Settlements Programme, International Institute for Environment and Development (IIED)

Bhagat, R. (2011) 'Bihar now a governance model', *Business Line*, 4 January (www.thehindubusinessline.com/opinion/columns/rasheeda-bhagat/bihar-now-a-governance-model/article1032839.ece)

Bhowmick, N. (2010) 'India: disasters, climate change, cloud Indian children's prospects', *Reliefweb*, 11 November (http://reliefweb.int/report/india/india-disasters-climate-change-cloud-indian-childrens-prospects)

BMTPC (Building Materials and Technology Promotion Council) India (n.d.) *Map showing multihazard zones in Bihar* (http://disastermgmt.bih.nic.in/Map/images/HazardBig.gif)

Borooah, V. (2008) 'Deprivation, violence, and conflict: an analysis of Naxalite activity in the districts of India', *International Journal of Conflict and Violence* 2(2)
Carabine, E., Jouanjean, M. and Tsui, J. (2015) *Kenya ending drought emergencies policy review: scenarios for building resilience in the ASALs*. Report prepared by the Technical Consortium, CGIAR. Technical Report Series No. 2: 'Strengthening the Evidence Base for Resilience in the Horn of Africa'. Nairobi: International Livestock Research Institute (ILRI)
Daily Nation (2014) 'Kakamega the poorest county in Kenya', 10 November (https://mobile.nation.co.ke/counties/Kakamega-Poverty-Devolution-Ministry-Report/1950480-2517956-format-xhtml-x5fgoqz/index.html)
Chand, R. and Raju, S. (2009) 'Dealing with effects of monsoon failures', *Economic and Political Weekly* XLIV(41)
Chandrasekhar, C. (2011) 'India's new, high-growth trajectory: implications for demand, technology and employment', *Indian Journal of Labour Economics* 54(1)
Cherono, S., Lutta, S., Kipsang, W., Bii, B., Oundoh, G., Mugo, I., Bett, K. and Hajir, A. (2017) 'Kenya: poor rainfall to blame for persistent drought', *AllAfrica.com*, 31 January (http://allafrica.com/stories/201701130284.html)
Children's Rights Alliance (2010) *The United Nations Convention on the Rights of the Child*
Datar, A., Liu, J., Linnemayr, S. and Stecher C. (2011) *The impact of natural disasters on child health and investments in rural India*. RAND Labour and Population working paper
Development Initiatives (2017) *Assessment of Kenya's preparedness to disasters caused by natural hazards: floods, drought and disease outbreak*. Bristol: Development Initiatives
Dhar, V. (2012) *Agricultural census in India*. Presentation to the Asia and Pacific Commission on Agricultural Statistics 24th Session, Da Lat, Vietnam.
Dickin, S. and Schuster-Wallace, C. (2014) 'Assessing changing vulnerability to dengue in northeastern Brazil using a water-associated disease index approach', *Global Environmental Change* 29
Diwakar, V., Shepherd, A. and Sturge, G. (2017a) *Conflict, pro-poorest growth, and wellbeing: a subnational analysis*. CPAN Challenge Paper. London: Chronic Poverty Advisory Network
Diwakar, V., Shepherd, A. and McKay, A. (2017b) *Pro-poorest growth and poverty dynamics: an assessment of Indian states*. CPAN Challenge Paper. London: Chronic Poverty Advisory Network
Doshi, V. (2016) 'India's drought migrants head to cities in desperate search for water', *The Guardian*, 27 April (https://www.theguardian.com/global-development/2016/apr/27/india-drought-migrants-head-to-cities-in-desperate-search-for-water)
EEAS (2013) 'Mobile maternal care for the mothers of Turkana', European External Action Service (www.eeas.europa.eu/archives/delegations/kenya/documents/press_corner/20131210.pdf)
van Eijk, A.M., Bles, H.M., Odhiambo, F., Ayisi, J.G., Blokland, I.E., Rosen, D.H., Adazu, K., Slutsker, L. and Lindblade, K.A. (2006) 'Use of antenatal services and delivery care among women in western Kenya: a community based survey', *Reproductive Health* 3(2) (https://doi.org/10.1186/1742-4755-3-2: doi:10.1186/1742-4755-3-2)
EM-DAT Database (2017) *The International Disaster Database*. Centre for Research on the Epidemiology of Disasters – CRED (www.emdat.be/database)
Ernst, K., Adoka, S., Kowuou, D., Wilson, M. and John, C. (2006) 'Malaria hotspot areas in a highland Kenya site are consistent in epidemic and non-epidemic years and are associated with ecological factors', *Malaria Journal 5*
Food Security Portal (2012) *Policy responses to food crisis in Kenya*. Kenya Agricultural Research Institute, IFPRI (www.foodsecurityportal.org/kenya/food-security-report-prepared-kenya-agricultural-research-institute)
Funk, C., Peterson, P., Landsfeld, M., Pedreros, D., Verdin, J., Shukla, K., Husak, G., Rowland, J., Harrison, L., Hoell, A. and Michaelsen, J. (2015) 'The climate hazards infrared precipitation with stations – a new environmental record for monitoring extremes', *Scientific Data* 2

Gaire, S., Delbiso, T., Pandey, S. and Guha-Sapir, D. (2016) 'Impact of disasters on child stunting in Nepal', *Risk Management and Healthcare Policy 9*
Ghosh, A. (2010) *Qualitative and quantitative water scarcity issues in Bihar, India*. Patna: Department of Environment and Water Management, A.N. College
Government of Bihar (n.d.) *Loss of public property.* Flood Management Information System. Disaster Management Department (http://disastermgmt.bih.nic.in/Statitics/Statistics.htm)
Government of Bihar (2014) *Bihar State Disaster Management Plan*. Bihar: Government of Bihar, Disaster Management Department
Government of Bihar (2015) *Bihar State Action Plan on Climate Change. Building resilience through development*. Bihar: Government of Bihar (http://envfor.nic.in/ccd-sapcc)
Government of Bihar (2016a) *Economic survey 2015–16*. Patna: Finance Department
Government of Bihar (2016b) *Roadmap for disaster risk reduction 2015–2030*. Revised draft as of 8 March. Bihar: Government of Bihar (www.disastermgmt.bih.nic.in/Circulars/Draft_Bihar_DRR%20Roadmap.pdf)
Government of Bihar and World Bank (2010) *Bihar Kosi flood (2008) needs assessment report*. With the World Bank's Global Facility for Disaster Reduction and Recovery
Government of India (2005) *The Disaster Management Act, 2005*. New Delhi: Government of India
Government of India (2008a) *National Action Plan on Climate Change*. New Delhi: Prime Minister's Council on Climate Change, Government of India
Government of India (2008b) *India: southwest monsoon 2008 – daily flood situation report No 104, 12 Sep 2008*. India: Disaster Management Division, Ministry of Home Affairs, Government of India (www.ndmindia.nic.in/flood-2008/floodMonth/SEPT08/SITREPNO.104DATED12.09.2008.pdf)
Government of India (2009) *National Policy on Disaster Management 2009*. New Delhi: National Disaster Management Authority and Ministry of Home Affairs
Government of India (2015) *India's Intended Nationally Determined Contribution: Working towards climate justice*. New Delhi: Government of India
Government of India (2016) *National Disaster Management Plan, 2016*. New Delhi: National Disaster Management Authority
Government of India (2018) Digital India. Ministry of Electronics and Information Technology. New Delhi: Government of India (http://digitalindia.gov.in/)
Government of the Republic of Kenya (2007) *Kenya Vision 2030: the popular version*. Nairobi: The National Economic and Social Council of Kenya, Office of the President, Government of the Republic of Kenya
Government of the Republic of Kenya (2010) *National Climate Change Response Strategy.* Nairobi: Government of the Republic of Kenya
Government of the Republic of Kenya (2013a) *Sector Plan for Drought Risk Management and Ending Drought Emergencies 2013–2017, 2nd Medium Term Plan*. Nairobi: Government of the Republic of Kenya
Government of the Republic of Kenya (2013b) *National Climate Change Action Plan 2013–2017*. Nairobi: Ministry of Environment and Mineral Resources
Government of the Republic of Kenya (2014) *Ending drought emergencies: common programme framework for drought risk management*. Nairobi: National Drought Management Authority
Government of the Republic of Kenya (2015) *Kenya's Intended Nationally Determined Contribution (INDC)*. Nairobi: Ministry of Environment and Natural Resources
Government of the Republic of Kenya (2016) *Kenya National Adaptation Plan 2015–2030. Enhanced climate resilience towards the attainment of Vision 2030 and beyond*. Nairobi: Ministry of Environment and Natural Resources
Government of Turkana County (2017) 'Clean water access' (www.turkana.go.ke/index.php/2017/03/22/half-turkana-residents-access-clean-water/)

Harris, I., Jones, P., Osborn, T. and Lister, D. (2014) 'Updated high-resolution grids of monthly climatic observations – the CRU TS3.10 dataset', *International Journal of Climatology* 34(3)
Harris, J. (2012) 'Family planning in emergencies: urgent need to focus on women made vulnerable by humanitarian disasters' *Huffpost*, 9 July (www.huffingtonpost.co.uk/josh-harris/family-planning-in-emergencies_b_1658272.html)
Huho, J., Ngaira, J. and Ogindo, H. (2011) 'Living with drought: the case of the Maasi pastoralists of northern Kenya', *Educational Research* 2(1)
Human Rights Watch (2015) *There is no time left. Climate change, environmental threats, and human rights in Turkana County, Kenya*. New York: Human Rights Watch (https://www.hrw.org/report/2015/10/15/there-no-time-left/climate-change-environmental-threats-and-human-rights-turkana)
IFRC (International Federation of Red Cross and Red Crescent Societies) (2014) *World disasters report: focus on culture and risk*. Geneva: IFRC
IFRC (International Federation of the Red Cross and Red Crescent Societies) (n.d.) *Geophysical hazards: mass movement dry* (www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/geophysical-hazards-mass-movement-dry/)
IHDS (n.d.) *Indian Human Development Survey. Dataset for 2005 and 2011* (https://ihds.umd.edu)
IMD (India Meteorological Department) (2017) *Customized Rainfall Information System (CRIS), Hydromet Division*. New Delhi: Ministry of Earth Sciences (http://hydro.imd.gov.in/hydrometweb/(S(ygbhg545irlwjlyjvdhuhpqw))/DistrictRaifall.aspx)
IMF (International Monetary Fund) (2014) *Kenya: Poverty Reduction Strategy Paper*. Washington DC: IMF. Available at: http://www.imf.org/external/pubs/ft/scr/2014/cr1474.pdf
India Water Portal (2017). *State and District-wise Meteorological Data from the India Meteorological Department* (www.indiawaterportal.org/met_data/)
INFORM (Index for Risk Management) (2015) *INFORM Greater Horn of Africa model*. Inter-Agency Standing Committee (IASC) on Risk, Early Warning and Preparedness and the European Commission (www.inform-index.org/Subnational/Greater-Horn-of-Africa#maps)
INFORM (2016) *INFORM global model – interpreting and applying, guidance note*. Inter-Agency Standing Committee (IASC) on Risk, Early Warning and Preparedness and the European Commission (http://www.inform-index.org/Portals/0/InfoRM/2016/Guidance%20Note%20-%20Interpreting%20and%20Applying%20the%20INFORM%20Global%20Model.pdf?ver=2015-11-26-174529-330)
INFORM (2017) *Index For Risk Management Results*. Inter-Agency Standing Committee (IASC) on Risk, Early Warning and Preparedness and the European Commission (http://www.inform-index.org/Portals/0/InfoRM/INFORM%20Global%20Results%20Report%202017%20FINAL%20WEB.pdf?ver=2016-11-21-164053-717)
IPCC (2012) *Managing the risks of extreme events and disasters to advance climate change adaptation*. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Field, C.B., Barros, V.R., Stocker, T.F., et al. (eds.). Cambridge: Cambridge University Press
IPCC (2014) 'Summary for policymakers' in *Climate change 2014: impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Field, C.B., Barros, V.R. et al. (eds). Cambridge: Cambridge University Press.
IRIN (2002) 'High rates of child labour blamed on poverty', IRIN, 31 May (http://www.irinnews.org/report/32209/kenya-high-rates-child-labour-blamed-poverty)
IRIN (2006) 'Pastoralist communities in Turkana face rising HIV rate', IRIN, 6 October (www.irinnews.org/news/2006/10/06/pastoralist-communities-turkana-face-rising-hiv-rate)
Jones, S. (2014) 'Kenya's Turkana region brought to the brink of humanitarian crisis by drought', *The Guardian*, 26 March (https://www.theguardian.com/global-development/2014/mar/26/kenya-drought-triggers-fears-humanitarian-crisis)

Joshi, K.M. (2010) 'Indigenous children of India: enrolment, gender parity and drop-out in school education', *International Journal of Sociology and Social Policy* 30(9/10)
Karanja, S. (2015) 'Kenya ranked sixth on extreme poverty index', *Daily Nation*, 18 February (www.nation.co.ke/news/Poverty-Africa-Index-Kenya-Inequality/-/1056/2628224/-/ltoepc/-/index.html)
Kariuki, J., Magambo, K., Njeruh, M., Muchiri E., Nzioka, S. and Kariuki, S. (2012) 'Effects of hygiene and sanitation interventions on reducing diarrhoea prevalence among children in resource constrained communities: case study of Turkana district, Kenya', *Journal of Community Health* 37(6)
Kottek, M., Grieser, J., Beck, C., Rudolf, B. and Rubel, F. (2006) 'World map of the Köppen-Geiger climate classification updated', *Meteorologische Zeitschrift* 15(3)
Kumari, R. (2014) 'Development and disparity in Bihar', *Regional Development and Planning* 3(2)
LINKAGES (2002) *Successful community nutrition programming: lessons from Kenya, Tanzania, and Uganda*. Eldis (www.eldis.org/document/A16389)
Lovell, E. and Le Masson, V. (2014) *Equity and inclusion in disaster risk reduction: building resilience for all*. London: CDKN and ODI
Lovell, E. and Le Masson, V. (2015). *Briefing: target 2. Number of people affected by disasters*. London: ODI
Lovell, E. and Mitchell, T. (2015) *Briefing: Target 4. Disaster damage to critical infrastructure and basic service provision*. London: ODI
Macharia, M. (2017) 'Drought causes Kenya street kids crisis', *CAJ News* (http://www.cajnews.co.ke/news/drought-causes-kenya-street-kids-crisis/)
Masih, I., Maskey, S., Mussá, F. and Tambauer, P. (2014) 'A review of droughts on the African continent: a geospatial and long-term perspective', *Hydrology and Earth System Sciences* 18
Mason, J., Bailes, A., Mason, K. and Yambi, O. (2005) 'AIDS, drought, and child malnutrition in southern Africa', *Public Health Nutrition* 8(6)
Mbogoril, T. and Murimi, M. (2017) 'Determinants of maternal and child malnutrition among low income households in Turkana County, Kenya', *FASEB Journal* 31(Supplement No. 1)
Mcloughlin, C. (2014) 'Politics – the problems and solutions to poor services?', *DLP* (www.dlprog.org/opinions/politics-the-problem-and-solution-to-poor-services.php)
Mehta, A.K. and Shah, A. (2001) *Chronic poverty in India; overview study*. CPRC Working Paper. Manchester: Chronic Poverty Research Centre
MICS (n.d.) 'Kenya Multiple Indicator Cluster Survey. Data for 2013/14' (http://mics.unicef.org/surveys)
Ministry of Devolution and Planning (2015) *National policy for the sustainable development of northern Kenya and other arid lands: unlocking our full potential for realization of the Kenya Vision 2030*. Nairobi: Government of the Republic of Kenya (www.devolutionplanning.go.ke/wp-content/uploads/2015/04/DRAFT%20ASAL%20POLICY.pdf)
Mishra, Y. and Tavares, R.R. (2015) 'A budget for women', *The Hindu* (www.thehindu.com/opinion/op-ed/a-budget-for-women/article6929819.ece)
Mitchell, T., Mechler, R. and Harris, K. (2012) *Tackling exposure: placing disaster risk management at the heart of national economic and fiscal policy*. London: Climate and Development Knowledge Network
MoEFCC (Ministry of Environment, Forests and Climate Change) (2017) *State Action Plan on Climate Change*. Endorsed by National Steering Committee on Climate Change (http://envfor.nic.in/ccd-sapcc)
Mottaleb, K., Mohanty, S., Hoang, H. and Rejesus, R. (2013) 'The effects of natural disasters on farm household income and expenditures: a study on rice farmers in Bangladesh', *Agricultural Systems* 121
Mubayiwa, R., Kharel, B. and Crook, S. (2008) *Evaluation of river basin programme in Bihar, India*. Oxfam GB Programme Evaluation, Oxfam
Mudavanhu, C. (2014) 'The impact of flood disasters on child education in Muzarabani District, Zimbabwe', *Jamba: Journal of Disaster Risk Studies* 6(1)

Mude, A., Chantarat, S., Barret, C., Carter, M., Ikegami, M. and McPeak, J. (2010) *Insuring against drought-related livestock mortality: piloting index-based livestock insurance in northern Kenya*. Nairobi: ILRI

Muyanga, M. and Musyoka, P. (2014) 'Household incomes and poverty dynamics in rural Kenya: a panel data analysis', *Journal of Poverty Alleviation and International Development (JPAID)* 5(2)

Nandan, R. (2012) 'Geospatial assessment of ground water condition of Patna District, Bihar', *International Journal of Geology, Earth and Environmental Sciences* 2(3)

NDMA (National Drought Management Authority) (2008) *Bihar*. Government of India (www.ndma.gov.in/en/bihar-sdma-office)

NDMA (2017a) *About NDMA*. Nairobi: National Drought Management Authority, Government of the Republic of Kenya (www.ndma.go.ke/index.php/features/about-ndma)

NDMA (2017b) *Turkana County Drought Early Warning Bulletin for May 2017. A vision 2030 flagship project.* Nairobi: National Drought Management Authority, Government of the Republic of Kenya

Newhouse, D., Suarez-Becerra, P. and Evans, M. (2016) *New estimates of extreme poverty for children*. World Bank Policy Research Working Paper No. 7845. Washington DC: World Bank

Niang, I., Ruppel, O., Abdrabo, M., Essel, A., Lennard, C., Padgham, J. and Urquhart, P. (2014) 'Africa' in *Climate change 2014: impacts, adaptation, and vulnerability. Part B: regional aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Field, C.B., Barros, V.R. et al. (eds). Cambridge: Cambridge University Press

Njeri, M. (2010) *Establishing the socio-economic factors that contribute to cholera outbreaks in Turkana South District, Kenya*. University of Nairobi College of Health Sciences

Nyamboga, T., Nyamweaya, B., Sisia, A. and George, G. (2014) 'The effectiveness of poverty reduction efforts in Kenya: an evaluation of Kenyan Government's policy initiatives on poverty alleviation', *International Affairs and Global Strategy* 23

Ochieng, O. and Evans, O. (2015) *Factors influencing perception of microenterprise activities by women in Turkana community in Kenya*. SSRN (https://ssrn.com/abstract=2837271)

Omolo, N. (2010) *Gender and climate change-induced conflict in pastoral communities. Case study of Turkana in north-western Kenya*. African Centre for the Constructive Resolution of Disputes (AJRC)

OPHI (Oxford Poverty and Human Development Initiative) (n.d.) *Multidimensional poverty* (http://ophi.org.uk/research/multidimensional-poverty/)

Opitz-Stapleton, S. (2014). *Understanding gendered climate variability and change impacts in Jinping and Guangnan counties, Yunnan Province, China*. China: Intasave

Opiyo, F., Wasonga, O., Nyangito, M., Mureithi, S., Obando, J. and Munang, R. (2015a) 'Determinants of perceptions of climate change and adaptation among Turkana pastoralists in northwestern Kenya', *Climate and Development* 8(2)

Opiyo, F., Wasonga, O., Nyangito, M., Schilling, J. and Munang, R. (2015b) 'Drought adaptation and coping strategies among Turkana pastoralists of northern Kenya', *International Journal of Disaster Risk Science* 6(3)

Ouma, C., Obando, J. and Koech, M. (2012) 'Post drought recovery strategies among the Turkana pastoralists in Northern Kenya', *Scholarly Journals of Biotechnology* 1(5)

Oxfam (2008) *Sheltering people after disasters: lessons from the tsunami.* Oxford: Oxfam International (www.oxfamamerica.org/static/oa3/files/sheltering-people-after-disasters.pdf)

Oyaro, K. (2016) 'Taking health services to remote areas', *Africa Renewal* (http://www.un.org/africarenewal/magazine/december-2016-march-2017/taking-health-services-remote-areas)

Pandve, H. (2009) 'India's National Action Plan on Climate Change', *Indian Journal Occupational and Environmental Medicine* 13(1)

Parry, J., Echeverria, D., Dekens, J. and Maitima, J. (2012) *Climate risks, vulnerability and governance in Kenya: a review*. International Institute for Sustainable Development (IIED) and UNDP

Peek, L. (2008) 'Children and disasters: understanding vulnerability, developing capacities and promoting resilience', *Children Youth and Environments* 18(1)

PGVS (Purvanchal Gramin Vikas Sansthan) and Christian Aid (2017) *Flood situation report* (https://reliefweb.int/sites/reliefweb.int/files/resources/situation-report-bihar-alert-17-august-2017_0.pdf)
PreventionWeb (n.d.) 'Monitoring implementation of the Sendai Framework', *PreventionWeb.net* (www.preventionweb.net/drr-framework/sendai-framework-monitor/)
Raghbendra Jha, A. (2011) 'India's economy: growing rapidly and unequally', *East Asia Forum*, 28 April (www.eastasiaforum.org/2011/04/28/india-s-economy-growing-rapidly-and-unequally/)
Rajshekar, M. (2017) 'Lessons from Bihar's 2016 dengue outbreak: migration, poverty, garbage are spreading new diseases', *Scroll.in*, 11 May (https://scroll.in/pulse/837091/bihar-cant-even-count-how-many-dengue-cases-it-has-had-let-alone-fight-the-disease)
Rathore, B., Sud, R., Saxena, V., Rathore, T., Subrahmanyam, V. and Roy, M. (2014) 'Drought conditions and management strategies in India. Country report for the Regional Workshop for Asia-Pacific as part of the UN-Water Initiative on Capacity Development to Support National Drought Management Policies', 6–9 May, Hanoi, Vietnam
ReliefWeb (2002) 'India: Bihar flood situation report – report 6 Sep. 2002', *Reliefweb* (http://reliefweb.int/report/india/india-bihar-flood-situation-report-06-sep-2002)
ReliefWeb (2006) 'India: emergency health precautions for flooded areas', *Reliefweb*, 15 August (https://reliefweb.int/report/india/india-emergency-health-precautions-flooded-areas)
Resilient Africa Network (2016) *Integrating family planning in disaster response programmes* (www.ranlab.org/wp-content/uploads/2016/12/Eastern-Africa-Resilience-Innovation-Lab_Family-Planning-Policy-Brief.pdf)
Ridsel, J. and McCormick, C. (2013) *Protect my future: the links between child protection and disasters, conflict and fragility*. ChildFund, Save the Children, Plan UK, Terre des Hommes, World Vision, Family for every child and Keeping Children Safe
Risk to Resilience Study Team (2009) *Catalyzing climate and disaster resilience: processes for identifying tangible and economically robust strategies. Final Report of the Risk to Resilience Study.* Moench, M., Fajber, L. et al. (eds). Boulder, CO and Kathmandu: ISET-International and ISET-Nepal
Rotich, L.C. and Koros, P. (2015) 'Pastoralists and girl child education in Kenya', *International Journal of Innovative Education Research* 3(1)
Salam, A., Anwer, E. and Alam, S. (2013) 'Agriculture and the economy of Bihar: an analysis', *International Journal Scientific and Research Publications* 3(11)
Save the Children (2007) *Legacy of disasters: the impact of climate change on children*. London: Save the Children
Scott, L. and Diwakar, V. (2016) 'Ensuring escapes from poverty are sustained in rural Bangladesh', *USAID Leo Report 32*
Seballos, F., Tanner, T., Tarazona, M. and Gallegos, J. (2011) *Children and disasters: understanding impacts and enabling agency.* Children in a Changing Climate
Shepherd, A., Mitchell, T., Lewis, K., Lenhardt, A., Lones, L., Scott, L. and Muir-Wood R. (2013) *The geography of poverty, disasters and climate change 2030*. London: ODI
Shepherd, A., Scott, L., Mariotti, C., Kessy, F., Gaiha, R., da Corta, L., Hanifnia, K., Kaicker, N., Lenhardt, A., Lwanga-Ntale, C., Sen, B., Sijapati, B., Strawson, T., Thapa, G., Underhill, H. and Wild, L. (2014) *The chronic poverty report 2014–2015: The road to zero extreme poverty*. London: ODI
Shepherd, A. and Bird, K., with Sarwar, M. (2018, forthcoming) *Leave no one behind in progress to the SDGs: priority actions for governments by 2020*. CPAN Challenge Paper
Shrivastava, A., Srikantiah, P., Kumar, A., Bhushan, G. et al. (2015) 'Outbreaks of unexplained neurologic illness – Muzaffarpur, India, 2013–2014', *Morbidity and Mortality Weekly Report* 64(3)
Silbert, M. and Usche, P. (2012) *Repeated natural disasters and poverty in island nations: a decade of evidence from Indonesia*. PURC Working Paper. University of Florida, Department of Economics
Silverman, W.K. and La Greca, A.M. (2002) 'Children experiencing disasters: definitions, reactions and predictors of outcomes' in La Greca, A.M., Silverman, W.K., Vernberg, E.M. and Roberts, M.C. (eds) *Helping children cope with disasters and terrorism*. American Psychological Association

Skillshare International India (2014) *State of the Adivasis in Odiesha 2014: a human development analysis*. SAGE
Tableau Public, Free Data Utilization Software (https://public.tableau.com/en-us/s/)
The Desakota Study Team (2008) *Re-imagining the rural–urban continuum. Understanding the role ecosystem services play in the livelihoods of the poor in desakota regions undergoing rapid change*. Kathmandu: ISET-Nepal
The Economist (2015) 'A glimpse of Africa's future. Wild, ancient and oil-rich Turkana shows how fast the continent is changing', 11 July (https://www.economist.com/news/middle-east-and-africa/21657384-wild-ancient-and-oil-rich-turkana-shows-how-fast-continent-changing)
Thorat, A., Vanneman, R., Desai, S. and Dubey, A. (2016) *Escaping and falling into poverty in India today.* India Human Development Survey. New Delhi: University of Maryland and National Council of Applied Economic Research
Turkana County Government (2016) *County Integrated Development Plan 2013–2017*. Lodwar, Kenya: Turkana County Government (www.turkana.go.ke/wp-content/uploads/2016/10/Turkana-CIDP-Final-1.pdf)
UNDAF (United Nations Development Assistance Framework) (2015) *Turkana County – United Nations Joint Programme 2015–2018*. Lodwar, Turkana: Executive Office, Turkana County Government and Nairobi: UN Resident Coordinator Office
UNICEF (2013) *Kenya: statistics* (https://www.unicef.org/infobycountry/kenya_statistics.html)
UNICEF (2014) Database on Child Marriage (http://data.unicef.org/topic/child-protection/child-marriage/#)
UNICEF (2015) *Unless we act now: the impact of climate change on children*. New York: UNICEF
UNICEF (2016a) *When coping crumbles – drought in India 2015–16*. New York: UNICEF (http://unicef.in/Uploads/Publications/Resources/pub_doc141.pdf)
UNICEF (2016b). *Kenya: HAC 2016*. (https://www.unicef.org/appeals/files/HAC_2016_Kenya.pdf)
UNICEF Kenya (2017) *Kenya Humanitarian Situation Report*, 5 July (https://reliefweb.int/sites/reliefweb.int/files/resources/UNICEF%20Kenya%20Humanitarian%20Situation%20Report%20-%205%20July%202017%20.pdf)
UNISDR (United Nations International Strategy for Disaster Reduction) (2015) *Sendai Framework for Disaster Risk Reduction 2015–2030*. Geneva: UNISDR
UNISDR (2016) *Report of the Open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*. Seventy-first session, Agenda item 19(c). Geneva: UNISDR (www.preventionweb.net/files/50683_oiewgreportenglish.pdf)
Urban, F. and Mitchell, T. (2011) *Climate change, disasters and electricity generation. Strengthening Climate Resilience Discussion Paper 8*. Brighton: Institute of Development Studies (https://assets.publishing.service.gov.uk/media/57a08ae4ed915d622c000989/SCR-DiscussionPaper8-Latest-Climate-change-disasters-and-electricity-generation.pdf)
USAID (2013) *Maternal and newborn healthcare in Kenya* (http://healthpolicyproject.com/ns/docs/MaternalNewbornHealthCare_Kenya_Oct2013.pdf)
Varma, X. (2017) 'This year's floods worst in a decade', *Times of India*, 6 September (https://reliefweb.int/report/india/year-s-floods-worst-decade)
Wanayama, O. (2014) 'Persistent drought forces more Turkana families into Uganda', *URN*, 2 May (https://ugandaradionetwork.com/story/persistent-drought-forces-more-turkana-families-into-uganda)
Whetten, R., Messer, L., Ostermann, J., Whetten, K., Wells Pence, B., Buckner, M., Thielman, N., O'Donnell, K. and The Positive Outcomes for Orphans (POFO) Research Team (2011) *Child work and labour among orphaned and abandoned children in five low and middle income countries*. BMC International Health and Human Rights (http://bmcinthealthhumrights.biomedcentral.com/articles/10.1186/1472-698X-11-1)
WHO (World Health Organization) (2017) *Climate change and health*. Geneva: World Health Organization (www.who.int/mediacentre/factsheets/fs266/en/)

World Bank (2011) *Response plan: drought in the Horn of Africa*. Washington DC: World Bank (http://siteresources.worldbank.org/INTAFRICA/Resources/Drought_in_the_Horn_of_Africa_7.28.2011.pdf)
World Bank (2017) *World Development Indicators 2017*. Washington DC: World Bank (https://openknowledge.worldbank.org/handle/10986/26447)

Annex 1 Policy frameworks

Governance of disasters and climate risk management in India

- Disaster management is decentralised in India. The State Disaster Management Authorities are responsible for developing and implementing disaster risk management plans at the state level and assisting in the development of plans at the district level.
- India is a signatory to the Paris Climate Agreement. The country has declared a voluntary emissions intensity reduction of 20–25% of GDP over 2005 levels by 2020 in its Intended Nationally Determined Contribution (INDC).

India's disaster risk management and climate change policies have been shaped by international agendas as well as disaster types and effects on the ground. In terms of managing **hazards**, the country's Disaster Management Act (2005) provides institutional and coordination mechanisms for effective disaster management at the national, state, district and local levels (Government of India, 2016). The country also has a National Policy on Disaster Management (2009) and a National Disaster Management Plan (NDMP) (Government of India, 2016). The NDMP provides a policy framework for all phases of the disaster management cycle, and is aligned with the post-2015 international policy processes, including the Sendai Framework.

Within India, disaster management is decentralised. States and union territories have developed state disaster management plans, as have 80% of the country's districts (Bahadur et al., 2016). These policies guide the work of national authorities responsible for managing disaster risk (ibid.). While these documents typically recognise different vulnerable and marginalised groups, including women, children and people with disability, and in some cases castes, this tends to be in terms of needs and vulnerabilities in the context of disaster response, as opposed to their participation in disaster risk management decision-making and implementation (ibid.).

On **climate** policy, India, which is a signatory to the Paris Climate Agreement, is taking several steps under the UNFCCC. The country has declared a voluntary emissions intensity reduction of 20–25% of GDP over 2005 levels by 2020 in its INDC, while acknowledging the difficulty of meeting such intentions given its larger percentage of poor people, with a rural population without access to electricity or stable power sources (Government of India, 2015). National actions related to mitigation and adaptation are outlined in the country's National Action Plan on Climate Change (Government of India, 2008a). This plan focuses on eight mission areas: solar energy, energy efficiency, sustainable habitat, water, sustaining the Himalayan ecosystem, forestry and creating a 'Green India', sustainable agriculture and strategic knowledge for climate change. The aim is to simultaneously reduce poverty, promote sustainable development and enhance resilience (Pandve, 2009; Government of India, 2008a).

Governance of disasters and climate risk management in Kenya

- Devolution to the county level in Kenya has provided an opportunity to enhance climate and disaster resilience policies and implementation that are hazard-appropriate (Carabine et al., 2015). Flood and disease preparedness appear to be less coordinated than drought preparedness (Development Initiatives, 2017).

- Kenya is a signatory to the Paris Climate Agreement under the UNFCCC, and its INDC contains both adaptation and mitigation components as a means of reducing poverty, supporting livelihood development and diversification and strengthening key sectors including health, water and energy (Government of the Republic of Kenya, 2015).

Kenya's policies for DRM and climate change, like India's, have been influenced by international agendas and local conditions. Kenya participated in the Sendai Framework negotiations and has signed up to the Africa Risk Capacity (ARC),[1] for which the country 'makes the highest premium

Box 3 Disaster risk management and climate change policy in Bihar

Bihar's State Disaster Management Plan (Government of Bihar, 2014) was developed in two parts: disaster risk management and disaster crisis management (Government of Bihar, 2016b). After the study period, and following the adoption of the Sendai Framework, Bihar produced a Roadmap for Disaster Risk Reduction (2015–2030) and adopted the Patna Declaration, which includes commitments that 'Community skills, knowledge and capacities will inform [DRR] decision making … at all levels through inclusive and participatory processes, with special emphasis on context-specific differential needs of social groups' (Government of Bihar, 2016b: 10). The roadmap outlines the state's vision of achieving a 'Disaster Resilient Bihar' through:

1. **'Primacy of rights of at-risk people and communities:** Governance-related decision making processes at all levels will prioritise the well-being, protection and safety of at-risk communities through risk-informed development action, undertaken with the realisation that "at-risk" is not a homogenous group'.
2. **Participation of and action by at-risk communities:** These communities include children who 'have the right to participate in decisions influencing the level of disaster risk to their lives'.
3. **Inclusive DRR:** Specifically, DRR 'actions will account for the fact that disaster risks are experienced differently by different sections of the population, including children, women, the elderly, people with disabilities, and other traditionally marginalised groups'.

The document also states that a baseline status will include 'disaggregated (sex, location, age, disability, caste-community) data with clear periodicity' (Government of Bihar, 2016b: 139–40).

Including Bihar, 32 states have developed climate action plans within the national plan framework (MoEFCC, 2017). While the National Action Plan on Climate Change does not mention children, Bihar's State Action Plan on Climate Change (2015) acknowledges the prevalence of undernourished and underweight children under the age of five. It also recognises that climate change is likely to disproportionately impact the poor, women and children – particularly those dependent on climate-sensitive livelihoods. The state has committed to begin using explicit gender-responsive language, data and analysis in its mitigation and adaptation plans and activities, including the Gram Panchayat-level (village council) Local Action Plans on Adaptation (Government of Bihar, 2015). Additionally, the plan includes education and awareness activities for enhancing disaster risk and climate change awareness through school curricula, and efforts to improve access to health infrastructure to reduce infant mortality rates and improve child health and wellbeing. However, the plan lacks explicit acknowledgement of the involvement of children and child rights, particularly related to participating in disaster risk and climate change adaptation (CCA) initiatives.

1 The ARC is 'Africa's first sovereign catastrophe insurance pool … highlighted as a model initiative enabling early action in preparing for drought, building long-term resilience and contributing to sustainable development' (Development Initiatives, 2017: 24).

contribution in Africa' (Development Initiatives, 2017: 6). However, there is no central DRM agency or law, and disaster preparedness and risk management are piecemeal and fragmented across the country; while the focus is strongest on drought through the NDMA, there is little corresponding action, allocation of resources, policy or coordination for other types of disasters, such as flood and disease preparedness (Development Initiatives, 2017). As in India, governance of disasters is decentralised to the county level. Local officials draft a County Integrated Development Plan, which includes policies and plans for disaster management. Devolution has provided an opportunity to strengthen climate and disaster resilience policies and implementation at the local level as design and implementation can be hazard- and context-appropriate (Carabine et al., 2015). However, resource and capacity constraints remain a challenge.

The NDMA, formed in 2011, is responsible for establishing 'mechanisms which ensure that drought does not result in emergencies and that the impacts of climate change are sufficiently mitigated' (NDMA, 2017a). In 2013, the government produced a Sector Plan for Drought Risk Management and Ending Drought Emergencies (2013–17). This plan recognises that 'drought management in Kenya has continued to take a reactive, crisis management approach rather than an anticipatory and preventive risk management approach', which has led to a greater reliance on emergency food aid (Government of the Republic of Kenya, 2013a: 20–21).

Reflecting the Sendai Framework's coverage of children, the Sector Plan highlights the impact of drought on children and youth in sectors including education, employment, health and nutrition. It also reaffirms the need 'to ensure equitable access to education for all children in arid [and] … pastoral areas, including the disadvantaged [and] … vulnerable groups' (Government of the Republic of Kenya, 2013a: 51). In 2014, the government produced the Ending Drought Emergencies: Common Programme Framework for Drought Risk Management (2014–2018). Focusing on the ASALs, it has three main components: drought risk and vulnerability reduction; drought early warning and early response; and institutional capacity for drought and climate resilience (Government of the Republic of Kenya, 2014). These policies and others feed into the Kenya Vision 2030 (Government of the Republic of Kenya, 2007), and the commitment to end drought emergencies in the country by 2022.

Flood preparedness and management in Kenya is led by the Water Resource Management Authority, which coordinates water resource management at the national and subnational level, and the Ministry of Water and Irrigation, responsible for water resource policy, including the 2016 Water Act (Development Initiatives, 2017). The Act covers responsibilities for flood control and mitigation activities. There is also a Strategy for Flood Management for Lake Victoria Basin, Kenya, developed by The Associated Programme on Flood Management and the World Meteorological Organisation (APFM, 2004). The government is aiming to produce a National Flood Management Strategy, based on an Integrated Risk Management Approach.[2] The Ministry of Devolution and Planning, Directorate of Special Programmes coordinates the Western Kenya Community Driven Development and Flood Mitigation project, in collaboration with the World Bank.[3] The project covers sub-counties within Bungoma and Kakamega, among others, with a focus on community-driven development, flood management and implementation support.

Kenya's INDC, announced in 2015, contains adaptation and mitigation components as a means of reducing poverty, supporting livelihood development and diversification, and strengthening key sectors like health, water and energy (Government of the Republic of Kenya, 2015). Kenya's various climate-related policies[4] acknowledge the particular impacts of climate-related hazards on children, noting

2 www.apfm.info/regional_projects/africa.htm

3 www.westernkenya.go.ke/

4 Additional key pieces of legislation related to Kenya's commitments to the UNFCCC are the National Climate Change Response Strategy 2010 (Government of the Republic of Kenya, 2010), the National Climate Change Action Plan 2013–2017 (Government of the Republic of Kenya, 2013b) and the National Adaptation Plan 2015–2030 (Government of the Republic of Kenya, 2016). These are reconciled within the long-term socioeconomic development plan Kenya Vision 2030 (Government of the Republic of Kenya, 2007).

that 'climate-related shocks such as drought … can contribute to children being taken out of school. Similarly, climate impacts can lead households to divert financial resources from education to food' (Government of the Republic of Kenya, 2016: 29). The government has several ongoing initiatives to include climate change in school curricula and to continue the expansion of educational opportunities in ASALs, including Turkana. Kenya's National Adaptation Plan 2015–30 explicitly mentions the rights of children, and the need to improve access to food, education, livelihood diversification and social protection for children, youth and other vulnerable groups (e.g. women, orphans, the elderly and people with disabilities). The government has established a vulnerability and risk simulation tool – Threshold 21 – to track climate impacts and inform national policies, including those targeted towards vulnerable groups, such as women and children.

Box 4 Disaster risk management and climate change policy in Turkana

In Turkana, the First County Integrated Development Plan 2013–2018 (Turkana County Government, 2016) outlines the county's approach to disasters, specifically drought management. The plan emphasises the need to support regular assessments of food, floods and conflict security, and to include DRR, CCA, social protection and EDE in planning and budgeting processes. It provides information by different age groups, and recognises the different socioeconomic development, challenges and strategies facing each age group within sectors including WASH, health access and nutrition, education and literacy in the county.

The NDMA also closely tracks drought conditions and impact indicators for the ASAL counties as part of the National Drought Management Authority Act of 2016 (NDMA, 2017b). The NDMA issues monthly drought early-warning bulletins with descriptions of biophysical and socioeconomic impacts, including quantitative indicators of livestock production, crop conditions, household distance to water sources and the percentage of children at risk of malnutrition. The NDMA uses its drought-monitoring system to determine non-food and food aid interventions.

The UN has been working with national and county governments, including Turkana, to institute a new development paradigm around more equitable and peaceful socioeconomic development that empowers marginalised communities in implementing the County Integrated Development Plans (UNDAF, 2015). Greater support around climate risk management is needed, but as of late 2015 the Turkana county government had yet to integrate any climate change and adaptation considerations into the County Integrated Development Plan 2013–2017 or other activities (Human Rights Watch, 2015). Research by Human Rights Watch found that Turkana officials acknowledge the serious risks posed by climate-related hazards and climate change, but coordination problems remain around disaster risk, natural resources, the environment and development management between the national and county level following devolution. Turkana officials currently have no central coordination mechanism for addressing climate-related insecurities, and no current plans for conducting a risk assessment or developing an adaptation plan.

Annex 2 Data sources and their limitations

The unique pairing of datasets in this study and their limitations are outlined below.

1 Child poverty and wellbeing data

India Human Development Survey (2005, 2011) and Kenya Multiple Indicator Cluster Survey for Turkana, Bungoma and Kakamega counties (2013/14).

In India, as a measure of poverty dynamics and child wellbeing, we use the Indian Human Development Survey, a national panel dataset from 2005 and 2011 which covers 41,554 households in 1,503 villages and 971 urban neighbourhoods across the country.

In Kenya, we will rely on MICS data as our primary source of analysis on child poverty and wellbeing. We opted for this data since it covers indicators of child wellbeing that are not available in panel datasets for the country. MICS covers Turkana, Bungoma and Kakamega counties in 2013–14. The combined dataset interviews 4,680 households across these counties.

Together, the cross-section MICS data and panel IHDS allows us to showcase different aspects of child poverty and wellbeing across the lifecycle over a relatively recent timeframe.

Limitations

- **Multiple Indicator Cluster Survey:**
  - No information on ethnicities, limiting what can be ascertained about particular marginalised groups within the poor.
  - No sub-county geographical indicators. In pairing the disaster data with the county datasets, we have to aggregate disasters at the county level, losing more detailed information to examine links with child wellbeing.
  - No information on income or expenditures. We have to rely on a wealth score created in the dataset, which reduces comparability with other household surveys. Accordingly, we proxy national poverty incidence rates to the percentile of the wealth score distribution in the MICS datasets.
- **India Human Development Survey:**
  - No consistent coverage for all indicators or modules. For example, shocks were only recorded in 2011, and even there, coverage of types of shocks remained sparse.
  - Only cautious inference may be made at the subnational level, and even so only for large states. This limits the comparability of poverty by state in IHDS compared with other sources, such as official state government data.

2 Disasters data

EM-DAT and INFORM databases

The EM-DAT database is often used in the literature as a source of national and state- level disaster data, providing datasets on types of disaster occurring in their study areas, and their frequency and intensity (Seballos et al., 2011; Gaire et al., 2016; Datar et al., 2011). The EM-DAT database also provides data on the separate total numbers of people affected and killed and economic damage (in US$) caused by a particular disaster.

The INFORM database, Index for Risk Management, is based on three dimensions: Hazard and Exposure (Natural and Human), Vulnerability (Socio Economic and Vulnerable Groups) and Lack of Coping Capacity (Institutional and Infrastructure), divided by a number of components grouped under each dimension. This index is available at subnational level for a limited number of countries (for our study Kenya was covered, but not India).

Limitations

- The three impact indicators demonstrate the complexity of analysing disaster impact data, as each type of hazard has a highly varied disaster impact.
- No information around poverty implications, such as the socioeconomic characteristics of affected populations or those killed in disasters.
- Measures of impact are presented as an aggregate per disaster, limiting what can be said about its impact within specific districts or counties.
- EM-DAT does not capture slow-onset disasters well, and some types of sudden-onset disasters. For example, it has very little wildfire data (a sudden-onset event), even though other research shows the significance of wildfire-related deaths and injuries in India. Droughts (a slow-onset disaster) are also underrepresented in the database. EM-DAT data underestimates the impact of hazards overall.
- Under-reporting of some hazards in EM-DAT:
  - There are more droughts during the Bihar monsoon season (June–September) than reported in EM-DAT.
  - Bihar experiences several severe disease outbreaks each year – Japanese encephalitis, dengue, chikungunia and cholera – that are reported in the Indian media but not in EM-DAT.
  - Severe winter conditions do not match the Extreme Temperatures data, nor do those of cold-wave spells.

3 Climate data

Climatic Research Unit Time Series 4; Climate Hazards Group InfraRed Precipitation with Station data; India Water Portal; and All India District-Wise Rainfall Data

Historical climate data for variables such as precipitation and minimum and maximum temperatures are often difficult to find in developing countries due to poor weather station spatial coverage and maintenance, short records with spotty data and difficulties in accessing available and timely data from national meteorological departments. We use grid-interpolated datasets produced by major climate research institutions as proxies for missing station observation data, as follows:

Bihar, India:

- District-wise monthly minimum and maximum temperatures (Tmin and Tmax) for the period 1970–2002 from India Water Portal (2017). The district-wise temperature datasets for 2003–2015 were interpolated from nearest-neighbour CRU grids by scaling CRU TS4.0 data using district-specific scaling derived from the 1970–2002 IWP data (Harris et al., 2014).
- District-wise monthly precipitation for the period 1970–2002 from India Water Portal (2017) and for the period 2004–2015 from the All India District-Wise Rainfall Data (IMD, 2017). Missing data were interpolated from the area-averaged nearest-neighbour CHIRPS pentad precipitation data (Funk et al., 2015).

Bungoma, Kakamega and Turkana, Kenya:

- Gridded Tmin and Tmax for the period 1970–2015 interpolated to the county level (Bungoma and Kakamega) and sub-county level (Turkana) from CRU TS4.0 (Harris et al., 2014).
- Area-averaged pentad precipitation data from CHIRPS (Funk et al., 2015).

Limitations

- The scant climate observation data for Kenya makes it difficult to assess the biases in the gridded CRU TS4.0 and CHIRPS datasets. From the Bihar analysis, we were able to see that the CHIRPS dataset has a wet bias, that is it over-estimates precipitation during the monsoon and winter seasons. The biases could be corrected by interpolating these datasets against the IMD district-wise data. The same bias correction and verification could not be done for the Kenya datasets, potentially leading to an over- or under-estimation in actual precipitation and temperature trends.
- Analysis of the climate data yielded discrepancies with reported climate-related disaster incidences and duration in the EM-DAT database. For instance, some large-scale 'flash floods' are reported for Bihar that, according to EM-DAT, persisted for two or more weeks. A flash flood by hydrological definition lasts only for a day or less. Such types of flooding would more appropriately be classified as riverine flooding or waterlogging.
- Due to a lack of robust climate observation data for Kenya, we cannot as readily point out discrepancies between the climate data and the EM-DAT database.

Annex 3 Methods of empirical analysis

Disasters and child poverty: analysis of relationships

In this report, we merge our child wellbeing and poverty data with information on disasters as provided through the EM-DAT database. Disasters were divided into biological, climatological, geophysical, hydrological and meteorological subgroups, and this information at the district and county level was merged with our wellbeing datasets. Using this combined dataset, we examine the relationship between disasters and child poverty and wellbeing. For robustness, disasters were measured in several ways, including:

- the average number of disasters in a three-year period preceding the survey year;
- the average duration of disasters over the same period; and
- in some cases, the average number of disasters disaggregated by type of disaster.

The relationship between disasters and child poverty was examined as follows:

We first employ **logistic regressions** to assess the *drivers of poverty incidence*. Our results are presented as odds ratios, where a ratio greater than one on a coefficient implies that the household is more likely to be poor. We use a fixed effects specification in India, to exploit the panel nature of the data and allow for changes in the prevalence of disasters (and other variables) between survey rounds. In our equation:

$$Log(Povertyi,t) = \beta_0 + \beta_1 Disasters_{i,t} + \beta_2 Household_{i,t} + \beta_1 Region_{i,t}$$

(1) where in equation (1) $Poverty_i$ is a binary equal to 1 if household *i* is below the poverty line, and 0 otherwise.

Disasters is defined as: 1) a binary equal to one if the average number of disasters over a three-year period leading up to the survey was higher than the mean for that period, and equal to zero otherwise. The same was done for 2) the duration of disasters, and for 3) disaster types. Additionally, disasters was employed as a continuous variable defined by 4) the average number of disasters, and 5) the average duration of disasters, both over the same timeframe as above.

Household is a vector of household specific controls, and *Region* is a vector of dummy variables communicating the state or county the household resides in, and whether it is located in an urban or rural area.

In the case of India, we also employ **multinomial logistic regressions** to assess the *drivers of poverty trajectories*, which is possible due to the panel nature of the dataset. We present results as relative risk ratios, where a variable coefficient greater than one indicates a higher risk of a household being in chronic poverty relative to escaping poverty. In our equation, we employ baseline characteristics of the households where:

$$Pr(PovTraj_{i,t} = 1 \mid \beta, v_{i,t}) = \beta_0 + \beta_1 Disasters_{i,t} + \beta_2 Household_{i,t} + \beta_3 Region_{i,t}$$

(2) In equation (2) for $\boldsymbol{v}_i$ = (1, $Disasters_i$, $Household_i$, $Region_i$) , we have *PovTraj* as the probability of the household *i* being chronically poor, relative to escaping poverty, and all other variables are the same as in equation (1).

In the above equations, we rely on household-level analysis. This is a useful starting point for understanding the monetary wellbeing of children in India and Kenya; however, child deprivation often extends beyond this monetary sphere. As such, we complement our household-level analysis with **t-tests** to examine the *demographics and human development of individual children* over their life course,[5] by disaster prevalence. These statistical tests assesses whether the means of two groups – areas above and below the mean of natural disasters in the three years leading up to the survey – are statistically different from each other. Specifically:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

(3) Where $\boldsymbol{x}$ refers to the means of our variables, $\boldsymbol{s}$ to the standard deviations, and $\boldsymbol{n}$ to the total number of observations per group.

To ensure robustness and that our results relate to disaster impacts specifically, rather than general trends in disaster-prone areas, we also run a **difference-in-difference estimation** for our *schooling outcomes for children* in India overall and among the persistently poor subset. This estimation overcomes the problem of the missing counterfactual – specifically, the problem that we cannot observe years of education for a child in a disaster-prone district and simultaneously observe years of education for that same child in a situation of fewer disasters. In our equation:

$$\boldsymbol{Difference - in - difference} = (\bar{Y}_{00} - \bar{Y}_{01}) - (\bar{Y}_{10} - \bar{Y}_{11})$$

(4) where $\bar{Y}_{wa} = \frac{1}{n}\sum_1^n Y_{iwa}$ refers to mean years of education completed by individual *i* born in district *w* (where *w*=1 if the area is disaster-prone and *w*=0 otherwise) and in year *a*.

Climate trend analysis

Part of analysing impacts of hazards on childhood poverty and wellbeing involved a Mann-Kendall trend analysis of climate data for the case study areas. The majority of disasters in India and Kenya are weather and climate-related, with climate change influencing the frequency of certain types of hazards, such as drought, flooding and heat waves. Shifting temperatures and changes in the rainy season(s) are also influencing the lifecycle conditions of various pathogens, including cholera in Kenya, and vector-borne diseases such as dengue and Japanese encephalitis in Bihar, that cause significant child morbidity and mortality. The climate trend analysis involved the following steps:

1. Collection of historical district-wise monthly precipitation and temperature data for Bihar, and station data for Turkana, Bungoma and Kakamega.
2. Data were analysed for gaps and data quality issues. Significant data gaps (more than 60% missing) were identified in the Kenyan station data.
3. Data gaps were filled for Bihar districts by interpolating from the nearest-neighbour gridded climate datasets (CRU TS4.0 and CHIRPS). The station data gaps were so significant for Kenya that the CRU TS4.0 and CHIRPS data were used directly for analysis.

5 We have sets of indicators around child wellbeing in utero up to the age of five, children of primary school age (6–14 years), and adolescents aged 10–19 and the subset of secondary school age (15–18 years).

4. Monthly and seasonal Mann-Kendall trend analysis were conducted to examine precipitation and temperature shifts in accordance with the hazards identified in the EM-DAT dataset. Trends with a p-value at the 90th percentile or greater are considered statistically significant trends that could influence livelihoods and childhood wellbeing as described in text.

Annex 4 Empirical results

Table 8 Associations between disasters and household poverty status: Kenya, logistic regression

Variables	Dependent variable: poor household						
Average number of disasters	1.470*** (0.0360)						
Average duration of disasters (days)		1.058*** (0.00369)					
Number of disasters > mean			19.28*** (3.523)				
Duration of disasters > mean				19.28*** (3.523)			
Average number of biological disasters					10.67*** (1.559)		
Average number of climatological disasters						3.266*** (0.239)	
Average number of hydrological disasters							2.019*** (0.0954)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.413*	0.476	0.590	0.590	0.590	0.590	0.361**
	(0.195)	(0.224)	(0.275)	(0.275)	(0.275)	(0.275)	(0.173)
Observations	3,744	3,744	3,744	3,744	3,744	3,744	3,744

*Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1*

Table 9 Associations between disasters and household poverty status: India, logistic regression, fixed effects

Variables	Dependent variable: poor household								
Average number of disasters	0.467***								
	(0.0811)								
Average duration of disasters (days)		0.963***							
		(0.00545)							
Number of disasters > mean			0.339***						
			(0.105)						
Duration of disasters > mean				0.301***					
				(0.0498)					
Average number of biological disasters					0.103***				
					(0.0655)				
Average number of climatological disasters						0.219*			
						(0.182)			
Average number of geographical disasters							0.0702**		
							(0.0920)		
Average number of hydrological disasters								0.280***	
								(0.0893)	
Average number of meteorological disasters									0.761
									(0.188)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,712	12,712	12,712	12,712	12,712	12,712	12,712	12,712	12,712
Number of IDHH	6,356	6,356	6,356	6,356	6,356	6,356	6,356	6,356	6,356

*Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1*

Table 10 Associations between disasters and household poverty trajectories: India, multinomial logistic regression effects

Variables	Dependent variable: chronic poverty relative to poverty escape	
Average number of disasters > mean	1.924***	
	(0.355)	
Average number of disasters		1.412*
		(0.296)
Household shock	0.762***	0.760***
	(0.0497)	(0.0495)
Log(per capita expenditures)	0.404***	0.398***
	(0.0475)	(0.0469)
Assets	0.0586***	0.0582***
	(0.0207)	(0.0205)
Female head	0.719***	0.726***
	(0.0886)	(0.0893)
Age	0.918***	0.917***
	(0.0145)	(0.0145)
Age-squared	1.001***	1.001***
	(0.000161)	(0.000161)
Urban residence	1.642***	1.625***
	(0.165)	(0.163)
Household size	1.048***	1.048***
	(0.0169)	(0.0169)
Share of children	1.057	1.041
	(0.190)	(0.187)
Primary education of household head	0.712***	0.716***
	(0.0522)	(0.0524)
Secondary education of household head	0.597***	0.604***
	(0.0789)	(0.0795)
Employment of household head	1.019	1.033
	(0.0809)	(0.0819)
Household engaged in non-agriculture enterprise	1.131*	1.128*
	(0.0734)	(0.0732)
Ownership of cultivable land	0.980	0.980
	(0.0158)	(0.0157)
Livestock > mean	0.998	0.997
	(0.0703)	(0.0702)
Social assistance	1.320**	1.323**
	(0.152)	(0.152)
Loan	0.982	0.982
	(0.0627)	(0.0626)

Variables	Dependent variable: chronic poverty relative to poverty escape	
Rooms per person	0.862	0.872
	(0.117)	(0.118)
Electricity	0.747**	0.757**
	(0.0930)	(0.0943)
Improved drinking water	0.751**	0.727***
	(0.0845)	(0.0812)
Private toilet	1.053	1.066
	(0.103)	(0.104)
State controls	Yes	Yes
Constant	140.4***	153.5***
	(183.2)	(206.2)
Observations	5,787	5,787

*Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1*

Table 11 Results of t-tests: child and adolescent wellbeing in disaster-prone areas vs others

	India *(chronically poor across states)*	Kenya *(poor in Kakamega, Bungoma, and Turkana)*
In utero and children U5		
Access to health services (%)	+ (.46 vs .39)**	N/A
Formal delivery care (%)	- (.20 vs .22)	- (.27 vs .43)***
Fewer than four antenatal visits (%)	+ (.90 vs .85)***	- (.74 vs .85)
Birth registration (%)	- (.67 vs .77)**	- (.20 vs .39)***
Diarrhoea (%)	+ (.11 vs .06)***	+ (.16 vs .15)
Children		
Primary school enrolment (%), 6–14 years	- (.84 vs .88)***	- (.96 vs .98)***
Years of education (years), 6–14 years	+ (2.7 vs 2.5)	- (2.4 vs 2.6)***
Adolescents		
Secondary school enrolment (%), 15–18 years	- (.43 vs .51)**	+ (.89 vs .84)**
Years of education (years), 15–18 years	- (2.7 vs 2.9)	- (6.9 vs 7.4)*
Farm labour (%), 10–19 years	- (.39 vs .44)*	- (.31 vs .65)***

*Note: In interpreting this table, a positive sign reflects a higher average for the indicator in disaster-prone areas relative to other areas of the country. Parentheses indicate the average in disaster-prone areas vs. other areas. *** p<0.01, ** p<0.05, * p<0.1*
Source: Authors' calculations, based on analysis of MICS and EM-DAT data.

Evidence.
Ideas.
Change.

ODI is an independent, global think tank, working for a sustainable and peaceful world in which every person thrives. We harness the power of evidence and ideas through research and partnership to confront challenges, develop solutions, and create change.

ODI
203 Blackfriars Road
London SE1 8NJ

+44 (0)20 7922 0300
info@odi.org

odi.org
odi.org/facebook
odi.org/twitter