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Powering Minds, Empowering Lives: Understanding The Effects of Energy Poverty- Low-Carbon Energy Transition Nexus on Children in MENA

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Abstract

Energy poverty across the Middle East and North Africa leads to health and growth hazards for millions of children, who are exposed and vulnerable to poor climate conditions at home. These hazards are heightened by the increasing occurrence of extreme temperature and precipitation events, as children become even more exposed and their organisms even more vulnerable to indoor climate conditions. This paper investigates the nexus between indoor and outdoor climate conditions, on the one hand, and children's anthropometric development (stunting, wasting) and mortality (neonatal and infant), on the other hand. Children's access to clean energy is gauged using a Multidimensional Energy Poverty Index or a principal component analysis score of households' connection to electricity, and usage of clean fuels and cooking facilities. High-resolution temperature data are matched to households at the level of provinces. The analysis is applied to household-level microdata from 22 health surveys across ten MENA developing countries, and trends over time are assessed. We find that energy poverty has positive effects on longer-term anthropometric growth (i.e., risk of stunting) across most countries, but the effects on shorter-term or more acute health indicators, including wasting and mortality, are limited. Energy poverty is associated with stunting particularly in Morocco, Mauritania, Palestine and Tunisia. It is also modestly associated with infant mortality, especially in Morocco, Tunisia and Turkey. Girls, and children of wealthier, more educated parents in urban areas face lower stunting, wasting and mortality risks in most countries. These results underscore the necessity for targeted gender-responsive policies addressing energy poverty and climate resilience to improve child health outcomes in the region.

Keywords: Energy poverty, Extreme temperatures, Stunting, Wasting, Child mortality, MENA region
JEL Classifications: Q54, I14, O13, O53

ملخص

يؤدي فقر الطاقة في جميع أنحاء الشرق الأوسط وشمال إفريقيا إلى مخاطر صحية ونمو لملايين الأطفال المعرضين لظروف مناخية سيئة في منازلهم. وتتفاقم هذه المخاطر بسبب تزايد الأحداث المتطرفة في درجات الحرارة والأمطار ، حيث يصبح الأطفال أكثر عرضة لظروف المناخ الداخلي. تبحث هذه الورقة في العلاقة بين الظروف المناخية الداخلية والخارجية، من جهة، والنمو الأنثروبومتري للأطفال (التقزم والهزال) والوفيات (حديثي الولادة والرضع)، من جهة أخرى. يتم قياس وصول الأطفال إلى الطاقة النظيفة باستخدام مؤشر فقر الطاقة متعدد الأبعاد أو درجة تحليل المكونات الرئيسية لتوصيل الأسر بالكهرباء واستخدام الوقود النظيف ومرافق الطهي. تتم مطابقة بيانات درجة الحرارة عالية الدقة مع الأسر على مستوى المحافظات. يتم تطبيق التحليل على البيانات الجزئية على مستوى الأسرة من 22 مسحًا صحيًا في عشر دول نامية في منطقة الشرق الأوسط وشمال إفريقيا، ويتم تقييم الاتجاهات بمرور الوقت. وجدنا أن فقر الطاقة له آثار إيجابية على النمو الأنثروبومتري طويل الأجل (أي خطر التقزم) في معظم البلدان، إلا أن آثاره على المؤشرات الصحية قصيرة الأجل أو الأكثر حدة، بما في ذلك الهزال والوفيات، محدودة. يرتبط فقر الطاقة بالتقزم، لا سيما في المغرب وموريتانيا وفلسطين وتونس. كما يرتبط ارتباطًا طفيفًا بوفيات الرضع، لا سيما في المغرب وتونس وتركيا. تواجه الفتيات وأطفال الآباء الأكثر ثراءً وتعليمًا في المناطق الحضرية مخاطر أقل للتقزم والهزال والوفاة في معظم البلدان. تؤكد هذه النتائج على ضرورة وضع سياسات موجهة تراعي النوع الاجتماعي وتعالج فقر الطاقة والقدرة على التكيف مع تغير المناخ لتحسين نتائج صحة الطفل في المنطقة.

1. Introduction

Energy poverty and systemic energy inequalities have long hindered socioeconomic development across the Middle East and North Africa (MENA). Among the region's 215 million residents, approximately 65 million lack access to electricity, while an additional 60 million face frequent power outages and unreliable energy supplies (Olawuyi, 2020). Challenges related to energy affordability, reliability, and cleanliness remain pervasive. From the standpoint of conditions conducive to healthy development, energy poverty is most manifested by the lack of access to clean cooking fuels and inadequate household electrification (Katoch et al., 2024). These deprivations contribute to respiratory and cardiovascular diseases, illnesses from improperly stored or prepared foods, and premature deaths linked to indoor air pollution exposure (González-Eguino, 2015; İpek and İpek, 2024; Pondie et al., 2024).

Many children in the MENA region face hazardous living conditions, inadequate prenatal and early-life care, and insufficient nutritional intake. These challenges contribute to a disproportionately high prevalence of chronic ailments, leading to wasting, stunting or, in severe cases, infant mortality. Malnutrition, both in the short and long terms, carries significant adverse effects. Pre-conception and early pregnancy malnutrition adversely affect maternal, neonatal, and child health outcomes, while in-utero malnutrition increases the risk of disability and reduced years of schooling (Almond & Mazumder, 2001; Meng & Qian, 2009). Beyond the immediate human tragedy, early-childhood deprivations can have lasting consequences even for the larger group who survive but are permanently scarred by these hardships. Stunting, for instance, is associated not only with increased mortality rates, but also diminished adult stature, educational attainment and incomes (Hoddinot & Kinsey, 2001; Alderman et al., 2006; Grantham-McGregor et al., 2007; Van den Berg et al., 2009; Molina, 2012; Currie & Vogl, 2013). As Randall Kuhn (2012) observed, "Improvements in basic human development can alter the shape of the human life course, creating entirely new patterns of human capital formation, savings, and time use" (p. 653). Given the higher prevalence of stunting in low and middle-income populations, particularly in developing countries, prioritizing these regions becomes imperative (Black et al., 2020).

Energy poverty may disproportionately affect women and girls, who are often tasked with collecting traditional energy sources including biomass fuels such as wood, agricultural residues, and animal waste (Leduchowicz-Municio et al., 2023; Iddrisu et al., 2024). This gendered burden has severe health and socioeconomic consequences. Women and girls can spend several hours daily on fuel collection and cooking, exposing themselves to high concentrations of polluted fumes and increasing their risk of respiratory diseases and injuries from carrying heavy loads (Haddad et. al, 2021). Household air pollution, primarily caused by relying on traditional fuels, is the fifth leading risk factor for morbidity among women in low and middle-income countries, compared to being eighth among men, and is responsible for 60% of premature deaths among women and children (Haddad et. al, 2021).

In addition to health risks, the time-intensive nature of fuel collection limits women's and girls' access to education and economic opportunities. For girls in low-income countries, the burden of energy-related household tasks contributes to their 'time poverty,' reducing girls' school enrollment rates and educational attainment, and preventing them from pursuing other personal development or income-generating activities. This perpetuates gender inequalities and reinforces

a cycle of disadvantage that limits women's future opportunities for advancement (Iddrisu et al., 2024).

Energy poverty thus poses profound disadvantages for families, particularly affecting the physical and mental health and cognitive development of children. Despite childhood being a critical period of vulnerability, there is a notable lack of empirical research on the relationship between energy poverty and childhood development in energy-poor countries (Karmaker et al., 2022; Byaro et al., 2024). In Sub-Saharan Africa and South Asia, existing research highlights that limited access to electricity, clean fuels and cooking facilities exacerbates health risks and developmental challenges. For instance, inadequate access to clean cooking facilities is linked to a higher prevalence of respiratory diseases due to indoor air pollution, while the lack of reliable electricity hampers the provision of essential health services and limits educational opportunities for children (IEA, 2019; ESMAP, 2020; Seforall, 2020). Evidence from China and India has demonstrated the adverse impact of energy poverty on the subjective well-being of children, primarily through adverse health outcomes such as respiratory illnesses and diminished academic performance caused by poor lighting and energy shortages (Rafi et al., 2021; Zhang et al., 2021a). In the Northern Mediterranean, studies have linked energy poverty to poor mental health, higher rates of asthma, and increased childhood obesity (Oliveras et al., 2021).

In the MENA region, energy poverty has been closely linked to income poverty, particularly in North Africa, Yemen, and parts of the Levant, where lower-income households struggle to afford reliable energy access (Hamed & Peric, 2020; Belaïd, 2022). Geography has also played a significant role, as urban areas typically enjoy better access to modern fuels and electricity compared to rural regions, where energy supply remains insufficient and unreliable (El-Katiri, 2014).

Climate change also presents a health risk to vulnerable households, particularly in relation to food security. The continuous rise in surface temperatures, coupled with more frequent and intense heatwaves and precipitation events is projected to have profound implications worldwide. These effects include reduced water availability, compromised food security, infrastructural damage, and decreased agricultural incomes. Notably, low and middle-income countries are expected to bear a disproportionate burden due to their heightened vulnerability to economic slowdowns and food shortages, exacerbating poverty and potentially escalating conflicts (Louis & Hess, 2008).

The repercussions of climate change for agriculture manifest themselves in a loss of aggregate crop production, with tropical and temperate regions relying on rainfed agriculture facing the strongest impact (Challinor et al., 2014). Among these regions, developing countries in Africa stand out as particularly vulnerable, experiencing adverse effects on agricultural production due to erratic rainfall patterns and soaring temperatures (Davenport et al., 2017). Frequent flooding, droughts, and extreme heat further challenge families which are dependent on subsistence farming to meet their nutritional needs. Given that children in developing regions, especially in impoverished communities, are already susceptible to food and nutritional insecurity, understanding the potential impact of climate change on their nutritional status is critical.

Climate change and extreme weather events interact with energy poverty, amplifying the health vulnerabilities of at-risk populations, particularly children. Climate change intensifies energy

poverty in several ways. First, increasingly extreme summers and winters, as well as localized temperature spikes, may directly exacerbate the experience of energy poverty of those who were already exposed to it. Second, extreme temperatures place significant strain on energy producers and distributors to meet heightened cooling and heating needs. Extreme weather events such as storms and floods also damage energy infrastructure, leading to disruptions in energy supply and access. In some cases, entire communities are cut off from the energy grid for extended periods, thrusting them into energy poverty or further deepening their preexisting deprivation.

Measuring the impacts of energy poverty on various social groups is subject to inherent challenges, particularly amid climate change and particularly in developing countries (Rafi et al., 2021; İpek & İpek, 2024). Dong et al. (2021b) highlighted the role of low-carbon energy transitions – and particularly government policies in promoting renewable energy technologies and reducing dependence on solid fuels – in reducing energy poverty and its health effects in China. While the impact of energy poverty on children's health has been explored in other regions, there is a notable lack of empirical evidence from the MENA region. Research into the repercussions of transitioning to low-carbon energy sources – such as electrification and promotion of natural gas and renewable energy – for energy-poverty alleviation also remains limited (Dong et al., 2021a; Karpinska & Śmiech, 2021). The following section and Table A1 in the appendix review the existing scholarship most relevant to our undertaking.

Our study addresses the gaps in literature by being the first to empirically analyze the relationship between energy poverty, extreme weather occurrences, and children's health outcomes in the MENA region, particularly in the context of climate change. The paper contributes by estimating the degree of households' energy poverty, interacting it with the households' exposure to extreme temperatures locally, and estimating their effects on children's health outcomes. We consider three alternative measures of energy poverty: the Multidimensional Energy Poverty Index (MEPI) developed by Nussbaumer et al. (2012, 2013), a distinct Multidimensional Energy Poverty Principal Component Analysis (MEP PCA) index, and a simple measure of households' use of clean energy sources for cooking. High-resolution data on recent, local maximum temperature anomalies (Baker & Anttila Hughes, 2021; McMahon & Gray, 2021; Thiede & Gray, 2020; van der Merwe et al., 2022) are matched to households at the level of provinces. The acute and more cumulative effects of energy poverty and extreme temperatures are then estimated for children's anthropometric development and health outcomes. Children's outcomes are measured using four key indicators: stunting and wasting among children under five, neonatal mortality within 28 days of birth, and infant mortality before the children's first birthday.

The energy–climate–development nexus is evaluated using 22 health surveys from across ten MENA countries – Algeria, Comoros, Egypt, Iraq, Jordan, Mauritania, Morocco, Palestine, Tunisia, Turkey – and over time (Figure A1 and Table A2 in the appendix). These surveys represent a variety of socioeconomic, political, cultural and energy-poverty challenges across the region. For most countries we rely on two most recent survey waves, allowing for a comparative assessment of trends in children's health outcomes and the effects of indoor climate conditions and climate change across the MENA region and over time. Using multivariate regression models for limited dependent variables, we estimate the effects of energy poverty and extreme temperatures on children's health outcomes. The models account for child demographics (age,

gender), family characteristics (wealth index, mother's and father's education) as well as regional differentials (urban/rural areas, and governorate/state of residence).

The rest of this study is organized as follows: Section 2 presents a literature review on existing approaches to energy poverty measurement and on the impacts of climate conditions on children's health. Section 3 describes our data and methods used for evaluating our hypotheses. Section 4 discusses the empirical results and their robustness. Finally, Section 5 summarizes the key findings and highlights their policy implications.

2. Literature review

Energy poverty has gained serious attention in recent scholarship and policy deliberations due to its critical impact on various aspects of individuals' wellbeing, including health and education outcomes, and economic empowerment. Recent research has also examined the interplay between energy transitions and wellbeing.[1]

Energy poverty has been found to exacerbate gender inequality, disproportionately affecting women and girls. Women and girls have historically shouldered the responsibility of gathering traditional energy sources, such as firewood and biomass, and using them for food preparation. These tasks not only expose them to health risks but also limit their access to educational and developmental opportunities, perpetuating cycles of inequality (Hamed and Peric, 2020). Hence, decarbonization implemented by transitioning to cleaner fuels, is likely to yield major benefits for vulnerable groups, including rural residents and women (Batool et al., 2022; Zhang et al., 2022; Iddrisu et al., 2024).

Energy poverty can be measured using various approaches, each focusing on different aspects of access to and utilization of energy. These methods range from income-based indices to multidimensional assessments of energy service access, and each offers insights into the impact of energy poverty on different population groups and different outcomes. Boardman (1991) introduced a single index approach based on household energy expenditure relative to total expenditure. This approach emphasizes the financial strain on households lacking access to affordable energy. Banerjee et al. (2021) advanced an energy development index gauging households' access to electricity and energy consumption. Xie et al. (2022) introduced the concept of energy poverty line – set at twice the median ratio of the household heating expenditure to income – and assessed statistics including energy poverty gap, breadth, and depth. The International Energy Agency (IEA, 2011) focused on the transition to modern fuels as a key indicator of energy poverty, recognizing the role of cleaner, more efficient energy sources in improving living conditions. Nussbaumer et al. (2012, 2013) developed a MEPI assessing deprivation in accessing modern energy services including electricity network, clean cooking fuels and facilities, and heating. Amin et al. (2020), Rafi et al. (2021) and Zhang et al. (2021a) expanded on the multidimensionality of energy poverty by considering factors such as electricity access, and energy consumption patterns.

[1] Table A1 in the appendix provides a concise overview of the evolving definition of energy poverty and its observed associations with children's health, economic development and energy transition.

A group of studies have evaluated the prevalence and depth of energy poverty and their effect on population health. Banerjee et al. (2021) confirmed the association between energy poverty and lower health and education outcomes, and higher child mortality, across 50 developing countries. Access to electricity exerted a stronger influence than actual energy use. In Turkey, energy poverty measured by inadequate heating was found to adversely impact health and out-of-pocket expenditures of the exposed individuals, calling for policy action at the level of households, such as improving housing conditions and insulation (Kose, 2019). In Vietnam, despite economic growth, energy poverty was found to persist, particularly among the economically disadvantaged and ethnic minorities, who continue relying on traditional energy sources (Nguyen et al., 2019). Similarly, in South Asia, energy poverty levels remain high, with Bangladesh and Afghanistan facing significant challenges due to a shortage of modern cooking fuels, with over 80% of households, concentrated primarily in rural areas, relying on contaminated traditional sources such as firewood and animal dung, and having inadequate ventilation (Abbas et al., 2021). The Maldives and Pakistan, by contrast, stood out as facing low energy deprivations, with few households lacking access to electricity. The cross-country analysis revealed that energy poverty in South Asia was closely related to socioeconomic outcomes including women's obesity, households' water sources, access to mosquito nets, sterilization conditions, educational level, marital status, and occupation (Abbas et al., 2021).

Extreme weather conditions have also been confirmed to affect child health outcomes, even before children's birth. In Gambia, pregnancies conceived during periods of low precipitation have been associated with shorter gestation periods and increased risk of preterm birth (Rayco-Solon et al., 2005). In Mali, extreme temperatures and reduced agricultural production have been linked to lower birth weights, while in South Asia, precipitation extremes during a child's first year of life have been associated with stunting, particularly in underprivileged households (Grace et al., 2021; McMahon & Gray, 2021).

Across Sub-Saharan Africa temperature and precipitation anomalies have had adverse effects on child weight, with high temperatures associated with lower weights and an increased risk of wasting, and low precipitation linked to weight reduction (Thiede & Strube, 2020). Rainfall shocks have also affected children's growth, with droughts resulting in decreased growth rates, particularly among children aged 12–24 months (Hoddinott & Kinsey, 2001), and increased stunting levels in children aged 1–5 years (Grace et al., 2012). Similarly, in the Nile Basin countries, precipitation and temperature anomalies have been linked to the risk of stunting, but the effects varied across Egypt, Ethiopia and Uganda (Elayouty et al., 2022).

These findings from across developing countries in South Asia and Sub-Saharan Africa – and their variation across national and sub-national contexts – underscore the need for further research in the understudied and heterogeneous MENA region. We hope to address the knowledge gap using a comparative approach on ten countries and two points in time accounting for both indoor energy and climate conditions and outdoor extreme temperature variations.

3. Methods and data

The following analysis investigates the effects of energy poverty, and their mediation by extreme weather events, on the prevalence and incidence of inadequate anthropometric development and mortality among MENA region children. Our research questions are:

1. How have energy poverty and the occurrence of extreme weather events evolved over the past decade across MENA countries? How have the anthropometric outcomes and mortality of local children evolved during the same times?
2. Which demographic and economic groups are the most vulnerable to indoor and outdoor climate conditions?
3. How are energy poverty and children's outcomes associated? What are the impacts of energy poverty on children's anthropometric development and their neonatal and infant mortality?
4. Do extreme weather events mediate the effects of energy poverty on children's outcomes?

The following subsections describe our data sources and the specific empirical methods used for the analysis.

3.1. Data

The study relies on a set of 22 standardized, nationally-representative population and health surveys from ten MENA countries, namely: Algeria (2012–13, 2018–19), Comoros (2012, 2022), Egypt (2014, 2021), Iraq (2011, 2018), Jordan (2012, 2017–18), Mauritania (2015, 2019–21), Morocco (2011, 2018), Palestine (2014, 2018–19), Tunisia (2011–12, 2018) and Turkey (2013, 2018–19). These surveys are generally taken from the UNICEF-coordinated Multiple Indicator Cluster Surveys (MICS) program and the US AID-coordinated Demographic and Health Surveys (DHS). The only exceptions are the Egyptian Family Health Survey (FHS), and Moroccan Surveys from the Pan-Arab Project for Family Health (PAPFAM) and National Survey on Population and Family Health (NSPFH), as summarized in Table A2 in the appendix. The surveys differ in their sample sizes, data completeness and missingness, and format and coverage of some variables, but efforts have been undertaken by the respective data providers and by the authors to harmonize the key variables and ensure comparability.

The surveys encompass a broad spectrum of indicators related to living conditions, education, health, nutrition, and time-use of the national population, with a particular emphasis on the living conditions of young children and their mothers. The surveys include variables related to indoor air pollution, access to electricity, and modern fuels and cooking facilities. The comprehensive datasets thus provide an ideal foundation for studying the health and anthropometric development outcomes of young children amid climatic challenges facing households.

Children's health, the outcome of interest, is measured using four indicators: Neonatal mortality refers to the death of a newborn within the first 28 days after birth; Infant mortality is the death within the first year of life after birth; Stunting means extremely low height for age and wasting means extremely low weight for height, using the World Health Organization's (WHO) 2006 global growth standards for children under the age of five years (de Onis *et al.*, 2006; Leroy,

2011).[2] These four health outcomes can be analyzed across cohorts of children, at different ages, to flag instability or poor safety of food prepared at home, chronic or repeated experience of illnesses, and overall child well-being.

Table 1 reports the prevalence of negative child-health outcomes across our surveys. Mauritania 2021 is shown to have the highest stunting rate at 25.21% and Turkey 2019 the lowest rate at 5.97%. Stunting rates declined or stagnated (with only slight increases in Mauritania, Morocco, Palestine and Tunisia) in all countries. Infant mortality was also highest in Mauritania, reaching 7.71% in 2011 but declining to 3.85% by 2021 – which was still the highest among all countries and years. The lowest infant mortality rate was observed in Tunisia and Jordan in 2023, at 1.4%. In fact, infant mortality declined or stagnated over the years in all countries except in Egypt where it doubled from 1.48% in 2014 to 3.06% in 2021. The trends in children's wasting and underweight are analogous to those for stunting, and neonatal mortality also generally tracks the trends in broader infant mortality.

Table 1. Summary statistics of extreme temperature occurrences, and children's health outcomes in regression samples

	Stunting (%)	Wasting (%)	Under-weight (%)	Infant mortality (%)	Neonatal mortality (%)	Temperature extremes up to 9 months pre birth (% deviations from long-term norms)	Temperature extremes up to 12 months post birth (% deviations from long-term norms)
ALG '13	9.33	3.60	3.44	2.21	1.59	-.337	-.221
ALG '19	8.05	2.46	2.89	2.25	1.90	.211	.222
COM '12	29.61	11.12	15.59	3.26	2.06	-.226	-.116
COM '22	14.10	4.82	11.74	2.98	1.84	.312	.356
EGY '14	17.74	7.85	6.85	1.48	1.09	.104	-.004
EGY '21	12.80	3.12	3.77	3.06	1.92	.009	-.213
IRQ '11	21.73	6.41	6.89	3.63	1.97	-.069	-.293
IRQ '18	9.89	2.45	2.94	2.59	1.53	.225	.495
JOR '12	7.65	2.43	3.01	2.44	1.45	-.054	-.017
JOR '18	--	--	--	1.57	1.13	-.116	-.025
JOR '23[a]	8.00	2.00	--	1.40	0.90	--	--
MRT '11	25.28	13.22	28.29	7.71	3.43	-.096	.002
MRT '15	23.52	14.02	30.18	4.96	3.25	-.219	-.106
MRT '21	25.41	6.15	16.55	3.85	2.17	.304	.357
MAR '11	15.62	2.38	3.32	2.70	1.95	-.215	-.312
MAR '18	15.88	3.15	3.08	1.74	1.24	.345	.279
PAL '14	7.39	1.19	1.39	2.22	1.17	.291	.258
PAL '20	8.72	1.33	2.12	1.93	1.03	.276	.281
TUN '12	10.13	2.76	2.33	2.33	1.39	-.210	-.241
TUN '18	8.27	2.07	1.52	1.45	0.70	.199	.240
TUN '23	13.50	3.14	3.14	1.43	0.83	-.164	-.007
TUR '13	9.54	1.74	2.10	3.22	0.73	-.459	-.136
TUR '19	5.97	1.67	1.58	2.82	0.89	.381	.306

Notes: Child samples are nationally weighted. Temperature extremes evaluated on sampling-weighted children's sample. [a] Initial figures as per Key Indicators report. "--" indicates missing survey data.

Explanatory variables in the analysis include households' wealth, the level of educational achievement of mothers and their partners (or children's fathers or household heads, depending on data availability), household's residence in rural versus urban areas, residence in individual

[2] Children's measurements are converted into standard deviations from the reference population with a healthy median and variance, and values two or more standard deviations below the median are flagged as stunting or wasting. The conversion is done using the *zscore06* automatic do-file program in Stata. *zscore06* takes children's height and weight, age in months, sex, and an indicator for whether the children were recumbent or standing while measurement was taken. These indicators are available in all health surveys used here.

administrative regions[3], and gender of the child and of the household head.[4] Household wealth is defined by quintiles based on the asset index of durable goods imputed by principal component analysis (Hlasny & AlAzzawi, 2019). Households' energy poverty is proxied by three alternative indices (refer to the next subsection) constructed using survey variables enumerated in Table 2.

Table 2. Key household energy variables in health surveys (binary indicators)

Exposure to non-clean fuels	Lack of electricity
- solid fuel used for cooking (charcoal, wood, straw/shrubs, dung, crop residue, garbage, other) - solid fuel used for space heating (charcoal, wood, straw/shrubs, dung, crop residue, garbage/plastic) - fuel used for lighting includes gasoline, kerosene, oil, candle or fire - cooking not done in a separate room from living quarters - households that cook have no chimney or hood - in child labor, child is exposed to dust, fumes, gas, extreme cold, heat or humidity - clean fuels (electricity, liquefied petroleum gas LPG, natural gas, biogas) are not used	- no access to electricity - lack of household appliances whose use depends on reliable energy (refrigerator/freezer, radio, television, telephone/mobile) - no electric lighting at home

Children's exposure to outdoor weather extremes is evaluated during the nine prenatal months and during the first two years of life. Children's experiences in these periods may lead to disruptions in their anthropometric growth or even to mortality (McMahon and Gray, 2021). Weather extremes variables are derived from geographically-gridded daily meteorological and anthropogenic data. Specifically, maximum temperature data are extracted from the National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center (CPC) in the form of Global Telecommunications System (GTS) data. The data are geospatially gridded using the Shepard (1968) algorithm. CPC global unified temperature data are of 0.5° × 0.5° geographic resolution, spanning the period 1979-01-01 to present. These data were obtained in the network common data form (NetCDF), extracted and analysed using geographic information system (GIS) and statistical software – ArcGIS and R. Time-standardized shapefiles from the Global Administrative Boundaries model (GADM) database and the extracted weather data were combined to compute the spatial means of maximum temperatures in degrees Celsius (°C) for each month from January 2005 to April 2024, for each province.[5] In each national province, the running 9-month (pre-birth) and 12-month (post-birth) means are transformed into deviations from historical means for the same months. These are interpreted as exogenous anomalies from locally familiar climate conditions.

The rightmost columns in Table 1 illustrate. In eight countries, the extremes have been above historic local norms (when evaluated both during pre-natal and post-natal months). Only in Jordan and Tunisia we see negative trends. This points to a region-wide destabilization of weather conditions over the past decade.

[3] They are typically governorates (henceforth, provinces), varying in size and count across MENA countries. They include 7 *espace de programmation territoriale* in Algeria, 25 governorates in Egypt, 3 islands in Comoros, 18 governorates in Iraq, 12 governorates in Jordon, 12 *wilaya* in Mauritania, 14 regions in Morocco, 16 governorates in Palestine, 9 regions in Tunisia, and 12 regions in Turkey. The North and South Sinai governorates in Egypt '14 are excluded from the analysis due to their idiosyncratic status as 'frontier provinces,' for which some data are not reported at the governorate level.

[4] The small group of women who head their own households is made up of women who are widowed, self-employed, reliant on remittances from relatives abroad, or divorced. As a result of this heterogeneity of circumstances of female household heads, estimates of the effects of household-head gender should be viewed with caution (AlAzzawi et al., 2024).

[5] GADM.org provides maps and spatial data for all countries and at various levels of sub-division. It provides data at high spatial resolutions that includes an extensive set of attributes.

These deviations are suspected to be stronger predictors of population health outcomes than, say, raw temperature levels (Gray & Wise, 2016; Nordkvelle, Rustad, & Salmivalli, 2017; Mueller et al. 2020; Thiede & Strube 2020; Nicholas et al. 2021). The constructed monthly climate anomalies are linked to children's prenatal and first-year outcomes based on their month of birth (including for deceased children) and province of residence.

3.2. Methods

Energy poverty index: Households' energy poverty is derived alternatively using the MEPI, the regionally tailored Multidimensional Energy Poverty Principal Component Analysis (MEP PCA), and a binary indicator for households' use of dirty energy sources for cooking.

We adopt the MEPI framework based on the Alkire–Foster aggregation approach (Alkire and Foster 2011; Nussbaumer et al. 2012), which is supported by up-to-date evidence in academic and international-organization studies (Nussbaumer et al. 2013; Mendoza et al. 2019; Zhang et al. 2019; Siksnelyte-Butkiene et al. 2021) and appears to be relevant to middle-income MENA countries. At the national level, the index ($M_0 = H \times A$) is computed as a product of the headcount ratio of multidimensional energy poverty ($H = \sum 1[MEPI > 0.3]/N$) and average intensity of that poverty ($A = \sum 1[MEPI > 0.3] \times MEPI$), where the summations are over the entire population N, and $MEPI$ is the weighted sum of energy deprivations of a person, as follows:

$$MEPI = {}^{0.6}/_{3} \times (Cooking\ Fuel\ +\ Open\ Stove\ +\ Electricity) + {}^{0.4}/_{3} \times (Fridge\ +\ Radio/TV\ +\ Phone) \quad (1)$$

$Cooking\ Fuel$, $Open\ Stove$, $Electricity$, $Fridge$, $Radio/TV$ and $Phone$ are binary indicators of the six respective energy deprivations, with the first three assigned 50% higher weights as those of the latter three. (The deprivation 'depth' cutoffs according to the Alkire–Foster approach are set at '<1' of the binary variables.) Individuals' $MEPI$ ranges from 0 to 1. The cutoff for poverty (the 'intensity' cutoff in the Alkire–Foster approach) is set at 30% of the weighted energy deprivations, at $MEPI > 0.3$. Individual-level subscripts are omitted for clarity of presentation. It should be noted that all members of a household including children are assigned the same $MEPI$ scores, and these scores in their continuous form enter the regression analysis. The inputs – indicator definitions and weights – and the results of the MEPI framework are validated for their normative relevance in the MENA context and their satisfactory statistical properties in the surveys used.

One limitation of MEPI and M_0 is that they are global indices, with fixed components that would have to be adjusted manually to tailor the index to the MENA context. As an alternative continuous index derived from the surveys at hand, we conduct the Multidimensional Energy Poverty Principal Component Analysis (MEP PCA) (Robertson et al. 2019; Gupta et al. 2020; Jayasinghe et al. 2021), which derives the indicator weights endogenously from the joint distribution of indicators across individuals. We derive MEP PCA scores as the weighted sum of energy-deprivation indicators – as in MEPI – where the weights come from the loading factors estimated endogenously in the first component of the PCA. These loading factors are fitted according to how much each indicator varies across individuals, thus informing on maximum discrimination in energy-deprivation profiles across individuals, and maximizing sample variance of the resulting

scores. At the national level, we can report the average score ($\overline{MEP\ PCA} = \sum MEP\ PCA/N$) across all N individuals.

Construction of our MEP PCA scores is validated using several statistical criteria. The eigenvalue of the first principal component exceeds by far the eigenvalues of the following components, suggesting that this first component is adequate at differentiating individuals according to their energy-deprivation profiles, and using alternative sets of components would not change the imputed energy-poverty scores substantially. The Kaiser-Meyer-Olkin measures of sampling adequacy, evaluating the proportion of variance among indicators common to them exceed 0.60 in all surveys, suggesting that the indicators are adequate to perform the PCA. The Bartlett tests of sphericity, determining whether the correlation matrix used for factor analysis is an identity matrix, rejects the null hypothesis of zero correlation across the indicators, implying that indicator correlations are not due to sampling error and justifying the use of these indicators (Cureton & D'Agostino,1983). Also worth noting, factor loading across the six indicators are normatively plausible and are qualitatively similar across surveys, validating the outcome of the exercise.

Finally, as yet another alternative proxy for individuals' energy poverty relevant in MENA countries, we also use a binary indicator for households' use of dirty energy sources for cooking, and we can report its mean in the population. The fact that all survey variables used for the construction of MEPI, MEP PCA and the dirty fuels indicator are binary, and non-cardinal facilitates certain comparability between the indices. Table 3 illustrates the alternative measures of energy deprivations and their selected aspects at the national level, across all surveys. Figures A2 and A3 in the appendix illustrate. Mauritania 2015 is seen with the highest M_0 score of 0.620, followed by Comoros 2012 with a score of 0.592, both of which far exceed the values in other countries. This is on account of very high headcount ratios of energy poverty in the two countries. Half the surveyed countries witnessed a decline in M_0 over the years – most notably Comoros, followed by Jordan, Morocco and Palestine – and only Algeria saw an increase. These trends are confirmed by the $\overline{MEP\ PCA}$ and by the mean dirty fuels index. In fact, in most countries where dirty fuels are surveyed, they are critical contributors to energy poverty in M_0 and $\overline{MEP\ PCA}$, and in ten surveys they are the single most significant contributor compared to other components. Table A3 in the appendix reports summary statistics of other explanatory variables in regression samples.

Child health regressions: Next, we use multivariate probability regressions to estimate the effects of children's energy deprivation (as measured alternatively by MEPI, MEP PCA or a dirty energy indicator) on their health outcomes (stunting, wasting, infant mortality and neonatal mortality, respectively), accounting for outdoor temperature extremes, and various child and household circumstances X. Validity of these models assumes that child i's true health outcome $Health_i$ is a linear function $E(Health_i|x_i) = f(x_i, \beta) = x_i\beta$. This unobserved variable $Health_i$ is related to the observed dependent variable $Health_i$ as follows: $Health_i = 1[Health_i > 0] = 1[\varepsilon_i > -x_i\beta]$. Here ε_i accounts for other uncontrolled factors including the child caretakers' efforts and the child's luck. Under the commonly made assumption that ε_i follows the normal distribution, the maximum-likelihood probit model is appropriate for estimating $\Pr(Health_i = 1|x_i)$. Each child i's health status in province j at age t is estimated by the following probit model:

$$\text{Health}_{ijt} = \alpha + \beta\ \text{EnergyDeprivation}_{it} + \gamma\ X_i + \varphi\ Z_{jt} + \varepsilon_{ijt} \quad (2)$$

Here $EnergyDeprivation = \{MEPI, MEP\ PCA, dirty\ fuel\}$. $Health_{ijt}$ denotes child i's health outcomes for child i in province j at age t. X_{it} is a vector of other socio-economic determinants of i's health outcomes. Z_{jt} is the exposure to temperature extremes in i's province j at age t. While the main model specifications estimate the effects of EnergyDeprivation$_{it}$ and Z_{jt} separately, their complementarity is considered in supplementary models via an interaction term $EnergyDeprivation_{it} \times Z_{jt}$. (Refer to models 6 and 13 in Table 4, and Tables A15–A16 in the appendix.)

The regressions account for population sampling weights, and coefficient standard errors are corrected for arbitrary heteroskedasticity and correlation at the household level. The estimated probit coefficients are converted into average marginal effects (AMEs) at variable means, and the AMEs are compared across countries and years. Probabilities of health outcomes for all children are also estimated and compared across selected demographic groups – the two genders and lower versus upper wealth quantiles (refer to Figures 1 and 2).

Finally worth noting, households' energy poverty may be endogenous in models of the households' health status – because of omitted third factors (e.g., parents' disability, income poverty, residence in deprived circumstances, etc.), or family-health contributors to poverty. Previous studies have shown a possible connection where health status influences income levels, thus contributing to energy poverty (Awaworyi Churchill et al., 2020; Zhang et al., 2019, Zhang et al., 2021).

To mitigate this potential endogeneity, we adopt an instrumental variable (IV) two-stage approach with a 'donut' instrument for households' MEPI scores. The instrument is constructed as the average MEPI score of similar households in the same province–urban/rural area, same wealth quintile, during the same season – except the household in question, $\overline{MEPI_{-ijt}}$ (refer to Tables A4 and A18 in the appendix). Essentially, we view households' membership in these clusters as relatively exogenous. In each survey, there are 100–400 of such clusters. These clusters are associated with different supplies of fuels by government and by nature, and so they affect MEPI. Households' average MEPI in these clusters may not directly affect any specific child's health. Hence, the instrument has the desirable properties of satisfying the exclusion restriction in the structural regressions, and the relevance condition in the first-stage regressions (Tables A23–A24). Following the first stage regressions, the instrumented variables are linearly transformed to have the same minimum and maximum values as MEPI.

Table 3. Summary statistics of multidimensional energy poverty (%/100)

	M_0	Deprivation intensity, constrained among poor (A)	MEP headcount ratio (H)	Contrib. of dirty fuels to MEP	Contrib. of open stove × dirty fuels to MEP	Contrib. of no electricity to MEP	Contrib. of no fridge/ freezer to MEP	Contrib. of no radio/TV to MEP	Contrib. of no phone to MEP	Pearson's correlation of MEPI with wealth quintile	MEP PCA: 1st component score [0–1]	Dirty fuels (0/1)
ALG '13	.005	.492	.011	.085	.083	.139	.094	.065	.026	-0.247	.011	.005
ALG '19	.051	.426	.120	.196	.195	.008	.011	.008	.008	-0.363	.038	.128
COM '12	.592	.649	.911	.182	.101	.081	.108	.050	.127	-0.722	.636	.859
COM '22	.313	.542	.578	.191	.133	.045	.103	.053	.017	-0.681	.334	.602
EGY '14	.001	.417	.002	--	--	.065	.122	.123	.107	-0.211	.018	--
EGY '21	.001	.410	.002	.070	--	.042	.119	.109	.071	0.098	.013	.001
IRQ '11	.008	.501	.017	.144	.136	.087	.078	.036	.020	-0.276	.014	.012
IRQ '18	.001	.450	.002	--	--	.141	.133	.128	.048	-0.179	.007	--
JOR '12	.065	.910	.071	.171	.171	.189	.125	.121	.133	-0.117	.085	.061
JOR '18	.020	.665	.030	.197	.197	--	.131	.131	.009	--	.035	.030
MRT '11	.502	.700	.717	.167	.155	.169	.127	.055	.027	-0.846	.532	.601
MRT '15	.620	.648	.402	.124	.117	.193	.132	.067	.016	-0.838	.446	.385
MRT '21	.486	.698	.697	.178	.155	.159	.124	.068	.013	-0.869	.521	.640
MAR '11	.077	.482	.161	.125	.111	.106	.095	.022	.024	-0.636	.092	.102
MAR '18	.027	.500	.054	.143	.141	.081	.070	.039	.026	-0.384	.039	.039
PAL '14	.011	.518	.022	.168	.156	.009	.040	.024	.122	-0.369	.037	.019
PAL '20	.005	.456	.012	.174	.172	.016	.039	.045	.011	-0.364	.014	.011
TUN '12	.006	.490	.013	.067	.066	.083	.111	.088	.075	-0.314	.011	.004
TUN '18	.003	.472	.006	.046	.044	.077	.121	.105	.077	-0.194	.005	.002
TUN '23	.006	.650	.010	.101	.101	.094	.125	.117	.111	-0.272	.010	.005
TUR '13	.002	.503	.004	--	--	.200	.133	.133	.037	-0.175	.011	--

Notes: "--" indicates missing data for a particular dimension of MEPI. The rest of statistics are computed as if the missing contributions are zero. Turkey 2019 has no energy indicators.

4. Main results

The following subsections present the estimated effects of the main explanatory variables on children's health outcomes. Table 4 reports the marginal effects of energy poverty and temperature extremes – namely, MEPI instrumented, MEPI, MEP PCA, dirty cooking fuels, and temperature extremes pre/post birth – on respective health outcomes from models estimated on individual surveys. Table 5 then shows the results of selected models estimated on pooled survey waves in each country. (Tables A4–A20 present the full sets of results of the models in Tables 4–5 as well as additional models.)

Table 4 covers 15 alternative model specifications. *Model 1* mitigates endogeneity concerns in modeling child stunting by excluding the potentially endogenous parts of households' MEPI scores and using only the parts distilled through instrumenting. (*Model 8* applies the same approach in explaining infant mortality.) *Model 2* uses the MEPI score directly without instrumentation, providing a straightforward assessment of its effect on stunting. *Model 3* replaces the MEPI score with the dirty cooking fuels indicator; *Model 4* with the MEP PCA; and *Model 5* with the deviations in temperature extremes 9 months before and 12 months post birth. For completeness, *Model 6* controls for both the MEPI score and the temperature extremes 12 months post birth, as well as their interaction term, to assess the full nexus of energy poverty, climate change and health impacts. *Model 7* mirrors *Model 2* for children's wasting, as an alternative and more immediate outcome of health and nutrition deprivations. *Models 8 to 13* follow the same structure as Models 1 to 6, respectively, for infant mortality. Finally, *Model 14* focuses on the effect of the MEPI on neonatal mortality, again as a more immediate outcome of severe deprivations, and *Model 15* examines the effect of temperature extremes in the first 12 months post birth on neonatal mortality.

Table 5 takes the most theoretically relevant and parsimonious models from Table 4 (namely Models 2, 5, 9 and 12) and re-estimates them on pooled surveys for each country as Models 16–19.

4.1. Anthropometric development models

Stunting, a key indicator of chronic malnutrition, reflects both immediate and long-term impacts on children's health, cognitive development, educational attainment, and overall well-being. The results of Models 1–6, as seen in Table 4 and especially in Tables A4–A9 in the appendix, reveal several consistencies regarding the climate effects on children's health outcomes. The large number of observations and clusters ensures the reliability and robustness of the estimated marginal effects, enhancing the statistical validity of the findings. Model statistics confirm a high degree of model fit and show that the selected covariates explain children's probability of stunting significantly.

We first take a cautious view that MEPI score may be endogenous in regressions of children's health, so we instrument for it using MEPI score of other comparator households (as described in section 3.2). Model 1 shows that the instrumented MEPI – as a proxy for the energy deprivations experienced by children – has a positive significant effect on the likelihood of children's stunting in ALG '13, IRQ '18, MAR '11 and TUN '12, but negative significant in EGY '14 and TUN '23.

In the rest of the surveys, the effect is insignificant, although it is positive in more than half of the cases.

In Model 2, assuming away the potential endogeneity of the MEPI to check whether this improves the models' significance, we use MEPI directly without instrumenting. In fact, the omission of instrumenting has no effect on the coefficient standard errors. Model 2 confirms that countries such as MAR '18, MRT '15, PAL '14 and TUN '11 show a positive significant effect of MEPI on children's stunting, while the effect is insignificant but for the most part positive in the rest of surveys. This suggests that energy poverty, characterized by limited access to modern energy sources, tends to exacerbate the risk of malnutrition, particularly in resource-constrained country settings.

The following models use alternative measures of energy deprivation. In Model 3, the simple binary indicator of dirty cooking fuels is insignificant in all but one survey but has a (weak) positive effect in the vast majority of surveys. In Model 4, MEP PCA score has a positive significant effect in ALG '13, MAR '11, MAR '18, MRT '15 and TUN '12, and again an insignificant positive effect in most of the other surveys. Generally, MEP PCA exhibits slightly weaker performance compared to the MEPI or the instrumented MEPI at predicting stunting.

Model 5 shows the effect of temperature extremes 9 months prior to birth and 12 months post birth on stunting. They are jointly significant positive in JOR '12, PAL '14 and TUN '12, but have mixed or negative significant signs in COM '22, IRQ '18, MRT '15, MRT '21 and TUR '19. Temperature extremes 12 months post birth tend to have positive effects in more surveys, suggesting that early post-birth climate conditions may be of greater concern to anthropometric growth than pre-birth conditions. Adding an interaction term of MEPI and temperature extremes 12 months post birth, in Model 6, leads to more significant positive effects of MEPI across most surveys – particularly in MAR '18, MRT '15, PAL '14, PAL '20, TUN '12, and TUN '18. The effect of the extreme temperatures also becomes more consistently positive across surveys, especially COM '22, MAR '18, TUN '12 and TUN '18. The interaction term itself is largely insignificant and of either sign across surveys, suggesting that the effects of the respective variables do not universally strengthen/complement or mitigate/replace each other.

For completeness, Model 7 extends the analysis to an alternative anthropometric indicator, child wasting. The results are very weak, positive but insignificant only in half the surveys. The full results of Models 1–7 are presented in Tables A4–A10. These reveal some interesting patterns about demographic and socioeconomic covariates, but these results are outside the scope of our analysis, and are only briefly discussed in the appendix.

4.2. Infant mortality models

Models 8–15 are concerned with the analogous effects of energy deprivation on child mortality, controlling for children's demographics and socioeconomics. It should be noted that mortality models account for only those factors that are available for both living and deceased children. Moreover, because infant deaths are relatively rare (refer to Table 1), we are restricted to using only those covariates that vary adequately in both outcome groups.[6] As a result, the results are

[6] For instance, there are incidentally no infant deaths in female headed households in TUN '12, so this factor is omitted.

weaker than those for children's stunting. In Models 8–11, according to the MEPI (instrumented or not), dirty cooking fuels or MEP PCA, energy deprivation is associated positively with infant mortality in most surveys, significantly in MAR '18, TUN '12, TUN '23 and TUR '13. MEP PCA also has a significant positive effect in IRQ '18 and PAL '20.

In Models 12 and 13, extreme temperatures 9 months before birth tend to have a weak negative effect on infant mortality (significant in IRQ '11 and '18, MRT '21, PAL '14 and TUR '19, but positive significant in COM '22). The effect of extreme temperatures 12 months post birth differs across surveys, with positive significant effects in COM '12, IRQ '18 and MRT '15, but negative significant effects in EGY '12, IRQ '11 and JOR '18. Partialling out the effects of extreme temperatures, in Model 13, does not appear to affect the estimates on MEPI consistently across surveys. MEPI has a significant positive effect only in MAR '18 and TUN '12, but a significant negative effect in COM '22.

In lower-income and conflict-affected settings such as COM '12, IRQ '18 and MRT '15, the results on temperature extremes may suggest the vulnerability of the population to agricultural output amid climate variability. As crop production declines because of climate change, tropical and poor-governance societies that depend on rain-nourished agriculture are most affected. Developing nations in North Africa are particularly vulnerable among the countries considered, with unpredictable rainfall patterns and extreme temperatures having negative impacts on agricultural output (Davenport et al., 2017).

The last models, Models 14 and 15, evaluate the effect of energy deprivation or temperature extremes on neonatal mortality as a more immediate health impact compared to broader infant mortality. The estimated effects are small economically and insignificant throughout. All in all, the results in Table 4 (and Tables A4–A18) suggest that energy deprivation has modest positive effects on longer-term anthropometric growth (i.e., stunting) across most countries, but the effects on shorter-term or more acute health indicators, including wasting and mortality, are limited. For the more serious health outcomes and risks of dying, other factors presumably play much more critical roles.

Comparing the results for alternative measures of energy deprivation, MEPI appears to be marginally stronger at explaining children's outcomes than MEP PCA, and clearly more relevant than other measures of indoor/outdoor environmental conditions including the dirty cooking fuels and extreme temperatures. Among the most significant models corroborating the deleterious effect of energy deprivation on children's health is one allowing for the interaction between MEPI and temperature extremes. Disentangling the effects of indoor and outdoor climate conditions seems to help distilling the effect of the indoor deprivations – by reducing error variances – even though there is no clear complementarity or offsetting between them.

Finally worth noting, the marginal effects have been compared across the survey waves for the same countries, and we find that the effects typically increase weakly over time. This, taken together with the time trends in energy deprivation and weather extremes (Tables A2–A3), suggests a greater vulnerability of children's health to environmental conditions. The following section evaluates this more directly by pooling survey waves together.

4.3 Pooled-survey regressions

Pooling the survey rounds in each country allows us to control for unobserved country-specific factors that are time-invariant, such as living norms, institutions, or geographic characteristics, which could potentially influence childcare and nutritional habits and other practices that affect children's health and mortality. (The one survey for Jordan is included for completeness, but the results are identical to those in Table 4). Pooling survey rounds also increases the overall sample size and variation in the explanatory variables, thereby potentially improving the precision of the estimates and enhancing the statistical power of the analysis. Substantively, this allows us to examine both cross-sectional variations and longitudinal variations in the data, providing valuable insights into how the relationship between energy deprivation, temperature extremes and child health outcomes vary across different development contexts.

Table 5 and Figures 1–2 take stock of the evidence in Table 4, and present the results of selected pooled regressions, using MEPI for indoor climate conditions (Models 16 and 18) or temperature extremes for outdoor climate conditions (Models 17 and 19). We again control for the full set of household characteristics including the administrative regions of residence. The results again confirm that MEPI has a positive effect in all countries but Iraq, significant for Morocco, Palestine and Tunisia.

In Model 17, the occurrence of extreme temperatures in the 9 months before birth has no clear association with children's stunting rates. The association is negative significant in Iraq and Mauritania, but positive significant in Jordan and Palestine. Extreme temperatures in the 12 months after birth are associated positively with stunting in Egypt and Tunisia, but negatively in Iraq. The joint significance tests on the two temperature-extremes variables do not resolve the mixed results. In Egypt, Jordan and Palestine, the two temperature-extremes variables are jointly significant and pointing to clear detrimental effects of climate change on stunting, but in Iraq and Mauritania they point significantly toward the unexpected negative effects on stunting.

Models 18 and 19 show the equivalent pooled-survey analysis for infant mortality. Energy deprivation as measured by MEPI is shown to have mixed effects across the countries, only significantly positive in Tunisia and Turkey. İpek and İpek (2024) also identified a significant impact of energy poverty on health in Turkey between 2018 and 2021. Lastly, Model 19 corroborates the unclear association from Table 4 between extreme temperatures (both before and after birth) and children's mortality. The two variables jointly (significantly) only point to a positive effect on mortality in Comoros, while they point to a negative effect in Palestine, Tunisia, and partially in Iraq. The weak results for infant mortality broadly are perhaps not surprising, since in most countries infant mortality has been on decline due to factors such as rising income, improving access to healthcare, lifesaving vaccines, and cleaner water and sanitation. Our analysis essentially tries to distill how the ever more extreme temperatures may be slowing the already very strong worldwide secular trend, and clearly their partial explanatory power is weak. As we concluded in Table 4, outdoor and particularly indoor climate conditions appear to have gradual detrimental effects on less severe health outcomes, but little effects on acute, immediately-observable outcomes – perhaps a silver lining to a grim story.

Figures 1 and 2 visualize the estimated effects and confirm the detrimental stunting effects of MEPI in most countries - particularly Algeria, Comoros, Morocco, Mauritania, Palestine, Tunisia and Turkey, but weaker mortality effects - mostly in Algeria, Morocco and Tunisia.

4.4 Research limitations

The analysis described above has various limitations that should be addressed in follow-up research. There are geographical data restrictions due to the fact that DHS data include only 'admin1' variables for provinces, while 'admin2' and 'admin3' variables, reflecting districts and sub-districts, are available only in shapefiles and not included for all survey waves.

Similar reservations apply to DHS geospatial covariate datasets. Jordan is the only country with detailed province-level variables in the main DHS dataset. This limits data merging with satellite images at finer disaggregations. DHS data providers should emphasize improving the quality and comprehensiveness of data, especially geographical locations, to facilitate merging with climate change and natural disaster datasets. Harmonization of variable names in DHS would also assist with further research. There should be standardized variable names across different countries and survey rounds to ensure consistency and ease of data integration.

Following research should explore gender differentiation regarding the disproportionate effects of energy poverty on girls. Girls often bear the burden of collecting traditional energy sources, leading to adverse health outcomes and limited access to developmental opportunities.

While the present analysis used limited measures of energy poverty, other proxies should be evaluated. Carbon monoxide emissions (carbon monoxide surface concentration, COSC) can be utilized as a proxy for anthropogenic emissions. This measurement, expressed in parts per billion by volume, indicates the amount of CO near the ground, which is crucial for assessing air quality and its impact on human health and the environment (Jessel et al., 2019). The Modern-Era Retrospective Analysis for Research and Applications, Version 2 (MERRA-2) provides a comprehensive dataset for analyzing these emissions. MERRA-2 offers time-averaged, two-dimensional monthly mean data for assimilated carbon monoxide and ozone diagnostics, covering the period from 1980 to the present with a spatial resolution of 0.5° x 0.625°. Precipitation anomalies should also be introduced to investigate the role of precipitation as a climate change variable using the CPC Unified Gauge-Based Analysis of Daily Precipitation and CPC Global Unified Temperature data provided by NOAA PSL.[7] As yet another measure of climate change, natural disasters data from Emergency Events Database (EM-DAT) from the OFDA/CRED International Disaster Database can be integrated with DHS data. This dataset includes variables such as top disasters, number of fatalities, number of affected individuals, and average annual disaster occurrence by type. Lastly, temperature and precipitation data from the World Bank Climate Change Knowledge Portal, which provides information by country and province, could be used. These data can be merged with DHS and used in models as a robustness check instead of relying solely on NOAA CPC data.

[7] These datasets are accessible from their website at https://psl.noaa.gov.

Table 4. Average marginal effects of key variables from probit regressions on child health outcomes, regressions on separate survey waves

		ALG13	ALG19	COM12	COM22	EGY14	EGY21	IRQ11	IRQ18	JOR12	JOR18	MAR11	MAR18	MRT11	MRT15	MRT21	PAL14	PAL20	TUN12	TUN18	TUN23	TUR13	TUR19
STUNTING																							
Model 1	MEPI score, instrumented	0.083***	-0.033	0.250	-0.089	-0.400***	-0.053	-0.035	0.439***	0.048		0.180*	0.002	0.047	0.108	-0.110	0.059	0.129	0.334**	-0.173	-0.793**	-0.147	
		(0.021)	(0.030)	(0.355)	(0.072)	(0.131)	(0.065)	(0.031)	(0.138)	(0.079)		(0.097)	(0.046)	(0.099)	(0.105)	(0.124)	(0.075)	(0.103)	(0.134)	(0.130)	(0.402)	(0.175)	
2	MEPI score	0.052	0.017	0.037	0.001	0.008	0.033	-0.036	-0.011	0.014		0.073	0.126***	-0.022	0.054*	-0.022	0.077**	0.080	0.190**	0.136	-0.197	0.187	
		(0.038)	(0.023)	(0.071)	(0.034)	(0.108)	(0.071)	(0.037)	(0.098)	(0.041)		(0.045)	(0.040)	(0.034)	(0.030)	(0.038)	(0.033)	(0.056)	(0.076)	(0.092)	(0.196)	(0.122)	
3	Dirty cooking fuels	0.028	0.004	-0.042	-0.025		0.054	0.021		0.014		-0.006	0.027	-0.029	0.010	-0.039**	0.021	0.038	0.127				
		(0.027)	(0.010)	(0.048)	(0.015)		(0.108)	(0.025)		(0.037)		(0.022)	(0.025)	(0.018)	(0.016)	(0.017)	(0.024)	(0.030)	(0.102)				
4	MEP PCA 1st-component score	0.056*	0.036	0.074	0.021	0.024	0.105	-0.007	-0.017	0.013		0.082*	0.116***	-0.014	0.053*	-0.015	0.035	0.047	0.221*	0.029	-0.460	0.116	
		(0.034)	(0.027)	(0.075)	(0.037)	(0.072)	(0.101)	(0.036)	(0.068)	(0.037)		(0.046)	(0.038)	(0.036)	(0.031)	(0.039)	(0.031)	(0.034)	(0.116)	(0.131)	(0.396)	(0.074)	
5	Tempr. Extremes 9months pre birth	0.008	0.004	0.186	-0.626***	-0.048*	-0.034	-0.007	-0.038***	0.052**		-0.023	0.016	0.021	-0.131***	-0.392***	0.032*	0.021	0.030	-0.026	-0.097	0.015	-0.051**
		(0.012)	(0.012)	(0.159)	(0.153)	(0.025)	(0.027)	(0.009)	(0.012)	(0.021)		(0.031)	(0.029)	(0.043)	(0.045)	(0.055)	(0.017)	(0.026)	(0.032)	(0.027)	(0.174)	(0.022)	(0.022)
	Tempr. Extremes 12months post birth	0.000	-0.059	-0.174	0.864***	0.087	0.171	-0.074	-0.100	0.049		-0.068	0.162	0.068	-0.037	-0.627***	0.022	0.033	0.327*	0.277	1.381	-0.034	-0.050
		(0.062)	(0.083)	(0.290)	(0.191)	(0.090)	(0.113)	(0.053)	(0.080)	(0.058)		(0.136)	(0.128)	(0.090)	(0.101)	(0.208)	(0.062)	(0.117)	(0.178)	(0.200)	(1.355)	(0.077)	(0.075)
6	MEPI score	0.032	0.018	0.037	0.004	0.013	0.081	-0.146	-0.067	0.400		0.076	0.153***	-0.020	0.060**	0.025	0.088***	0.155**	0.185**	0.218*	0.031	0.189	
		(0.040)	(0.023)	(0.071)	(0.034)	(0.108)	(0.082)	(0.162)	(0.103)	(0.508)		(0.049)	(0.044)	(0.034)	(0.030)	(0.048)	(0.034)	(0.076)	(0.087)	(0.117)	(0.415)	(0.122)	
	Tempr. extremes 12months post birth	0.003	-0.052	-0.341	0.807***	0.107	0.134	-0.071	-0.090	0.038		-0.065	0.225*	0.114	-0.248	-0.386	0.085	0.072	0.320*	0.330*	0.848	-0.044	-0.026
		(0.062)	(0.087)	(0.438)	(0.217)	(0.093)	(0.125)	(0.052)	(0.085)	(0.095)		(0.148)	(0.136)	(0.174)	(0.201)	(0.412)	(0.071)	(0.121)	(0.186)	(0.200)	(0.898)	(0.079)	(0.073)
	MEPI score × Tempr. extremes 12months	-0.348	-0.117	0.086	0.124	-0.654	1.344	0.038	0.010	-0.136		0.136	-1.113*	-0.062	0.405	-0.638	-0.670*	-1.865	0.268	-2.998	-0.618	-0.163	
		(0.552)	(0.483)	(0.542)	(0.236)	(1.191)	(1.455)	(0.053)	(0.038)	(0.200)		(0.495)	(0.620)	(0.233)	(0.310)	(0.606)	(0.398)	(1.368)	(1.452)	(2.160)	(8.247)	(1.575)	
WASTING																							
7	MEPI score	0.030	-0.022**	-0.058	0.020	0.011	-0.046	0.016	0.029	-0.014		-0.007	0.014	0.004	0.013	0.024	-0.001	-0.013	-0.016	-0.045	-0.114	0.117*	
		(0.023)	(0.011)	(0.045)	(0.020)	(0.069)	(0.030)	(0.018)	(0.042)	(0.021)		(0.018)	(0.017)	(0.028)	(0.024)	(0.022)	(0.013)	(0.028)	(0.068)	(0.047)	(0.111)	(0.063)	
INFANT MORTALITY																							
8	MEPI score, instrumented	-0.001	0.000	0.003	0.015	-0.049	0.002	-0.011	0.033	-0.003	-0.020	0.018	0.023*	-0.011	-0.043	-0.011	0.006	-0.005	-0.027	-0.001	-0.065	-0.048	
		(0.012)	(0.015)	(0.089)	(0.038)	(0.041)	(0.035)	(0.012)	(0.051)	(0.033)	(0.078)	(0.035)	(0.014)	(0.050)	(0.057)	(0.044)	(0.029)	(0.056)	(0.040)	(0.055)	(0.091)	(0.055)	
9	MEPI score	-0.026	0.006	-0.006	-0.018	0.004	0.010	0.011	0.039	-0.011	-0.011	0.008	0.020*	0.003	0.001	0.005	-0.013	-0.003	0.051**	0.004	0.071*	0.081**	
		(0.019)	(0.011)	(0.023)	(0.018)	(0.029)	(0.027)	(0.015)	(0.031)	(0.015)	(0.018)	(0.023)	(0.011)	(0.018)	(0.017)	(0.015)	(0.015)	(0.024)	(0.021)	(0.030)	(0.038)	(0.034)	
10	Dirty cooking fuels	-0.019	0.004	-0.023	0.002			0.004		-0.002	-0.004	0.005	0.015*	-0.003	-0.002	0.007	-0.011		0.023				
		(0.015)	(0.004)	(0.019)	(0.008)			(0.008)		(0.010)	(0.000)	(0.011)	(0.008)	(0.009)	(0.008)	(0.007)	(0.013)		(0.020)				
11	MEP PCA 1st-component score	-0.024	0.008	-0.008	-0.012	0.011	0.001	0.007	0.038*	-0.004	-0.006	0.009	0.020*	0.005	0.001	0.002	-0.015	-0.028*	0.039*	0.002	-0.136	0.039**	
		(0.020)	(0.013)	(0.022)	(0.021)	(0.017)	(0.026)	(0.013)	(0.019)	(0.010)	(0.012)	(0.023)	(0.011)	(0.018)	(0.017)	(0.016)	(0.015)	(0.017)	(0.020)	(0.067)	(0.183)	(0.018)	
12	Tempr. Extremes 9months pre birth	-0.009	-0.005	0.033	0.293***	0.000	0.003	-0.014***	-0.017***	0.006	-0.002	-0.003	-0.008	-0.008	-0.012	-0.030*	-0.019**	-0.009	-0.018	0.010	-0.027	0.001	-0.029**
		(0.007)	(0.006)	(0.040)	(0.108)	(0.007)	(0.007)	(0.005)	(0.006)	(0.011)	(0.009)	(0.014)	(0.010)	(0.022)	(0.026)	(0.017)	(0.010)	(0.009)	(0.011)	(0.009)	(0.017)	(0.008)	(0.014)
	Tempr. Extremes 12months post birth	0.012	0.007	0.082	0.077	0.022	0.029	-0.009	0.024	-0.015	-0.003	-0.046	0.019	-0.038	0.046	-0.060	-0.030	0.046	-0.110	-0.086	0.017	0.029	-0.010
		(0.032)	(0.034)	(0.051)	(0.110)	(0.022)	(0.031)	(0.023)	(0.024)	(0.032)	(0.056)	(0.053)	(0.040)	(0.040)	(0.050)	(0.066)	(0.025)	(0.038)	(0.068)	(0.055)	(0.052)	(0.030)	(0.039)
13	MEPI score	-0.025	-0.003	-0.007	-0.050**	0.004	0.015	0.027	0.050	-0.003	-0.064	0.001	0.022**	-0.014	0.000	-0.003	-0.005	0.017	0.033*	0.020	-0.045	0.045	
		(0.015)	(0.006)	(0.023)	(0.025)	(0.023)	(0.017)	(0.032)	(0.033)	(0.023)	(0.050)	(0.020)	(0.011)	(0.013)	(0.011)	(0.011)	(0.011)	(0.019)	(0.018)	(0.025)	(0.030)	(0.032)	
	Tempr. extremes 12months post birth	-0.006	0.020	0.270**	-0.125	0.031	-0.033*	-0.003*	0.009*	0.001	-0.006**	-0.012	0.013	-0.041	0.098**	-0.046	-0.005	0.011	-0.094	-0.009	0.027	-0.006	-0.015
		(0.026)	(0.017)	(0.134)	(0.144)	(0.022)	(0.018)	(0.002)	(0.005)	(0.003)	(0.002)	(0.057)	(0.037)	(0.068)	(0.049)	(0.045)	(0.019)	(0.024)	(0.062)	(0.025)	(0.025)	(0.028)	(0.021)
	MEPI score × Tempr. extremes 12months	0.039	0.118	-0.303	0.728**	-0.534	0.237	-0.004	-0.020*	0.004	0.020	-0.304	-0.042	0.005	-0.145*	0.060	0.051	-0.312	0.115	-0.649	0.812***	0.052	
		(0.251)	(0.115)	(0.210)	(0.337)	(0.473)	(0.365)	(0.011)	(0.012)	(0.010)	(0.019)	(0.204)	(0.165)	(0.100)	(0.086)	(0.066)	(0.123)	(0.202)	(0.256)	(0.617)	(0.315)	(0.394)	
NEO-NATAL MORTALITY																							
14	MEPI score	-0.040*	-0.009	-0.026	-0.013	-0.004	0.003	0.011	-0.015	-0.021	0.001	-0.034	0.006	-0.003	0.009	0.004	-0.015	-0.030	0.040**	0.019		0.029	
		(0.023)	(0.011)	(0.019)	(0.013)	(0.019)	(0.023)	(0.012)	(0.032)	(0.017)	(0.013)	(0.021)	(0.010)	(0.014)	(0.015)	(0.012)	(0.013)	(0.033)	(0.016)	(0.019)		(0.021)	
15	Tempr. Extremes 9months pre birth	-0.001	-0.000	-0.002	0.012*	-0.000	0.000	-0.001**	-0.002***	0.000	-0.000	0.000	-0.000	-0.002	0.001	-0.002	-0.002***	-0.001	-0.001	0.000	-0.001	0.001	-0.000
		(0.001)	(0.001)	(0.003)	(0.007)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. The baseline group is newborn boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

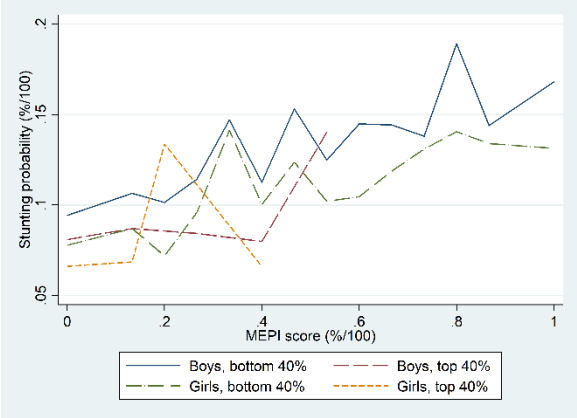
Table 5. Average marginal effects of key variables, regressions on pooled survey waves by country

		ALG13-19	COM12-22	EGY14-21	IRQ11-18	JOR12	MAR11-18	MRT11-15-21	PAL14-20	TUN12-18-23	TUR13-19
STUNTING (Pooled survey rounds)											
Model 16	MEPI score	0.018	0.018	0.051	-0.044	0.014	0.131***	0.014	0.077***	0.139**	0.144
		(0.020)	(0.032)	(0.057)	(0.032)	(0.041)	(0.030)	(0.019)	(0.030)	(0.058)	(0.106)
17	Tempr. Extremes 9months pre birth	0.005	-0.014	0.011	-0.014*	0.052**	0.000	-0.137***	0.047***	0.003	-0.010
		(0.008)	(0.009)	(0.015)	(0.009)	(0.021)	(0.021)	(0.025)	(0.014)	(0.019)	(0.016)
	Tempr. Extremes 12months post birth	0.005	-0.008	0.176***	-0.086**	0.049	0.034	-0.006	0.035	0.145*	-0.040
		(0.046)	(0.009)	(0.056)	(0.040)	(0.058)	(0.088)	(0.055)	(0.054)	(0.082)	(0.054)
	(Joint significance test, Chi-squared statistic)	0.35	4.76*	10.17***	6.78**	6.15**	0.15	30.02***	12.04***	3.15	0.77
INFANT MORTALITY (Pooled survey rounds)											
18	MEPI score	-0.002	-0.018	-0.008	0.013	-0.011	0.011	0.002	-0.013	0.022**	0.075**
		(0.009)	(0.015)	(0.021)	(0.012)	(0.011)	(0.013)	(0.010)	(0.013)	(0.010)	(0.032)
19	Tempr. Extremes 9months pre birth	-0.007	0.008**	-0.002	-0.014***	0.003	-0.004	-0.014	-0.016**	-0.008*	-0.011
		(0.005)	(0.004)	(0.005)	(0.004)	(0.007)	(0.009)	(0.012)	(0.007)	(0.005)	(0.008)
	Tempr. Extremes 12months post birth	0.011	0.008*	0.013	0.001	-0.008	-0.032	-0.013	-0.008	-0.039	0.013
		(0.023)	(0.005)	(0.018)	(0.017)	(0.029)	(0.033)	(0.025)	(0.021)	(0.025)	(0.025)
	(Joint significance test, Chi-squared statistic)	2.63	7.23**	0.71	13.85***	0.25	1.03	1.96	5.39*	6.72**	2.65

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. The baseline group is newborn boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

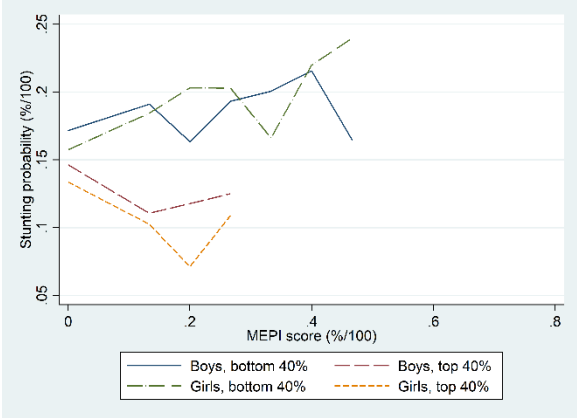
Figure 1. Fitted probability of stunting by MEPI score, by child's sex and household wealth quantile, regressions on pooled survey rounds (model 16)

Algeria (2013–2019)

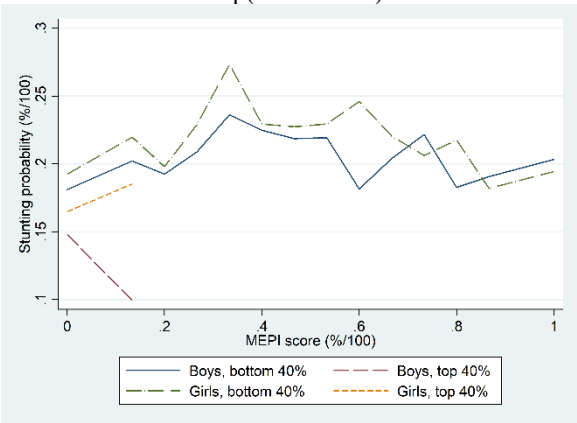


Comoros (2012–2022)

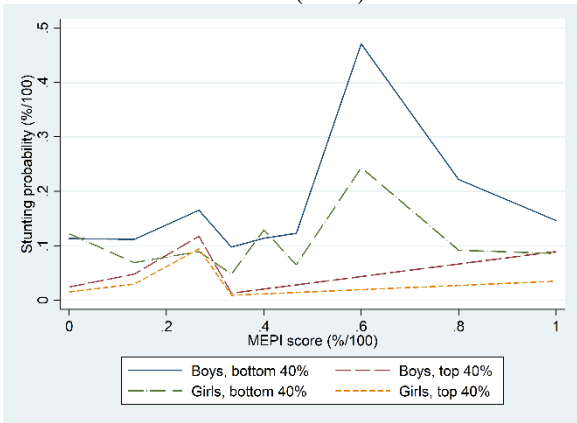
Egypt (2014–2021)



Iraq (2011–2018)



Jordan (2012)



Morocco (2011–2018)

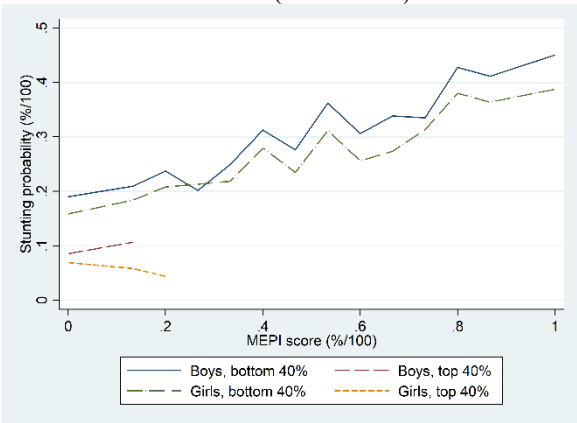
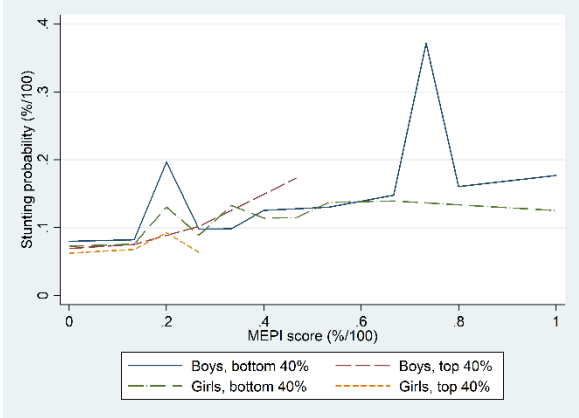


Figure 1. Fitted probability of stunting by MEPI score, by child's sex and household wealth quantile, regressions on pooled survey rounds (model 16) (Continued)

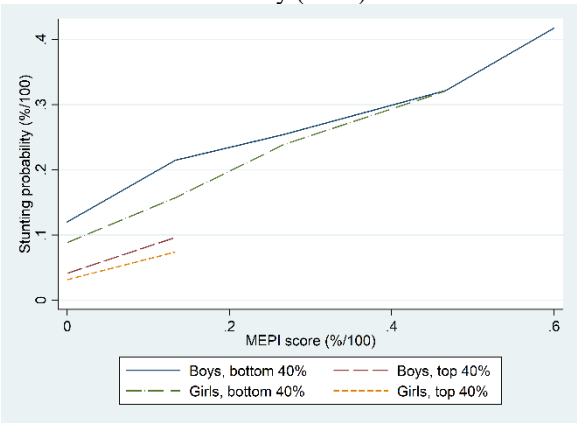
Mauritania (2011–2021)

Palestine (2014–2020)



Tunisia (2012–2018)

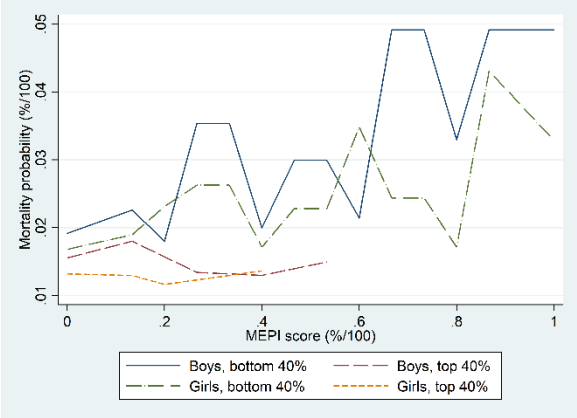
Turkey (2013)



Notes: These estimates come from Model 16 in table 6b, accounting for demographics but excluding temperature extremes variables in order to show the effects of MEPI clearly. Probabilities shown are the median expectations among individuals of each gender and wealth group facing MEPI scores within 0.05-point intervals. Jordan 2012 is excluded because of missing anthropometrics, and Turkey 2019 because of missing energy indicators.

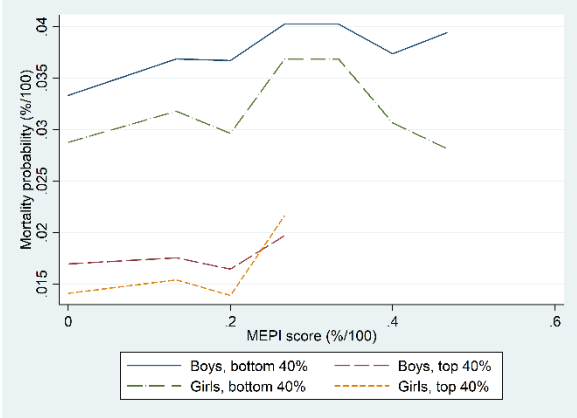
Figure 2. Fitted probability of mortality by MEPI score, by child's sex and household wealth quantile, regressions on pooled survey rounds (model 18)

Algeria (2013–2019)



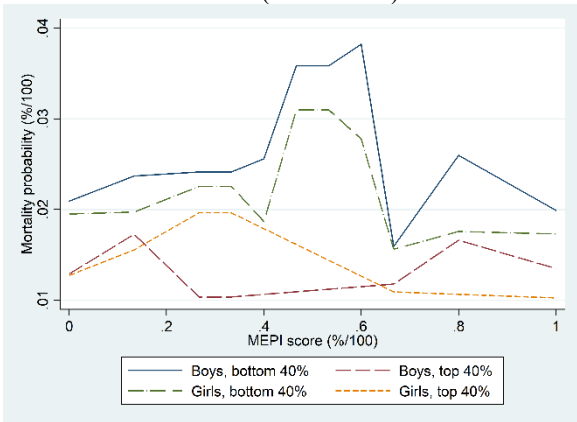
Comoros (2012–2022)

Egypt (2014–2021)



Iraq (2011–2018)

Jordan (2012–2018)



Morocco (2011–2018)

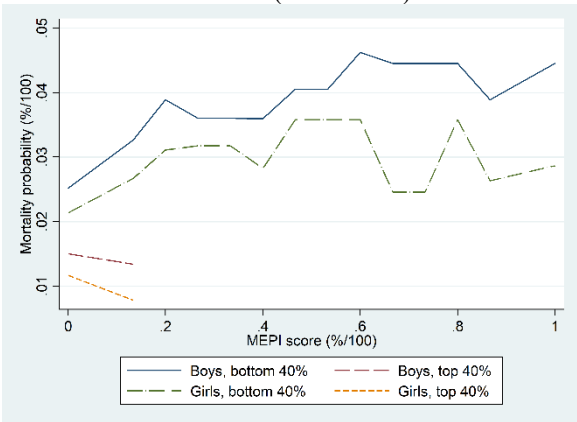
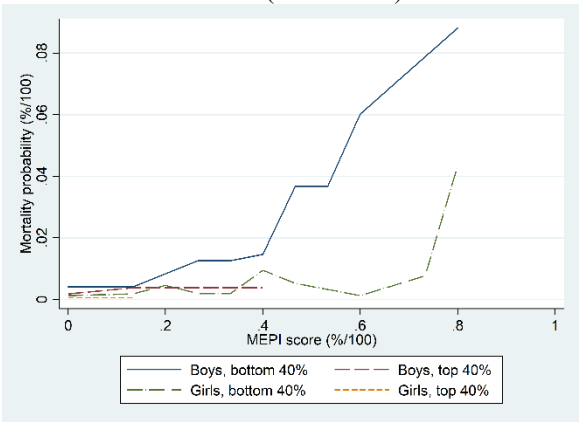


Figure 2. Fitted probability of mortality by MEPI score, by child's sex and household wealth quantile, regressions on pooled survey rounds (model 18) (Continued)

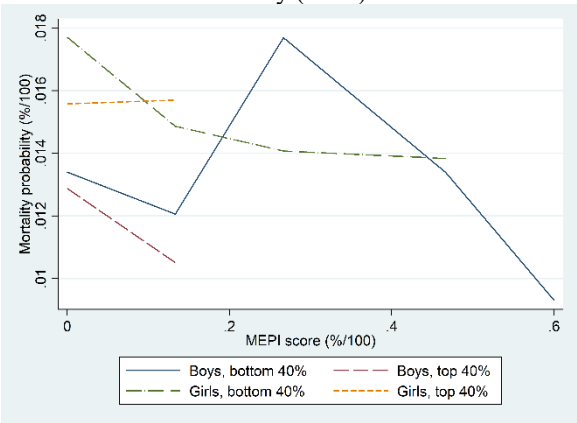
Mauritania (2011–2021)

Palestine (2014–2020)

Tunisia (2012–2018)



Turkey (2013)



Notes: These estimates come from Model 18 in table 6b, accounting for demographics but excluding temperature extremes variables in order to show the effects of MEPI clearly. Probabilities shown are the median expectations among individuals of each gender and wealth group facing MEPI scores within 0.1-point intervals. Turkey 2019 is excluded because of missing energy indicators.

5. Conclusions and policy implications

Our study, particularly the estimated effects of energy deprivation on stunting in most countries, highlights the importance of addressing energy poverty as part of broader efforts to combat health and nutrition deprivations. First, our study underscores the complexity and the need for better conceptualizing energy poverty and its multifaceted relationship with socioeconomic development. Second, our findings provide valuable insights for policymakers aiming to formulate targeted interventions to alleviate energy poverty and promote sustainable development.

Our findings underscore the intricate interplay of socioeconomic, demographic, and environmental factors in shaping children's health status in MENA countries. The use of the MEPI as a proxy for household energy poverty confirms a significant association between higher MEPI scores and increased probability of stunting across most countries. Notably, socioeconomic disparities, gender dynamics, education levels, and household characteristics significantly influence stunting outcomes. In some countries, stunting is significantly more prevalent among children in female headed households, in others, lower education and lower wealth are also associated with higher prevalence of children's health problem. These findings highlight the importance of gender-sensitive and socio-economic specific interventions to address nutritional disparities within and across households.

This implies that energy poverty, characterized by restricted access to contemporary energy sources, may heighten the risk of malnutrition, particularly in resource-constrained settings. Addressing the underlying causes of children's health problems requires a multifaceted approach, including women's empowerment, education interventions, poverty reduction, and focused healthcare activities tailored to vulnerable populations. Further research is necessary to ensure gender-responsive interventions and to explore contextual factors contributing to potential biases in data collection and reporting due to gender discrimination.

Our study has emphasized the unique challenges faced by MENA countries, including their diverse climates, energy resource profiles, political dynamics, and living norms, all of which influence energy transitions and their health implications. As both resource-rich and resource-poor nations in the region pursue decarbonization and energy diversification, this study highlights the importance of putting children's health on policy agendas. As the emerging generation of stakeholders, children's welfare should be a cornerstone in shaping effective strategies to alleviate energy poverty, promote equitable access to clean energy, and foster sustainable development.

In light of the findings of this study, several targeted policy implications can be proposed: i) enhanced access to clean energy for households, ii) expanded infrastructure investment in modern and clean energy sources, particularly in rural and underserved areas, iii) rolling out of renewable energy projects such as solar and wind power, iv) subsidies and financial incentives for households to transition from traditional fuels to cleaner energy sources, v) promoting integrated health services that address both energy poverty and child malnutrition, vi) providing nutritional support and healthcare services in localities with high energy poverty rates, vii) strengthening disaster preparedness and response systems to better handle the impacts of extreme weather events (including early warning systems and emergency healthcare services), viii) expanding cash transfer programs aimed at the poorest households to alleviate energy poverty, ix) fostering

regional cooperation among MENA countries to share best practices and resources in combating energy poverty and improving child health, and x) seeking international funding and technical assistance from international donors to support the implementation of these policies. By addressing energy poverty and its health impacts through these targeted policies, MENA countries can improve child health outcomes and foster sustainable development in the region.

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Appendix

This appendix presents additional tables supplementing the analysis in the main text. Table A1 supplements the literature review with the evolution of definitions of energy poverty. Tables A2 and A3 report selected summary statistics. Tables A4–A18 supplement the key results presented in Table 4. Tables A19–A22 supplement the results in Table 5.

In stunting models – Tables A4–A10 – female-headed households exhibit a higher prevalence of stunting among children, particularly in JOR‘12, MRT’21 and TUR‘13. This underscores the need for gender-sensitive interventions to address nutritional disparities within households. Girls in ALG ‘19, EGY ‘14, IRQ ‘11, PAL ‘14 and TUR ‘13 are less susceptible to stunting compared to boys. The negative marginal effect for girls in relation to stunting may seem counterintuitive, but it underscores the complexity of factors influencing the evolution of child growth. It is possible that biological differences between genders affect the susceptibility to stunting. For instance, hormonal differences may influence nutrient absorption and metabolism differently in males and females (Headey et al., 2016; Pande, 2003). Further research is needed to explore the underlying mechanisms and contextual factors contributing to this phenomenon, to ensure that policy interventions effectively address the nutritional needs of all children, regardless of gender. Advancing age is associated with an increased likelihood of stunting in several countries, indicating that older children may face prolonged exposure to nutritional deficiencies, exacerbating the risk of stunted growth at a decreasing rate. The education attainment of both fathers and mothers significantly influences stunting outcomes in some countries. Higher levels of parental education are generally associated with reduced probabilities of stunting among children, emphasizing the importance of education in improving child nutrition outcomes.

Household characteristics also play a role in child stunting. Children residing in rural areas are more likely to experience stunting compared to their urban counterparts. This rural-urban disparity underscores the need for targeted interventions addressing the challenges faced by rural citizens. Household wealth status plays a pivotal role in determining children's nutritional status. Wealthier households, as observed in ALG‘13, EGY‘21, MRT’21, PAL’14 and PAL’20, demonstrate lower probabilities of stunting, indicating the protective effect of socioeconomic prosperity against health and nutrition deprivation.

In child mortality models – Tables A11–A18 – infant girls are seen to have a lower mortality rate than boys, a common finding. Fathers’ education has a mixed record of association with infant mortality, while mothers’ higher education is typically associated with lower mortality rates, especially the (excluded) highest level of education. Similarly, household wealth is associated negatively with mortality, especially the (excluded) highest wealth quintile.

Considering Models 1–15 (Tables A4–A18) in their entirety, we find a high degree of consistency and robustness of their results. The substantial number of observations and clusters ensures the reliability and robustness of the estimated marginal effects, confirming the statistical validity of the findings. The traditionally used criteria (pseudo-R^2, model Chi^2 – available on request) confirm a high degree of model fit and show that the selected sets of covariates explain a non-trivial share of children’s predisposition for stunting, and even wasting and infant mortality. Nevertheless,

energy deprivation is just one factor affecting children's health – according to the model (pseudo-)R^2, less than 10% of the variation in the children's likelihood of stunting, wasting, infant mortality and neonatal mortality is explained by the considered variables.

Tables A19–A22 report on the regressions on pooled surveys for each country (Models 16–19). In Model 16, being a girl is associated with lower probability of stunting in the majority of countries. This result needs to be interpreted with caution however, since international anthropometric standards on height may need to be better adapted to region-specific trends before we can safely conclude that girls are less likely to be stunted. Wealth is associated with lower stunting, except in Jordan and Mauritania.

Table A1. The evolution of definitions of energy poverty

Author	Energy Poverty Index (EPI)	Relationship with		
		Economic development	Children's health	Energy transition
Boardman (1991)	a single index method is proposed, which indicated that if energy expenditure exceeded 10% of household income, household was said to be energy poor.			
IEA (2011)	a single index measurement was proposed to assess the process of a region's transition to modern fuels.			
Nussbaumer et al. (2012)	a new index, the MEPI, was developed to test the deprivation of access to modern energy services.			
Amin et al. (2020)	they measured EPI by the % of the population who have access to electricity.	energy poverty has a negative impact on economic development in both the short-run and long-run in the sampled South Asian countries.		
Zhang et al. (2021a)	MEPI that considers the economic condition as well as clean energy adoption practices at the household level using China Family Panel Studies dataset. To construct MEPI, they assign relative weights to five indicators, including cooking, lighting, household appliance ownership, entertainment/education, and communication.		energy poverty has a negative impact on children's subjective wellbeing, and that academic performance is an important channel through which energy poverty lowers children's subjective wellbeing.	
Rafi et al. (2021)	multidimensional measure of energy poverty, which focuses on quantifying energy deprivation, covering both accessibility to and affordability of a broad range of energy forms.		energy poverty has significant negative effects on children's health and educational achievements.	
Dong et al. (2021b)	energy structure (denoted as ES) by employing the proportion of the sum of coal and oil consumption converted into standard coal by the conversion coefficient in total energy consumption.			low-carbon energy transition can affect the reduction of energy poverty by having an impact on the energy services availability, energy cleanliness, as well as affordability and efficiency of energy use.

Xie et al. (2022)	by setting an energy poverty line, given its wide acceptance in literature and its objectivity in measurement. Following Boardman (2010), twice the median proportion of energy expenditure in household income is taken as the energy poverty line. energy poverty measured in the following three dimensions: (1) energy poverty gap, which is defined as the gap between actual energy expenditure and someone energy expenditure threshold; (2) the breadth of energy poverty, which is defined as the proportion of households whose energy expenditure ratio is below the energy poverty line; and (3) the depth of the energy gap, which is defined as the distance between threshold energy expenditure and the average energy expenditure of households in energy poverty.	it observed that the low-income, and less educated households are the ones who have high probability in experiencing energy poverty.		energy poverty increased significantly when coal was replaced with electricity and gas. However, energy poverty decreased when it was replaced with clean coal.
Okushima (2016)	change in domestic energy prices (as measured by the energy consumer price index, the energy CPI) in Japan after the 2000s. 'Energy price' is a composite index of electricity, gas, and other fuels (kerosene) prices using the 2010 official weights.	the findings show that throughout the previous ten years, energy poverty among lower-income and vulnerable households has gotten worse due to a combination of rising energy prices and declining income.		
Papada & Kaliampakos (2018)	$Energy\ poverty\ index = \frac{Modelled\ fuel\ costs\ (i.e.\ modelled\ consumption\ x\ price)}{Income}$ the basic household energy uses in Greece were taken into consideration: ● Space heating ● Space cooling ● Domestic hot water ● Cooking, lighting and electrical devices	The results showed that Greece has a rate of energy poverty of 70.4%. Income is the key factor influencing energy poverty, accounting for 63% of the total, while other variables (Htot, etc.) follow at much smaller percentages.		

Table A2. Description of survey samples

	Survey instrument	Households (complete interviews)	Ever-married women 15–49 in women's module (complete int.)	Children younger than 5 covered by responding women (complete int.)	Live births covered by responding women
Algeria '12-13	MICS	27,198	38,547	14,701	53,668
Algeria '18-19	MICS	29,919	37,227	14,889	50,679
Comoros '12	DHS	4,482	3,149	2,886	11,497
Comoros '22	MICS	6,158	6,945	4,497	16,533
Egypt '14	DHS	28,175	59,266	56,568	15,848
Egypt '21	FHS	30,667	21,267	15,785	59,490
Iraq '11	MICS	35,701	55,194	33,908	13,994
Iraq '18	MICS	20,214	30,660	16,689	70,986
Jordan '12	DHS	15,190	10,304	6,350	8,462
Jordan '17-18	DHS	7,176	10,529	10,210	47,040
Mauritania '11	MICS	10,320	13,657	9,543	30,335
Mauritania '15	MICS	11,765	14,342	10,663	37,506
Mauritania '19-21	DHS	6,391	19,941	11,176	39,793
Morocco '11	PAPFAM	15,343	11,069	6,117	8,136
Morocco '18	NSPFH	15,022	9,969	6,662	6,332
Palestine '14	MICS	10,182	13,367	7,816	7,948
Palestine '19-20	MICS	9,326	11,135	6,328	25,482
Tunisia '11-12	MICS	9,171	10,215	2,899	2,977
Tunisia '18	MICS	11,225	10,559	3,420	14,058
Tunisia '22-23	MICS	8,937	7,140	1,926	9,415
Turkey '13	DHS	11,794	9,746	3,487	3,326
Turkey '18-19	DHS	11,056	7,346	2,979	2,568

*Notes: Sample sizes are only partially standardized due to differences in format, variable coverage, and missing observations in individual surveys. Samples sizes used in regression models may be lower than these numbers due to missing data for dependent or explanatory variables, or perfect prediction of probability-model outcomes among some explanatory variables for some observations. "--" indicates missing data for a particular survey module. * Currently unavailable.*

Table A3. Summary statistics of variables in stunting regression samples

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13
Stunted	0.093	0.081	0.296	0.141	0.177	0.128	0.217	0.099	0.076	0.156	0.159	0.253	0.235	0.254	0.074	0.087	0.101	0.083	0.135	0.095
	(0.291)	(0.272)	(0.457)	(0.348)	(0.382)	(0.334)	(0.412)	(0.299)	(0.266)	(0.363)	(0.366)	(0.435)	(0.424)	(0.435)	(0.262)	(0.282)	(0.302)	(0.275)	(0.342)	(0.294)
MEPI score	0.017	0.061	0.609	0.359	0.012	0.029	0.019	0.007	0.163	0.121	0.054	0.561	0.465	0.543	0.093	0.026	0.019	0.010	0.012	0.007
	(0.068)	(0.145)	(0.244)	(0.268)	(0.046)	(0.060)	(0.082)	(0.036)	(0.174)	(0.209)	(0.153)	(0.325)	(0.328)	(0.340)	(0.108)	(0.081)	(0.072)	(0.048)	(0.047)	(0.036)
Temperature extremes up to 9 months pre birth	-0.035	0.020	-0.023	0.031	0.014	0.011	-0.008	0.021	-0.004	-0.037	0.031	-0.009	-0.022	0.036	0.032	0.028	-0.021	0.020	0.041	-0.045
	(0.242)	(0.235)	(0.090)	(0.049)	(0.178)	(0.196)	(0.305)	(0.320)	(0.238)	(0.201)	(0.200)	(0.120)	(0.110)	(0.113)	(0.180)	(0.191)	(0.209)	(0.204)	(0.243)	(0.277)
Temperature extremes up to 12 months post birth	-0.022	0.022	-0.010	-0.010	0.000	0.005	-0.029	0.049	-0.003	-0.026	0.029	0.001	-0.010	0.045	0.026	0.025	-0.024	0.024	0.084	-0.013
	(0.047)	(0.048)	(0.079)	(0.097)	(0.062)	(0.049)	(0.068)	(0.066)	(0.073)	(0.056)	(0.057)	(0.069)	(0.054)	(0.041)	(0.064)	(0.044)	(0.038)	(0.036)	(0.086)	(0.079)
Female HH	0.043	0.036	0.332	0.378	0.032	0.067	0.065	0.057	0.044	0.084	0.064	0.201	0.331	0.369	0.025	0.028	0.016	0.053	0.055	0.071
	(0.202)	(0.186)	(0.471)	(0.485)	(0.175)	(0.250)	(0.247)	(0.232)	(0.204)	(0.277)	(0.244)	(0.401)	(0.471)	(0.483)	(0.155)	(0.164)	(0.125)	(0.224)	(0.228)	(0.258)
Female child	0.489	0.487	0.499	0.487	0.482	0.493	0.489	0.482	0.484	0.501	0.483	0.495	0.500	0.489	0.485	0.485	0.473	0.485	0.497	0.461
	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.499)	(0.500)	(0.500)	(0.499)
Age	2.331	2.494	2.377	2.463	2.449	2.632	2.381	2.518	2.563	2.392	2.488	2.361	2.461	2.385	2.497	2.407	2.421	2.606	2.756	2.521
	(1.433)	(1.437)	(1.417)	(1.448)	(1.413)	(1.438)	(1.424)	(1.427)	(1.417)	(1.446)	(1.452)	(1.437)	(1.413)	(1.471)	(1.441)	(1.423)	(1.416)	(1.428)	(1.399)	(1.425)
Age-squared	7.486	8.285	7.658	8.163	7.995	8.992	7.698	8.376	8.578	7.813	8.296	7.638	8.053	7.855	8.312	7.819	7.866	8.831	9.550	8.383
	(7.143)	(7.352)	(7.120)	(7.322)	(7.183)	(7.578)	(7.147)	(7.258)	(7.385)	(7.321)	(7.433)	(7.117)	(7.175)	(7.380)	(7.403)	(7.165)	(7.076)	(7.395)	(7.404)	(7.364)
Father: incomplete primary	0.197	0.175	0.284	0.205	0.143	0.222	0.392	0.407	0.104	0.115	0.273	0.375	0.718	0.418	0.029	0.307	0.402	0.359	0.026	0.377
	(0.398)	(0.380)	(0.451)	(0.404)	(0.350)	(0.416)	(0.488)	(0.491)	(0.306)	(0.319)	(0.446)	(0.484)	(0.450)	(0.493)	(0.168)	(0.461)	(0.490)	(0.480)	(0.160)	(0.485)
Father: complete primary	0.589	0.613	0.238	0.420	0.567	0.595	0.507	0.521	0.648	0.105	0.201	0.149	0.117	0.112	0.354	0.338	0.375	0.428	0.777	0.431
	(0.492)	(0.487)	(0.426)	(0.494)	(0.495)	(0.491)	(0.500)	(0.500)	(0.478)	(0.307)	(0.401)	(0.356)	(0.322)	(0.315)	(0.478)	(0.473)	(0.484)	(0.495)	(0.416)	(0.495)
Father: incomplete secondary	0.083	0.106	0.120	0.190	0.158	0.183	0.019		0.238	0.023	0.059	0.306		0.038	0.596		0.134	0.185	0.056	0.146
	(0.276)	(0.307)	(0.325)	(0.392)	(0.365)	(0.386)	(0.136)		(0.426)	(0.151)	(0.236)	(0.461)		(0.190)	(0.491)		(0.341)	(0.388)	(0.229)	(0.353)
Mother: incomplete primary	0.176	0.149	0.235	0.208	0.091	0.088	0.503	0.438	0.065	0.145	0.427	0.571	0.568	0.428	0.011	0.350	0.333	0.246	0.182	0.388
	(0.381)	(0.356)	(0.424)	(0.406)	(0.288)	(0.283)	(0.500)	(0.496)	(0.246)	(0.352)	(0.495)	(0.495)	(0.495)	(0.495)	(0.104)	(0.477)	(0.471)	(0.431)	(0.386)	(0.487)
Mother: complete primary	0.544	0.547	0.226	0.540	0.566	0.622	0.319	0.369	0.614	0.087	0.165	0.153	0.149	0.160	0.283	0.459	0.361	0.398	0.495	0.360
	(0.498)	(0.498)	(0.418)	(0.498)	(0.496)	(0.485)	(0.466)	(0.483)	(0.487)	(0.282)	(0.371)	(0.360)	(0.356)	(0.367)	(0.450)	(0.498)	(0.480)	(0.490)	(0.500)	(0.480)
Mother: incomplete secondary	0.099	0.179	0.061		0.150	0.185			0.304	0.013	0.045			0.013	0.702		0.176	0.286	0.268	0.108
	(0.298)	(0.384)	(0.239)		(0.357)	(0.388)			(0.460)	(0.113)	(0.207)			(0.115)	(0.457)		(0.381)	(0.452)	(0.443)	(0.311)
Rural residence	0.384	0.431	0.734	0.694	0.715	0.609	0.337	0.321	0.185	0.583	0.506	0.606	0.563	0.598	0.236	0.235	0.373	0.363	0.412	0.218
	(0.486)	(0.495)	(0.442)	(0.461)	(0.451)	(0.488)	(0.473)	(0.467)	(0.388)	(0.493)	(0.500)	(0.489)	(0.496)	(0.490)	(0.425)	(0.424)	(0.484)	(0.481)	(0.492)	(0.413)
Wealth: poorest	0.217	0.241	0.258	0.222	0.205	0.154	0.244	0.225	0.235	0.255	0.244	0.234	0.229	0.247	0.265	0.248	0.203	0.193	0.229	0.228
	(0.413)	(0.427)	(0.438)	(0.416)	(0.404)	(0.361)	(0.430)	(0.417)	(0.424)	(0.436)	(0.429)	(0.423)	(0.420)	(0.431)	(0.442)	(0.432)	(0.402)	(0.394)	(0.420)	(0.420)
Wealth: poorer	0.220	0.231	0.213	0.209	0.199	0.191	0.224	0.223	0.223	0.229	0.251	0.208	0.215	0.223	0.218	0.188	0.222	0.218	0.240	0.231
	(0.414)	(0.421)	(0.410)	(0.406)	(0.400)	(0.393)	(0.417)	(0.416)	(0.417)	(0.420)	(0.434)	(0.406)	(0.411)	(0.416)	(0.413)	(0.391)	(0.415)	(0.413)	(0.427)	(0.422)
Wealth: middle	0.199	0.201	0.198	0.202	0.249	0.208	0.205	0.199	0.224	0.195	0.181	0.191	0.194	0.198	0.189	0.204	0.188	0.200	0.219	0.208
	(0.399)	(0.401)	(0.399)	(0.401)	(0.432)	(0.406)	(0.404)	(0.400)	(0.417)	(0.396)	(0.385)	(0.393)	(0.396)	(0.399)	(0.392)	(0.403)	(0.391)	(0.400)	(0.414)	(0.406)
Wealth: richer	0.192	0.181	0.179	0.186	0.199	0.233	0.179	0.181	0.182	0.178	0.167	0.197	0.191	0.179	0.182	0.198	0.222	0.210	0.179	0.171
	(0.394)	(0.385)	(0.383)	(0.389)	(0.399)	(0.423)	(0.384)	(0.385)	(0.386)	(0.383)	(0.373)	(0.398)	(0.393)	(0.384)	(0.385)	(0.398)	(0.415)	(0.408)	(0.383)	(0.376)
Wealth: richest	0.172	0.147	0.152	0.181	0.148	0.215	0.148	0.172	0.136	0.142	0.158	0.170	0.171	0.153	0.146	0.162	0.166	0.179	0.133	0.161
	(0.377)	(0.354)	(0.359)	(0.385)	(0.355)	(0.411)	(0.355)	(0.378)	(0.342)	(0.350)	(0.365)	(0.376)	(0.376)	(0.360)	(0.353)	(0.369)	(0.372)	(0.383)	(0.340)	(0.368)
N	13,742	13,972	2,387	4,254	13,147	10,052	35,036	16,366	6,267	6,571	6,014	8,316	9,811	9,830	6,939	5,695	2,640	3,296	1,723	2,777

Notes: Standard deviations in parentheses. Child samples are nationally weighted.

Table A4. Average marginal effects from probit regressions of *stunting on MEPI scores*, instrumental variable approach (Model 1)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13
MEPI score, instrumented	0.083***	-0.033	0.250	-0.089	-0.400***	-0.053	-0.035	0.439***	0.048	0.180*	0.002	0.047	0.108	-0.110	0.059	0.129	0.334**	-0.173	-0.793**	-0.147
	(0.021)	(0.030)	(0.355)	(0.072)	(0.131)	(0.065)	(0.031)	(0.138)	(0.079)	(0.097)	(0.046)	(0.099)	(0.105)	(0.124)	(0.075)	(0.103)	(0.134)	(0.130)	(0.402)	(0.175)
Female household	0.003	0.002	-0.060**	-0.014	-0.031	0.008	0.024	0.013	0.067**	-0.041**	-0.005	-0.008	0.008	0.024**	-0.003	0.017	0.026	0.007	-0.009	0.053**
	(0.015)	(0.016)	(0.026)	(0.013)	(0.031)	(0.016)	(0.017)	(0.014)	(0.033)	(0.020)	(0.027)	(0.016)	(0.012)	(0.012)	(0.022)	(0.023)	(0.056)	(0.021)	(0.051)	(0.025)
Female child	-0.008	-0.023***	-0.028	-0.002	-0.020**	-0.003	-0.013**	0.050***	-0.030***	-0.016	-0.044***	-0.009	-0.012	-0.031***	-0.016**	0.002	-0.021*	0.009	0.026	-0.034***
	(0.006)	(0.006)	(0.023)	(0.012)	(0.009)	(0.008)	(0.006)	(0.007)	(0.010)	(0.013)	(0.012)	(0.010)	(0.010)	(0.010)	(0.006)	(0.008)	(0.013)	(0.010)	(0.018)	(0.012)
Child age (yrs)	0.021***	-0.006	0.126***	0.032**	0.062***	-0.005	0.052***	0.040***	0.023*	0.105***	0.088***	0.185***	0.176***	0.154***	0.013	0.005	-0.013	0.008	-0.071**	0.030
	(0.008)	(0.008)	(0.029)	(0.016)	(0.012)	(0.011)	(0.009)	(0.010)	(0.013)	(0.018)	(0.016)	(0.014)	(0.014)	(0.015)	(0.009)	(0.012)	(0.018)	(0.015)	(0.029)	(0.020)
Child age squared	-0.004**	0.002	-0.024***	-0.009***	-0.009***	-0.004*	-0.012***	-0.008***	-0.007**	-0.019***	-0.018***	-0.028***	-0.028***	-0.026***	-0.004*	-0.003	0.000	-0.003	0.010*	-0.006
	(0.002)	(0.002)	(0.006)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.004)	(0.003)	(0.005)	(0.004)
Father: Primary education	-0.019*	-0.003	-0.058*	-0.024	0.019	0.028*	-0.021*	0.013	-0.037	-0.004	-0.020	-0.010	-0.004	-0.024*	-0.087*	-0.007	-0.005	-0.012	-0.029	0.030
	(0.011)	(0.012)	(0.031)	(0.020)	(0.018)	(0.014)	(0.012)	(0.014)	(0.031)	(0.020)	(0.014)	(0.016)	(0.016)	(0.013)	(0.046)	(0.012)	(0.026)	(0.035)	(0.062)	(0.028)
Father: Secondary education	-0.003	0.002	-0.019	-0.028	-0.026	0.014	-0.044***	-0.003	-0.026	-0.026	-0.001	-0.028	-0.044*	-0.033	-0.073*	0.006	-0.022	-0.017	-0.021	0.017
	(0.010)	(0.011)	(0.032)	(0.018)	(0.017)	(0.012)	(0.013)	(0.014)	(0.030)	(0.021)	(0.021)	(0.022)	(0.024)	(0.023)	(0.043)	(0.012)	(0.028)	(0.036)	(0.031)	(0.031)
Father: Higher education	-0.001	0.016	0.037	-0.012	-0.037*				-0.030	-0.072*	0.022			0.049	-0.087**		-0.043	-0.009		0.065*
	(0.015)	(0.015)	(0.048)	(0.021)	(0.021)				(0.034)	(0.041)	(0.024)			(0.043)	(0.043)		(0.036)	(0.038)		(0.039)
Father: Not present	-0.009	0.019					-0.106***					0.015			-0.047		0.066*		0.021	
	(0.021)	(0.019)					(0.027)					(0.018)			(0.048)		(0.037)		(0.059)	
Mother: Primary education	-0.001	-0.023**	0.053*	0.008	0.034	-0.009	-0.015	-0.037***	0.029	-0.033		-0.004	0.014	0.001	-0.009	0.031**	-0.018	-0.037*	-0.026	0.017
	(0.011)	(0.012)	(0.031)	(0.019)	(0.021)	(0.016)	(0.009)	(0.012)	(0.026)	(0.021)		(0.013)	(0.013)	(0.013)	(0.050)	(0.013)	(0.018)	(0.022)	(0.044)	(0.017)
Mother: Secondary education	-0.012	-0.034***	-0.043	-0.011	-0.001	-0.011	-0.036***	-0.049***	0.029	0.029		-0.023	-0.033	-0.057***	-0.069	0.015	-0.008	-0.046**	-0.009	-0.003
	(0.009)	(0.010)	(0.033)	(0.016)	(0.015)	(0.010)	(0.012)	(0.013)	(0.024)	(0.024)		(0.021)	(0.020)	(0.021)	(0.044)	(0.011)	(0.022)	(0.022)	(0.043)	(0.020)
Mother: Higher education	-0.012	-0.054***	-0.213***		0.015				0.005	-0.024				-0.154**	-0.087**		-0.028	-0.047**	-0.044	-0.003
	(0.015)	(0.013)	(0.071)		(0.021)				(0.027)	(0.055)				(0.071)	(0.044)		(0.029)	(0.024)	(0.048)	(0.034)
Rural residence	-0.004	-0.009	-0.007	0.009	-0.040	0.015	0.006	-0.006	0.012	0.024	0.054***	-0.040**	-0.033	0.015	-0.004	0.012	0.024	-0.001	-0.044	-0.004
	(0.008)	(0.007)	(0.037)	(0.017)	(0.035)	(0.034)	(0.008)	(0.010)	(0.012)	(0.018)	(0.017)	(0.018)	(0.023)	(0.021)	(0.009)	(0.008)	(0.019)	(0.017)	(0.036)	(0.016)
Wealth: poorest	-0.007	0.033*	-0.095	0.164***	0.023	0.052***	0.053***	-0.001	0.115***	0.038	0.067**	0.166**	0.055	0.207**	-0.001	0.039	-0.066	0.040	0.329*	0.166***
	(0.015)	(0.018)	(0.225)	(0.052)	(0.028)	(0.016)	(0.019)	(0.017)	(0.034)	(0.066)	(0.030)	(0.072)	(0.075)	(0.090)	(0.031)	(0.034)	(0.044)	(0.039)	(0.192)	(0.040)
Wealth: poorer	0.022*	0.001	-0.077	0.109***	-0.002	0.036**	0.033**	-0.003	0.069**	0.056*	0.064***	0.144**	0.052	0.158*	0.014	0.052***	-0.027	0.003	0.004	0.082**
	(0.012)	(0.013)	(0.179)	(0.034)	(0.026)	(0.016)	(0.015)	(0.015)	(0.030)	(0.031)	(0.024)	(0.064)	(0.064)	(0.081)	(0.020)	(0.018)	(0.031)	(0.025)	(0.059)	(0.033)
Wealth: middle	0.009	-0.006	-0.080	0.070**	-0.044*	0.029**	-0.001	-0.007	0.067**	0.029	0.044**	0.126**	0.021	0.114**	-0.009	0.030**	-0.040	-0.017	-0.029	0.052
	(0.011)	(0.011)	(0.110)	(0.029)	(0.023)	(0.015)	(0.015)	(0.014)	(0.029)	(0.024)	(0.022)	(0.049)	(0.047)	(0.058)	(0.014)	(0.015)	(0.032)	(0.020)	(0.040)	(0.033)
Wealth: richer	0.016	-0.006	-0.015	0.057**	-0.036**	0.024*	0.002	0.003	0.077***	0.003	-0.005	0.060**	0.015	0.073**	-0.000	0.007	-0.007	-0.019	-0.030	0.039
	(0.011)	(0.011)	(0.069)	(0.024)	(0.017)	(0.014)	(0.016)	(0.014)	(0.027)	(0.024)	(0.022)	(0.029)	(0.028)	(0.032)	(0.012)	(0.014)	(0.028)	(0.018)	(0.035)	(0.032)
Observations	13,742	13,972	2,385	4,254	13,125	10,052	35,010	16,366	6,260	6,553	6,006	8,316	9,811	9,827	6,939	5,695	2,640	3,296	1,723	2,761

*Notes: MEPI scores are instrumented using first-stage regressions in Table A21. Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old.*

Table A5. Average marginal effects from probit regressions of *stunting on MEPI scores* (Model 2)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR18
MEPI score	0.052	0.017	0.037	0.001	0.008	0.033	-0.036	-0.011	0.014	0.073	0.126***	-0.022	0.054*	-0.022	0.077**	0.080	0.190**	0.136	-0.197	0.187	
	(0.038)	(0.023)	(0.071)	(0.034)	(0.108)	(0.071)	(0.037)	(0.098)	(0.041)	(0.045)	(0.040)	(0.034)	(0.030)	(0.038)	(0.033)	(0.056)	(0.076)	(0.092)	(0.196)	(0.122)	
Female household	0.003	0.002	-0.060**	-0.015	-0.034	0.010	0.023	0.013	0.065**	-0.039*	-0.006	-0.007	0.007	0.024**	-0.001	0.016	0.028	0.008	-0.008	0.053**	0.006
	(0.015)	(0.016)	(0.026)	(0.013)	(0.031)	(0.016)	(0.017)	(0.014)	(0.029)	(0.021)	(0.027)	(0.016)	(0.012)	(0.012)	(0.022)	(0.023)	(0.057)	(0.021)	(0.052)	(0.025)	(0.021)
Female child	-0.008	-0.023***	-0.028	-0.001	-0.020**	-0.003	-0.013**	0.049***	-0.030***	-0.017	-0.042***	-0.009	-0.012	-0.031***	-0.016**	0.002	-0.020	0.009	0.026	-0.034***	-0.002
	(0.006)	(0.006)	(0.023)	(0.012)	(0.009)	(0.008)	(0.006)	(0.008)	(0.010)	(0.013)	(0.011)	(0.010)	(0.010)	(0.010)	(0.006)	(0.008)	(0.013)	(0.010)	(0.018)	(0.012)	(0.011)
Child age (yrs)	0.021***	-0.006	0.125***	0.032**	0.063***	-0.005	0.052***	0.040***	0.024*	0.105***	0.087***	0.185***	0.177***	0.154***	0.013	0.005	-0.012	0.008	-0.072**	0.032	0.038**
	(0.008)	(0.008)	(0.029)	(0.016)	(0.012)	(0.011)	(0.009)	(0.010)	(0.013)	(0.018)	(0.016)	(0.014)	(0.014)	(0.015)	(0.009)	(0.012)	(0.018)	(0.015)	(0.029)	(0.020)	(0.016)
Child age squared	-0.004**	0.002	-0.024***	-0.009***	-0.009***	-0.004*	-0.012***	-0.008***	-0.007**	-0.019***	-0.018***	-0.028***	-0.028***	-0.026***	-0.004*	-0.003	-0.000	-0.003	0.010*	-0.006	-0.007**
	(0.002)	(0.002)	(0.006)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.004)	(0.003)	(0.005)	(0.004)	(0.003)
Father: Primary education	-0.021*	-0.002	-0.056*	-0.024	0.022	0.008	-0.022*	0.015	-0.038	-0.003	-0.018	-0.010	-0.003	-0.024*	-0.088**		-0.007	-0.008	-0.023	0.035	-0.005
	(0.011)	(0.012)	(0.031)	(0.020)	(0.018)	(0.015)	(0.012)	(0.015)	(0.031)	(0.020)	(0.014)	(0.016)	(0.016)	(0.013)	(0.044)		(0.026)	(0.035)	(0.062)	(0.028)	(0.028)
Father: Secondary education	-0.006	0.004	-0.017	-0.027	-0.024	0.000	-0.044***	-0.002	-0.027	-0.025	0.002	-0.028	-0.042*	-0.033	-0.074*	0.013	-0.022	-0.011	-0.022	0.022	-0.029
	(0.010)	(0.011)	(0.032)	(0.018)	(0.017)	(0.013)	(0.013)	(0.014)	(0.030)	(0.021)	(0.021)	(0.022)	(0.024)	(0.023)	(0.041)	(0.011)	(0.028)	(0.036)	(0.031)	(0.031)	(0.029)
Father: Higher education	-0.004	0.018	0.040	-0.011	-0.034				-0.031	-0.071*	0.024			0.047	-0.087**	0.007	-0.042	-0.004		0.069*	-0.034
	(0.015)	(0.015)	(0.048)	(0.021)	(0.021)				(0.034)	(0.041)	(0.024)			(0.043)	(0.041)	(0.012)	(0.037)	(0.038)		(0.039)	(0.033)
Father: Not present	-0.012	0.021					-0.098***					0.015			-0.049		0.058		0.024		
	(0.021)	(0.019)					(0.027)					(0.018)			(0.046)		(0.037)		(0.060)		
Mother: Primary education	-0.001	-0.022*	0.053*	0.007	0.036*		-0.015	-0.037***	0.028	-0.032		-0.005	0.015	0.001	-0.012		-0.014	-0.036*	-0.033	0.014	0.007
	(0.011)	(0.012)	(0.031)	(0.019)	(0.021)		(0.009)	(0.012)	(0.026)	(0.021)		(0.013)	(0.013)	(0.013)	(0.051)		(0.019)	(0.022)	(0.045)	(0.017)	(0.018)
Mother: Secondary education	-0.012	-0.033***	-0.043	-0.011	0.002	-0.024**	-0.037***	-0.049***	0.028	0.029		-0.026	-0.031	-0.059***	-0.073*	-0.015	-0.006	-0.044**	-0.015	-0.006	0.008
	(0.009)	(0.010)	(0.033)	(0.016)	(0.015)	(0.011)	(0.012)	(0.014)	(0.024)	(0.024)		(0.021)	(0.020)	(0.021)	(0.044)	(0.012)	(0.022)	(0.022)	(0.043)	(0.020)	(0.019)
Mother: Higher education	-0.011	-0.054***	-0.215***		0.017	-0.040**			0.003	-0.022				-0.155**	-0.089**	-0.030**	-0.026	-0.044*	-0.052	-0.005	-0.031
	(0.015)	(0.013)	(0.071)		(0.021)	(0.016)			(0.027)	(0.055)				(0.071)	(0.044)	(0.013)	(0.030)	(0.024)	(0.048)	(0.033)	(0.029)
Rural residence	-0.004	-0.009	0.009	-0.002	-0.027	0.008	0.005	-0.010	0.010	0.018	0.055***	-0.040**	-0.025	0.005	-0.003	0.013	0.024	0.011	0.009	0.000	-0.023*
	(0.008)	(0.007)	(0.028)	(0.015)	(0.035)	(0.034)	(0.008)	(0.011)	(0.011)	(0.018)	(0.017)	(0.018)	(0.018)	(0.016)	(0.009)	(0.008)	(0.019)	(0.015)	(0.023)	(0.015)	(0.014)
Wealth: poorest	0.017	0.018	0.048	0.104***	-0.023	0.043***	0.045***	0.034**	0.123***	0.124***	0.043*	0.212***	0.094***	0.142***	0.007	0.060***	-0.011	-0.005	-0.033	0.141***	0.076***
	(0.013)	(0.013)	(0.059)	(0.027)	(0.024)	(0.016)	(0.016)	(0.017)	(0.029)	(0.033)	(0.026)	(0.036)	(0.035)	(0.039)	(0.018)	(0.021)	(0.035)	(0.024)	(0.042)	(0.034)	(0.029)
Wealth: poorer	0.025**	-0.006	0.034	0.073***	-0.033	0.030*	0.032**	0.013	0.077***	0.077***	0.063***	0.184***	0.084**	0.102***	0.018	0.057***	-0.018	-0.016	-0.075*	0.076**	0.039
	(0.012)	(0.011)	(0.053)	(0.024)	(0.024)	(0.015)	(0.015)	(0.015)	(0.027)	(0.026)	(0.024)	(0.033)	(0.033)	(0.037)	(0.015)	(0.017)	(0.031)	(0.021)	(0.040)	(0.033)	(0.026)
Wealth: middle	0.010	-0.009	-0.016	0.046*	-0.061***	0.024*	-0.001	0.003	0.071**	0.033	0.045**	0.156***	0.043	0.077**	-0.006	0.032**	-0.037	-0.023	-0.061*	0.050	0.011
	(0.011)	(0.011)	(0.047)	(0.024)	(0.022)	(0.015)	(0.015)	(0.014)	(0.028)	(0.024)	(0.022)	(0.029)	(0.028)	(0.031)	(0.012)	(0.015)	(0.032)	(0.020)	(0.036)	(0.033)	(0.026)
Wealth: richer	0.015	-0.007	0.018	0.046**	-0.045***	0.019	0.002	0.005	0.079***	0.003	-0.005	0.074***	0.024	0.057**	0.001	0.008	-0.003	-0.019	-0.035	0.036	-0.001
	(0.011)	(0.011)	(0.046)	(0.023)	(0.017)	(0.014)	(0.016)	(0.013)	(0.027)	(0.024)	(0.022)	(0.023)	(0.023)	(0.026)	(0.012)	(0.014)	(0.028)	(0.018)	(0.035)	(0.032)	(0.025)
Observations	13,742	13,972	2,387	4,254	13,147	10,052	35,036	16,366	6,267	6,571	6,014	8,316	9,811	9,830	6,939	5,695	2,640	3,296	1,723	2,777	2,102

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old.*

Table A6. Average marginal effects from probit regressions of *stunting on dirty cooking fuels* indicator (Model 3)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12
Dirty fuels	0.028	0.004	-0.042	-0.025		0.054	0.021		0.014	-0.006	0.027	-0.029	0.010	-0.039**	0.021	0.038	0.127
	(0.027)	(0.010)	(0.048)	(0.015)		(0.108)	(0.025)		(0.037)	(0.022)	(0.025)	(0.018)	(0.016)	(0.017)	(0.024)	(0.030)	(0.102)
Female household	0.003	0.002	-0.059**	-0.015	-0.034	0.010	0.022	0.013	0.065**	-0.041**	-0.006	-0.007	0.008	0.023*	-0.003	0.015	0.028
	(0.015)	(0.016)	(0.026)	(0.013)	(0.031)	(0.016)	(0.017)	(0.014)	(0.029)	(0.020)	(0.027)	(0.016)	(0.012)	(0.012)	(0.022)	(0.023)	(0.057)
Female child	-0.008	-0.023***	-0.029	-0.001	-0.020**	-0.003	-0.013**	0.049***	-0.030***	-0.018	-0.043***	-0.009	-0.012	-0.031***	-0.016**	0.003	-0.021*
	(0.006)	(0.006)	(0.023)	(0.012)	(0.009)	(0.008)	(0.006)	(0.008)	(0.010)	(0.013)	(0.012)	(0.010)	(0.010)	(0.010)	(0.006)	(0.008)	(0.013)
Child age (yrs)	0.021***	-0.006	0.126***	0.032**	0.063***	-0.005	0.052***	0.040***	0.024*	0.105***	0.088***	0.185***	0.176***	0.154***	0.013	0.005	-0.012
	(0.008)	(0.008)	(0.029)	(0.016)	(0.012)	(0.011)	(0.009)	(0.010)	(0.013)	(0.018)	(0.016)	(0.014)	(0.014)	(0.015)	(0.009)	(0.012)	(0.018)
Child age squared	-0.004**	0.002	-0.024***	-0.009***	-0.009***	-0.004*	-0.013***	-0.008***	-0.007**	-0.019***	-0.018***	-0.028***	-0.028***	-0.026***	-0.004*	-0.003	-0.000
	(0.002)	(0.002)	(0.006)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.004)
Father: Primary education	-0.022*	-0.002	-0.058*	-0.023	0.021	0.008	-0.020	0.015	-0.038	-0.003	-0.019	-0.009	-0.003	-0.023*	-0.090**		-0.013
	(0.011)	(0.012)	(0.031)	(0.020)	(0.018)	(0.015)	(0.012)	(0.015)	(0.031)	(0.020)	(0.014)	(0.016)	(0.016)	(0.013)	(0.045)		(0.025)
Father: Secondary education	-0.007	0.003	-0.019	-0.026	-0.024	0.000	-0.043***	-0.002	-0.027	-0.025	0.001	-0.028	-0.043*	-0.033	-0.075*	0.013	-0.029
	(0.010)	(0.011)	(0.033)	(0.018)	(0.017)	(0.013)	(0.013)	(0.014)	(0.029)	(0.021)	(0.021)	(0.022)	(0.024)	(0.023)	(0.042)	(0.011)	(0.028)
Father: Higher education	-0.004	0.017	0.037	-0.010	-0.034				-0.032	-0.071*	0.023			0.047	-0.089**	0.008	-0.049
	(0.015)	(0.015)	(0.048)	(0.020)	(0.021)				(0.034)	(0.041)	(0.024)			(0.043)	(0.042)	(0.012)	(0.036)
Father: Not present	-0.012	0.020					-0.096***					0.015			-0.050		0.054
	(0.021)	(0.019)					(0.027)					(0.018)			(0.047)		(0.037)
Mother: Primary education	-0.001	-0.023*	0.050	0.007	0.036*		-0.014	-0.037***	0.028	-0.033		-0.006	0.014	-0.000	-0.010		-0.018
	(0.011)	(0.012)	(0.031)	(0.019)	(0.020)		(0.009)	(0.012)	(0.026)	(0.021)		(0.013)	(0.013)	(0.013)	(0.051)		(0.018)
Mother: Secondary education	-0.012	-0.033***	-0.044	-0.012	0.002	-0.024**	-0.036***	-0.049***	0.028	0.029		-0.028	-0.033	-0.060***	-0.071	-0.016	-0.009
	(0.009)	(0.010)	(0.033)	(0.016)	(0.015)	(0.011)	(0.012)	(0.014)	(0.024)	(0.024)		(0.021)	(0.020)	(0.021)	(0.044)	(0.012)	(0.022)
Mother: Higher education	-0.011	-0.055***	-0.219***		0.017	-0.041**			0.003	-0.021				-0.156**	-0.088**	-0.031**	-0.029
	(0.015)	(0.013)	(0.072)		(0.021)	(0.016)			(0.027)	(0.055)				(0.071)	(0.044)	(0.013)	(0.029)
Rural residence	-0.004	-0.009	0.024	0.005	-0.027	0.008	0.004	-0.010	0.010	0.017	0.053***	-0.045**	-0.019	-0.001	-0.004	0.013	0.024
	(0.008)	(0.007)	(0.032)	(0.015)	(0.035)	(0.034)	(0.008)	(0.011)	(0.011)	(0.018)	(0.017)	(0.018)	(0.018)	(0.016)	(0.009)	(0.008)	(0.019)
Wealth: poorest	0.019	0.020	0.080	0.117***	-0.022	0.042***	0.042***	0.033**	0.123***	0.158***	0.063**	0.217***	0.118***	0.158***	0.018	0.066***	0.002
	(0.013)	(0.013)	(0.055)	(0.023)	(0.024)	(0.016)	(0.016)	(0.017)	(0.030)	(0.028)	(0.025)	(0.031)	(0.032)	(0.034)	(0.018)	(0.020)	(0.034)
Wealth: poorer	0.026**	-0.006	0.062	0.085***	-0.033	0.029*	0.032**	0.013	0.077***	0.085***	0.066***	0.189***	0.105***	0.116***	0.024	0.058***	-0.016
	(0.012)	(0.011)	(0.052)	(0.023)	(0.024)	(0.015)	(0.015)	(0.015)	(0.027)	(0.026)	(0.024)	(0.029)	(0.031)	(0.033)	(0.015)	(0.017)	(0.031)
Wealth: middle	0.010	-0.009	0.006	0.054**	-0.061***	0.023	-0.001	0.003	0.071**	0.035	0.046**	0.159***	0.058**	0.085***	-0.002	0.033**	-0.037
	(0.011)	(0.011)	(0.052)	(0.023)	(0.022)	(0.014)	(0.015)	(0.014)	(0.028)	(0.024)	(0.022)	(0.026)	(0.026)	(0.029)	(0.012)	(0.015)	(0.032)
Wealth: richer	0.015	-0.007	0.032	0.050**	-0.045***	0.019	0.002	0.005	0.079***	0.003	-0.004	0.074***	0.030	0.058**	0.002	0.008	-0.002
	(0.011)	(0.011)	(0.049)	(0.023)	(0.017)	(0.014)	(0.016)	(0.013)	(0.027)	(0.024)	(0.022)	(0.022)	(0.023)	(0.025)	(0.012)	(0.014)	(0.028)
Observations	13,742	13,972	2,387	4,254	13,147	10,052	35,036	16,366	6,267	6,571	6,014	8,316	9,811	9,830	6,939	5,695	2,640

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old.*

Table A7. Average marginal effects from probit regressions of *stunting on MEP PCA* scores (Model 4)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR18
MEP PCA 1st-component score	0.056*	0.036	0.074	0.021	0.024	0.105	-0.007	-0.017	0.013	0.082*	0.116***	-0.014	0.053*	-0.015	0.035	0.047	0.221*	0.029	-0.460	0.116	
	(0.034)	(0.027)	(0.075)	(0.037)	(0.072)	(0.101)	(0.036)	(0.068)	(0.037)	(0.046)	(0.038)	(0.036)	(0.031)	(0.039)	(0.031)	(0.034)	(0.116)	(0.131)	(0.396)	(0.074)	
Female household	0.003	0.002	-0.061**	-0.015	-0.034	0.010	0.023	0.013	0.065**	-0.039*	-0.006	-0.008	0.007	0.024**	-0.002	0.015	0.030	0.008	-0.008	0.053**	0.006
	(0.015)	(0.016)	(0.026)	(0.013)	(0.031)	(0.016)	(0.017)	(0.014)	(0.029)	(0.021)	(0.027)	(0.016)	(0.012)	(0.012)	(0.022)	(0.023)	(0.056)	(0.021)	(0.051)	(0.025)	(0.021)
Female child	-0.008	-0.023***	-0.028	-0.001	-0.020**	-0.003	-0.013**	0.049***	-0.030***	-0.017	-0.043***	-0.009	-0.012	-0.031***	-0.016**	0.003	-0.021	0.009	0.026	-0.034***	-0.002
	(0.006)	(0.006)	(0.023)	(0.012)	(0.009)	(0.008)	(0.006)	(0.008)	(0.010)	(0.013)	(0.012)	(0.010)	(0.010)	(0.010)	(0.006)	(0.008)	(0.013)	(0.010)	(0.018)	(0.012)	(0.011)
Child age (yrs)	0.021***	-0.006	0.125***	0.032**	0.063***	-0.005	0.052***	0.040***	0.024*	0.105***	0.088***	0.185***	0.177***	0.154***	0.013	0.005	-0.012	0.009	-0.072**	0.032	0.038**
	(0.008)	(0.008)	(0.029)	(0.016)	(0.012)	(0.011)	(0.009)	(0.010)	(0.013)	(0.018)	(0.016)	(0.014)	(0.014)	(0.015)	(0.009)	(0.012)	(0.018)	(0.015)	(0.029)	(0.021)	(0.016)
Child age squared	-0.004**	0.002	-0.024***	-0.009***	-0.009***	-0.004*	-0.012***	-0.008***	-0.007**	-0.019***	-0.018***	-0.028***	-0.028***	-0.026***	-0.004*	-0.003	-0.000	-0.003	0.010*	-0.006	-0.007**
	(0.002)	(0.002)	(0.006)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.004)	(0.003)	(0.005)	(0.004)	(0.003)
Father: Primary education	-0.021*	-0.001	-0.055*	-0.024	0.022	0.008	-0.021*	0.015	-0.038	-0.002	-0.018	-0.010	-0.003	-0.024*	-0.090**		-0.008	-0.011	-0.023	0.034	-0.005
	(0.011)	(0.012)	(0.031)	(0.020)	(0.018)	(0.015)	(0.012)	(0.015)	(0.031)	(0.020)	(0.014)	(0.016)	(0.016)	(0.013)	(0.045)		(0.026)	(0.035)	(0.062)	(0.028)	(0.028)
Father: Secondary education	-0.006	0.004	-0.016	-0.026	-0.023	0.000	-0.044***	-0.002	-0.026	-0.025	0.002	-0.028	-0.042*	-0.033	-0.075*	0.013	-0.024	-0.015	-0.022	0.022	-0.029
	(0.010)	(0.011)	(0.032)	(0.018)	(0.016)	(0.013)	(0.013)	(0.014)	(0.030)	(0.021)	(0.021)	(0.022)	(0.024)	(0.023)	(0.042)	(0.011)	(0.028)	(0.036)	(0.031)	(0.031)	(0.029)
Father: Higher education	-0.004	0.018	0.041	-0.012	-0.034				-0.031	-0.071*	0.024			0.048	-0.089**	0.008	-0.044	-0.007		0.069*	-0.034
	(0.015)	(0.015)	(0.048)	(0.021)	(0.021)				(0.034)	(0.041)	(0.024)			(0.043)	(0.042)	(0.012)	(0.037)	(0.038)		(0.039)	(0.033)
Father: Not present	-0.012	0.021					-0.097***					0.015			-0.051		0.055		0.025		
	(0.021)	(0.019)					(0.027)					(0.018)			(0.047)		(0.037)		(0.060)		
Mother: Primary education	-0.001	-0.022*	0.055*	0.008	0.037*		-0.014	-0.037***	0.028	-0.032		-0.005	0.015	0.001	-0.010		-0.014	-0.037*	-0.035	0.014	0.007
	(0.011)	(0.012)	(0.031)	(0.019)	(0.021)		(0.009)	(0.012)	(0.026)	(0.021)		(0.013)	(0.013)	(0.013)	(0.051)		(0.019)	(0.022)	(0.045)	(0.017)	(0.018)
Mother: Secondary education	-0.012	-0.033***	-0.041	-0.011	0.002	-0.023**	-0.037***	-0.049***	0.028	0.029		-0.025	-0.031	-0.058***	-0.072	-0.016	-0.006	-0.046**	-0.017	-0.005	0.008
	(0.009)	(0.010)	(0.033)	(0.016)	(0.015)	(0.011)	(0.012)	(0.013)	(0.024)	(0.024)		(0.021)	(0.020)	(0.021)	(0.045)	(0.012)	(0.022)	(0.021)	(0.043)	(0.020)	(0.019)
Mother: Higher education	-0.011	-0.054***	-0.213***		0.018	-0.040**			0.003	-0.022				-0.155**	-0.088**	-0.031**	-0.026	-0.046*	-0.053	-0.005	-0.031
	(0.015)	(0.013)	(0.070)		(0.021)	(0.016)			(0.027)	(0.055)				(0.071)	(0.044)	(0.013)	(0.030)	(0.024)	(0.048)	(0.033)	(0.029)
Rural residence	-0.004	-0.009	0.009	-0.003	-0.027	0.008	0.005	-0.010	0.010	0.019	0.054***	-0.040**	-0.025	0.004	-0.004	0.013	0.024	0.009	0.009	-0.000	-0.023*
	(0.008)	(0.007)	(0.028)	(0.014)	(0.035)	(0.034)	(0.008)	(0.011)	(0.011)	(0.018)	(0.017)	(0.018)	(0.018)	(0.016)	(0.009)	(0.008)	(0.019)	(0.015)	(0.023)	(0.015)	(0.014)
Wealth: poorest	0.017	0.017	0.023	0.094***	-0.023	0.042**	0.043***	0.034**	0.123***	0.122***	0.044*	0.207***	0.094***	0.139***	0.016	0.065***	-0.004	-0.001	-0.033	0.142***	0.076***
	(0.013)	(0.013)	(0.068)	(0.028)	(0.024)	(0.016)	(0.016)	(0.017)	(0.030)	(0.032)	(0.026)	(0.036)	(0.036)	(0.039)	(0.018)	(0.020)	(0.035)	(0.023)	(0.042)	(0.034)	(0.029)
Wealth: poorer	0.025**	-0.006	0.014	0.068***	-0.033	0.029*	0.032**	0.013	0.077***	0.077***	0.063***	0.180***	0.084**	0.099***	0.023	0.058***	-0.017	-0.015	-0.075*	0.077**	0.039
	(0.012)	(0.011)	(0.059)	(0.024)	(0.024)	(0.015)	(0.015)	(0.015)	(0.027)	(0.026)	(0.024)	(0.034)	(0.033)	(0.037)	(0.015)	(0.017)	(0.031)	(0.021)	(0.040)	(0.033)	(0.026)
Wealth: middle	0.010	-0.009	-0.028	0.043*	-0.061***	0.024	-0.001	0.003	0.071**	0.033	0.045**	0.153***	0.042	0.075**	-0.003	0.033**	-0.037	-0.023	-0.061*	0.050	0.011
	(0.011)	(0.011)	(0.050)	(0.024)	(0.022)	(0.014)	(0.015)	(0.014)	(0.028)	(0.024)	(0.022)	(0.029)	(0.028)	(0.031)	(0.012)	(0.015)	(0.032)	(0.020)	(0.036)	(0.033)	(0.026)
Wealth: richer	0.015	-0.007	0.011	0.044*	-0.045***	0.019	0.002	0.005	0.079***	0.003	-0.005	0.072***	0.023	0.056**	0.002	0.008	-0.002	-0.019	-0.035	0.036	-0.001
	(0.011)	(0.011)	(0.047)	(0.023)	(0.017)	(0.014)	(0.016)	(0.013)	(0.027)	(0.024)	(0.022)	(0.023)	(0.023)	(0.026)	(0.012)	(0.014)	(0.028)	(0.018)	(0.035)	(0.032)	(0.025)
Observations	13,742	13,972	2,387	4,254	13,147	10,052	35,036	16,366	6,267	6,571	6,014	8,316	9,811	9,830	6,939	5,695	2,640	3,296	1,723	2,774	2,102

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old.*

Table A8. Average marginal effects from probit regressions of *stunting on temperature extremes* (Model 5)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR18
Tempr. Extremes 9months pre birth	0.008	0.004	0.186	-0.626***	-0.048*	-0.034	-0.007	-0.038***	0.052**	-0.023	0.016	0.021	-0.131***	-0.392***	0.032*	0.021	0.030	-0.026	-0.097	0.015	-0.051**
	(0.012)	(0.012)	(0.159)	(0.153)	(0.025)	(0.027)	(0.009)	(0.012)	(0.021)	(0.031)	(0.029)	(0.043)	(0.045)	(0.055)	(0.017)	(0.026)	(0.032)	(0.027)	(0.174)	(0.022)	(0.022)
Tempr. Extremes 12months post bir	0.000	-0.059	-0.174	0.864***	0.087	0.171	-0.074	-0.100	0.049	-0.068	0.162	0.068	-0.037	-0.627***	0.022	0.033	0.327*	0.277	1.381	-0.034	-0.050
	(0.062)	(0.083)	(0.290)	(0.191)	(0.090)	(0.113)	(0.053)	(0.080)	(0.058)	(0.136)	(0.128)	(0.090)	(0.101)	(0.208)	(0.062)	(0.117)	(0.178)	(0.200)	(1.355)	(0.077)	(0.075)
Female household	-0.002	0.003	-0.061**	-0.021	-0.035	0.007	0.020	0.013	0.071**	-0.038*	-0.002	-0.008	0.006	0.026*	-0.007	0.027	0.019	0.008	0.038	0.054**	0.006
	(0.016)	(0.017)	(0.026)	(0.014)	(0.031)	(0.018)	(0.018)	(0.014)	(0.033)	(0.021)	(0.027)	(0.016)	(0.012)	(0.014)	(0.024)	(0.025)	(0.058)	(0.021)	(0.073)	(0.025)	(0.021)
Female child	-0.009	-0.023***	-0.027	-0.006	-0.020**	-0.004	-0.013**	0.049***	-0.030***	-0.019	-0.044***	-0.008	-0.013	-0.030**	-0.016**	0.009	-0.022*	0.010	0.077**	-0.034***	-0.001
	(0.006)	(0.006)	(0.023)	(0.012)	(0.009)	(0.010)	(0.007)	(0.008)	(0.010)	(0.013)	(0.012)	(0.010)	(0.010)	(0.012)	(0.006)	(0.009)	(0.013)	(0.010)	(0.031)	(0.012)	(0.011)
Child age (yrs)	0.019**	-0.003	0.147***	-0.092**	0.070***	-0.334***	0.058***	0.039***	0.018	0.102***	0.084***	0.182***	0.171***	0.163***	0.014	0.012	-0.015	-0.011	1.006	0.029	0.036**
	(0.008)	(0.010)	(0.039)	(0.042)	(0.014)	(0.097)	(0.010)	(0.010)	(0.013)	(0.020)	(0.017)	(0.015)	(0.015)	(0.031)	(0.010)	(0.022)	(0.018)	(0.020)	(2.273)	(0.020)	(0.016)
Child age squared	-0.003*	0.002	-0.028***	0.009	-0.011***	0.040***	-0.014***	-0.009***	-0.006**	-0.018***	-0.017***	-0.027***	-0.027***	-0.030***	-0.004*	-0.004	0.001	0.001	-0.102	-0.006	-0.007**
	(0.002)	(0.002)	(0.010)	(0.007)	(0.003)	(0.012)	(0.002)	(0.002)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.005)	(0.002)	(0.004)	(0.004)	(0.004)	(0.253)	(0.004)	(0.003)
Father: Primary education	-0.019*	-0.004	-0.056*	-0.035*	0.022	0.014	-0.022*	0.016	-0.036	-0.000	-0.019	-0.010	-0.004	-0.019	-0.089**		-0.014	-0.010	-0.159*	0.029	-0.006
	(0.011)	(0.012)	(0.030)	(0.020)	(0.018)	(0.018)	(0.012)	(0.015)	(0.031)	(0.020)	(0.014)	(0.016)	(0.016)	(0.015)	(0.044)		(0.025)	(0.035)	(0.092)	(0.028)	(0.028)
Father: Secondary education	-0.006	0.002	-0.017	-0.028	-0.024	0.003	-0.045***	0.000	-0.024	-0.024	0.002	-0.028	-0.047**	-0.016	-0.077*	0.009	-0.026	-0.014	-0.103**	0.017	-0.030
	(0.010)	(0.011)	(0.032)	(0.018)	(0.016)	(0.015)	(0.013)	(0.014)	(0.029)	(0.022)	(0.021)	(0.022)	(0.024)	(0.028)	(0.041)	(0.012)	(0.028)	(0.035)	(0.043)	(0.031)	(0.029)
Father: Higher education	-0.003	0.016	0.040	-0.008	-0.034				-0.029	-0.069	0.022			0.050	-0.091**	0.003	-0.047	-0.007		0.064*	-0.036
	(0.015)	(0.015)	(0.048)	(0.023)	(0.021)				(0.034)	(0.042)	(0.025)			(0.045)	(0.041)	(0.013)	(0.037)	(0.038)		(0.038)	(0.033)
Father: Not present	-0.009	0.019					-0.110***					0.015			-0.044		0.062		-0.089		
	(0.023)	(0.022)					(0.028)					(0.018)			(0.047)		(0.039)		(0.074)		
Mother: Primary education	-0.001	-0.020*	0.052*	0.008	0.036*		-0.013	-0.037***	0.029	-0.033		-0.005	0.013	0.010	-0.022		-0.026	-0.041*	-0.089	0.014	0.009
	(0.011)	(0.012)	(0.031)	(0.019)	(0.020)		(0.009)	(0.012)	(0.026)	(0.022)		(0.013)	(0.013)	(0.015)	(0.056)		(0.019)	(0.022)	(0.064)	(0.017)	(0.018)
Mother: Secondary education	-0.013	-0.032***	-0.045	-0.014	0.001	-0.012	-0.035***	-0.050***	0.029	0.035		-0.025	-0.034*	-0.071***	-0.073	-0.028**	-0.013	-0.051**	-0.050	-0.004	0.008
	(0.009)	(0.010)	(0.033)	(0.017)	(0.015)	(0.013)	(0.012)	(0.013)	(0.024)	(0.025)		(0.021)	(0.020)	(0.024)	(0.051)	(0.013)	(0.022)	(0.022)	(0.064)	(0.021)	(0.019)
Mother: Higher education	-0.009	-0.053***	-0.216***		0.017	-0.013			0.004	-0.016				-0.365***	-0.089*	-0.041***	-0.035	-0.052**	-0.136*	-0.004	-0.029
	(0.015)	(0.013)	(0.070)		(0.021)	(0.019)			(0.027)	(0.056)				(0.100)	(0.051)	(0.014)	(0.030)	(0.024)	(0.074)	(0.034)	(0.028)
Rural residence	-0.010	-0.009	0.011	-0.006	-0.028	0.002	0.005	-0.009	0.009	0.016	0.054***	-0.040**	-0.017	-0.001	-0.003	0.015	0.029	0.011	0.055	-0.001	-0.023*
	(0.008)	(0.007)	(0.028)	(0.015)	(0.035)	(0.036)	(0.008)	(0.011)	(0.011)	(0.018)	(0.017)	(0.018)	(0.018)	(0.018)	(0.009)	(0.009)	(0.020)	(0.015)	(0.038)	(0.015)	(0.014)
Wealth: poorest	0.025**	0.022*	0.068	0.106***	-0.022	0.051**	0.044***	0.032*	0.124***	0.157***	0.069***	0.199***	0.121***	0.161***	0.020	0.073***	-0.000	-0.005	-0.029	0.148***	0.079***
	(0.013)	(0.013)	(0.048)	(0.023)	(0.024)	(0.020)	(0.016)	(0.017)	(0.030)	(0.028)	(0.025)	(0.028)	(0.030)	(0.037)	(0.018)	(0.023)	(0.035)	(0.024)	(0.081)	(0.034)	(0.028)
Wealth: poorer	0.029**	-0.005	0.049	0.071***	-0.033	0.024	0.032**	0.013	0.078***	0.087***	0.065***	0.172***	0.104***	0.120***	0.024	0.058***	-0.018	-0.019	-0.025	0.078**	0.041
	(0.012)	(0.011)	(0.045)	(0.023)	(0.024)	(0.019)	(0.016)	(0.015)	(0.027)	(0.027)	(0.024)	(0.027)	(0.030)	(0.036)	(0.015)	(0.020)	(0.031)	(0.021)	(0.073)	(0.033)	(0.026)
Wealth: middle	0.013	-0.007	-0.006	0.040*	-0.060***	0.021	-0.001	0.002	0.071**	0.035	0.045**	0.147***	0.058**	0.088***	-0.002	0.031*	-0.038	-0.027	-0.093	0.051	0.013
	(0.011)	(0.011)	(0.044)	(0.024)	(0.022)	(0.018)	(0.015)	(0.014)	(0.028)	(0.025)	(0.023)	(0.025)	(0.026)	(0.033)	(0.012)	(0.017)	(0.032)	(0.020)	(0.062)	(0.033)	(0.026)
Wealth: richer	0.015	-0.003	0.024	0.042*	-0.045***	0.036**	0.002	0.007	0.078***	0.001	-0.005	0.070***	0.029	0.042	0.002	0.019	-0.004	-0.022	-0.051	0.037	-0.000
	(0.011)	(0.011)	(0.045)	(0.024)	(0.017)	(0.017)	(0.016)	(0.013)	(0.027)	(0.025)	(0.022)	(0.022)	(0.023)	(0.030)	(0.012)	(0.016)	(0.029)	(0.018)	(0.065)	(0.032)	(0.024)
Observations	13,471	13,631	2,387	3,884	13,147	4,873	34,697	16,204	6,267	6,148	5,680	8,304	9,748	7,381	6,879	4,642	2,585	3,247	367	2,777	2,102

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old.*

Table A9. Average marginal effects from probit regressions of *stunting on MEPI scores and temperature extremes* (Model 6)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR18
MEPI score	0.032	0.018	0.037	0.004	0.013	0.081	-0.146	-0.067	0.400	0.076	0.153***	-0.020	0.060**	0.025	0.088***	0.155**	0.185**	0.218*	0.031	0.189	
	(0.040)	(0.023)	(0.071)	(0.034)	(0.108)	(0.082)	(0.162)	(0.103)	(0.508)	(0.049)	(0.044)	(0.034)	(0.030)	(0.048)	(0.034)	(0.076)	(0.087)	(0.117)	(0.415)	(0.122)	
Tempr. extremes 12months	0.003	-0.052	-0.341	0.807***	0.107	0.134	-0.071	-0.090	0.038	-0.065	0.225*	0.114	-0.248	-0.386	0.085	0.072	0.320*	0.330*	0.848	-0.044	-0.026
post birth	(0.062)	(0.087)	(0.438)	(0.217)	(0.093)	(0.125)	(0.052)	(0.085)	(0.095)	(0.148)	(0.136)	(0.174)	(0.201)	(0.412)	(0.071)	(0.121)	(0.186)	(0.200)	(0.898)	(0.079)	(0.073)
MEPI score × Tempr.	-0.348	-0.117	0.086	0.124	-0.654	1.344	0.038	0.010	-0.136	0.136	-1.113*	-0.062	0.405	-0.638	-0.670*	-1.865	0.268	-2.998	-0.618	-0.163	
extremes 12months	(0.552)	(0.483)	(0.542)	(0.236)	(1.191)	(1.455)	(0.053)	(0.038)	(0.200)	(0.495)	(0.620)	(0.233)	(0.310)	(0.606)	(0.398)	(1.368)	(1.452)	(2.160)	(8.247)	(1.575)	
Female household	-0.002	0.003	-0.060**	-0.022	-0.035	0.006	0.020	0.012	0.096*	-0.037*	-0.003	-0.008	0.005	0.026*	-0.005	0.028	0.026	0.008	0.043	0.053**	0.006
	(0.016)	(0.017)	(0.026)	(0.014)	(0.031)	(0.018)	(0.018)	(0.014)	(0.055)	(0.021)	(0.027)	(0.016)	(0.012)	(0.014)	(0.023)	(0.025)	(0.058)	(0.021)	(0.072)	(0.025)	(0.021)
Female child	-0.009	-0.023***	-0.027	-0.006	-0.020**	-0.003	-0.013**	0.050***	-0.015	-0.018	-0.043***	-0.008	-0.013	-0.031**	-0.016**	0.010	-0.021	0.010	0.080**	-0.034***	-0.002
	(0.006)	(0.006)	(0.023)	(0.012)	(0.009)	(0.010)	(0.007)	(0.008)	(0.015)	(0.013)	(0.012)	(0.010)	(0.010)	(0.012)	(0.006)	(0.009)	(0.013)	(0.010)	(0.031)	(0.012)	(0.011)
Child age (yrs)	0.018**	-0.002	0.151***	-0.136***	0.071***	-0.291***	0.057***	0.040***	0.032	0.105***	0.082***	0.181***	0.177***	0.154***	0.014	0.012	-0.017	-0.012	0.537	0.028	0.038**
	(0.008)	(0.010)	(0.039)	(0.043)	(0.014)	(0.098)	(0.009)	(0.010)	(0.020)	(0.020)	(0.016)	(0.015)	(0.015)	(0.031)	(0.010)	(0.022)	(0.018)	(0.020)	(1.928)	(0.021)	(0.015)
Child age squared	-0.003*	0.002	-0.031***	0.017**	-0.011***	0.035***	-0.014***	-0.009***	-0.008*	-0.019***	-0.016***	-0.027***	-0.028***	-0.027***	-0.004*	-0.004	0.001	0.001	-0.048	-0.006	-0.007**
	(0.002)	(0.002)	(0.009)	(0.007)	(0.003)	(0.012)	(0.002)	(0.002)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.005)	(0.002)	(0.004)	(0.004)	(0.004)	(0.213)	(0.004)	(0.003)
Father: Primary education	-0.018*	-0.003	-0.057*	-0.034*	0.021	0.013	-0.023*	0.017	0.041	-0.000	-0.016	-0.010	-0.005	-0.021	-0.090**		-0.008	-0.006	-0.153*	0.035	-0.005
	(0.011)	(0.012)	(0.030)	(0.020)	(0.018)	(0.018)	(0.012)	(0.015)	(0.050)	(0.020)	(0.014)	(0.016)	(0.016)	(0.015)	(0.043)		(0.026)	(0.035)	(0.091)	(0.028)	(0.028)
Father: Secondary education	-0.005	0.003	-0.018	-0.028	-0.024	0.002	-0.046***	0.001	0.055	-0.025	0.004	-0.028	-0.047**	-0.019	-0.078**	0.009	-0.020	-0.010	-0.101**	0.022	-0.029
	(0.010)	(0.011)	(0.032)	(0.018)	(0.017)	(0.015)	(0.013)	(0.014)	(0.048)	(0.022)	(0.021)	(0.022)	(0.024)	(0.028)	(0.039)	(0.012)	(0.029)	(0.036)	(0.043)	(0.031)	(0.029)
Father: Higher education	-0.002	0.017	0.042	-0.009	-0.034				0.033	-0.070*	0.024			0.040	-0.091**	0.003	-0.041	-0.004		0.069*	-0.034
	(0.015)	(0.015)	(0.049)	(0.023)	(0.021)				(0.054)	(0.042)	(0.024)			(0.045)	(0.039)	(0.013)	(0.037)	(0.038)		(0.039)	(0.033)
Father: Not present	-0.009	0.019					-0.111***					0.015			-0.047		0.058		-0.095		
	(0.023)	(0.022)					(0.028)					(0.018)			(0.046)		(0.039)		(0.075)		
Mother: Primary education	-0.000	-0.019	0.054*	0.009	0.036*		-0.013	-0.039***	0.070	-0.033		-0.005	0.013	0.010	-0.031		-0.018	-0.038*	-0.086	0.014	0.007
	(0.011)	(0.012)	(0.031)	(0.020)	(0.021)		(0.009)	(0.012)	(0.043)	(0.022)		(0.013)	(0.013)	(0.015)	(0.056)		(0.019)	(0.022)	(0.067)	(0.017)	(0.018)
Mother: Secondary education	-0.013	-0.032***	-0.043	-0.014	0.002	-0.010	-0.035***	-0.051***	0.048	0.035		-0.026	-0.033	-0.069***	-0.079	-0.027**	-0.007	-0.048**	-0.044	-0.005	0.008
	(0.009)	(0.010)	(0.033)	(0.017)	(0.015)	(0.013)	(0.012)	(0.014)	(0.042)	(0.024)		(0.021)	(0.020)	(0.024)	(0.051)	(0.013)	(0.022)	(0.022)	(0.066)	(0.020)	(0.019)
Mother: Higher education	-0.009	-0.053***	-0.218***		0.018	-0.011			0.019	-0.015				-0.357***	-0.093*	-0.039***	-0.031	-0.048**	-0.130*	-0.005	-0.031
	(0.015)	(0.013)	(0.070)		(0.021)	(0.019)			(0.044)	(0.056)				(0.102)	(0.051)	(0.014)	(0.030)	(0.024)	(0.076)	(0.033)	(0.029)
Rural residence	-0.010	-0.009	0.010	-0.006	-0.027	0.001	0.005	-0.009	0.032*	0.019	0.054***	-0.040**	-0.024	-0.002	-0.002	0.015	0.028	0.012	0.056	0.000	-0.023*
	(0.008)	(0.007)	(0.028)	(0.015)	(0.035)	(0.036)	(0.008)	(0.011)	(0.016)	(0.018)	(0.017)	(0.018)	(0.018)	(0.019)	(0.009)	(0.009)	(0.019)	(0.015)	(0.038)	(0.015)	(0.014)
Wealth: poorest	0.022*	0.020	0.050	0.107***	-0.023	0.053***	0.046***	0.033*	0.145***	0.126***	0.043*	0.211***	0.091***	0.161***	0.007	0.063***	-0.014	-0.008	-0.030	0.141***	0.076***
	(0.013)	(0.013)	(0.059)	(0.028)	(0.024)	(0.020)	(0.016)	(0.017)	(0.042)	(0.033)	(0.026)	(0.036)	(0.035)	(0.045)	(0.018)	(0.024)	(0.035)	(0.024)	(0.082)	(0.034)	(0.029)
Wealth: poorer	0.028**	-0.006	0.036	0.072***	-0.033	0.027	0.032**	0.013	0.079**	0.080***	0.062***	0.183***	0.080**	0.117***	0.017	0.057***	-0.020	-0.020	-0.026	0.076**	0.039
	(0.012)	(0.012)	(0.052)	(0.025)	(0.024)	(0.019)	(0.016)	(0.015)	(0.037)	(0.027)	(0.024)	(0.033)	(0.033)	(0.042)	(0.015)	(0.020)	(0.031)	(0.021)	(0.073)	(0.033)	(0.026)
Wealth: middle	0.012	-0.007	-0.015	0.041	-0.061***	0.024	-0.001	0.004	0.103**	0.034	0.044*	0.155***	0.041	0.087**	-0.006	0.031*	-0.039	-0.027	-0.093	0.050	0.011
	(0.011)	(0.011)	(0.047)	(0.025)	(0.022)	(0.018)	(0.015)	(0.014)	(0.045)	(0.025)	(0.023)	(0.029)	(0.028)	(0.036)	(0.012)	(0.016)	(0.032)	(0.020)	(0.062)	(0.033)	(0.026)
Wealth: richer	0.015	-0.003	0.020	0.044*	-0.045***	0.037**	0.003	0.007	0.108***	0.001	-0.006	0.073***	0.022	0.042	0.001	0.018	-0.005	-0.021	-0.051	0.036	-0.002
	(0.011)	(0.011)	(0.046)	(0.024)	(0.017)	(0.017)	(0.016)	(0.013)	(0.041)	(0.025)	(0.022)	(0.023)	(0.023)	(0.030)	(0.012)	(0.016)	(0.028)	(0.018)	(0.065)	(0.032)	(0.025)
Observations	13,471	13,631	2,387	3,884	13,147	4,873	34,697	16,204	2,740	6,148	5,680	8,304	9,748	7,381	6,879	4,642	2,588	3,247	367	2,774	2,102

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old.*

Table A10. Average marginal effects from probit regressions of *wasting on MEPI scores* (Model 7)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR18
MEPI score	0.030	-0.022**	-0.058	0.020	0.011	-0.046	0.016	0.029	-0.014	-0.007	0.014	0.004	0.013	0.024	-0.001	-0.013	-0.016	-0.045	-0.114	0.117*	
	(0.023)	(0.011)	(0.045)	(0.020)	(0.069)	(0.030)	(0.018)	(0.042)	(0.021)	(0.018)	(0.017)	(0.028)	(0.024)	(0.022)	(0.013)	(0.028)	(0.068)	(0.047)	(0.111)	(0.063)	
Female household	-0.003	0.013	-0.011	-0.005	-0.013	0.001	-0.021**	0.006	0.003	0.006	-0.006	0.005	-0.007	0.000	-0.005	-0.021*	-0.041	-0.000	-0.037	0.012	
	(0.010)	(0.008)	(0.016)	(0.008)	(0.017)	(0.007)	(0.010)	(0.007)	(0.014)	(0.007)	(0.013)	(0.012)	(0.010)	(0.006)	(0.015)	(0.012)	(0.030)	(0.012)	(0.041)	(0.008)	
Female child	0.000	-0.008**	-0.016	-0.014*	-0.004	-0.002	-0.004	0.006**	0.004	-0.010**	0.003	-0.008	-0.022***	-0.011**	0.000	0.000	-0.019**	0.002	-0.018**	0.008	-0.005
	(0.004)	(0.003)	(0.014)	(0.008)	(0.006)	(0.004)	(0.004)	(0.003)	(0.007)	(0.005)	(0.006)	(0.008)	(0.008)	(0.005)	(0.002)	(0.003)	(0.009)	(0.005)	(0.009)	(0.006)	(0.006)
Child age (yrs)	-0.017***	-0.020***	-0.087***	0.004	-0.007	-0.024***	-0.044***	-0.031***	-0.016*	-0.020***	-0.028***	0.056***	0.067***	-0.004	-0.010***	-0.006	-0.028***	-0.032***	-0.014	-0.027***	-0.033***
	(0.006)	(0.004)	(0.020)	(0.010)	(0.008)	(0.005)	(0.005)	(0.004)	(0.010)	(0.007)	(0.009)	(0.010)	(0.011)	(0.007)	(0.003)	(0.005)	(0.010)	(0.007)	(0.012)	(0.008)	(0.008)
Child age squared	0.002	0.003***	0.015***	-0.002	-0.002	0.003***	0.006***	0.005***	0.003*	0.003**	0.005**	-0.015***	-0.016***	0.000	0.001**	0.001	0.004**	0.005***	0.002	0.004**	0.005***
	(0.001)	(0.001)	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
Father: Primary education	-0.010	-0.011	-0.012	0.018	-0.025**	0.005	-0.007	-0.006	-0.008	0.008	0.012	0.020	-0.019	-0.003	0.073***		-0.025	-0.026**	0.065**	0.031*	-0.050***
	(0.007)	(0.007)	(0.019)	(0.012)	(0.012)	(0.007)	(0.007)	(0.005)	(0.018)	(0.007)	(0.008)	(0.012)	(0.012)	(0.006)	(0.014)		(0.015)	(0.012)	(0.029)	(0.017)	(0.019)
Father: Secondary education	-0.010	-0.010	0.004	-0.005	-0.009	0.003	-0.003	-0.007	-0.006	-0.029***	-0.007	0.020	-0.023	-0.013	0.087***	-0.004	-0.017	-0.020*	0.021	0.013	-0.059***
	(0.007)	(0.007)	(0.022)	(0.011)	(0.011)	(0.006)	(0.007)	(0.005)	(0.016)	(0.011)	(0.008)	(0.017)	(0.020)	(0.012)	(0.011)	(0.004)	(0.016)	(0.012)	(0.015)	(0.016)	(0.020)
Father: Higher education	0.007	-0.002	-0.049*	-0.009	0.005				-0.017		0.006			-0.025	0.084***	-0.007	-0.022	-0.007		0.031*	-0.055***
	(0.010)	(0.009)	(0.029)	(0.013)	(0.014)				(0.018)		(0.012)			(0.021)	(0.010)	(0.004)	(0.018)	(0.013)		(0.017)	(0.021)
Father: Not present	-0.008	-0.017					-0.018					0.002			0.086***		0.002		0.035		
	(0.014)	(0.011)					(0.016)					(0.014)			(0.018)		(0.021)		(0.035)		
Mother: Primary education	0.003	-0.007	-0.049**	-0.010	-0.022		0.001	0.006	-0.041**	-0.011		-0.016	-0.032***	-0.005			0.004	-0.003	0.010	0.005	0.026
	(0.007)	(0.006)	(0.021)	(0.011)	(0.016)		(0.005)	(0.004)	(0.016)	(0.007)		(0.010)	(0.010)	(0.006)			(0.013)	(0.008)	(0.021)	(0.006)	(0.019)
Mother: Secondary education	0.001	-0.007	-0.032	-0.010	-0.016	0.002	0.008	0.006	-0.005	0.013		-0.028*	-0.043***	-0.021**	0.003	-0.002	-0.002	-0.009	0.013	-0.001	0.033*
	(0.006)	(0.005)	(0.022)	(0.011)	(0.010)	(0.005)	(0.007)	(0.005)	(0.014)	(0.009)		(0.016)	(0.017)	(0.010)	(0.011)	(0.004)	(0.015)	(0.009)	(0.021)	(0.008)	(0.019)
Mother: Higher education	-0.014	-0.010	-0.015		-0.013	0.004			-0.016	0.008				-0.043	0.001	-0.005	0.012	-0.009	0.038*	0.004	0.034*
	(0.010)	(0.007)	(0.037)		(0.014)	(0.008)			(0.015)	(0.018)				(0.034)	(0.011)	(0.004)	(0.018)	(0.010)	(0.023)	(0.013)	(0.020)
Rural residence	0.000	-0.006	-0.032*	-0.006	0.015	0.015	-0.004	0.002	-0.003	-0.008	-0.001	-0.007	-0.028*	0.006	0.001	-0.002	-0.003	-0.005	0.002	0.008	0.008
	(0.005)	(0.004)	(0.018)	(0.008)	(0.021)	(0.016)	(0.005)	(0.004)	(0.006)	(0.006)	(0.008)	(0.014)	(0.014)	(0.008)	(0.003)	(0.003)	(0.010)	(0.007)	(0.009)	(0.006)	(0.009)
Wealth: poorest	-0.002	0.002	0.047	-0.025	0.030*	0.005	0.017*	-0.002	0.001	0.039***	0.005	0.081***	0.063**	0.016	0.006	0.000	-0.002	0.012	-0.015	0.024	-0.009
	(0.008)	(0.007)	(0.037)	(0.017)	(0.016)	(0.007)	(0.009)	(0.006)	(0.012)	(0.015)	(0.012)	(0.027)	(0.029)	(0.019)	(0.008)	(0.008)	(0.019)	(0.011)	(0.019)	(0.020)	(0.011)
Wealth: poorer	-0.005	-0.011*	0.022	-0.011	0.032**	-0.006	0.017**	-0.012**	-0.003	0.016	0.009	0.060**	0.063**	0.008	-0.000	-0.003	0.004	-0.003	-0.010	0.036*	-0.017
	(0.007)	(0.006)	(0.032)	(0.016)	(0.015)	(0.007)	(0.008)	(0.006)	(0.013)	(0.012)	(0.010)	(0.025)	(0.027)	(0.018)	(0.006)	(0.007)	(0.015)	(0.010)	(0.018)	(0.019)	(0.012)
Wealth: middle	-0.002	-0.005	0.022	0.008	0.047***	-0.003	0.009	-0.007	-0.010	0.013	0.003	0.043*	0.052**	0.007	-0.001	-0.006	-0.004	0.001	-0.034	0.041**	-0.004
	(0.007)	(0.006)	(0.029)	(0.013)	(0.014)	(0.007)	(0.008)	(0.006)	(0.013)	(0.011)	(0.010)	(0.022)	(0.024)	(0.016)	(0.005)	(0.005)	(0.015)	(0.009)	(0.020)	(0.019)	(0.009)
Wealth: richer	0.006	-0.011*	-0.004	-0.011	0.035***	0.004	0.003	0.002	-0.008	0.014	-0.009	0.033*	0.031	0.018	0.001	-0.001	-0.004	-0.009	-0.046**	0.037**	0.000
	(0.007)	(0.007)	(0.029)	(0.013)	(0.011)	(0.006)	(0.008)	(0.006)	(0.014)	(0.010)	(0.011)	(0.018)	(0.020)	(0.014)	(0.004)	(0.005)	(0.013)	(0.010)	(0.019)	(0.018)	(0.009)
Observations	13,666	13,972	2,387	4,249	13,147	11,969	35,034	16,312	6,267	6515	5,989	8,312	9,844	9,849	6,896	5,639	2,576	3,277	1,672	2,777	2,090
Governorates/Regions	7	7	3	3	7	7	18	18	12	14	12	12	13	14	17	16	9	7	7	12	12

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old.*

Table A11. Average marginal effects from probit regressions of *infant mortality on MEPI scores*, instrumental variable approach (Model 8)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	JO18	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13
MEPI score, instrumented	-0.001	0.000	0.003	0.015	-0.049	0.002	-0.011	0.033	-0.003	-0.020	0.018	0.023*	-0.011	-0.043	-0.011	0.006	-0.005	-0.027	-0.001	-0.065	-0.048
	(0.012)	(0.015)	(0.089)	(0.038)	(0.041)	(0.035)	(0.012)	(0.051)	(0.033)	(0.078)	(0.035)	(0.014)	(0.050)	(0.057)	(0.044)	(0.029)	(0.056)	(0.040)	(0.055)	(0.091)	(0.055)
Female household	-0.002	-0.015	-0.019*	-0.004	0.015*	0.006	-0.001	-0.003	-0.014	0.000	-0.006	-0.047***	-0.010	0.012*	-0.004	-0.012	0.001		0.009	0.006	-0.003
	(0.009)	(0.010)	(0.011)	(0.007)	(0.009)	(0.006)	(0.007)	(0.007)	(0.009)	(0.016)	(0.010)	(0.013)	(0.008)	(0.006)	(0.005)	(0.011)	(0.011)		(0.007)	(0.010)	(0.007)
Female child	-0.004	-0.002	-0.003	-0.003	-0.003	-0.004	-0.007**	-0.004	0.002	-0.005	-0.009*	-0.001	-0.010*	-0.009*	-0.008*	-0.002	-0.003	-0.012**	-0.006	0.010*	0.005
	(0.003)	(0.003)	(0.008)	(0.007)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.006)	(0.004)	(0.006)	(0.005)
Father: Primary education	-0.018***	-0.011**	-0.010	0.004	-0.007	-0.007*	0.002	-0.014***	-0.000	0.006	-0.006	0.004	-0.011	-0.051***	0.002	0.008		-0.019**	0.003	-0.017	0.118***
	(0.005)	(0.005)	(0.011)	(0.009)	(0.005)	(0.004)	(0.004)	(0.005)	(0.012)	(0.013)	(0.009)	(0.005)	(0.008)	(0.008)	(0.005)	(0.015)		(0.009)	(0.008)	(0.012)	(0.022)
Father: Secondary education	-0.025***	-0.017***	0.010	0.001	-0.005	-0.005	0.002	-0.012**	-0.000	0.004	-0.004	0.012**	-0.024***	-0.026**	0.008	0.004	0.004	-0.008	0.013	-0.014	0.112***
	(0.006)	(0.005)	(0.013)	(0.008)	(0.004)	(0.007)	(0.004)	(0.005)	(0.011)	(0.012)	(0.009)	(0.006)	(0.009)	(0.011)	(0.008)	(0.013)	(0.004)	(0.010)	(0.008)	(0.010)	(0.022)
Father: Higher education	-0.037***	-0.023***	0.009		-0.011*			-0.011**	-0.005	-0.001	-0.011	0.010	-0.018*		-0.012	0.007	0.004	-0.010	0.017*	-0.016	0.101***
	(0.012)	(0.007)	(0.017)		(0.006)			(0.005)	(0.013)	(0.013)	(0.017)	(0.010)	(0.010)		(0.013)	(0.013)	(0.005)	(0.014)	(0.010)	(0.013)	(0.021)
Mother: Primary education	0.006	0.007	0.010	-0.031***	-0.005	-0.006	-0.006*	0.002	0.016	0.167***	0.000	-0.005	0.002	0.012	-0.004	0.013		-0.020***	0.032***	0.037***	-0.011
	(0.005)	(0.005)	(0.011)	(0.010)	(0.007)	(0.004)	(0.004)	(0.004)	(0.012)	(0.024)	(0.009)	(0.005)	(0.008)	(0.007)	(0.005)	(0.016)		(0.008)	(0.007)	(0.011)	(0.007)
Mother: Secondary education	0.008	-0.002	0.005	-0.021**	0.002	-0.014*	-0.006	0.004	0.021*	0.156***	-0.002	0.003	0.020***	-0.001	0.003	-0.015	0.124***	-0.028***			-0.000
	(0.005)	(0.005)	(0.012)	(0.008)	(0.007)	(0.008)	(0.005)	(0.005)	(0.011)	(0.022)	(0.013)	(0.005)	(0.008)	(0.011)	(0.007)	(0.015)	(0.017)	(0.010)			(0.008)
Mother: Higher education	0.012	0.002			0.006		-0.015**	-0.005	0.007	0.150***	-0.042*	-0.007	-0.005		-0.006	-0.040***	0.118***	-0.022*			-0.010
	(0.009)	(0.007)			(0.004)		(0.007)	(0.008)	(0.012)	(0.020)	(0.025)	(0.012)	(0.011)		(0.021)	(0.015)	(0.016)	(0.013)			(0.012)
Rural residence	0.002	0.004	0.027**	0.004	-0.002	-0.018	0.001	-0.005	0.000	0.006	0.000	-0.000	0.003	-0.002	-0.003	-0.006	0.001	0.011	0.007	-0.019*	-0.001
	(0.004)	(0.004)	(0.013)	(0.008)	(0.009)	(0.019)	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)	(0.005)	(0.010)	(0.012)	(0.007)	(0.004)	(0.003)	(0.008)	(0.006)	(0.011)	(0.006)
Wealth: poorest	0.009	-0.002	-0.029	-0.010	0.023**	0.013*	-0.006	0.010	0.010	-0.008	0.000	0.017	-0.008	0.048	0.044	-0.015	0.025**	-0.010	0.001	0.029	0.001
	(0.008)	(0.009)	(0.074)	(0.026)	(0.011)	(0.007)	(0.008)	(0.009)	(0.017)	(0.012)	(0.025)	(0.010)	(0.036)	(0.039)	(0.033)	(0.014)	(0.012)	(0.016)	(0.017)	(0.058)	(0.012)
Wealth: poorer	0.000	-0.005	-0.021	0.004	0.015	0.008	-0.011	0.003	-0.001	-0.007	0.007	0.021**	-0.002	0.048	0.041	-0.008	0.014**	-0.010	0.005	-0.008	-0.000
	(0.007)	(0.007)	(0.057)	(0.018)	(0.010)	(0.007)	(0.007)	(0.008)	(0.015)	(0.009)	(0.013)	(0.009)	(0.031)	(0.033)	(0.029)	(0.010)	(0.007)	(0.012)	(0.012)	(0.016)	(0.010)
Wealth: middle	0.000	-0.003	-0.023	0.002	0.015*	0.007	-0.016**	0.005	0.000	-0.011	0.003	0.019**	-0.005	0.036	0.038*	-0.000	0.007	0.004	0.018	0.002	-0.015
	(0.006)	(0.006)	(0.039)	(0.015)	(0.009)	(0.007)	(0.007)	(0.008)	(0.013)	(0.010)	(0.012)	(0.008)	(0.025)	(0.024)	(0.021)	(0.007)	(0.006)	(0.011)	(0.012)	(0.013)	(0.011)
Wealth: richer	0.005	-0.003	-0.019	-0.005	0.001	-0.003	-0.013*	0.007	0.002	-0.005	0.001	0.011	-0.011	0.020	0.029**	-0.003	-0.002	-0.030**	0.020*	-0.008	-0.009
	(0.006)	(0.006)	(0.026)	(0.013)	(0.006)	(0.007)	(0.007)	(0.008)	(0.012)	(0.009)	(0.012)	(0.009)	(0.015)	(0.013)	(0.012)	(0.006)	(0.007)	(0.012)	(0.010)	(0.010)	(0.011)
Observations	12,206	12,446	2,504	3,585	11,832	13,793	30,334	14,083	8,612	8,516	5,539	5,116	8,512	9,765	9,373	6,536	5,262	2,470	2,927	1,717	2,986

*Notes: MEPI scores are instrumented using first-stage regressions in Table A22. Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Table A12. Average marginal effects from probit regressions of *infant mortality on MEPI* scores (Model 9)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	JO18	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR19
MEPI score	-0.026	0.006	-0.006	-0.018	0.004	0.010	0.011	0.039	-0.011	-0.011	0.008	0.020*	0.003	0.001	0.005	-0.013	-0.003	0.051**	0.004	0.071*	0.081**	
	(0.019)	(0.011)	(0.023)	(0.018)	(0.029)	(0.027)	(0.015)	(0.031)	(0.015)	(0.018)	(0.023)	(0.011)	(0.018)	(0.017)	(0.015)	(0.015)	(0.024)	(0.021)	(0.030)	(0.038)	(0.034)	
Female household	-0.002	-0.015	-0.019*	-0.004	0.015*	0.005	-0.001	-0.002	-0.012	0.002	-0.005	-0.048***	-0.011	0.012*	-0.004	-0.012	0.001		0.009	0.004	-0.004	
	(0.009)	(0.010)	(0.011)	(0.007)	(0.009)	(0.006)	(0.007)	(0.007)	(0.009)	(0.016)	(0.010)	(0.013)	(0.008)	(0.007)	(0.005)	(0.011)	(0.011)		(0.007)	(0.009)	(0.007)	
Female child	-0.004	-0.002	-0.003	-0.003	-0.003	-0.004	-0.007**	-0.004	0.003	-0.005	-0.009*	-0.001	-0.010*	-0.009*	-0.008*	-0.002	-0.003	-0.012**	-0.006	0.010*	0.005	0.000
	(0.003)	(0.003)	(0.008)	(0.007)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.006)	(0.004)	(0.006)	(0.005)	(0.006)
Father: Primary education	-0.019***	-0.011**	-0.010	0.004	-0.006	-0.007*	0.002	-0.013***	-0.001	0.007	-0.006	0.003	-0.011	-0.051***	0.002	0.008		-0.016*	0.003	-0.019*	0.135***	-0.024*
	(0.005)	(0.005)	(0.011)	(0.009)	(0.005)	(0.004)	(0.004)	(0.005)	(0.012)	(0.014)	(0.009)	(0.005)	(0.008)	(0.008)	(0.005)	(0.014)		(0.009)	(0.008)	(0.011)	(0.028)	(0.014)
Father: Secondary education	-0.025***	-0.017***	0.010	0.000	-0.004	-0.005	0.003	-0.011**	-0.001	0.004	-0.005	0.011**	-0.024***	-0.026**	0.008	0.004	0.004	-0.006	0.013	-0.015*	0.128***	-0.017
	(0.006)	(0.005)	(0.013)	(0.008)	(0.004)	(0.007)	(0.004)	(0.005)	(0.011)	(0.012)	(0.009)	(0.006)	(0.009)	(0.011)	(0.008)	(0.013)	(0.004)	(0.010)	(0.008)	(0.009)	(0.027)	(0.014)
Father: Higher education	-0.037***	-0.023***	0.008		-0.011*			-0.011**	-0.006	-0.001	-0.011	0.010	-0.019*		-0.012	0.007	0.004	-0.009	0.017*	-0.017	0.117***	-0.023
	(0.012)	(0.007)	(0.017)		(0.006)			(0.005)	(0.013)	(0.013)	(0.017)	(0.010)	(0.010)		(0.013)	(0.013)	(0.005)	(0.014)	(0.010)	(0.013)	(0.026)	(0.018)
Mother: Primary education	0.006	0.008	0.009	-0.032***	-0.004	-0.006	-0.006	0.003	0.016	0.149***	0.000	-0.005	0.002	0.012*	-0.003	0.013		-0.018**	0.032***	0.038***	-0.011	0.008
	(0.005)	(0.005)	(0.011)	(0.010)	(0.007)	(0.004)	(0.004)	(0.004)	(0.012)	(0.021)	(0.009)	(0.005)	(0.008)	(0.007)	(0.005)	(0.016)		(0.008)	(0.007)	(0.011)	(0.007)	(0.010)
Mother: Secondary education	0.008	-0.001	0.005	-0.021**	0.002	-0.014*	-0.006	0.004	0.021*	0.138***	-0.002	0.003	0.021***	-0.001	0.003	-0.014	0.124***	-0.027***			-0.001	0.007
	(0.005)	(0.005)	(0.012)	(0.008)	(0.007)	(0.008)	(0.005)	(0.005)	(0.011)	(0.018)	(0.013)	(0.005)	(0.008)	(0.011)	(0.007)	(0.015)	(0.017)	(0.010)			(0.008)	(0.010)
Mother: Higher education	0.012	0.002			0.007		-0.014*	-0.005	0.007	0.132***	-0.042*	-0.007	-0.005		-0.005	-0.040***	0.118***	-0.021*			-0.010	-0.004
	(0.009)	(0.007)			(0.004)		(0.007)	(0.008)	(0.012)	(0.018)	(0.025)	(0.012)	(0.011)		(0.021)	(0.015)	(0.016)	(0.012)			(0.012)	(0.017)
Rural residence	0.002	0.004	0.028**	0.008	-0.001	-0.018	-0.000	-0.005	0.000	0.006	-0.000	-0.002	0.003	-0.008	-0.005	-0.006	0.001	0.011	0.007	-0.012**	0.002	0.006
	(0.004)	(0.004)	(0.013)	(0.008)	(0.009)	(0.019)	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)	(0.005)	(0.010)	(0.010)	(0.006)	(0.004)	(0.003)	(0.008)	(0.005)	(0.006)	(0.006)	(0.007)
Wealth: poorest	0.010	-0.003	-0.023	0.009	0.018*	0.013*	-0.010	0.011	0.009	-0.009	0.008	0.024**	-0.017	0.020	0.034**	-0.011	0.024***	-0.023*	0.001	-0.014	-0.008	0.126***
	(0.007)	(0.007)	(0.019)	(0.014)	(0.010)	(0.007)	(0.007)	(0.008)	(0.012)	(0.010)	(0.015)	(0.010)	(0.017)	(0.019)	(0.014)	(0.009)	(0.009)	(0.014)	(0.012)	(0.013)	(0.011)	(0.026)
Wealth: poorer	0.000	-0.006	-0.018	0.015	0.011	0.008	-0.011	0.004	-0.002	-0.008	0.009	0.023**	-0.011	0.024	0.032**	-0.006	0.014**	-0.012	0.005	-0.018	-0.002	0.124***
	(0.007)	(0.006)	(0.018)	(0.013)	(0.009)	(0.007)	(0.007)	(0.008)	(0.011)	(0.009)	(0.012)	(0.009)	(0.016)	(0.017)	(0.013)	(0.008)	(0.007)	(0.012)	(0.011)	(0.012)	(0.010)	(0.025)
Wealth: middle	0.000	-0.004	-0.021	0.009	0.013	0.008	-0.016**	0.005	-0.000	-0.012	0.004	0.020**	-0.011	0.020	0.032***	0.001	0.007	0.004	0.018	-0.001	-0.016	0.132***
	(0.006)	(0.006)	(0.018)	(0.013)	(0.008)	(0.007)	(0.007)	(0.008)	(0.012)	(0.009)	(0.012)	(0.008)	(0.014)	(0.015)	(0.011)	(0.006)	(0.006)	(0.011)	(0.011)	(0.012)	(0.011)	(0.026)
Wealth: richer	0.005	-0.003	-0.018	-0.002	-0.000	-0.003	-0.013*	0.007	0.002	-0.006	0.001	0.012	-0.013	0.014	0.027***	-0.003	-0.002	-0.031***	0.020*	-0.009	-0.010	0.157***
	(0.006)	(0.006)	(0.016)	(0.012)	(0.006)	(0.007)	(0.007)	(0.008)	(0.012)	(0.009)	(0.012)	(0.009)	(0.011)	(0.012)	(0.010)	(0.006)	(0.007)	(0.012)	(0.010)	(0.010)	(0.011)	(0.032)
Observations	12,206	12,446	2,504	3,585	11,853	13,793	30,334	14,083	8,614	8,516	5,549	5,123	8,512	9,765	9,374	6,536	5,262	2,470	2,927	1,717	2,987	2,254

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Table A13. Average marginal effects from probit regressions of *infant mortality on dirty cooking fuels* indicator (Model 10)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	JO18	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR18
Dirty cooking fuels	-0.019	0.004	-0.023	0.002			0.004		-0.002	-0.004	0.005	0.015*	-0.003	-0.002	0.007	-0.011		0.023				
	(0.015)	(0.004)	(0.019)	(0.008)			(0.008)		(0.010)	(0.000)	(0.011)	(0.008)	(0.009)	(0.008)	(0.007)	(0.013)		(0.020)				
Female household	-0.002	-0.015	-0.020*	-0.004	0.015*	0.006	-0.001	-0.003	-0.014	0.001	-0.005	-0.047***	-0.010	0.012*	-0.003	-0.012	0.001		0.009	0.005	-0.004	
	(0.009)	(0.010)	(0.011)	(0.007)	(0.009)	(0.006)	(0.007)	(0.007)	(0.009)	(0.000)	(0.010)	(0.013)	(0.008)	(0.007)	(0.005)	(0.011)	(0.011)		(0.007)	(0.010)	(0.007)	
Female child	-0.004	-0.002	-0.003	-0.003	-0.003	-0.004	-0.007**	-0.004	0.002	-0.005	-0.009*	-0.001	-0.010*	-0.009*	-0.008*	-0.002	-0.003	-0.012**	-0.006	0.010*	0.005	0.000
	(0.003)	(0.003)	(0.008)	(0.007)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.000)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.006)	(0.004)	(0.006)	(0.005)	(0.006)
Father: Primary education	-0.018***	-0.011**	-0.011	0.005	-0.006	-0.008*	0.002	-0.014***	-0.000	0.007	-0.006	0.003	-0.011	-0.051***	0.002	0.008		-0.017**	0.003	-0.018	0.118***	-0.024*
	(0.005)	(0.005)	(0.011)	(0.009)	(0.006)	(0.004)	(0.004)	(0.005)	(0.012)	(0.000)	(0.009)	(0.005)	(0.008)	(0.008)	(0.005)	(0.014)		(0.009)	(0.008)	(0.012)	(0.021)	(0.014)
Father: Secondary education	-0.025***	-0.017***	0.008	0.001	-0.004	-0.005	0.003	-0.012**	-0.000	0.004	-0.005	0.011**	-0.024***	-0.026**	0.008	0.004	0.003	-0.007	0.013	-0.014	0.111***	-0.017
	(0.006)	(0.005)	(0.013)	(0.008)	(0.004)	(0.007)	(0.004)	(0.005)	(0.011)	(0.000)	(0.009)	(0.006)	(0.009)	(0.011)	(0.008)	(0.013)	(0.004)	(0.010)	(0.008)	(0.010)	(0.021)	(0.014)
Father: Higher education	-0.037***	-0.022***	0.006		-0.011*			-0.011**	-0.005	-0.001	-0.012	0.010	-0.019*		-0.012	0.006	0.003	-0.010	0.017*	-0.017	0.100***	-0.023
	(0.012)	(0.007)	(0.016)		(0.006)			(0.005)	(0.013)	(0.000)	(0.017)	(0.010)	(0.010)		(0.013)	(0.013)	(0.005)	(0.014)	(0.010)	(0.013)	(0.021)	(0.018)
Mother: Primary education	0.006	0.008	0.008	-0.031***	-0.004	-0.006	-0.006	0.003	0.016	0.167	0.000	-0.005	0.002	0.012	-0.003	0.012		-0.020**	0.032***	0.037***	-0.011	0.008
	(0.005)	(0.005)	(0.010)	(0.010)	(0.007)	(0.004)	(0.004)	(0.004)	(0.012)	(0.000)	(0.009)	(0.005)	(0.008)	(0.007)	(0.005)	(0.016)		(0.008)	(0.007)	(0.011)	(0.007)	(0.010)
Mother: Secondary education	0.008	-0.001	0.004	-0.021**	0.002	-0.014*	-0.006	0.004	0.021*	0.156	-0.002	0.003	0.020**	-0.001	0.004	-0.015	0.136***	-0.027***			-0.000	0.007
	(0.005)	(0.005)	(0.012)	(0.008)	(0.007)	(0.008)	(0.005)	(0.005)	(0.011)	(0.000)	(0.013)	(0.005)	(0.008)	(0.011)	(0.007)	(0.015)	(0.018)	(0.010)			(0.008)	(0.010)
Mother: Higher education	0.012	0.002			0.007		-0.014*	-0.005	0.007	0.150	-0.042*	-0.007	-0.005		-0.006	-0.040***	0.129***	-0.021*			-0.010	-0.004
	(0.009)	(0.007)			(0.004)		(0.007)	(0.008)	(0.012)	(0.000)	(0.025)	(0.012)	(0.011)		(0.021)	(0.015)	(0.018)	(0.013)			(0.012)	(0.017)
Rural residence	0.003	0.004	0.036**	0.005	-0.001	-0.018	-0.000	-0.006	0.000	0.006	-0.000	-0.002	0.003	-0.008	-0.004	-0.006	0.001	0.011	0.007	-0.013**	0.001	0.006
	(0.004)	(0.004)	(0.016)	(0.007)	(0.009)	(0.019)	(0.004)	(0.004)	(0.004)	(0.000)	(0.008)	(0.005)	(0.010)	(0.009)	(0.006)	(0.004)	(0.003)	(0.008)	(0.005)	(0.006)	(0.006)	(0.007)
Wealth: poorest	0.009	-0.003	-0.017	-0.001	0.018*	0.013*	-0.010	0.012	0.009	-0.009	0.009	0.025***	-0.013	0.021	0.032***	-0.012	0.025***	-0.018	0.001	-0.009	-0.004	0.126***
	(0.007)	(0.007)	(0.019)	(0.013)	(0.010)	(0.007)	(0.007)	(0.008)	(0.013)	(0.000)	(0.013)	(0.010)	(0.015)	(0.018)	(0.012)	(0.009)	(0.008)	(0.014)	(0.012)	(0.014)	(0.010)	(0.026)
Wealth: poorer	0.000	-0.006	-0.011	0.009	0.011	0.008	-0.011	0.004	-0.002	-0.008	0.009	0.023***	-0.007	0.026	0.030***	-0.006	0.014**	-0.011	0.005	-0.016	-0.001	0.124***
	(0.007)	(0.006)	(0.018)	(0.011)	(0.009)	(0.007)	(0.007)	(0.008)	(0.012)	(0.000)	(0.012)	(0.009)	(0.014)	(0.016)	(0.011)	(0.008)	(0.007)	(0.012)	(0.011)	(0.012)	(0.010)	(0.025)
Wealth: middle	0.000	-0.004	-0.014	0.005	0.013	0.007	-0.016**	0.006	-0.001	-0.012	0.004	0.020**	-0.009	0.020	0.031***	0.000	0.007	0.004	0.018	-0.001	-0.015	0.132***
	(0.006)	(0.006)	(0.018)	(0.012)	(0.008)	(0.007)	(0.007)	(0.008)	(0.012)	(0.000)	(0.012)	(0.008)	(0.012)	(0.014)	(0.011)	(0.006)	(0.006)	(0.011)	(0.011)	(0.012)	(0.011)	(0.026)
Wealth: richer	0.005	-0.003	-0.013	-0.004	-0.000	-0.003	-0.013*	0.007	0.002	-0.005	0.001	0.012	-0.012	0.014	0.026***	-0.003	-0.002	-0.031***	0.020*	-0.008	-0.010	0.157***
	(0.006)	(0.006)	(0.016)	(0.012)	(0.006)	(0.007)	(0.007)	(0.008)	(0.012)	(0.000)	(0.012)	(0.009)	(0.011)	(0.012)	(0.010)	(0.006)	(0.007)	(0.012)	(0.010)	(0.010)	(0.011)	(0.032)
Observations	12,206	12,446	2,504	3,585	11,853	13,781	30,334	14,083	8,614	8,516	5,549	5,123	8,512	9,765	9,374	6,536	5,201	2,470	2,927	1,717	2,987	2,254

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Table A14. Average marginal effects from probit regressions of *infant mortality on MEP PCA* scores (Model 11)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	JO18	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13
MEP PCA 1st-component score	-0.024	0.008	-0.008	-0.012	0.011	0.001	0.007	0.038*	-0.004	-0.006	0.009	0.020*	0.005	0.001	0.002	-0.015	-0.028*	0.039*	0.002	-0.136	0.039**
	(0.020)	(0.013)	(0.022)	(0.021)	(0.017)	(0.026)	(0.013)	(0.019)	(0.010)	(0.012)	(0.023)	(0.011)	(0.018)	(0.017)	(0.016)	(0.015)	(0.017)	(0.020)	(0.067)	(0.183)	(0.018)
Female household	-0.002	-0.015	-0.019*	-0.004	0.015*	0.006	-0.001	-0.002	-0.013	0.002	-0.005	-0.048***	-0.011	0.012*	-0.004	-0.012	0.001		0.009	0.021	-0.004
	(0.009)	(0.010)	(0.011)	(0.007)	(0.009)	(0.006)	(0.007)	(0.007)	(0.009)	(0.016)	(0.010)	(0.013)	(0.008)	(0.007)	(0.005)	(0.011)	(0.011)		(0.007)	(0.037)	(0.008)
Female child	-0.004	-0.002	-0.003	-0.003	-0.003	-0.004	-0.007**	-0.004	0.002	-0.005	-0.009*	-0.001	-0.010*	-0.009*	-0.008*	-0.002	-0.003	-0.012**	-0.006	0.040*	0.005
	(0.003)	(0.003)	(0.008)	(0.007)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.006)	(0.004)	(0.022)	(0.005)
Father: Primary education	-0.019***	-0.011**	-0.010	0.004	-0.006	-0.007*	0.002	-0.013***	-0.001	0.007	-0.006	0.003	-0.011	-0.051***	0.002	0.008		-0.017*	0.003	-0.036	0.128***
	(0.005)	(0.005)	(0.011)	(0.009)	(0.006)	(0.004)	(0.004)	(0.005)	(0.012)	(0.014)	(0.009)	(0.005)	(0.008)	(0.008)	(0.005)	(0.014)		(0.009)	(0.008)	(0.038)	(0.027)
Father: Secondary education	-0.025***	-0.017***	0.010	0.000	-0.004	-0.005	0.003	-0.011**	-0.000	0.004	-0.005	0.011**	-0.024***	-0.026**	0.008	0.004	0.003	-0.007	0.013	0.002	0.121***
	(0.006)	(0.005)	(0.012)	(0.008)	(0.004)	(0.007)	(0.004)	(0.005)	(0.011)	(0.012)	(0.009)	(0.006)	(0.009)	(0.011)	(0.008)	(0.013)	(0.004)	(0.010)	(0.008)	(0.034)	(0.027)
Father: Higher education	-0.037***	-0.023***	0.009		-0.011*			-0.011**	-0.005	-0.001	-0.011	0.010	-0.018*		-0.012	0.006	0.003	-0.009	0.017*	0.051	0.110***
	(0.012)	(0.007)	(0.017)		(0.006)			(0.005)	(0.013)	(0.013)	(0.017)	(0.010)	(0.010)		(0.013)	(0.013)	(0.005)	(0.014)	(0.010)	(0.058)	(0.025)
Mother: Primary education	0.006	0.008	0.009	-0.031***	-0.004	-0.006	-0.006	0.002	0.016	0.167***	0.000	-0.005	0.003	0.012*	-0.004	0.013		-0.019**	0.032***	-0.035	-0.011
	(0.005)	(0.005)	(0.011)	(0.010)	(0.007)	(0.004)	(0.004)	(0.004)	(0.012)	(0.025)	(0.009)	(0.005)	(0.008)	(0.007)	(0.005)	(0.016)		(0.008)	(0.007)	(0.027)	(0.007)
Mother: Secondary education	0.008	-0.001	0.005	-0.021**	0.002	-0.014*	-0.006	0.004	0.021*	0.156***	-0.002	0.003	0.021***	-0.001	0.003	-0.015	0.124***	-0.027***			-0.001
	(0.005)	(0.005)	(0.012)	(0.008)	(0.007)	(0.008)	(0.005)	(0.005)	(0.011)	(0.023)	(0.013)	(0.005)	(0.008)	(0.011)	(0.007)	(0.015)	(0.017)	(0.010)			(0.008)
Mother: Higher education	0.012	0.002			0.007		-0.014*	-0.005	0.007	0.150***	-0.042*	-0.007	-0.005		-0.005	-0.040***	0.118***	-0.021			-0.010
	(0.009)	(0.007)			(0.004)		(0.007)	(0.008)	(0.012)	(0.022)	(0.025)	(0.012)	(0.011)		(0.021)	(0.015)	(0.016)	(0.013)			(0.012)
Rural residence	0.002	0.004	0.028**	0.007	-0.001	-0.018	-0.000	-0.005	0.000	0.006	-0.000	-0.002	0.003	-0.008	-0.005	-0.006	0.001	0.011	0.007	-0.046*	0.001
	(0.004)	(0.004)	(0.013)	(0.008)	(0.009)	(0.019)	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)	(0.005)	(0.010)	(0.010)	(0.006)	(0.004)	(0.003)	(0.008)	(0.005)	(0.025)	(0.006)
Wealth: poorest	0.009	-0.003	-0.021	0.006	0.017*	0.013*	-0.010	0.011	0.009	-0.009	0.007	0.024**	-0.018	0.019	0.035**	-0.012	0.025***	-0.020	0.001	-0.118*	-0.007
	(0.007)	(0.007)	(0.019)	(0.015)	(0.010)	(0.007)	(0.007)	(0.008)	(0.013)	(0.010)	(0.015)	(0.010)	(0.018)	(0.019)	(0.014)	(0.009)	(0.008)	(0.014)	(0.012)	(0.061)	(0.010)
Wealth: poorer	0.000	-0.005	-0.016	0.013	0.011	0.008	-0.011	0.004	-0.002	-0.008	0.009	0.023**	-0.012	0.024	0.033***	-0.006	0.014**	-0.011	0.005	-0.132**	-0.001
	(0.007)	(0.006)	(0.017)	(0.013)	(0.009)	(0.007)	(0.007)	(0.008)	(0.012)	(0.009)	(0.012)	(0.009)	(0.016)	(0.018)	(0.013)	(0.008)	(0.007)	(0.012)	(0.011)	(0.060)	(0.010)
Wealth: middle	0.000	-0.003	-0.020	0.008	0.013	0.007	-0.016**	0.005	-0.001	-0.012	0.004	0.020**	-0.012	0.019	0.033***	0.001	0.007	0.004	0.018	-0.067	-0.016
	(0.006)	(0.006)	(0.019)	(0.013)	(0.008)	(0.007)	(0.007)	(0.008)	(0.012)	(0.009)	(0.012)	(0.008)	(0.014)	(0.015)	(0.011)	(0.006)	(0.006)	(0.011)	(0.011)	(0.062)	(0.011)
Wealth: richer	0.005	-0.003	-0.017	-0.002	-0.000	-0.003	-0.013*	0.007	0.002	-0.006	0.001	0.012	-0.014	0.014	0.027***	-0.003	-0.002	-0.031***	0.020*	-0.093	-0.010
	(0.006)	(0.006)	(0.016)	(0.012)	(0.006)	(0.007)	(0.007)	(0.008)	(0.012)	(0.009)	(0.012)	(0.009)	(0.011)	(0.012)	(0.010)	(0.006)	(0.007)	(0.012)	(0.010)	(0.060)	(0.011)
Observations	12,206	12,446	2,504	3,585	11,853	13,793	30,334	14,083	8,614	8,516	5,549	5,123	8,512	9,765	9,374	6,536	5,262	2,470	2,927	436	2,987

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Table A15. Average marginal effects from probit regressions of *infant mortality on temperature extremes* (Model 12)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	JO18	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR18
Tempr. Extremes 9months pre birth	-0.009	-0.005	0.003	0.029***	0.000	0.003	-0.014***	-0.017***	0.006	-0.002	-0.003	-0.008	-0.008	-0.012	-0.030*	-0.019**	-0.009	-0.018	0.010	-0.027	0.001	-0.029**
	(0.007)	(0.006)	(0.004)	(0.011)	(0.007)	(0.007)	(0.005)	(0.006)	(0.011)	(0.009)	(0.014)	(0.010)	(0.022)	(0.026)	(0.017)	(0.010)	(0.009)	(0.011)	(0.009)	(0.017)	(0.008)	(0.014)
Tempr. Extremes 12months post birth	0.012	0.007	0.008	0.008	0.022	0.029	-0.009	0.024	-0.015	-0.003	-0.046	0.019	-0.038	0.046	-0.060	-0.030	0.046	-0.110	-0.086	0.017	0.029	-0.010
	(0.032)	(0.034)	(0.005)	(0.011)	(0.022)	(0.031)	(0.023)	(0.024)	(0.032)	(0.056)	(0.053)	(0.040)	(0.040)	(0.050)	(0.066)	(0.025)	(0.038)	(0.068)	(0.055)	(0.052)	(0.030)	(0.039)
Female household	-0.001	-0.014	-0.019*	-0.004	0.015*	0.003	-0.001	-0.005	-0.014	0.001	-0.005	-0.048***	0.003	0.011	-0.005	-0.010	0.003		0.006	-0.004	-0.004	
	(0.009)	(0.009)	(0.011)	(0.007)	(0.009)	(0.005)	(0.007)	(0.007)	(0.009)	(0.015)	(0.010)	(0.013)	(0.008)	(0.007)	(0.005)	(0.010)	(0.010)		(0.007)	(0.012)	(0.007)	
Female child	-0.002	-0.002	-0.003	-0.004	-0.003	-0.005*	-0.008***	-0.003	0.002	-0.005	-0.010*	-0.001	-0.009*	-0.006	-0.008*	-0.000	-0.004	-0.006	-0.005	0.006	0.005	0.000
	(0.003)	(0.003)	(0.008)	(0.007)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.006)	(0.005)	(0.005)
Father: Primary education	-0.019***	-0.012**	-0.011	0.005	-0.006	-0.003	0.002	-0.013***	0.000	0.007	-0.006	0.003	-0.012	-0.051***	0.001	0.014		-0.019**	0.002	-0.020*	0.118***	-0.026*
	(0.005)	(0.005)	(0.011)	(0.009)	(0.005)	(0.004)	(0.004)	(0.005)	(0.012)	(0.014)	(0.009)	(0.005)	(0.008)	(0.008)	(0.005)	(0.016)		(0.008)	(0.007)	(0.011)	(0.021)	(0.014)
Father: Secondary education	-0.024***	-0.017***	0.010	0.001	-0.004	0.001	0.002	-0.011**	0.000	0.004	-0.004	0.010*	-0.024**	-0.027**	-0.002	0.012	0.006	-0.011	0.009	-0.025**	0.111***	-0.018
	(0.006)	(0.005)	(0.013)	(0.008)	(0.004)	(0.006)	(0.004)	(0.005)	(0.011)	(0.012)	(0.009)	(0.005)	(0.009)	(0.011)	(0.009)	(0.015)	(0.004)	(0.008)	(0.008)	(0.010)	(0.021)	(0.014)
Father: Higher education	-0.035***	-0.022***	0.009		-0.011*			-0.010**	-0.005	-0.001	-0.008	0.009	-0.016		-0.010	0.015	0.005	-0.010	0.013	-0.039**	0.100***	-0.025
	(0.011)	(0.007)	(0.017)		(0.006)			(0.005)	(0.013)	(0.013)	(0.017)	(0.010)	(0.010)		(0.013)	(0.015)	(0.005)	(0.010)	(0.010)	(0.018)	(0.021)	(0.017)
Mother: Primary education	0.008	0.007	0.008	-0.029***	-0.004	-0.002	-0.003	0.001	0.016	0.167***	0.002	-0.006	-0.013	0.005	-0.002	0.026		-0.008	0.029***	0.026***	-0.011	0.008
	(0.005)	(0.005)	(0.011)	(0.010)	(0.007)	(0.004)	(0.004)	(0.004)	(0.012)	(0.022)	(0.009)	(0.005)	(0.008)	(0.007)	(0.005)	(0.018)		(0.006)	(0.007)	(0.010)	(0.007)	(0.010)
Mother: Secondary education	0.010*	-0.001	0.002	-0.019**	0.002	-0.008	-0.003	0.003	0.021*	0.156***	-0.002	0.002	0.018**	-0.002	0.004	-0.002	0.125***	-0.004			-0.000	0.006
	(0.005)	(0.005)	(0.012)	(0.008)	(0.007)	(0.007)	(0.005)	(0.005)	(0.011)	(0.020)	(0.013)	(0.005)	(0.008)	(0.011)	(0.007)	(0.017)	(0.018)	(0.007)			(0.008)	(0.010)
Mother: Higher education	0.013	0.003			0.007*		-0.010	-0.005	0.007	0.150***	-0.040	-0.007	-0.014		0.003	-0.026	0.120***	0.001			-0.009	-0.004
	(0.009)	(0.007)			(0.004)		(0.007)	(0.007)	(0.012)	(0.019)	(0.025)	(0.012)	(0.011)		(0.022)	(0.017)	(0.018)	(0.009)			(0.012)	(0.016)
Rural residence	0.001	0.005	0.027**	0.006	-0.001	-0.014	-0.001	-0.005	0.001	0.006	-0.000	-0.002	0.012	-0.007	-0.005	-0.007*	0.001	-0.000	0.006	-0.010	0.001	0.006
	(0.004)	(0.003)	(0.013)	(0.007)	(0.009)	(0.016)	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)	(0.005)	(0.010)	(0.010)	(0.006)	(0.004)	(0.003)	(0.007)	(0.005)	(0.007)	(0.006)	(0.007)
Wealth: poorest	0.007	-0.002	-0.027	0.002	0.018*	0.012*	-0.008	0.009	0.009	-0.009	0.014	0.029***	-0.016	0.017	0.033***	-0.013	0.021***	0.010	-0.001	-0.016	-0.004	0.124***
	(0.007)	(0.006)	(0.018)	(0.012)	(0.010)	(0.007)	(0.007)	(0.008)	(0.012)	(0.010)	(0.013)	(0.010)	(0.013)	(0.017)	(0.012)	(0.008)	(0.008)	(0.009)	(0.011)	(0.014)	(0.010)	(0.025)
Wealth: poorer	0.001	-0.004	-0.020	0.009	0.011	0.008	-0.010	0.002	-0.002	-0.007	0.012	0.023**	-0.006	0.023	0.031***	-0.007	0.015**	0.000	0.002	-0.021	-0.000	0.122***
	(0.007)	(0.006)	(0.017)	(0.012)	(0.009)	(0.007)	(0.007)	(0.008)	(0.011)	(0.009)	(0.012)	(0.009)	(0.013)	(0.016)	(0.012)	(0.008)	(0.007)	(0.009)	(0.010)	(0.013)	(0.010)	(0.024)
Wealth: middle	-0.000	-0.003	-0.021	0.006	0.013	0.007	-0.016**	0.003	-0.000	-0.012	0.008	0.020**	-0.011	0.022	0.031***	-0.000	0.007	0.010	0.016	-0.015	-0.015	0.130***
	(0.006)	(0.005)	(0.018)	(0.012)	(0.008)	(0.006)	(0.006)	(0.008)	(0.012)	(0.009)	(0.013)	(0.009)	(0.011)	(0.014)	(0.011)	(0.006)	(0.006)	(0.008)	(0.011)	(0.014)	(0.010)	(0.026)
Wealth: richer	0.004	-0.002	-0.017	-0.004	-0.000	-0.003	-0.012*	0.004	0.002	-0.005	0.004	0.012	-0.015	0.010	0.021**	-0.002	-0.001	-0.012	0.017*	-0.021	-0.009	0.154***
	(0.006)	(0.005)	(0.016)	(0.012)	(0.006)	(0.006)	(0.007)	(0.008)	(0.011)	(0.009)	(0.012)	(0.009)	(0.010)	(0.012)	(0.010)	(0.006)	(0.006)	(0.008)	(0.010)	(0.013)	(0.010)	(0.032)
Observations	11,975	12,366	2,495	3,560	11,853	13,574	30,168	14,033	8,614	8,516	5,413	4,843	6,883	8,041	8,945	6,520	5,248	2,360	2,913	1,250	2,987	2,254

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Table A16. Average marginal effects from probit regressions of *infant mortality on MEPI scores and temperature extremes* (Model 13)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	JO18	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR18
MEPI score	-0.025	-0.003	-0.007	-0.050**	0.004	0.015	0.027	0.050	-0.003	-0.064	0.001	0.022**	-0.014	0.000	-0.003	-0.005	0.017	0.033*	0.020	-0.045	0.045	
	(0.015)	(0.006)	(0.023)	(0.025)	(0.023)	(0.017)	(0.032)	(0.033)	(0.023)	(0.050)	(0.020)	(0.011)	(0.013)	(0.011)	(0.011)	(0.011)	(0.019)	(0.018)	(0.025)	(0.030)	(0.032)	
Tempr. extremes 12months post birth	-0.006	0.020	0.270**	-0.125	0.031	-0.033*	-0.003*	0.009*	0.001	-0.006**	-0.012	0.013	-0.041	0.098**	-0.046	-0.005	0.011	-0.094	-0.009	0.027	-0.006	-0.015
	(0.026)	(0.017)	(0.134)	(0.144)	(0.022)	(0.018)	(0.002)	(0.005)	(0.003)	(0.002)	(0.057)	(0.037)	(0.068)	(0.049)	(0.045)	(0.019)	(0.024)	(0.062)	(0.025)	(0.025)	(0.028)	(0.021)
MEPI score × Tempr. extremes 12months	0.039	0.118	-0.303	0.728**	-0.534	0.237	-0.004	-0.020*	0.004	0.020	-0.304	-0.042	0.005	-0.145*	0.060	0.051	-0.312	0.115	-0.649	0.812***	0.052	
	(0.251)	(0.115)	(0.210)	(0.337)	(0.473)	(0.365)	(0.011)	(0.012)	(0.010)	(0.019)	(0.204)	(0.165)	(0.100)	(0.086)	(0.066)	(0.123)	(0.202)	(0.256)	(0.617)	(0.315)	(0.394)	
Female household	-0.005	-0.005	-0.019*	-0.005	0.014*	-0.004	0.000	-0.002	-0.003	0.006	-0.004	-0.020*	0.011*	0.010**	-0.002	-0.011	-0.004		-0.003	-0.002	0.000	-0.009
	(0.008)	(0.004)	(0.011)	(0.007)	(0.007)	(0.004)	(0.006)	(0.004)	(0.007)	(0.006)	(0.008)	(0.010)	(0.006)	(0.005)	(0.003)	(0.008)	(0.006)		(0.005)	(0.004)	(0.007)	(0.006)
Female child	-0.002	-0.002	-0.004	-0.004	-0.003	-0.002	-0.007***	-0.004**	-0.002	-0.007***	-0.009**	-0.000	-0.006	-0.006*	-0.006**	-0.005**	-0.003	-0.002	-0.002	-0.003	0.005	-0.002
	(0.002)	(0.002)	(0.008)	(0.007)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.005)	(0.003)	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.003)
Father: Primary education	-0.016***	-0.005**	-0.011	0.004	-0.005	-0.003	0.005	-0.004*	-0.003	-0.003	-0.006	0.000	-0.021***	-0.042***	-0.001	-0.005		-0.007	-0.005	-0.010**	0.022**	0.002
	(0.004)	(0.003)	(0.011)	(0.009)	(0.005)	(0.002)	(0.003)	(0.003)	(0.008)	(0.008)	(0.007)	(0.005)	(0.006)	(0.006)	(0.003)	(0.010)		(0.007)	(0.004)	(0.004)	(0.011)	(0.010)
Father: Secondary education	-0.021***	-0.010***	0.010	0.001	-0.002	-0.005	0.003	-0.007**	-0.001	-0.003	-0.002	0.008	-0.027***	-0.025***	0.001	-0.006	0.002	-0.007	0.003	-0.004	0.013	0.002
	(0.004)	(0.003)	(0.013)	(0.008)	(0.003)	(0.004)	(0.004)	(0.003)	(0.007)	(0.007)	(0.007)	(0.005)	(0.007)	(0.008)	(0.006)	(0.009)	(0.003)	(0.008)	(0.004)	(0.004)	(0.012)	(0.010)
Father: Higher education	-0.030***	-0.011***	0.009		-0.007			-0.007**	-0.006	-0.004	-0.007	-0.001	-0.021***		-0.015*	-0.002	-0.005	-0.003	0.005	-0.004	0.010	-0.003
	(0.007)	(0.004)	(0.017)		(0.005)			(0.003)	(0.008)	(0.008)	(0.013)	(0.010)	(0.008)		(0.009)	(0.009)	(0.003)	(0.010)	(0.006)	(0.006)	(0.014)	(0.012)
Father: Not present										0.001								0.007				
										(0.009)								(0.009)				
Mother: Primary education	0.003	0.001	0.009	-0.029***	-0.005	0.001	-0.004	0.005**	0.021***	0.004	0.005	-0.005	-0.010	0.014***	0.003	0.034**		-0.000	0.028***	0.032***	-0.005	0.006
	(0.004)	(0.003)	(0.011)	(0.010)	(0.006)	(0.002)	(0.003)	(0.002)	(0.008)	(0.008)	(0.007)	(0.004)	(0.006)	(0.005)	(0.003)	(0.015)		(0.005)	(0.004)	(0.006)	(0.007)	(0.004)
Mother: Secondary education	0.008**	-0.001	0.003	-0.020**	0.001	-0.004	-0.003	0.003	0.019**	-0.002	-0.007	0.002	0.016**	0.011	0.002	0.011	0.147***	0.001			-0.009	0.005
	(0.004)	(0.003)	(0.012)	(0.008)	(0.006)	(0.004)	(0.004)	(0.003)	(0.007)	(0.008)	(0.010)	(0.005)	(0.006)	(0.007)	(0.005)	(0.014)	(0.012)	(0.006)			(0.008)	(0.005)
Mother: Higher education	0.009	-0.000			0.004		-0.011*	-0.004	0.009	-0.005	-0.027	0.006	-0.007		-0.005	-0.014	0.137***	-0.000			-0.012	0.003
	(0.006)	(0.004)			(0.003)		(0.007)	(0.004)	(0.008)	(0.009)	(0.017)	(0.009)	(0.008)		(0.015)	(0.014)	(0.012)	(0.009)			(0.012)	(0.009)
Rural residence	0.000	0.003	0.028**	0.008	-0.003	-0.009	-0.005*	-0.002	-0.002	0.001	-0.000	-0.001	0.009	0.000	-0.005	-0.002	0.001	0.005	0.006**	-0.001	-0.001	-0.001
	(0.003)	(0.002)	(0.013)	(0.008)	(0.008)	(0.010)	(0.003)	(0.002)	(0.003)	(0.003)	(0.006)	(0.004)	(0.007)	(0.007)	(0.004)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)	(0.004)
Wealth: poorest	0.007	0.001	-0.025	0.012	0.015*	-0.002	-0.001	0.007	0.016	0.001	0.012	0.018**	0.002	0.002	0.019*	-0.005	0.012**	-0.003	-0.008	-0.015***	-0.001	0.017
	(0.005)	(0.004)	(0.020)	(0.014)	(0.008)	(0.004)	(0.006)	(0.004)	(0.010)	(0.005)	(0.012)	(0.008)	(0.013)	(0.012)	(0.010)	(0.006)	(0.006)	(0.009)	(0.006)	(0.006)	(0.011)	(0.011)
Wealth: poorer	0.003	-0.001	-0.018	0.014	0.010	-0.003	-0.002	0.002	0.005	-0.005	0.008	0.018**	0.011	0.004	0.016*	-0.009	0.012**	0.002	-0.011**	-0.012**	0.005	0.015
	(0.005)	(0.003)	(0.018)	(0.013)	(0.008)	(0.004)	(0.005)	(0.004)	(0.009)	(0.005)	(0.010)	(0.007)	(0.012)	(0.011)	(0.009)	(0.005)	(0.005)	(0.008)	(0.005)	(0.005)	(0.010)	(0.010)
Wealth: middle	-0.001	0.001	-0.021	0.010	0.012*	0.001	-0.003	0.004	0.006	-0.001	0.013	0.013*	0.005	0.001	0.010	0.002	0.007*	0.006	-0.001	-0.009*	0.005	0.009
	(0.005)	(0.003)	(0.018)	(0.013)	(0.007)	(0.004)	(0.006)	(0.004)	(0.009)	(0.005)	(0.010)	(0.007)	(0.010)	(0.010)	(0.008)	(0.004)	(0.004)	(0.007)	(0.005)	(0.005)	(0.011)	(0.009)
Wealth: richer	-0.001	0.002	-0.017	-0.001	0.000	-0.002	-0.002	0.006	0.004	-0.005	0.004	0.007	0.000	-0.005	0.004	0.001	-0.003	-0.001	-0.003	-0.012**	0.006	0.019**
	(0.004)	(0.003)	(0.016)	(0.012)	(0.005)	(0.004)	(0.006)	(0.004)	(0.009)	(0.005)	(0.010)	(0.008)	(0.008)	(0.008)	(0.007)	(0.004)	(0.004)	(0.006)	(0.005)	(0.005)	(0.010)	(0.009)
Observations	23,152	38,406	2,495	3,560	15,029	37,832	47,173	46,852	16,093	28,202	7,935	5,977	11,395	19,138	28,367	14,099	16,066	4,186	9,201	6,368	6,460	7,693

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Table A17. Average marginal effects from probit regressions of *neonatal mortality on MEPI scores* (Model 14)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	JO18	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR19
MEPI score	-0.040*	-0.009	-0.026	-0.013	-0.004	0.003	0.011	-0.015	-0.021	0.001	-0.034	0.006	-0.003	0.009	0.004	-0.015	-0.030	0.040**	0.019		0.029	
	(0.023)	(0.011)	(0.019)	(0.013)	(0.019)	(0.023)	(0.012)	(0.032)	(0.017)	(0.013)	(0.021)	(0.010)	(0.014)	(0.015)	(0.012)	(0.013)	(0.033)	(0.016)	(0.019)		(0.021)	
Female household	0.004	-0.008	-0.015*	-0.001	0.008	0.000	-0.003	0.001	-0.023**	-0.014*	-0.014*	-0.033***	-0.001	0.010*	-0.005	-0.011	0.004		0.001		0.003	
	(0.007)	(0.008)	(0.008)	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)	(0.010)	(0.007)	(0.008)	(0.010)	(0.007)	(0.006)	(0.004)	(0.009)	(0.009)		(0.006)		(0.004)	
Female child	-0.004	-0.004	-0.002	-0.000	-0.006**	-0.008***	-0.008***	-0.001	0.002	-0.006	-0.014***	-0.004	-0.012***	-0.006	-0.004	-0.001	-0.003	-0.004	-0.005	0.000	-0.002	0.002
	(0.003)	(0.003)	(0.006)	(0.005)	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)	(0.004)	(0.005)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)
Father: Primary education	-0.016***	-0.008	-0.006	-0.001	-0.003	-0.005	0.000	-0.006	0.004	0.023**	-0.005	0.003	-0.007	-0.035***	0.002	0.010		-0.022***	0.004	-0.023**	0.070***	-0.018*
	(0.005)	(0.005)	(0.009)	(0.006)	(0.004)	(0.003)	(0.003)	(0.004)	(0.011)	(0.011)	(0.008)	(0.004)	(0.007)	(0.007)	(0.004)	(0.012)		(0.007)	(0.007)	(0.010)	(0.018)	(0.011)
Father: Secondary education	-0.018***	-0.012***	0.010	-0.001	-0.002	-0.001	0.003	-0.007*	0.005	0.023**	-0.003	0.010*	-0.009	-0.013	0.012**	0.005	0.004	-0.010	0.010	-0.010	0.066***	-0.008
	(0.005)	(0.005)	(0.008)	(0.006)	(0.003)	(0.006)	(0.004)	(0.004)	(0.010)	(0.011)	(0.007)	(0.005)	(0.008)	(0.009)	(0.006)	(0.011)	(0.004)	(0.008)	(0.007)	(0.006)	(0.017)	(0.008)
Father: Higher education	-0.027***	-0.020***	0.000		-0.005			-0.009*	0.004	0.022**	-0.016	0.010	-0.009		-0.001	0.005	0.004	-0.010	0.008	-0.015	0.064***	-0.011
	(0.010)	(0.007)	(0.013)		(0.005)			(0.005)	(0.011)	(0.011)	(0.012)	(0.009)	(0.009)		(0.010)	(0.011)	(0.004)	(0.012)	(0.008)	(0.009)	(0.018)	(0.011)
Father: Not present																		-0.001				
																		(0.010)				
Mother: Primary education	0.004	0.005	0.007	-0.018**	-0.002	-0.004	-0.003	0.003	0.008	0.095***	0.002	-0.002	-0.004	0.011	-0.003	-0.002		-0.014**	0.018***	0.025***	-0.006	0.003
	(0.004)	(0.005)	(0.008)	(0.008)	(0.006)	(0.004)	(0.003)	(0.004)	(0.010)	(0.017)	(0.007)	(0.004)	(0.007)	(0.007)	(0.004)	(0.011)		(0.007)	(0.005)	(0.008)	(0.005)	(0.006)
Mother: Secondary education	0.008*	-0.001	0.011	-0.019***	0.003	-0.014*	-0.003	0.005	0.010	0.085***	0.002	0.003	0.014**	0.003	-0.001	-0.013	0.103***	-0.025***			0.002	-0.007
	(0.005)	(0.005)	(0.009)	(0.006)	(0.005)	(0.007)	(0.004)	(0.004)	(0.009)	(0.015)	(0.010)	(0.004)	(0.007)	(0.010)	(0.005)	(0.010)	(0.018)	(0.009)			(0.005)	(0.007)
Mother: Higher education	0.013*	0.003			0.008***		-0.005	-0.005	-0.003	0.082***	-0.021	-0.013	0.001		0.001	-0.031***	0.096***	-0.014			-0.006	-0.021
	(0.008)	(0.006)			(0.003)		(0.006)	(0.007)	(0.010)	(0.015)	(0.017)	(0.010)	(0.009)		(0.015)	(0.010)	(0.017)	(0.010)			(0.008)	(0.013)
Rural residence	0.004	0.003	0.017*	0.002	-0.006	-0.014	-0.001	-0.004	-0.002	-0.005	-0.001	0.003	0.001	-0.007	-0.005	-0.004	-0.001	0.010	0.004	-0.004	0.003	0.003
	(0.003)	(0.003)	(0.009)	(0.005)	(0.008)	(0.014)	(0.003)	(0.003)	(0.004)	(0.006)	(0.006)	(0.004)	(0.008)	(0.008)	(0.005)	(0.003)	(0.003)	(0.007)	(0.003)	(0.004)	(0.004)	(0.004)
Wealth: poorest	0.007	0.002	0.000	0.002	0.010	0.008	-0.007	0.008	0.004	-0.006	0.010	0.015*	-0.009	0.015	0.024**	-0.009	0.014*	-0.022*	-0.009	-0.007	0.004	0.065***
	(0.006)	(0.006)	(0.014)	(0.011)	(0.007)	(0.006)	(0.005)	(0.007)	(0.010)	(0.009)	(0.012)	(0.008)	(0.013)	(0.015)	(0.012)	(0.008)	(0.008)	(0.013)	(0.008)	(0.007)	(0.008)	(0.018)
Wealth: poorer	0.000	-0.001	-0.003	0.009	0.004	0.005	-0.004	0.001	-0.005	-0.003	0.008	0.017**	-0.007	0.014	0.021**	-0.000	0.006	-0.010	0.002	-0.017**	0.005	0.068***
	(0.006)	(0.005)	(0.012)	(0.009)	(0.006)	(0.006)	(0.005)	(0.007)	(0.009)	(0.007)	(0.009)	(0.008)	(0.012)	(0.014)	(0.011)	(0.007)	(0.006)	(0.010)	(0.007)	(0.008)	(0.008)	(0.019)
Wealth: middle	-0.006	-0.001	-0.005	-0.002	0.007	0.005	-0.008*	0.001	-0.003	-0.003	-0.005	0.015**	-0.014	0.014	0.018*	0.001	0.004	0.000	0.007	0.007	0.001	0.067***
	(0.005)	(0.005)	(0.012)	(0.009)	(0.006)	(0.006)	(0.005)	(0.007)	(0.010)	(0.008)	(0.010)	(0.007)	(0.010)	(0.012)	(0.009)	(0.005)	(0.005)	(0.009)	(0.007)	(0.006)	(0.008)	(0.019)
Wealth: richer	0.004	-0.001	-0.002	-0.003	0.002	-0.002	-0.005	0.006	-0.000	-0.001	-0.002	0.011	-0.009	0.015	0.018**	-0.002	-0.001	-0.020**	0.005	-0.001	0.001	0.083***
	(0.005)	(0.005)	(0.011)	(0.009)	(0.004)	(0.006)	(0.005)	(0.007)	(0.010)	(0.008)	(0.009)	(0.008)	(0.009)	(0.010)	(0.008)	(0.005)	(0.006)	(0.009)	(0.006)	(0.006)	(0.009)	(0.025)
Observations	12,206	12,446	2,504	3,585	11,853	13,793	30,334	14,083	8,614	8,516	5,549	5,123	8,512	9,765	9,374	6,536	5,262	2,470	2,927	1,717	2,987	2,254

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Table A18. Average marginal effects from probit regressions of *neonatal mortality on temperature extremes* (Model 15)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	JO18	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13	TUR18
Tempr. Extremes 9months pre birth	-0.001	-0.000	-0.002	0.012*	-0.000	0.000	-0.001**	-0.002***	0.000	-0.000	0.000	-0.000	-0.002	0.001	-0.002	-0.002***	-0.001	-0.001	0.000	-0.001	0.001	-0.000
	(0.001)	(0.001)	(0.003)	(0.007)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female household	0.005	-0.007	-0.015*	-0.001	0.008	0.001	-0.002	-0.000	-0.026***	-0.014**	-0.014*	-0.033***	0.012*	0.008	-0.004	-0.009	0.006		0.002		0.003	
	(0.007)	(0.007)	(0.008)	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)	(0.010)	(0.007)	(0.008)	(0.010)	(0.007)	(0.006)	(0.004)	(0.008)	(0.008)		(0.006)		(0.004)	
Female child	-0.002	-0.004	-0.002	-0.001	-0.006**	-0.008***	-0.009***	-0.000	0.002	-0.006	-0.014***	-0.004	-0.010**	-0.003	-0.004	-0.001	-0.004	0.001	-0.003	0.000	-0.002	0.002
	(0.003)	(0.003)	(0.006)	(0.005)	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)	(0.004)	(0.005)	(0.003)	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)
Father: Primary education	-0.016***	-0.009*	-0.006	0.000	-0.003	-0.002	0.000	-0.006	0.005	0.023**	-0.004	0.003	-0.014**	-0.036***	0.002	0.097***		-0.023***	0.004	0.055**	0.069***	-0.018*
	(0.005)	(0.005)	(0.009)	(0.006)	(0.004)	(0.003)	(0.003)	(0.004)	(0.011)	(0.011)	(0.008)	(0.004)	(0.007)	(0.007)	(0.004)	(0.013)		(0.007)	(0.006)	(0.023)	(0.016)	(0.011)
Father: Secondary education	-0.018***	-0.013***	0.011	0.000	-0.002	0.003	0.002	-0.006	0.006	0.023**	-0.003	0.010*	-0.013	-0.017*	0.011*	0.093***	0.006	-0.014**	0.007	0.063**	0.065***	-0.008
	(0.005)	(0.005)	(0.008)	(0.006)	(0.003)	(0.005)	(0.004)	(0.004)	(0.010)	(0.011)	(0.008)	(0.005)	(0.008)	(0.009)	(0.006)	(0.011)	(0.004)	(0.006)	(0.006)	(0.027)	(0.016)	(0.008)
Father: Higher education	-0.026***	-0.019***	0.001		-0.005			-0.008*	0.004	0.022**	-0.014	0.010	-0.014*		-0.002	0.093***	0.005	-0.011	0.007		0.062***	-0.012
	(0.010)	(0.007)	(0.013)		(0.005)			(0.004)	(0.011)	(0.011)	(0.012)	(0.008)	(0.009)		(0.010)	(0.011)	(0.004)	(0.007)	(0.008)		(0.017)	(0.011)
Mother: Primary education	0.007	0.004	0.008	-0.016**	-0.002	-0.001	-0.001	0.001	0.008	0.095***	0.003	-0.003	-0.013*	0.006	-0.003	0.006		-0.005	0.016***		-0.006	0.003
	(0.004)	(0.004)	(0.008)	(0.008)	(0.006)	(0.003)	(0.003)	(0.004)	(0.010)	(0.017)	(0.007)	(0.004)	(0.007)	(0.007)	(0.004)	(0.012)		(0.005)	(0.005)		(0.005)	(0.006)
Mother: Secondary education	0.010**	-0.001	0.012	-0.017***	0.003	-0.008	-0.001	0.005	0.010	0.085***	0.002	0.002	0.014**	0.001	0.001	-0.005	0.096***	-0.004			0.002	-0.007
	(0.005)	(0.005)	(0.009)	(0.006)	(0.005)	(0.006)	(0.004)	(0.004)	(0.009)	(0.015)	(0.010)	(0.004)	(0.007)	(0.010)	(0.005)	(0.011)	(0.017)	(0.005)			(0.005)	(0.007)
Mother: Higher education	0.014*	0.004			0.008***		-0.002	-0.005	-0.003	0.082***	-0.019	-0.013	-0.008		0.003	-0.023**	0.091***	0.005			-0.005	-0.021
	(0.008)	(0.006)			(0.003)		(0.006)	(0.006)	(0.010)	(0.015)	(0.017)	(0.010)	(0.009)		(0.016)	(0.011)	(0.017)	(0.007)			(0.009)	(0.013)
Rural residence	0.002	0.004	0.016*	0.000	-0.006	-0.011	-0.001	-0.004	-0.001	-0.005	-0.000	0.003	0.012	-0.004	-0.005	-0.006*	-0.001	0.002	0.002	-0.009	0.002	0.003
	(0.003)	(0.003)	(0.009)	(0.005)	(0.008)	(0.012)	(0.003)	(0.003)	(0.004)	(0.006)	(0.006)	(0.004)	(0.008)	(0.008)	(0.005)	(0.003)	(0.003)	(0.006)	(0.003)	(0.008)	(0.004)	(0.004)
Wealth: poorest	0.005	-0.001	-0.012	-0.002	0.010	0.009	-0.005	0.004	0.003	-0.006	-0.000	0.016*	-0.016	0.016	0.026**	-0.013*	0.011	0.005	-0.012		0.005	0.066***
	(0.006)	(0.006)	(0.013)	(0.009)	(0.006)	(0.006)	(0.005)	(0.007)	(0.011)	(0.009)	(0.010)	(0.008)	(0.011)	(0.013)	(0.010)	(0.007)	(0.007)	(0.008)	(0.008)		(0.008)	(0.018)
Wealth: poorer	0.001	-0.002	-0.012	0.005	0.004	0.006	-0.004	-0.001	-0.006	-0.003	0.007	0.017**	-0.011	0.016	0.023**	-0.004	0.007	0.006	0.002	0.056**	0.005	0.069***
	(0.006)	(0.005)	(0.012)	(0.008)	(0.006)	(0.006)	(0.005)	(0.007)	(0.010)	(0.007)	(0.009)	(0.008)	(0.011)	(0.013)	(0.009)	(0.006)	(0.006)	(0.007)	(0.006)	(0.023)	(0.008)	(0.020)
Wealth: middle	-0.006	-0.002	-0.011	-0.003	0.007	0.004	-0.009*	-0.001	-0.004	-0.003	-0.003	0.015**	-0.022**	0.016	0.018**	-0.002	0.004	0.005	0.006	0.068**	0.001	0.068***
	(0.005)	(0.005)	(0.012)	(0.008)	(0.006)	(0.005)	(0.005)	(0.007)	(0.010)	(0.008)	(0.010)	(0.008)	(0.009)	(0.012)	(0.009)	(0.005)	(0.005)	(0.006)	(0.006)	(0.030)	(0.008)	(0.019)
Wealth: richer	0.004	-0.001	-0.004	-0.003	0.002	-0.002	-0.005	0.003	-0.001	-0.001	0.002	0.012	-0.010	0.011	0.017**	-0.004	-0.001	-0.003	0.005	0.055**	0.001	0.083***
	(0.005)	(0.005)	(0.011)	(0.009)	(0.004)	(0.005)	(0.005)	(0.007)	(0.010)	(0.008)	(0.009)	(0.008)	(0.008)	(0.010)	(0.008)	(0.005)	(0.005)	(0.005)	(0.006)	(0.023)	(0.009)	(0.025)
Observations	11,975	12,366	2,495	3,560	11,853	13,574	30,168	14,033	8,614	8,516	5,413	4,843	6,883	8,041	9,303	6,520	5,248	2,360	2,913	857	2,987	2,254

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. In most regressions, the baseline group is boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment – but some covariates had to be removed because of their values' perfect association with mortality outcomes. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Table A19. Average marginal effects from probit regressions of *stunting* on *MEPI scores*, regressions on pooled survey waves (Model 16)

	ALG13-19	COM12-22	EGY14-21	IRQ11-18	JOR12	MAR11-18	MRT11-15-21	PAL14-20	TUN12-18-23	TUR13-19
MEPI score	0.018	0.018	0.051	-0.044	0.014	0.131***	0.014	0.077***	0.139**	0.144
	(0.020)	(0.032)	(0.057)	(0.032)	(0.041)	(0.030)	(0.019)	(0.030)	(0.058)	(0.106)
Female household	0.003	-0.033***	-0.010	0.018	0.065**	-0.027	0.014*	0.013	-0.004	0.030*
	(0.011)	(0.013)	(0.014)	(0.013)	(0.029)	(0.017)	(0.007)	(0.016)	(0.021)	(0.018)
Female child	-0.016***	-0.011	-0.013**	0.009*	-0.030***	-0.028***	-0.018***	-0.007	0.001	-0.019**
	(0.004)	(0.011)	(0.006)	(0.005)	(0.010)	(0.009)	(0.006)	(0.005)	(0.008)	(0.008)
Child age (yrs)	0.008	0.062***	0.026***	0.049***	0.024*	0.098***	0.170***	0.009	-0.014	0.034**
	(0.006)	(0.015)	(0.008)	(0.007)	(0.013)	(0.012)	(0.008)	(0.007)	(0.011)	(0.014)
Child age squared	-0.001	-0.014***	-0.006***	-0.011***	-0.007**	-0.019***	-0.027***	-0.003**	0.001	-0.007**
	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)
Father: Primary education	-0.012	-0.035**	0.010	-0.009	-0.038	-0.016	-0.016*	-0.099**	-0.017	0.013
	(0.008)	(0.017)	(0.013)	(0.010)	(0.031)	(0.011)	(0.008)	(0.041)	(0.022)	(0.021)
Father: Secondary education	-0.002	-0.023	-0.012	-0.031***	-0.027	-0.006	-0.031**	-0.086**	-0.031	-0.008
	(0.008)	(0.017)	(0.012)	(0.010)	(0.030)	(0.016)	(0.013)	(0.040)	(0.023)	(0.022)
Father: Higher education	0.007	0.003	-0.014		-0.031	0.016		-0.097**	-0.027	0.014
	(0.011)	(0.020)	(0.015)		(0.034)	(0.021)		(0.040)	(0.026)	(0.027)
Father: Not present	0.004			-0.052**			0.004	-0.068	0.034	
	(0.014)			(0.020)			(0.014)	(0.046)	(0.032)	
Mother: Primary education	-0.011	0.027	0.001	-0.026***	0.028	-0.013	0.003	-0.059	-0.029**	0.010
	(0.008)	(0.016)	(0.012)	(0.008)	(0.026)	(0.012)	(0.008)	(0.048)	(0.014)	(0.013)
Mother: Secondary education	-0.022***	-0.016	-0.017*	-0.046***	0.028	0.006	-0.041***	-0.079*	-0.029*	0.002
	(0.007)	(0.016)	(0.009)	(0.010)	(0.024)	(0.016)	(0.012)	(0.047)	(0.015)	(0.014)
Mother: Higher education	-0.035***	-0.136**	-0.022*		0.003	-0.064**		-0.094**	-0.045**	-0.017
	(0.010)	(0.054)	(0.013)		(0.027)	(0.030)		(0.047)	(0.018)	(0.023)
Rural residence	-0.005	0.001	-0.009	-0.001	0.010	0.034***	-0.015	0.002	0.017	-0.012
	(0.005)	(0.014)	(0.008)	(0.007)	(0.011)	(0.012)	(0.010)	(0.006)	(0.011)	(0.011)
Wealth: poorest	0.015*	0.084***	0.017	0.036***	0.123***	0.078***	0.137***	0.033**	-0.019	0.105***
	(0.009)	(0.027)	(0.013)	(0.012)	(0.029)	(0.020)	(0.021)	(0.014)	(0.019)	(0.023)
Wealth: poorer	0.006	0.061**	0.015	0.020*	0.077***	0.068***	0.111***	0.037***	-0.033*	0.053**
	(0.008)	(0.024)	(0.012)	(0.011)	(0.027)	(0.017)	(0.020)	(0.011)	(0.017)	(0.022)
Wealth: middle	-0.002	0.024	-0.002	-0.005	0.071**	0.037**	0.083***	0.013	-0.038**	0.026
	(0.008)	(0.023)	(0.011)	(0.011)	(0.028)	(0.016)	(0.017)	(0.009)	(0.016)	(0.022)
Wealth: richer	0.002	0.039*	-0.002	0.001	0.079***	-0.002	0.046***	0.004	-0.020	0.014
	(0.008)	(0.022)	(0.010)	(0.012)	(0.027)	(0.016)	(0.014)	(0.009)	(0.015)	(0.021)
Wave 2	-0.012***	-0.124***	-0.045***	-0.124***		0.034***	-0.015*	0.013*	-0.007	-0.031***
	(0.005)	(0.014)	(0.006)	(0.007)		(0.011)	(0.009)	(0.007)	(0.010)	(0.010)
Wave 3							0.001		0.051***	
							(0.009)		(0.014)	
Observations	27,714	6,641	23,774	51,402	6267	12,585	27,957	12,634	7,659	4,879
Chi-squared	190.6***	288.19***	532.7***	1036***	146.29***	391.4***	1026***	158.70***	118.2***	158.7***
Pseudo R-squared	0.018	0.073	0.036	0.057	0.078	0.072	0.053	0.026	0.028	0.075

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. The baseline group is newborn boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old.*

Table A20. Average marginal effects from probit regressions of *stunting* on *temperature extremes*, regressions on pooled surveys (Model 17)

	ALG13-19	COM12-22	EGY14-21	IRQ11-18	JOR12	MAR11-18	MRT11-15-21	PAL14-20	TUN12-18-23	TUR13-19
Tempr. Extremes 9months pre birth	0.005	-0.014	0.011	-0.014*	0.052**	0.000	-0.137***	0.047***	0.003	-0.010
	(0.008)	(0.009)	(0.015)	(0.009)	(0.021)	(0.021)	(0.025)	(0.014)	(0.019)	(0.016)
Tempr. Extremes 12months post birth	0.005	-0.008	0.176***	-0.086**	0.049	0.034	-0.006	0.035	0.145*	-0.040
	(0.046)	(0.009)	(0.056)	(0.040)	(0.058)	(0.088)	(0.055)	(0.054)	(0.082)	(0.054)
(Joint significance test, Chi-squared statistic)	0.35	4.76*	10.17***	6.78**	6.15**	0.15	30.02***	12.04***	3.15	0.77
Female household	0.001	-0.036***	-0.009	0.016	0.071**	-0.024	0.013*	0.013	-0.004	0.031*
	(0.012)	(0.013)	(0.014)	(0.013)	(0.033)	(0.017)	(0.007)	(0.017)	(0.021)	(0.018)
Female child	-0.016***	-0.015	-0.013**	0.009*	-0.030***	-0.030***	-0.018***	-0.008	0.000	-0.019**
	(0.004)	(0.012)	(0.006)	(0.005)	(0.010)	(0.009)	(0.006)	(0.005)	(0.008)	(0.008)
Child age (yrs)	0.006	0.080***	0.034***	0.052***	0.018	0.100***	0.166***	0.008	-0.018	0.032**
	(0.006)	(0.020)	(0.009)	(0.007)	(0.013)	(0.013)	(0.008)	(0.008)	(0.012)	(0.014)
Child age squared	-0.000	-0.018***	-0.008***	-0.012***	-0.006**	-0.019***	-0.027***	-0.003**	0.002	-0.006**
	(0.001)	(0.004)	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Father: Primary education	-0.012	-0.040**	0.010	-0.008	-0.036	-0.017	-0.016*	-0.101**	-0.022	0.010
	(0.008)	(0.017)	(0.013)	(0.010)	(0.031)	(0.012)	(0.008)	(0.041)	(0.023)	(0.020)
Father: Secondary education	-0.003	-0.023	-0.013	-0.030***	-0.024	-0.006	-0.031**	-0.089**	-0.035	-0.010
	(0.008)	(0.017)	(0.012)	(0.010)	(0.029)	(0.017)	(0.013)	(0.041)	(0.023)	(0.022)
Father: Higher education	0.007	0.012	-0.015		-0.029	0.019		-0.099**	-0.031	0.012
	(0.011)	(0.022)	(0.015)		(0.034)	(0.022)		(0.041)	(0.026)	(0.027)
Father: Not present	0.004			-0.061***			0.006	-0.066	0.033	
	(0.016)			(0.021)			(0.013)	(0.048)	(0.033)	
Mother: Primary education	-0.010	0.029*	0.000	-0.025***	0.029	-0.012	0.003	-0.061	-0.039***	0.010
	(0.008)	(0.017)	(0.012)	(0.008)	(0.026)	(0.012)	(0.008)	(0.054)	(0.014)	(0.013)
Mother: Secondary education	-0.022***	-0.022	-0.018*	-0.045***	0.029	0.008	-0.041***	-0.081	-0.037**	0.002
	(0.007)	(0.017)	(0.009)	(0.010)	(0.024)	(0.016)	(0.012)	(0.054)	(0.015)	(0.014)
Mother: Higher education	-0.034***	-0.149***	-0.022*		0.004	-0.061**		-0.096*	-0.057***	-0.017
	(0.010)	(0.053)	(0.013)		(0.027)	(0.031)		(0.054)	(0.018)	(0.023)
Rural residence	-0.008	0.001	-0.009	-0.001	0.009	0.032**	-0.013	0.003	0.020*	-0.012
	(0.005)	(0.014)	(0.008)	(0.007)	(0.011)	(0.012)	(0.010)	(0.006)	(0.011)	(0.011)
Wealth: poorest	0.020**	0.091***	0.017	0.035***	0.124***	0.123***	0.143***	0.043***	-0.017	0.107***
	(0.009)	(0.023)	(0.013)	(0.012)	(0.030)	(0.019)	(0.018)	(0.013)	(0.019)	(0.023)
Wealth: poorer	0.008	0.063***	0.015	0.021*	0.078***	0.078***	0.116***	0.039***	-0.033*	0.054**
	(0.008)	(0.022)	(0.012)	(0.012)	(0.027)	(0.018)	(0.017)	(0.011)	(0.017)	(0.022)
Wealth: middle	0.001	0.022	-0.002	-0.004	0.071**	0.039**	0.087***	0.014	-0.040**	0.026
	(0.008)	(0.022)	(0.011)	(0.011)	(0.028)	(0.017)	(0.015)	(0.009)	(0.016)	(0.022)
Wealth: richer	0.004	0.035	-0.002	0.002	0.078***	-0.002	0.048***	0.003	-0.020	0.015
	(0.008)	(0.022)	(0.010)	(0.012)	(0.027)	(0.017)	(0.014)	(0.009)	(0.015)	(0.021)
Wave 2	-0.012**	-0.119***	-0.044***	-0.116***		0.020	-0.017**	0.008	-0.013	-0.030***
	(0.005)	(0.014)	(0.006)	(0.008)		(0.012)	(0.009)	(0.006)	(0.011)	(0.010)
Wave 3							0.008		0.033*	
							(0.010)		(0.019)	
Observations	27,102	6,271	23,774	50,901	6267	11,828	27,882	12,536	7,471	4,879
Chi-squared	180.3***	281.74***	536.6***	1053***	156.16***	370.4***	1053***	159.52***	119.2***	158.3***
Pseudo R-squared	0.018	0.074	0.037	0.057	0.082	0.069	0.054	0.026	0.028	0.075

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. The baseline group is newborn boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old.*

Table A21. Average marginal effects from probit regressions of *infant mortality* on *MEPI scores*, pooled surveys by country (Model 18)

	ALG13-19	COM12-22	EGY14-21	IRQ11-18	JOR12-18	MAR11-18	MRT11-15-21	PAL14-20	TUN12-18-23	TUR13-19
MEPI score	-0.002	-0.018	-0.008	0.013	-0.011	0.011	0.002	-0.013	0.022**	0.075**
	(0.009)	(0.015)	(0.021)	(0.012)	(0.011)	(0.013)	(0.010)	(0.013)	(0.010)	(0.032)
Female household	-0.007	-0.011*	0.006	-0.001	-0.005	-0.012	-0.053***	-0.005	-0.008	-0.012
	(0.007)	(0.006)	(0.005)	(0.005)	(0.010)	(0.008)	(0.004)	(0.008)	(0.009)	(0.008)
Female child	-0.003	-0.005	-0.004*	-0.006***	-0.001	-0.006	-0.009***	-0.002	-0.007***	0.004
	(0.002)	(0.005)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)
Father: Primary education	-0.015***	-0.004	-0.005	-0.016***	0.003	-0.002	0.002	0.004	-0.007	0.008
	(0.004)	(0.007)	(0.006)	(0.005)	(0.010)	(0.005)	(0.004)	(0.005)	(0.004)	(0.011)
Father: Secondary education	-0.021***	0.001	-0.009*	-0.014**	0.002	0.004	0.000	0.001	-0.002	0.005
	(0.004)	(0.007)	(0.005)	(0.005)	(0.009)	(0.005)	(0.006)	(0.005)	(0.004)	(0.012)
Father: Higher education	-0.029***		-0.007	-0.013**	-0.003	-0.003		0.005	-0.001	-0.003
	(0.007)		(0.007)	(0.006)	(0.010)	(0.010)		(0.005)	(0.006)	(0.014)
Mother: Primary education	0.007**	-0.010	0.006	-0.003	0.027**	-0.003	0.001	0.039***	-0.010***	-0.002
	(0.004)	(0.008)	(0.005)	(0.003)	(0.011)	(0.005)	(0.004)	(0.009)	(0.004)	(0.006)
Mother: Secondary education	0.003	-0.012	0.001	-0.003	0.023**	0.002	-0.007	0.026***	-0.017***	0.004
	(0.004)	(0.008)	(0.005)	(0.004)	(0.010)	(0.006)	(0.007)	(0.009)	(0.005)	(0.007)
Mother: Higher education	0.007		-0.010	-0.011*	0.014	-0.017		0.002	-0.017***	-0.007
	(0.006)		(0.007)	(0.006)	(0.010)	(0.013)		(0.010)	(0.006)	(0.010)
Rural residence	0.003	0.017**	0.002	-0.002	0.003	-0.000	-0.005	-0.002	0.005	0.003
	(0.003)	(0.007)	(0.004)	(0.003)	(0.004)	(0.005)	(0.005)	(0.003)	(0.003)	(0.005)
Wealth: poorest	0.003	-0.004	0.011**	-0.002	0.001	0.017*	0.015	0.004	-0.009*	-0.007
	(0.005)	(0.012)	(0.005)	(0.005)	(0.008)	(0.009)	(0.010)	(0.007)	(0.006)	(0.010)
Wealth: poorer	-0.003	0.003	0.007	-0.005	-0.004	0.017**	0.018**	0.003	-0.006	-0.002
	(0.005)	(0.011)	(0.005)	(0.005)	(0.007)	(0.008)	(0.009)	(0.006)	(0.005)	(0.010)
Wealth: middle	-0.002	-0.004	0.007	-0.008	-0.005	0.012	0.016**	0.004	0.001	-0.007
	(0.004)	(0.011)	(0.005)	(0.005)	(0.008)	(0.008)	(0.008)	(0.004)	(0.004)	(0.010)
Wealth: richer	0.001	-0.009	-0.000	-0.005	-0.002	0.007	0.011*	-0.002	-0.014***	0.011
	(0.004)	(0.010)	(0.005)	(0.005)	(0.007)	(0.008)	(0.006)	(0.005)	(0.005)	(0.009)
Wave 2	-0.004*	-0.003	0.004	-0.011***	-0.001	-0.013***	-0.001	-0.021***	-0.009***	0.004
	(0.002)	(0.007)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)	(0.004)
Wave 3							-0.011***		-0.015***	
							(0.004)		(0.003)	
Observations	24,652	6,089	26,244	44,417	17,130	10,672	27,651	11,798	7,072	5,241
Chi-squared	117.7***	18.97	110.3***	79***	32.4	60.80***	233.7***	148.2***	1386***	45.63***
Pseudo R-squared	0.0308	0.0156	0.0226	0.0128	0.0157	0.0395	0.0391	0.0671	0.3450	0.0503

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. The baseline group is newborn boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Table A22. Average marginal effects from probit regressions of *infant mortality* on *temperature extremes*, pooled surveys by country (Model 19)

	ALG13-19	COM12-22	EGY14-21	IRQ11-18	JOR12-18	MAR11-18	MRT11-15-21	PAL14-20	TUN12-18-23	TUR13-19
Tempr. extremes 9months pre birth	-0.007	0.008**	-0.002	-0.014***	0.003	-0.004	-0.014	-0.016**	-0.008*	-0.011
	(0.005)	(0.004)	(0.005)	(0.004)	(0.007)	(0.009)	(0.012)	(0.007)	(0.005)	(0.008)
Tempr. extremes 12months post birth	0.011	0.008*	0.013	0.001	-0.008	-0.032	-0.013	-0.008	-0.039	0.013
	(0.023)	(0.005)	(0.018)	(0.017)	(0.029)	(0.033)	(0.025)	(0.021)	(0.025)	(0.025)
(Joint significance test, Chi-squared statistic)	2.63	7.23**	0.71	13.85***	0.25	1.03	1.96	5.39*	6.72**	2.65
Female household	-0.006	-0.011*	0.004	-0.002	-0.007	-0.012	-0.042***	-0.003	-0.005	-0.011
	(0.006)	(0.006)	(0.004)	(0.005)	(0.010)	(0.008)	(0.004)	(0.008)	(0.006)	(0.008)
Female child	-0.002	-0.005	-0.004**	-0.006***	-0.001	-0.006	-0.008***	-0.002	-0.004*	0.004
	(0.002)	(0.005)	(0.002)	(0.002)	(0.003)	(0.004)	(0.003)	(0.002)	(0.002)	(0.004)
Father: Primary education	-0.016***	-0.004	-0.007	-0.015***	0.003	-0.002	-0.003	0.007	-0.006*	0.005
	(0.004)	(0.007)	(0.005)	(0.005)	(0.010)	(0.005)	(0.005)	(0.005)	(0.003)	(0.010)
Father: Secondary education	-0.020***	0.002	-0.008	-0.013**	0.002	0.004	-0.003	0.004	-0.004	0.003
	(0.004)	(0.007)	(0.005)	(0.005)	(0.009)	(0.005)	(0.006)	(0.005)	(0.004)	(0.011)
Father: Higher education	-0.028***		-0.006	-0.013**	-0.002	-0.001		0.008	-0.002	-0.006
	(0.006)		(0.006)	(0.006)	(0.010)	(0.010)		(0.005)	(0.005)	(0.013)
Mother: Primary education	0.008**	-0.010	0.004	-0.002	0.027**	-0.003	-0.004	0.044***	-0.007**	-0.002
	(0.004)	(0.008)	(0.005)	(0.003)	(0.011)	(0.005)	(0.004)	(0.011)	(0.003)	(0.006)
Mother: Secondary education	0.004	-0.012	0.001	-0.001	0.023**	0.003	-0.011*	0.032***	-0.009**	0.004
	(0.004)	(0.008)	(0.004)	(0.004)	(0.010)	(0.006)	(0.007)	(0.011)	(0.004)	(0.007)
Mother: Higher education	0.008		-0.008	-0.008	0.014	-0.016		0.011	-0.009*	-0.006
	(0.005)		(0.006)	(0.006)	(0.010)	(0.013)		(0.011)	(0.005)	(0.010)
Rural residence	0.003	0.015**	0.003	-0.002	0.003	-0.000	-0.003	-0.003	0.000	0.003
	(0.003)	(0.007)	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)	(0.003)	(0.003)	(0.005)
Wealth: poorest	0.003	-0.011	0.011**	-0.002	0.001	0.022**	0.015**	0.001	0.000	-0.005
	(0.005)	(0.010)	(0.005)	(0.005)	(0.008)	(0.009)	(0.008)	(0.006)	(0.004)	(0.010)
Wealth: poorer	-0.002	-0.003	0.006	-0.005	-0.004	0.020**	0.019***	0.002	-0.001	-0.001
	(0.004)	(0.010)	(0.005)	(0.005)	(0.007)	(0.009)	(0.007)	(0.005)	(0.004)	(0.010)
Wealth: middle	-0.002	-0.006	0.006	-0.009*	-0.005	0.015*	0.017***	0.003	0.003	-0.006
	(0.004)	(0.010)	(0.005)	(0.005)	(0.008)	(0.009)	(0.007)	(0.004)	(0.003)	(0.010)
Wealth: richer	0.002	-0.009	-0.000	-0.006	-0.002	0.009	0.010*	-0.001	-0.006*	0.012
	(0.004)	(0.010)	(0.004)	(0.005)	(0.007)	(0.009)	(0.006)	(0.004)	(0.003)	(0.009)
Wave 2	-0.004	-0.009	0.000	-0.010***	0.000	-0.011**	0.005	-0.017***	-0.003	0.003
	(0.003)	(0.007)	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)	(0.003)	(0.004)
Wave 3							-0.000		-0.008***	
							(0.004)		(0.002)	
Observations	24,341	6,055	26,025	44,201	17,130	10,256	24,298	11,768	6,883	5,241
Chi-squared	102***	26.03*	92.52***	91.23***	33.03***	62.08***	182.1***	128.7***	992.8***	58.06***
Pseudo R-squared	0.0288	0.0212	0.0198	0.0164	0.0153	0.0400	0.0342	0.0703	0.3540	0.0514

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. The baseline group is newborn boys in male-headed urban wealthy households with highly educated mothers, and fathers of unknown educational attainment. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Table A23. First-stage regression results (sample for children's *stunting* Model 1 in Table A4)

	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13
Instrument (MEPI	0.955***	0.987***	0.571***	0.998***	0.816***	0.962***	0.804***	0.880***	0.337***	0.823***	1.016***	0.908***	0.974***	0.817***	0.931***	1.002***	0.994***	0.981***	0.074	0.458***
score of neighbors)	(0.060)	(0.040)	(0.092)	(0.051)	(0.104)	(0.035)	(0.034)	(0.085)	(0.088)	(0.065)	(0.066)	(0.030)	(0.043)	(0.035)	(0.058)	(0.125)	(0.201)	(0.219)	(0.096)	(0.099)
Rural	-0.000	-0.003	0.024**	-0.011	-0.001	0.000	-0.001	0.000	-0.007	-0.009***	0.003	-0.003	-0.001	0.017**	0.001	-0.000	0.003	-0.003	-0.005*	-0.005
	(0.002)	(0.003)	(0.011)	(0.009)	(0.002)	(0.001)	(0.001)	(0.001)	(0.006)	(0.003)	(0.004)	(0.006)	(0.009)	(0.007)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Wealth: poorest	0.007**	-0.008	0.204***	0.003	-0.003	0.001	0.013***	-0.001	-0.002	-0.050**	-0.000	0.057***	0.023	0.117***	0.008	0.005	-0.006	0.002	0.036***	0.017***
	(0.004)	(0.008)	(0.045)	(0.028)	(0.002)	(0.001)	(0.002)	(0.002)	(0.009)	(0.020)	(0.011)	(0.020)	(0.027)	(0.023)	(0.010)	(0.011)	(0.015)	(0.008)	(0.008)	(0.005)
Wealth: poorer	0.001	-0.001	0.160***	-0.007	-0.005**	0.003***	0.004***	0.001	-0.019**	-0.068***	-0.002	0.049***	0.017	0.107***	0.005	-0.004	-0.005	0.001	0.007***	0.003*
	(0.002)	(0.004)	(0.036)	(0.018)	(0.002)	(0.001)	(0.001)	(0.001)	(0.009)	(0.024)	(0.012)	(0.018)	(0.024)	(0.021)	(0.006)	(0.003)	(0.004)	(0.004)	(0.003)	(0.001)
Wealth: middle	-0.001	-0.003	0.089***	-0.015	-0.006***	0.005***	0.001***	-0.000	-0.023**	-0.068***	-0.000	0.042***	0.015	0.069***	0.005	0.000	-0.003	-0.002	0.003	0.001
	(0.001)	(0.003)	(0.023)	(0.015)	(0.002)	(0.001)	(0.001)	(0.001)	(0.010)	(0.025)	(0.012)	(0.015)	(0.016)	(0.016)	(0.004)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
Wealth: richer	-0.002	-0.001	0.044***	-0.015	-0.007***	0.003***	0.001	-0.001	-0.031**	-0.068***	0.000	0.007	0.005	0.027***	0.002	0.001	0.001	-0.002	0.000	0.001
	(0.001)	(0.002)	(0.016)	(0.011)	(0.002)	(0.001)	(0.000)	(0.001)	(0.015)	(0.025)	(0.013)	(0.009)	(0.007)	(0.009)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Governorate indicators	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***
Month indicators	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***
Constant	0.006***	-0.002	0.068***	0.029*	0.004	-0.002	0.001	0.000	0.133***	0.062**	-0.012	0.058***	-0.009	0.010	0.006	-0.001	-0.002	-0.000	-0.000	0.008**
	(0.002)	(0.003)	(0.024)	(0.017)	(0.003)	(0.002)	(0.001)	(0.001)	(0.021)	(0.025)	(0.012)	(0.015)	(0.015)	(0.011)	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)
Observations	14,701	14,873	3,146	4,464	15,003	90,455	36,280	16,623	10,353	6,553	6,159	9,278	10,663	10,583	7,816	6,328	2,899	3,420	1,926	3,560
R-squared	0.165	0.283	0.583	0.556	0.100	0.059	0.198	0.153	0.015	0.651	0.454	0.786	0.762	0.830	0.249	0.257	0.235	0.071	0.109	0.09
Chi-squared	843***	3058***	3131***	5356***	673***	3468***	2549***	524***	162***	4151***	1094***	5330***	5480***	8292***	1773***	773***	339***	116***	103***	128***

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old.*

Table A24. First-stage regression results (sample for *infant mortality* Model 8 in Table A11)

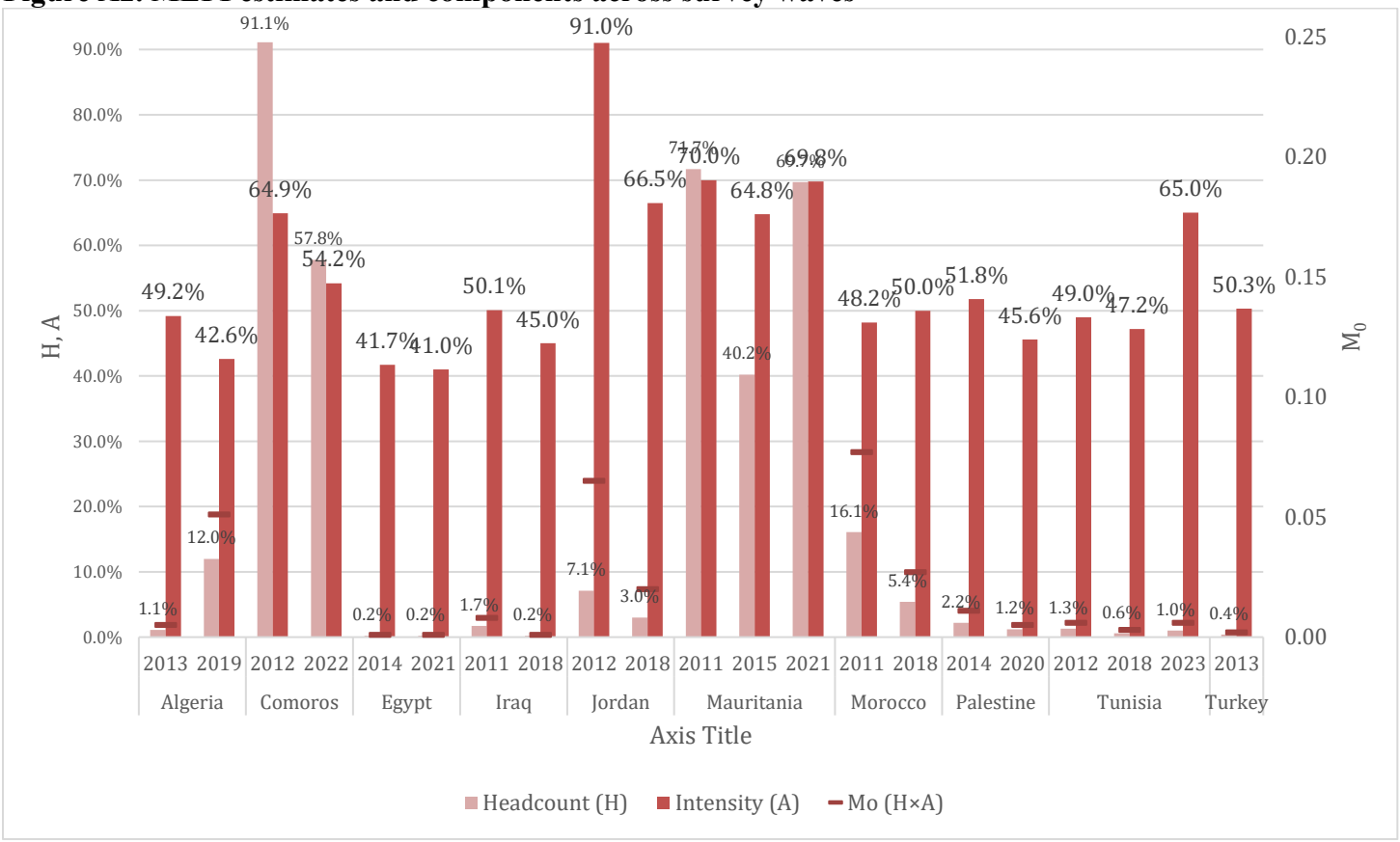
	ALG13	ALG19	COM12	COM22	EG14	EG21	IQ11	IQ18	JO12	JO18	MAR11	MAR18	MRT11	MRT15	MRT21	PA14	PA20	TUN12	TUN18	TUN23	TUR13
Instrument (MEPI score of neighbors)	0.955***	0.987***	0.924***	0.836***	0.816***	0.884***	0.804***	0.880***	0.684***	0.786***	0.891***	0.953***	0.908***	0.974***	0.918***	0.931***	1.002***	0.994***	0.981***	0.074	0.888***
	(0.060)	(0.040)	(0.047)	(0.053)	(0.104)	(0.040)	(0.034)	(0.085)	(0.061)	(0.067)	(0.061)	(0.060)	(0.030)	(0.043)	(0.020)	(0.058)	(0.125)	(0.201)	(0.219)	(0.096)	(0.089)
Rural	-0.000	-0.003	-0.008	0.008*	-0.001	0.001	-0.001	0.000	-0.001	0.001	-0.005	0.000	-0.003	-0.001	0.006*	0.001	-0.000	0.003	-0.003	-0.005*	-0.002*
	(0.002)	(0.003)	(0.009)	(0.005)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.006)	(0.009)	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.001)
Wealth: poorest	0.007**	-0.008	0.044*	0.077***	-0.003	-0.000	0.013***	-0.001	-0.003	-0.003	-0.038**	-0.011	0.057***	0.023	0.060***	0.008	0.005	-0.006	0.002	0.036***	0.005***
	(0.004)	(0.008)	(0.026)	(0.026)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.017)	(0.010)	(0.020)	(0.027)	(0.013)	(0.010)	(0.011)	(0.015)	(0.008)	(0.008)	(0.001)
Wealth: poorer	0.001	-0.001	0.020	0.060***	-0.005**	0.000	0.004***	0.001	-0.010***	-0.002	-0.048**	-0.014	0.049***	0.017	0.059***	0.005	-0.004	-0.005	0.001	0.007***	0.000
	(0.002)	(0.004)	(0.017)	(0.020)	(0.002)	(0.001)	(0.001)	(0.001)	(0.003)	(0.004)	(0.021)	(0.011)	(0.018)	(0.024)	(0.012)	(0.006)	(0.003)	(0.004)	(0.004)	(0.003)	(0.000)
Wealth: middle	-0.001	-0.003	0.002	0.035***	-0.006***	0.001	0.001***	-0.000	-0.013***	-0.005	-0.049**	-0.013	0.042***	0.015	0.041***	0.005	0.000	-0.003	-0.002	0.003	0.000
	(0.001)	(0.003)	(0.014)	(0.013)	(0.002)	(0.001)	(0.001)	(0.001)	(0.005)	(0.004)	(0.022)	(0.011)	(0.015)	(0.016)	(0.009)	(0.004)	(0.001)	(0.002)	(0.002)	(0.002)	(0.000)
Wealth: richer	-0.002	-0.001	-0.005	0.013	-0.007***	0.001	0.001	-0.001	-0.027***	-0.006	-0.050**	-0.013	0.007	0.005	0.015***	0.002	0.001	0.001	-0.002	0.000	0.000
	(0.001)	(0.002)	(0.010)	(0.010)	(0.002)	(0.001)	(0.000)	(0.001)	(0.006)	(0.005)	(0.022)	(0.011)	(0.009)	(0.007)	(0.005)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Governorate indicators	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***
Month indicators	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***	Y***
Constant	0.006***	-0.002	0.049***	0.027	0.004	0.001	0.001	0.000	0.054***	0.024***	0.042*	0.005	0.058***	-0.009	-0.007	0.006	-0.001	-0.002	-0.000	-0.000	0.003***
	(0.002)	(0.003)	(0.016)	(0.017)	(0.003)	(0.002)	(0.001)	(0.001)	(0.010)	(0.007)	(0.022)	(0.011)	(0.015)	(0.015)	(0.005)	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Observations	14,701	14,873	4,464	11,497	15,003	59,490	36,280	16,623	42,273	47,039	8,123	6,318	9,278	10,663	39,791	7,816	6,328	2,899	3,420	1,926	17,869
R-squared	0.165	0.283	0.556	0.526	0.100	0.058	0.198	0.153	0.053	0.046	0.659	0.444	0.786	0.762	0.823	0.249	0.257	0.235	0.071	0.109	0.090
Chi-squared	843***	3058***	5396***	9613***	673***	2302***	2549***	524***	883***	1445***	5218***	1219***	5323***	5480***	3030***	1773***	773***	339***	116***	103***	468***

*Notes: Variable AMEs are reported, significant at 10 percent *, 5 percent **, and 1 percent *** level. Standard errors in parentheses are heteroskedasticity robust and clustered at the household level. Child samples are nationally weighted. Regressions evaluated among children 12–59 months old, mortality evaluated during 5 years before survey.*

Figure A1. Map illustrating the MENA region with the studied countries highlighted

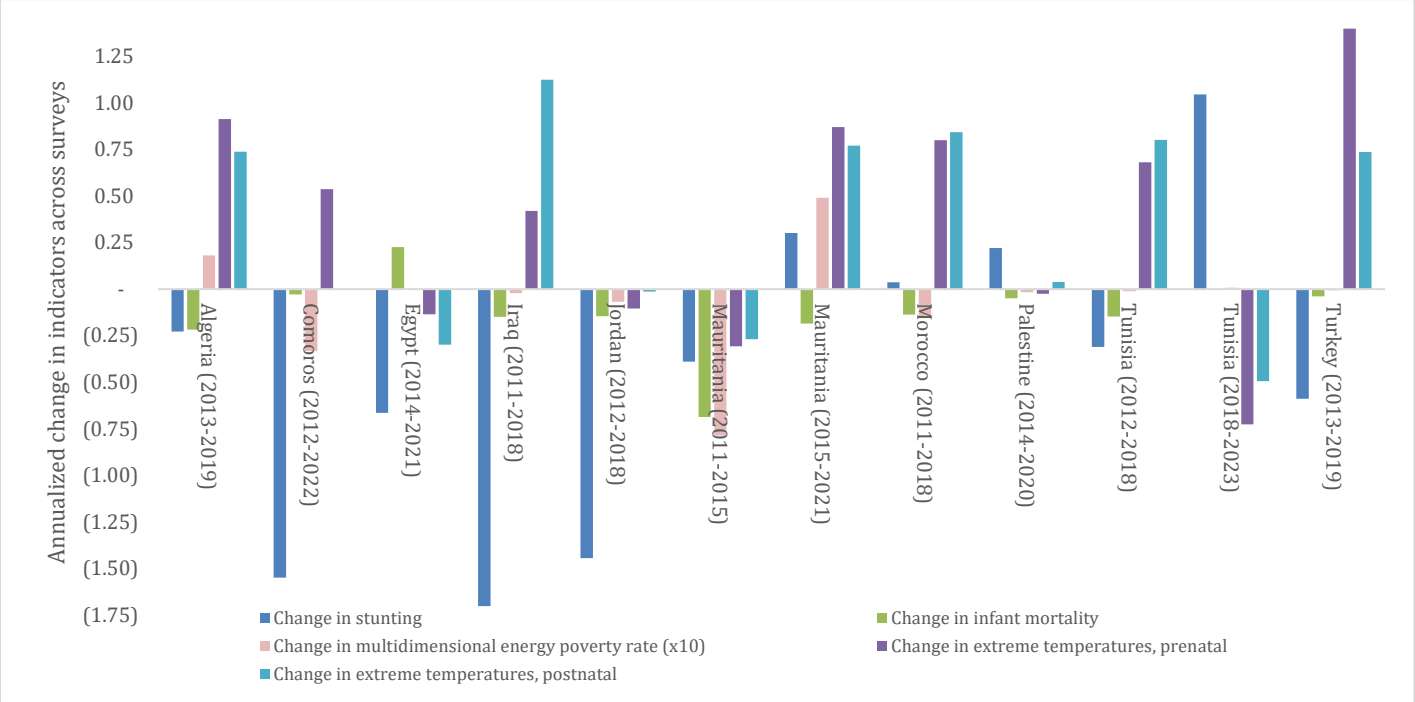
Source: Authors' graphic created using data from Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA USGS, AeroGRID, IGN, and the GIS User Community.

Figure A2. MEPI estimates and components across survey waves



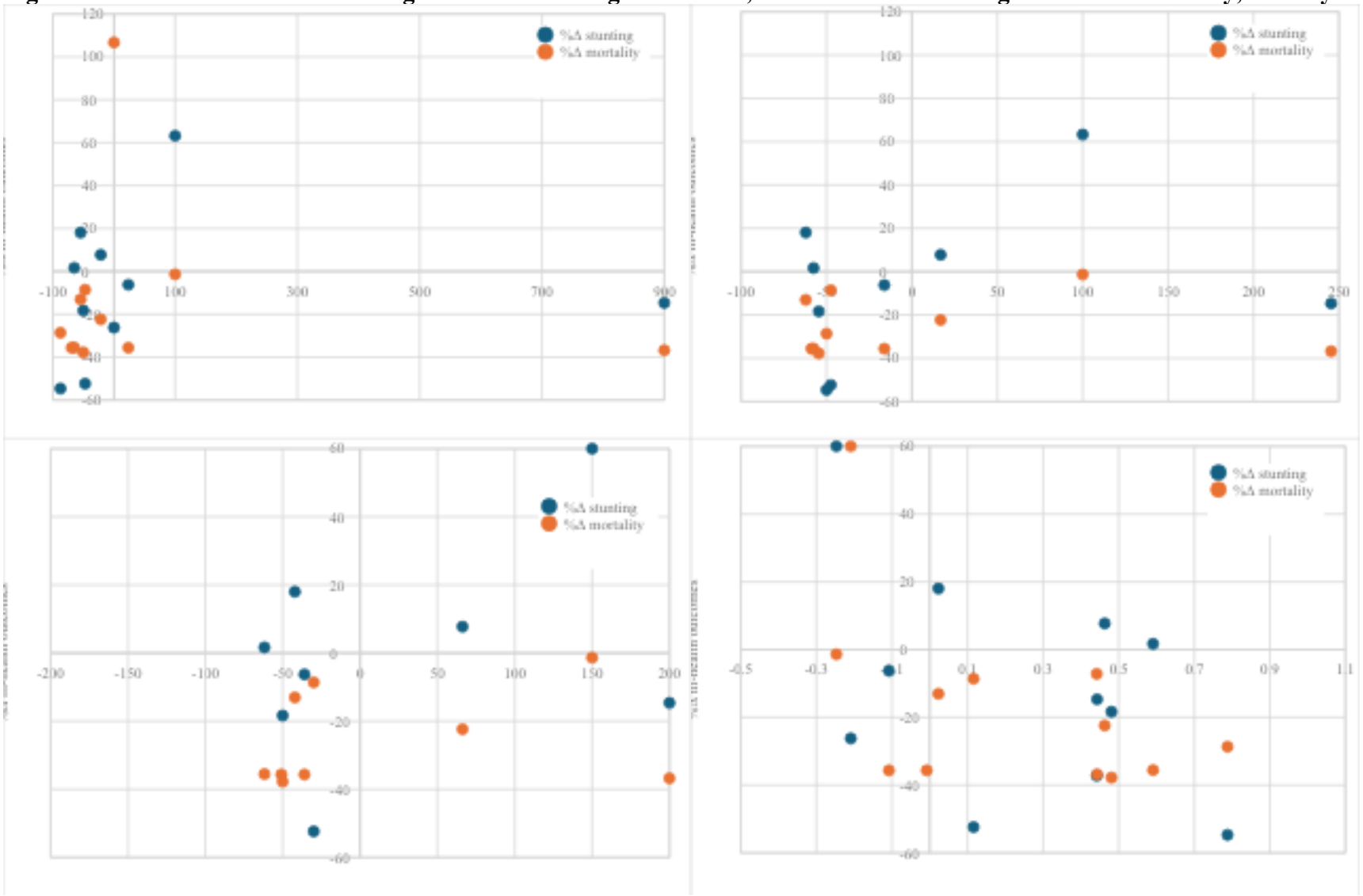
Notes: The indicators are taken from Table 3. Samples are nationally weighted.

Figure A3. Annualized changes in children's health outcomes, MEP rate (*H*), and extreme temperature deviations from historic norms (% points)



Notes: The indicators are taken from Tables 1 and 3. Samples are nationally weighted.

Figure A4. Association between changes in climate change indicators, and children's stunting and infant mortality, country level



Note: Algeria 13–19 omitted from panel (c) for its outlying value.