Supplemental material

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Supplementary materials

Table S1: Disaster Definitions

Disaster Type	EM-DAT/IRDR Definition
Drought	"An extended period of unusually low precipitation that produces a shortage of water for people, animals and plants. Drought is different from most other hazards in that it develops slowly, sometimes even over years, and its onset is generally difficult to detect. Drought is not solely a physical phenomenon because its impacts can be exacerbated by human activities and water supply demands. Drought is therefore often defined both conceptually and operationally. Operational definitions of drought, meaning the degree of precipitation reduction that constitutes a drought, vary by locality, climate and environmental sector."
Earthquake	"Sudden movement of a block of the Earth's crust along a geological fault and associated ground shaking."
Flood	"A general term for the overflow of water from a stream channel onto normally dry land in the floodplain (riverine flooding), higher-than normal levels along the coast and in lakes or reservoirs (coastal flooding) as well as ponding of water at or near the point where the rain fell (flash floods)."
Landslide	Relevant Subtype: Debris Flow, Mud Flow, Rock Fall "Types of landslides that occur when heavy rain or rapid snow/ice melt send large amounts of vegetation, mud, or rock downslope by gravitational forces."
Storm	Relevant Subtype: Convective Storm "A type of meteorological hazard generated by the heating of air and the availability of moist and unstable air masses. Convective storms range from localised thunderstorms (with heavy rain and/or hail, lightning, high winds, tornadoes) to meso-scale, multi-day events."
Wildfire	"Any uncontrolled and non-prescribed combustion or burning of plants in a natural setting such as a forest, grassland, brush land or tundra, which consumes the natural fuels and spreads based on environmental conditions (e.g., wind, topography). Wildfires can be triggered by lightning or human actions."

Definitions are derived from EM-DAT, available online at https://doc.emdat.be/docs/data-structure-and-content/glossary/

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S1. Survey waves and participants included and excluded.

Two publicly available DHS survey waves during the study period (January 1, 2020 to December 31, 2019) included neither cluster location information nor GPS covariate data, preventing linkages to the EM-DAT dataset to generate exposure measures. These datasets are thus excluded from analysis: Congo 2011-2012; Gambia 2013.

Among the 51 included survey waves, there are a total of 524 322 children under five years of age. 191 977 children with missing height or weight data are excluded from analysis. Among these children, 181 128 were not included in anthropometric data collection, that is, their household was not randomly selected for inclusion in the anthropometric sub-study and no height or weight measures were intended to be collected for those children. Among other children missing anthropometric measures, 3 636 children were not present at the time of survey; 3 300 children refused to participate; and 3 913 are missing for other or unknown reasons. We excluded a further 11 813 children who had non-missing but implausible height or weight measures. 53 children were excluded because they were missing information about their mother's education. The final analytic sample for stunting and wasting analyses is 320 479 children under five years of age.

Next, we excluded 90 814 children missing haemoglobin measures from anaemia analyses, that is, their household was not sampled to participate in an anaemia-related data collection. The final analytic sample for stunting and wasting analyses is 196 869 children under five years of age (as noted in the main text, children less than six months of age are excluded from anaemia-related analyses).

A summary of children included in the analysis by survey wave is shown in Table S1 below.

Table S2: Study Population by Country

Country	Survey waves Included	Number of Children under 5	Weighted Percentage of Sample	Disaster Events
Angola	2015-2016	6 337	1.87	4
Benin	2011-2012	9 131	2.82	1
	2017-2018	11 997	3.81	0
Burkina Faso	2010	6 550	2.12	3
Burundi	2010	3 455	1.12	4
	2016-2017	6 042	1.97	1
Cameroon	2011	5 070	1.62	1
	2018	4 452	1.47	1
Chad	2014-2015	10 046	3.17	0
Democratic Republic of the Congo	2013-2014	8 077	2.50	1
Comoros	2012	2,416	0.79	1
Côte d'Ivoire	2011-2012	3,212	0.97	0
Ethiopia	2011	9 624	3.19	4
	2016	8 860	3.02	4
Gabon	2012	3,350	0.89	1
Ghana	2014	2 720	0.84	0
Guinea	2012	3 101	0.99	1
	2018	3 389	1.04	1
Kenya	2014	18 705	5.49	3
Lesotho	2014	1 314	0.41	1
Liberia	2013	3 180	0.88	0

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Malawi	2010	4 601	1.45	3
	2015-2016	5 132	1.63	3
Mali	2012-2013	4 339	1.39	1
	2018	8 526	2.82	1
Mozambique	2011	9 394	3.16	4
Namibia	2013	1 794	0.52	1
Niger	2012	4 806	1.63	3
Nigeria	2013	24 650	7.83	3
	2018	11 332	3.61	3
Rwanda	2010	4 084	1.31	2
	2014-2015	3 542	1.14	1
Senegal	2010-2011	3 740	1.13	2
	2012-2013	5 905	1.74	2
	2014	6 003	1.71	3
	2015	6 100	1.77	1
	2016	5 979	1.72	2
	2017	10 727	3.16	1
	2018	6 065	1.73	0
	2019	5 525	1.61	1
South Africa	2016	1 076	0.33	4
Tanzania	2015-2016	8 941	2.77	4
Togo	2013-2014	3 195	0.97	0

Uganda	2011	2 073	0.66	3
	2016	4 396	1.37	3
Zambia	2013-2014	11 451	3.59	2
	2018	8 679	2.71	1
Zimbabwe	2010-2011	4 314	1.36	3
	2015	4 905	1.63	3
Total	**51**	**320 507**	**N/A**	**92**

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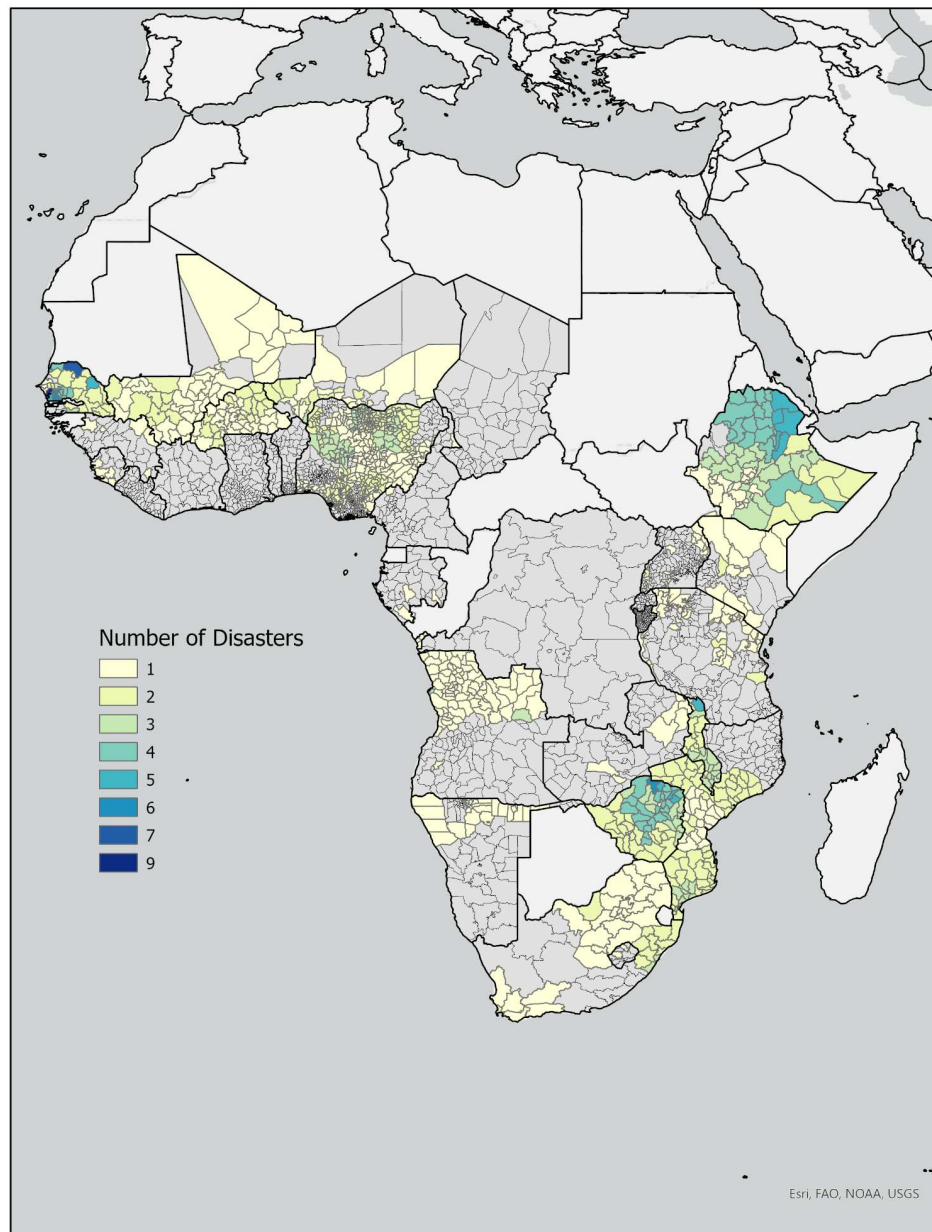
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Figure S1. Natural disaster exposure by administrative unit in the year preceding Demographic and Health Survey(s) (DHS) in 30 sub-Saharan African countries, 2010 to 2019.

Notes: Areas in dark grey with demarcated administrative units indicate countries or regions that are included in the analysis but that did not experience any natural disaster in the year preceding included DHS waves.

Table S3: Stunting relative risks and 95% confidence intervals by model with six-month exposure period (N=320 507).

	Model 1	Model 2	Model 3
All disasters	1.112 (1.077, 1.148)	1.100 (1.065, 1.136)	1.023 (1.000, 1.052)
Drought	0.971 (0.923, 1.021)	1.037 (0.985, 1.093)	0.919 (0.873, 0.967)
Flood	1.140 (1.098, 1.183)	1.112 (1.071, 1.155)	1.048 (1.016, 1.082)

Notes: Measure displayed is estimated relative risk (95% confidence interval). Model 1 is unadjusted; Model 2 controls for child age, child sex, year of survey, and country. Model 3 controls for child age, child sex, year of survey, country, low birth weight, birth order, maternal education, paternal education, household size, urban/rural location, and household wealth.

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Table S4: Wasting relative risks and 95% confidence intervals by model with six-month exposure period (N=320 507).

	Model 1	**Model 2**	**Model 3**
All disasters	1.679 (1.573, 1.793)	1.210 (1.132, 1.294)	1.132 (1.060, 1.208)
Drought	1.348 (1.229, 1.480)	1.510 (1.306, 1.745)	1.398 (1.223, 1.599)
Flood	1.732 (1.606, 1.868)	1.159 (1.076, 1.248)	1.084 (1.008, 1.165)

Notes: Measure displayed is estimated relative risk (95% confidence interval). Model 1 is unadjusted; Model 2 controls for child age, child sex, year of survey, and country. Model 3 controls for child age, child sex, year of survey, country, low birth weight, birth order, maternal education, paternal education, household size, urban/rural location, and household wealth.

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Table S5: Anaemia relative risks and 95% confidence intervals by model with six-month exposure period (N=320 507).

	Crude Model	**Model 1**	**Model 2**	**Model 3**
All disasters	1.043 (0.990, 1.099)	1.086 (1.039, 1.135)	1.085 (1.038, 1.134)	1.076 (1.031, 1.123)
Drought	0.771 (0.699, 0.850)	1.120 (1.015, 1.236)	1.117 (1.012, 1.233)	1.082 (0.983, 1.192)
Flood	1.187 (1.118, 1.260)	1.074 (1.022, 1.129)	1.074 (1.022, 1.129)	1.072 (1.022, 1.125)

Notes: Measure displayed is estimated relative risk (95% confidence interval). Model 1 is unadjusted; Model 2 controls for child age, child sex, year of survey, and country. Model 3 controls for child age, child sex, year of survey, country, low birth weight, birth order, maternal education, paternal education, household size, urban/rural location, and household wealth.

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Table S6. Relative risks of stunting, wasting, and anaemia among children ages 12 to 59 months exposed versus unexposed to any disaster within the preceding 12 months, excluding children exposed to any disaster in utero.

	Model 1	Model 2
Stunting (N=249 454)	1.039 (1.014, 1.064)	0.987 (0.966, 1.009)
Wasting (N=249 454)	1.534 (1.458, 1.616)	1.222 (1.157, 1.291)
Anaemia (N=168 898)	1.144 (1.099, 1.190)	1.060 (1.028, 1.093)

Notes: Models exclude children who had any exposure to a disaster in utero. Exposure is defined as experience of any disaster in the 12 months preceding the interview. Measure displayed is estimated relative risk (95% confidence interval). Model 1 is unadjusted. Model 2 controls for child age at interview, child sex, year of survey, country, low birth weight, birth order, maternal education, paternal education, household size, urban/rural location, and household wealth.