Article

The effects of cash transfers on adult and child mortality in low- and middle-income countries

https://doi.org/10.1038/s41586-023-06116-2

Received: 22 September 2022

Accepted: 21 April 2023

Published online: 31 May 2023

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Poverty is an important social determinant of health that is associated with increased risk of death[1–5]. Cash transfer programmes provide non-contributory monetary transfers to individuals or households, with or without behavioural conditions such as children's school attendance[6,7]. Over recent decades, cash transfer programmes have emerged as central components of poverty reduction strategies of many governments in low- and middle-income countries[6,7]. The effects of these programmes on adult and child mortality rates remains an important gap in the literature, however, with existing evidence limited to a few specific conditional cash transfer programmes, primarily in Latin America[8–14]. Here we evaluated the effects of large-scale, government-led cash transfer programmes on all-cause adult and child mortality using individual-level longitudinal mortality datasets from many low- and middle-income countries. We found that cash transfer programmes were associated with significant reductions in mortality among children under five years of age and women. Secondary heterogeneity analyses suggested similar effects for conditional and unconditional programmes, and larger effects for programmes that covered a larger share of the population and provided larger transfer amounts, and in countries with lower health expenditures, lower baseline life expectancy, and higher perceived regulatory quality. Our findings support the use of anti-poverty programmes such as cash transfers, which many countries have introduced or expanded during the COVID-19 pandemic, to improve population health.

Poverty has long been recognized as an important social determinant of health. Poverty can negatively influence health outcomes through numerous, often interconnected pathways—food insecurity, access to and quality of healthcare, housing stability, neighbourhood safety, occupational risk, educational attainment, health behaviours, and social well-being, among others[15–19]. Consequently, living in poverty has been closely linked to a decrease in life expectancies, with a greater risk of mortality among both adults and children[1–5].

Despite many years of progress, nearly 10% of the world's population lived on less than US$1.90 per day (extreme poverty) in 2018, and more than 40% lived on less than US$5.50 per day[20] (upper middle-income poverty line). The COVID-19 pandemic has markedly worsened these figures—an estimated 97 million more people lived in extreme poverty in 2020 (a 12% increase) and additional increases were seen in low-income countries in 2021[21]. These enduring pandemic-related effects make the assessment and implementation of evidence-based strategies to combat poverty and improve health an even more urgent priority.

Over the past two decades, more than 100 low- and middle-income countries (LMICs) have introduced cash transfer programmes as components of their poverty reduction and social protection strategies[6]. Cash transfer programmes are defined as those that provide non-contributory monetary transfers to individuals or households. They include unconditional transfers (more common in sub-Saharan Africa), conditional transfers (more common in Latin America), public pensions and enterprise grants (money provided to support income-generating activities).

Cash transfer programmes have become even more common during the COVID-19 pandemic. A World Bank report in February 2022 identified 962 cash transfer programmes in 203 countries—672 of these were newly introduced during the pandemic[7]. Indeed, it is estimated that cash transfers were distributed to 1.36 billion people—17% of the world's population—during the pandemic period[22].

Large-scale, government-run cash transfer programmes have been successful in reducing poverty and improving economic autonomy, school attendance, child nutrition, women's empowerment and health-service use among beneficiaries[23,24]. A few studies have also documented population-wide effects such as greater economic activity in communities where beneficiaries reside[25], and—in the case of

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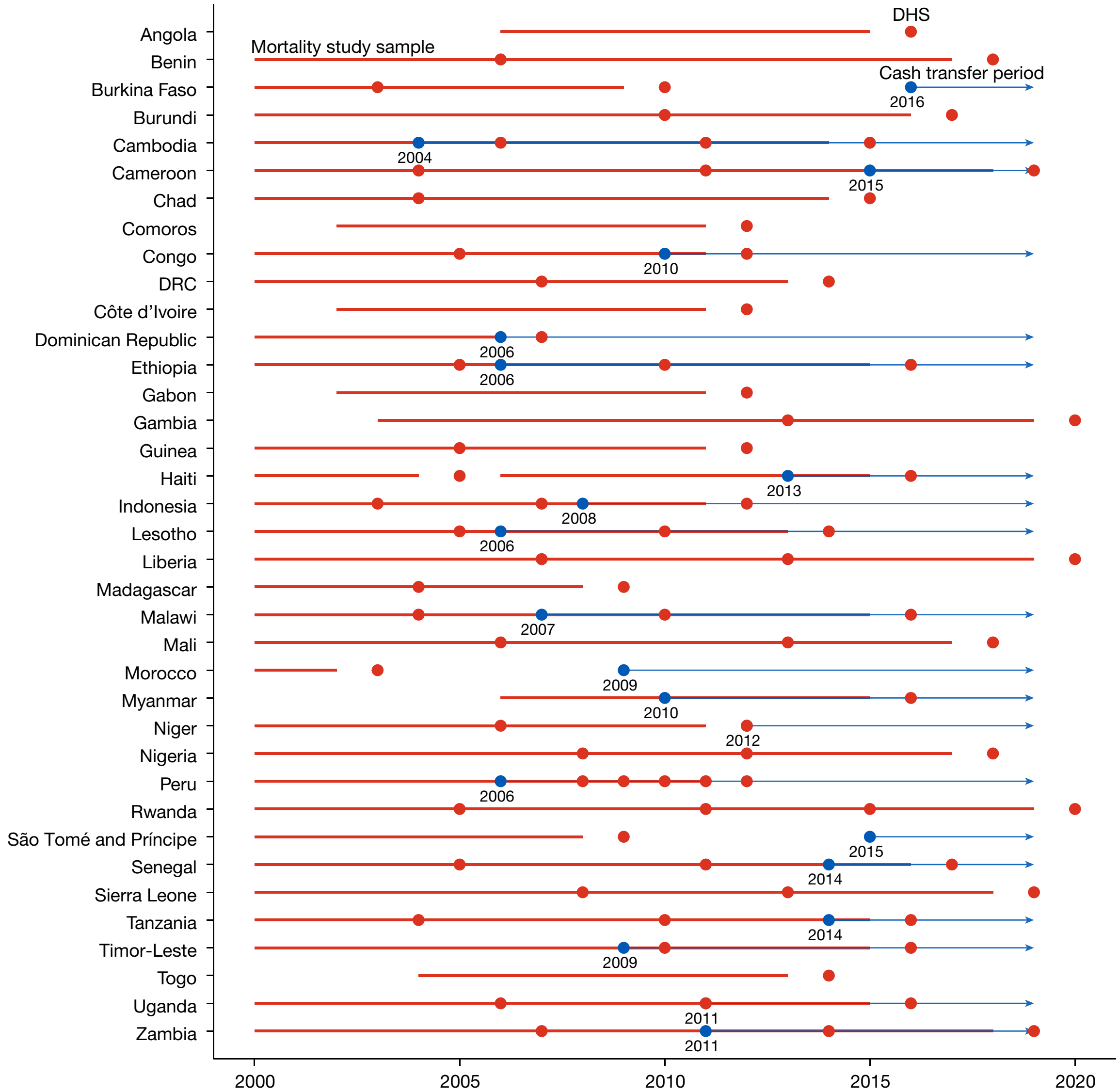

Fig. 1 | Study timeline. The study period (2000–2019) is along the *x*-axis, included countries ($n = 37$) are listed on the *y*-axis, red points represent national demographic and health surveys ($n = 84$), red lines represent corresponding years with included mortality data generated from sibling and birth histories, blue points represent the first complete year of cash transfer programme(s) covering more than 5% of the impoverished population ($n = 20$ total; $n = 16$ with mortality data during the cash transfer period), and blue lines represent the cash transfer period. DHS, demographic and health survey; DRC, Democratic Republic of the Congo.

infectious diseases such as HIV—reduced new infections following the introduction of cash transfer programmes[26]. The improvements seen with cash transfers could be driven by the removal of economic and psychological barriers of poverty as a result of receiving cash transfers, as well as spillover effects on non-beneficiaries[27–32].

Despite the large body of literature on the effects of cash transfer programmes on various outcomes, there is limited evidence about the effect of such programmes on overall, population-level mortality rates, particularly outside of a few conditional cash transfer programmes in Latin America. Several municipal-level analyses have shown a decline in infant mortality associated with the *Bolsa Familia* programme in Brazil[8–10]. An individual-level analysis found 17% decreased odds of mortality among children aged less than 5 years who were beneficiaries of *Bolsa Familia*, with stronger associations for children from the poorest communities[11]. Other single-country municipal-level analyses have suggested reductions in infant mortality associated with conditional cash transfer programmes in Mexico, Ecuador and India[33–35].

There are even fewer studies of relationships between cash transfer programmes and adult mortality rates. Evaluations of the Mexican conditional cash transfer programme *Oportunidades* found an 11% decline in maternal mortality and a 4% decline in overall mortality in regions where the programme had been phased in[12,13]. A municipal-level study of *Bolsa Familia* similarly found a 10–20% reduction in maternal mortality[14]. In an analysis of 42 countries, we found that cash transfer programmes were associated with population-wide reductions in AIDS-related deaths that grew larger over time[26]. Notably, however, most randomized and non-randomized evaluations of cash transfers have lacked adequate sample sizes or study durations to detect differences in adult or child mortality. The design of most country-specific evaluations is typically also focused on estimating programme effects on beneficiaries rather than the entire population. Unlike large-scale, multinational evaluations of major health aid programmes such as the US President's Emergency Plan for AIDS Relief[36,37] (PEPFAR), no such multinational studies assess the effectiveness of cash transfer programmes in reducing population-level adult and child mortality rates.

Subgroup	Total deaths over total person-years (%) Cash years	Total deaths over total person-years (%) Comparison years	Adjusted risk ratio (95% CI)
Women	9,683/3,020,434 (0.32)	50,675/11,974,500 (0.42)	0.80 (0.67 to 0.95)
Men	12,446/3,036,953 (0.41)	53,910/12,212,390 (0.44)	0.87 (0.75 to 1.00)
Children under 5	12,575/1,063,601 (1.18)	129,185/5,693,683 (2.27)	0.92 (0.85 to 0.99)
Children 5 to 9	1,347/870,798 (0.15)	11,440/3,947,572 (0.29)	0.96 (0.86 to 1.08)
Children 10 to 17	1,139/1,009,511 (0.11)	6,802/3,815,380 (0.18)	0.93 (0.78 to 1.10)

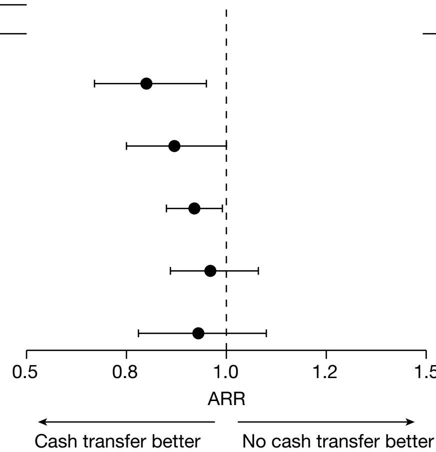

Fig. 2 | The effects of cash transfer programmes on all-cause mortality. Forest plot showing the fully adjusted overall associations between cash transfer programmes and mortality among women (n = 14,994,934 person-years), men (n = 15,249,343 person-years) and children aged less than 5 years (n = 6,757,284 person-years), 5 to 9 years (n = 4,818,370 person-years) and 10 to 17 years (n = 4,824,891 person-years). Effect estimates are ARRs and error bars represent 95% confidence intervals. Estimates were generated using multivariable modified Poisson models with country and year fixed effects, country-level covariates (GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: control of corruption, political stability and absence of violence, and voice and accountability), and individual-level covariates (age and rural or urban setting in all models; sex, age of mother and birth order in child analyses). We used robust standard errors clustered at the country level. CI, confidence interval.

Given the growing popularity of cash transfer programmes, evaluating their overall effects on adult and child mortality rates remains an important and policy-relevant gap in the literature. To close this gap, we used multinational longitudinal data generated from sibling and birth histories collected in national household surveys to evaluate the effects of cash transfer programmes on adult and child mortality among more than seven million people from 2000 to 2019. We used a difference-in-differences approach, a quasi-experimental technique that can be used to estimate causal effects from observational data by comparing the differences in outcomes between intervention and comparison groups during pre-intervention and post-intervention periods, under an assumption of parallel trends (that is, that in the absence of cash transfer programmes, trends in outcomes would be similar in intervention and comparison countries). Our primary finding was that these programmes were associated with significant mortality reductions among women and children aged less than 5 years, indicating the important role that these anti-poverty initiatives have had in promoting population health over the last 20 years.

Cash transfer programmes and mortality datasets

There were 37 LMICs included in our analysis (see Methods, 'Mortality data' and 'Cash transfer programme data' for selection criteria and Supplementary Table 1 for excluded countries)—29 in sub-Saharan Africa, 3 in Latin America and the Caribbean, 4 in the Asia–Pacific region, and 1 in northern Africa (Fig. 1). Sixteen countries introduced large-scale cash transfer programme(s) during the study period and had mortality data available during their respective cash transfer periods (see Methods, 'Cash transfer programme data' and 'Statistical analysis' for how we identified programmes and defined the cash transfer programme exposure, and Extended Data Fig. 1 for the country inclusion flow diagram).

Within these 16 'intervention countries', there were 29 total cash transfer programmes, 14 (48%) of which were unconditional (Supplementary Tables 2 and 3 show programme-specific details). Intervention countries had a median most recent impoverished population coverage of 27% (interquartile range 16–100%), with a median most recent maximum transfer amount per beneficiary equating to 10% of per capita gross domestic product (GDP) (interquartile range 6.25–13.25%). Six countries had high (above-median) coverage with high (above-median) maximum transfer amounts, two had high coverage with low maximum transfer amounts, two had low coverage with high maximum transfer amounts, and six had low coverage with low maximum transfer amounts.

There were 4,325,484 people included in the adult dataset, with a total of 30,244,277 person-years (6,057,387 (20%) during intervention years) and 126,714 deaths (42 per 10,000 person-years) (Supplementary Table 4; see Methods, 'Mortality data' for details about the generation of the mortality datasets). There were 2,867,940 people included in the child dataset, with a total of 16,400,545 person-years (2,943,910 (18%) during intervention years) and 162,488 deaths (99 per 10,000 person-years) (Supplementary Table 5). For both datasets, comparison person-years had lower GDP per capita, lower percentiles for the World Bank Worldwide Governance Indicators, and a greater proportion of person-years from sub-Saharan Africa (Extended Data Tables 1 and 2).

Effects of cash transfers on mortality

In our primary difference-in-differences analyses, cash transfer programmes were associated with reductions in mortality among women (adult female individuals at least 18 years of age) (adjusted risk ratio (ARR) 0.80, 95% confidence interval 0.67–0.95) and children aged less than 5 years (ARR 0.92, 95% confidence interval 0.85–0.99) (Fig. 2 and Supplementary Tables 6–10; see Methods, 'Statistical analysis' for additional details about the models). These reductions are at the higher end of the range of estimates from single-country studies of specific cash transfer programmes[8–14,33–35]. There were no associations between cash transfer programmes and mortality among men (adult male individuals at least 18 years of age) (ARR 0.87, 95% confidence interval 0.75–1.00), children aged 5–9 years (ARR 0.96, 95% confidence interval 0.86–1.08) or children aged 10–17 years (ARR 0.93, 95% confidence interval 0.78–1.10).

We next assessed the temporal patterns in relationships between cash transfer programmes and mortality by creating a series of binary indicators for each year before and after each cash transfer period began. Consistent with our primary analyses, fully adjusted models showed that significant reductions in mortality among adult women

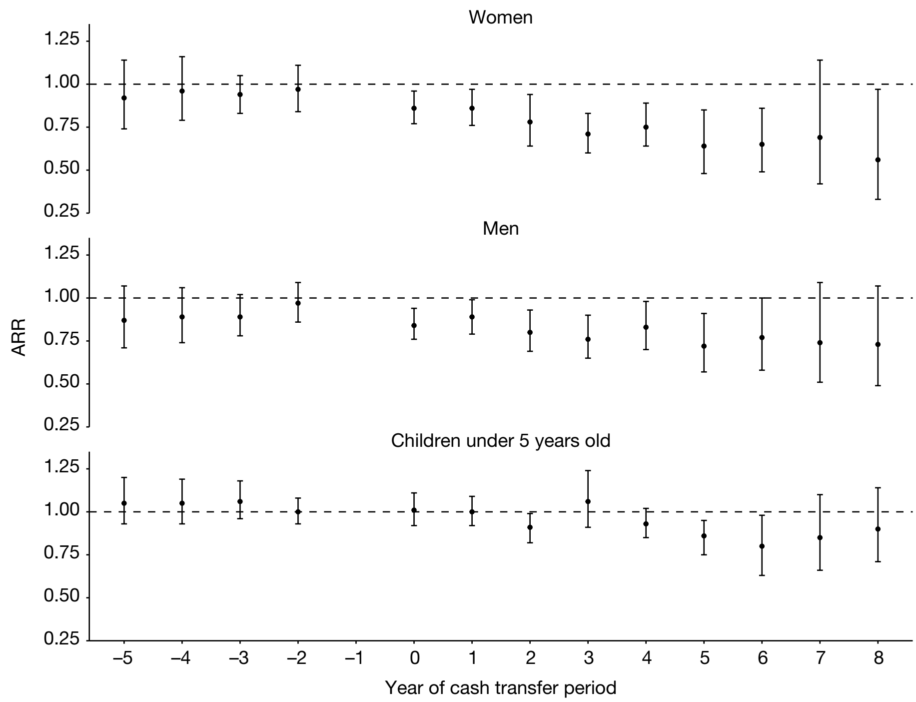

Fig. 3 | The effects of cash transfer programmes on all-cause mortality over time. Temporal plots showing the associations between cash transfer programmes and mortality as a function of the year of the cash transfer period. Effect estimates are ARRs and error bars show 95% confidence intervals. Estimates were generated using multivariable modified Poisson models with country and year fixed effects, country-level covariates (GDP per capita, PEPFAR funding budgeted and three Worldwide Governance Indicators: control of corruption, political stability and absence of violence, and voice and accountability), and individual-level covariates (age and rural or urban setting in all models; sex, age of mother and birth order in child analyses). We used robust standard errors clustered at the country level. Top, estimates for women (n = 14,994,934 person-years). Middle, estimates for men (n = 15,249,343 person-years). Bottom, estimates for children aged less than 5 years (n = 6,757,284 person-years).

and children aged less than 5 years occurred within 2 years of programme introduction (Fig. 3), with even larger reductions detected over time among women. Temporal analyses also suggested reductions in mortality among men over time (Fig. 3). There was no evidence of associations between cash transfer programmes and mortality over time among children aged 5–9 years or 10–17 years (Extended Data Fig. 2).

We also used these temporal plots to show that there were no differential pre-trends in the years before the introduction of cash transfer programmes (Fig. 3 and Extended Data Fig. 2). The parallel trends assumption was further supported by regression models showing that trends in mortality rates were similar between intervention and comparison countries before the introduction of cash transfers (see Methods, 'Statistical analysis' for details of these models, and Supplementary Table 11).

Secondary heterogeneity analyses

We then explored the heterogeneity of the effects of cash transfer programmes on mortality through subgroup analyses based on individual characteristics, cash transfer programme design features and country characteristics (Tables 1 and 2 show subgroups for women; men and children are shown in Extended Data Figs. 3–6). Although these subgroup analyses should be considered exploratory in the setting of multiple comparisons, there were several notable findings.

There was a significant reduction in mortality among men aged 18–40 years (ARR 0.86, 95% confidence interval 0.77–0.96) (Extended Data Fig. 2), with a possible mortality reduction among some men also supported by findings from our temporal analyses. Among women, there were reductions in both pregnancy-related deaths (ARR 0.74, 95% confidence interval 0.61–0.91) and non-pregnancy-related deaths (ARR 0.81, 95% confidence interval 0.68–0.94).

There were no apparent differences between the effects of unconditional and conditional transfers on mortality. At a minimum this provides reassurance that the mortality benefits of cash transfers were not limited to conditional transfers, which have been the focus of the few country-specific studies that evaluated the effects of cash transfers on mortality[8–14,33–35]. Conditional cash transfer programmes typically incentivize behaviours surrounding nutrition, education or health services use (commonly focused on children), whereas unconditional cash transfer programmes tend to be more direct anti-poverty approaches, have fewer administrative costs, and are more widely used in sub-Saharan Africa.

We also found that programmes with higher coverage and larger cash transfer amounts were associated with the largest reductions in mortality, with these types of programmes being associated with significant reductions among women (ARR 0.70, 95% confidence interval 0.62–0.79), men (ARR 0.77, 95% confidence interval 0.71–0.84), children aged less than 5 years (ARR 0.86, 95% confidence interval 0.81–0.93) and children aged 10–17 years (ARR 0.80, 95% confidence interval 0.65–0.97), but not for children aged 5–9 years (ARR 0.94, 95% confidence interval 0.83–1.07). This finding further supports a causal relationship between cash transfer programmes and risks of death. It also indicates that programmes with lower coverage or transfer amounts may be less effective or ineffective in reducing population-level mortality rates, although the confidence intervals in these lower-coverage, lower-amount groups were generally too wide to draw firm conclusions.

Countries with higher regulatory quality ratings within the Worldwide Governance Indicators generally showed greater reductions in mortality, with significant reductions seen among women (ARR 0.71, 95% confidence interval 0.63–0.80), men (ARR 0.80, 95% confidence interval 0.73–0.88) and children aged less than 5 years (ARR 0.89, 95% confidence interval 0.83–0.94). Findings related to voice

Table 1 | Heterogeneity analyses for women—individual factors

	Total deaths over total person-years (%)		
	Cash years	**Comparison years**	**Adjusted risk ratio (95% CI)**
Overall	9,683/3,020,434 (0.32)	50,675/11,974,500 (0.42)	0.80 (0.67–0.95)
Wealth (sibling)			
Quintile 1 (richest)	1,973/607,251 (0.32)	10,572/2,531,184 (0.42)	0.78 (0.6–1.01)
Quintile 2	1,938/591,564 (0.33)	9,907/2,388,349 (0.41)	0.84 (0.71–0.995)
Quintile 3	1,891/613,185 (0.31)	9,952/2,383,474 (0.42)	0.78 (0.65–0.95)
Quintile 4	1,924/612,606 (0.31)	9,920/2,329,410 (0.43)	0.8 (0.71–0.90)
Quintile 5 (poorest)	1,957/595,828 (0.33)	10,324/2,342,083 (0.44)	0.81 (0.66–0.99)
Age			
18–40	6,603/2,419,245 (0.27)	39,784/10,292,908 (0.39)	0.78 (0.67–0.91)
41–60	2,933/568,687 (0.52)	10,156/1,558,844 (0.65)	0.85 (0.72–1.01)
>60	147/32,502 (0.45)	735/122,748 (0.60)	0.89 (0.57–1.39)
Education			
Less than secondary	6,402/1,606,818 (0.40)	36,281/7,739,522 (0.47)	0.80 (0.68–0.95)
Secondary or higher	3,159/1,365,718 (0.23)	13,943/4,111,950 (0.34)	0.79 (0.62–1.01)
Setting			
Rural	6,356/1,729,984 (0.37)	31,856/7,052,504 (0.45)	0.79 (0.67–0.93)
Urban	3,206/1,242,593 (0.26)	18,385/4,799,781 (0.38)	0.81 (0.66–1.00)
Cause of death			
Pregnancy-related	1,288/3,012,039 (0.04)	10,852/11,934,677 (0.09)	0.74 (0.61–0.91)
Not pregnancy-related	8,395/3,019,146 (0.28)	39,821/11,963,646 (0.33)	0.81 (0.68–0.94)

Subgroup analyses showing fully ARRs of mortality with 95% confidence intervals among women (n=14,994,934 person-years), generated using multivariable modified Poisson models with country and year fixed effects, country-level covariates (GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: control of corruption, political stability and absence of violence, and voice and accountability), and individual-level covariates (age and rural or urban setting). We used robust standard errors clustered at the country level.

and accountability ratings were less intuitive, with significant mortality reductions seen in countries with lower ratings among women (ARR 0.74, 95% confidence interval 0.66–0.85), men (ARR 0.81, 95% confidence interval 0.73–0.90) and children aged less than 5 years (ARR 0.89, 95% confidence interval 0.83–0.95), but not in countries with higher ratings. Subgroup analyses based on these indicators are therefore of unclear overall significance and should be interpreted with caution.

We also found greater effect sizes in countries with lower health expenditures per capita and in those with lower life expectancies (a finding that has been noted elsewhere[10]), indicating that people living in countries with little healthcare infrastructure or substantial public health challenges may especially benefit from cash transfer programmes.

Stratification by region showed a stronger association between cash transfers and mortality among adult women in sub-Saharan Africa (ARR 0.77, 95% confidence interval 0.62–0.95) relative to outside sub-Saharan Africa (ARR 0.93, 95% confidence interval 0.79–1.11).

Despite the heterogeneities noted above, country-specific estimates for the 16 individual intervention countries were largely similar to our primary analyses, indicating benefits of cash transfer programmes across broadly diverse contexts (Extended Data Fig. 7). There were a few noteworthy exceptions—the Dominican Republic (ARR 1.20, 95% confidence interval 0.85–1.68), Indonesia (ARR 1.04, 95% confidence interval 0.82–1.34) and Lesotho (ARR 1.25, 95% confidence interval 1.11–1.41). The Dominican Republic had only one year of mortality data available post-intervention, and Lesotho was the only intervention country in our dataset that had a cash transfer period during which only older adults were targeted by cash transfer programmes. Country-specific estimates may also be more vulnerable to an important confounding factor specific to that country, such as a positive or negative shock or policy changes other than the cash transfer programme occurring approximately simultaneously with its introduction. We therefore caution against placing too much weight on estimates for any single country.

Other sensitivity analyses

Our findings were generally robust to a variety of additional sensitivity analyses (detailed in Methods, 'Statistical analysis'). Fully adjusted logistic regression models (rather than modified Poisson models) yielded identical results for all outcomes to two decimal places. Fully adjusted linear models were consistent with those from our primary analyses except that there were overall associations between cash transfer programmes and mortality among men, and there were no longer any associations among children aged less than 5 years (Supplementary Table 12). Recent advances in difference-in-differences analyses with variation in intervention timing have shown that estimates may be biased, particularly if there is heterogeneity in intervention effects over time[38–40]. Use of an alternate fully adjusted linear estimator that is not vulnerable to this bias showed highly similar results to standard fully adjusted linear models, which provides reassurance that bias resulting from heterogeneous intervention effects over time is minimal[41] (Supplementary Table 13). This bias also tends to be influenced by later country-years during the intervention period, and excluding intervention years after year five did not substantially influence our effect estimates—although, as with some other modelling approaches, there were now overall associations between cash transfer programmes and mortality among men, and there were no longer any associations among children aged less than five years (Supplementary Table 14). Repeating the adult female analysis with the exclusion of individual countries did not reveal possible outlier countries (Supplementary Table 15). The addition of the survey respondent's wealth quintile and educational attainment to

Table 2 | Heterogeneity analyses for women—programme and country factors

	Total deaths over total person-years (%)		
	Cash years	**Comparison years**	**Adjusted risk ratio (95% CI)**
Overall	9,683/3,020,434 (0.32)	50,675/11,974,500 (0.42)	0.80 (0.67–0.95)
Transfer type			
Unconditional	5,927/956,958 (0.62)	50,675/11,974,500 (0.42)	0.77 (0.61–0.98)
Mixed	325/143,046 (0.23)	50,675/11,974,500 (0.42)	0.79 (0.67–0.93)
Conditional	3,431/1,920,430 (0.18)	50,675/11,974,500 (0.42)	0.90 (0.82–0.99)
Coverage/amount			
High/high	2,241/515,260 (0.43)	50,675/11,974,500 (0.42)	0.70 (0.62–0.79)
Low/high	557/114,364 (0.49)	50,675/11,974,500 (0.42)	0.95 (0.71–1.27)
High/low	1,195/1,088,317 (0.11)	50,675/11,974,500 (0.42)	0.83 (0.74–0.93)
Low/low	5,690/1,302,493 (0.44)	50,675/11,974,500 (0.42)	0.91 (0.71–1.16)
Voice and accountability			
High	4,143/1,570,155 (0.26)	50,675/11,974,500 (0.42)	0.87 (0.62–1.22)
Low	5,321/1,336,776 (0.40)	50,675/11,974,500 (0.42)	0.74 (0.66–0.85)
Political stability			
High	6,396/1,318,528 (0.49)	50,675/11,974,500 (0.42)	0.76 (0.61–0.94)
Low	3,068/1,588,403 (0.19)	50,675/11,974,500 (0.42)	0.85 (0.76–0.96)
Government effectiveness			
High	6,703/1,293,566 (0.52)	50,675/11,974,500 (0.42)	0.79 (0.63–0.97)
Low	2,761/1,613,365 (0.17)	50,675/11,974,500 (0.42)	0.82 (0.75–0.89)
Regulatory quality			
High	5,815/2,009,824 (0.29)	50,675/11,974,500 (0.42)	0.71 (0.63–0.80)
Low	3,649/897,107 (0.41)	50,675/11,974,500 (0.42)	0.99 (0.79–1.22)
Rule of law			
High	6,824/1,341,423 (0.51)	50,675/11,974,500 (0.42)	0.82 (0.75–0.91)
Low	2,640/1,565,508 (0.17)	50,675/11,974,500 (0.42)	0.79 (0.64–0.97)
Corruption control			
High	6,481/1,970,220 (0.33)	50,675/11,974,500 (0.42)	0.77 (0.61–0.97)
Low	2,983/936,711 (0.32)	50,675/11,974,500 (0.42)	0.82 (0.76–0.89)
Health expenditure			
High	2,857/1,537,416 (0.19)	50,675/11,974,500 (0.42)	0.86 (0.76–0.97)
Low	6,607/1,369,515 (0.48)	50,675/11,974,500 (0.42)	0.76 (0.61–0.94)
Life expectancy			
High	3,427/1,928,519 (0.18)	50,675/11,974,500 (0.42)	0.90 (0.81–0.99)
Low	6,037/978,412 (0.62)	50,675/11,974,500 (0.42)	0.77 (0.62–0.96)
Region			
Sub-Saharan Africa	6,320/1,096,750 (0.58)	45,081/8,953,321 (0.50)	0.77 (0.62–0.95)
Not sub-Saharan Africa	3,363/1,923,684 (0.17)	5,594/3,021,179 (0.19)	0.93 (0.79–1.11)

Subgroup analyses showing fully ARRs of mortality with 95% confidence intervals among women (n=14,994,934 person-years), generated using multivariable modified Poisson models with country and year fixed effects, country-level covariates (GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: control of corruption, political stability and absence of violence, and voice and accountability), and individual-level covariates (age and rural or urban setting). We used robust standard errors clustered at the country level.

our primary models resulted in minimal changes to our estimates (Supplementary Table 16).

Discussion and conclusions

Although our analytic approach has previously been used to evaluate the relationship between health aid programmes and mortality[36,37], to our knowledge, this is the first study to use it to examine the effects of government-led anti-poverty programmes on population-level mortality rates. Our results were consistent with previous single-country studies predominantly of conditional cash transfer programmes in Latin America[8–14,33–35], although notably we focus on many LMICs outside of Latin America that have higher underlying poverty and mortality. We also study effects on the entire populations rather than on beneficiaries alone. The results are also consistent with our previous multi-country study showing associations between cash transfer programmes and reductions in AIDS-related deaths in a subset of countries with generalized HIV epidemics[26].

The largest and most convincing mortality reductions were among women. This adds to previous evidence that cash transfers may disproportionately benefit women, or be more effective when women are the primary beneficiaries[23,42–45]. Reflecting this, many of the cash programmes that we identified either targeted women directly or were designed in ways that favoured women (for example, minimum age-based eligibility will tend to benefit women, who live longer). Much of the sex-specific mortality reductions were driven by large decreases in pregnancy-related deaths, defined as deaths while pregnant or within two months following pregnancy termination. In part, this may relate to improved engagement in antenatal care and skilled birth attendance[46]. Together with the mortality reduction seen among young children, this suggests that poverty reduction may have had particularly important effects on young families. Indeed, a number of high-profile, government-led cash transfer programmes have focused on pregnant women and young children, either with or without conditions for behaviours such as facility-based delivery[47].

We were not able to differentiate whether people were beneficiaries of a given cash transfer programme because this was not generally elicited in the survey questionnaires, and thus we evaluated changes in mortality for entire populations. Although this might underestimate the effects of cash transfers on direct beneficiaries, our approach has the advantage that it captures spillover effects among non-beneficiaries. For example, cash transfers are often pooled within households, families and even communities[48,49]. Large-scale cash transfer programmes may also affect local and regional economies in favourable ways[25]. This may in part explain why we found population-wide mortality reductions despite many included programmes targeting specific groups (such as older adults or poor families).

This study has several limitations. Because the surveys focus on women of childbearing age, adults over the age of 60 made up only 1% of our adult dataset. Our findings may therefore not apply to these older age groups. Additionally, we were unable to include several populous countries with sizable cash transfer programmes such as Mexico, Brazil and India.

Although we were able to assess heterogeneity across some individual, programme and country factors, the primary contribution of this study remains the overall assessment of the effects of cash transfer programmes across many countries, and the heterogeneity analyses should be considered to be exploratory. In addition, there were other important factors that we were unable to assess that may influence the effectiveness of cash transfer programmes. For example, our study does not address the possibility of implementation quality (programme outreach, enrolment procedures and 'leakage' of funds due to corruption, among others) influencing the success or failure of individual programmes. In India, implementation challenges have been cited as a major reason for the failure of some anti-poverty programmes in the past and recent advances in the ability to make secure payments have led to improvements in implementation[50]. The effect of these factors (and other unrelated, granular characteristics) is better assessed through more detailed, programme-specific evaluations, particularly given the lack of comparable implementation data across many countries. Indeed, an important challenge facing many countries is to determine how to improve the design of cash transfer programmes[51,52], including through differing coverage and transfer amounts. For example, recent experimental evidence supports the usefulness of accompanying capital, educational and psychosocial interventions[51]. We did not make cost estimates, so we do not know from our study alone whether the benefits relative to costs of these programmes exceed those of alternative programmes.

Finally, although we attempted to control for confounding through the inclusion of fixed effects and other time-varying covariates, as with any observational study, the possibility of residual confounding remains. Recent advances in the difference-in-differences approach have highlighted instances where findings may be biased, but our use of alternate approaches that are not vulnerable to these biases yielded similar results in our study[38,39,41].

In conclusion, we found that cash transfer programmes were associated with important reductions in the risk of death among adult women and young children across many LMICs. Our findings support the use of such anti-poverty programmes, which many countries have introduced or expanded during the COVID-19 pandemic, to improve population health and reduce mortality.

Online content

Any methods, additional references, Nature Portfolio reporting summaries, source data, extended data, supplementary information, acknowledgements, peer review information; details of author contributions and competing interests; and statements of data and code availability are available at https://doi.org/10.1038/s41586-023-06116-2.

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Methods

We performed analyses of changes in adult and child mortality associated with implementation of cash transfer programmes between 2000 to 2019, a study period when many countries introduced cash transfer programmes.

Mortality data

To estimate mortality, we generated two individual-level longitudinal datasets—one for adults aged ≥18 years and one for children aged <18 years—using demographic and health surveys (DHS)[36,37,53]. The DHS are conducted in many LMICs about every five years. They use a two-stage cluster sampling design to produce national and sub-national estimates for a variety of indicators that are representative of their target populations[54]. The first stage involves systematic selection of enumeration areas drawn from census files with probability proportional to population size, and the second stage involves a random sampling of households from each enumeration area. Primary respondents were all female household members of reproductive ages (15–49 years). Procedures and questionnaires for DHS have been reviewed and approved by the ICF Institutional Review Board. All analysed data were anonymized. In accordance with standard procedures for secondary data analysis, the University of Pennsylvania Institutional Review Board waived ethical review.

We used surveys that included a maternal mortality module to create the adult dataset. This module collects information from all primary respondents about every sibling born to her biological mother—sex, current vital status, year of death if deceased, current age (or age at death), and for female siblings whether the death was pregnancy-related (death while pregnant or within two months following termination of pregnancy, irrespective of the cause). As there are limited, heterogeneous, and inconsistent data available about other causes of death, we focus on mortality from all causes. Using previously established methodology[36,37,53], we first restructured the dataset such that there was one observation per sibling, and then again such that each observation corresponded to one person-year from one sibling. Each observation included a binary variable indicating the sibling's survival status during that person-year. We excluded observations from incomplete years (that is, the year of the survey). To minimize recall bias, we excluded observations earlier than ten years before the survey. We excluded person-years during which a sibling was aged <18 years for the purposes of this adult dataset. Of note, because primary respondents in the DHS were 15–49 years of age, older adults were underrepresented.

We created a child dataset from the same set of surveys using the birth history module, which asked female respondents for information about all births—sex, birth date, survival status, and death date. As above, we constructed a longitudinal dataset with observations at the level of the person-year, including an indicator variable for survival and excluding incomplete years and observations earlier than ten years prior to the survey. We excluded person-years during which a child was >17 years old.

We extracted additional data about the primary respondent (sibling in the adult dataset, mother in the child dataset)—age, rural or urban setting, wealth quintile, and schooling attainment (categorized as none, primary, secondary, or greater than secondary). Respondents were classified into wealth quintiles using the DHS Wealth Index, a composite measure of households' cumulative living standard generated using a principal components analysis based on ownership of certain assets, materials used for housing construction, and types of water access and sanitation facilities[55].

Cash transfer programme data

We identified all major, government-led cash transfer programmes within included countries using previously established methods[26]. We manually searched a variety of sources to identify the programmes as well as the years in which they were implemented, the population targeted by the programmes (for example, older adults, families with young children), whether the programmes had behavioural conditionalities, amounts of annual cash transfers, and most recently available number of beneficiaries[56–60]. Data sources included social protection databases from the World Bank, United Nations, and non-governmental organizations, as well as primary documentation and reporting from individual programmes. We excluded countries with pre-existing cash transfer programmes at the start of the study period.

We calculated the impoverished population coverage for each programme as the most recent estimate of the number of programme beneficiaries divided by the number of individuals in a country with income less than the international poverty line of US$1.90 per day (2011 purchasing power parity). To do this, we divided the most recent estimate of total household beneficiaries by the impoverished population size. If estimates for total beneficiaries were not available, we multiplied direct beneficiaries by the average household size to estimate total beneficiaries[61]. In general, the number of beneficiaries was available during only a limited number of years. Impoverished population sizes were calculated by multiplying the percentages of the populations with income less than the international poverty line (that is, the poverty headcount) prior to programme implementation by the mid-year population from the year of the total beneficiaries estimate[62]. We used the poverty headcount prior to programme implementation because poverty headcount estimates after programme implementation may be decreased by the programmes themselves. For example, if a cash transfer programme began in 2012, we divided the most recent estimate of beneficiaries (numerator) by the poverty headcount in 2012 (denominator) to calculate the impoverished population coverage.

We also calculated the maximum transfer amounts as percentages of GDP per capita in the most recent year the maximum transfer amounts were reported.

Additional country-level data

We obtained additional time-varying covariates for each country and year that are known to be or are likely to be associated with changes in cash transfer programmes and mortality: GDP per capita[62], total health expenditures per capita[62], life expectancies at birth[62], PEPFAR funding budgeted[63], and six Worldwide Governance Indicators from the World Bank that are composite indicators based on 30 data sources: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption[62].

Statistical analysis

We used a difference-in-differences approach, a quasi-experimental technique that can be used to estimate causal effects from observational data by comparing the differences in outcomes between intervention and comparison groups during pre-intervention and post-intervention periods, under an assumption of parallel trends (that is, that in the absence of cash transfer programmes, trends in outcomes would be similar in intervention and comparison countries). To do this, we estimated multivariable modified Poisson regression models with the unit of observation being the person-year and a binary outcome variable indicating whether an individual died in a given year[64].

Our primary explanatory variable was a binary variable set to 1 if a cash transfer programme (or combination of programmes) with total impoverished population coverage greater than 5% was active in the respondent's country during that year. We were prevented from considering coverage as a continuous, time-varying exposure because beneficiary data were available only during a limited number of years for most programmes. We chose 5% based on our prior analyses showing this threshold was associated with improvements in HIV-related outcomes[26], but conducted subgroup analyses (described below) to explore the association with different levels of coverage. We excluded intervention countries that lacked at least two years of mortality data prior to the cash transfer period.

To optimize our comparison country-years, we excluded from our analysis country-years during which cash transfer programmes (or combination of programmes) were implemented with coverage between 2% and 5%. Comparison country-years were therefore defined as those during which there were no active cash transfer programmes, or cash transfer programmes (or combination of programmes) had coverage <2%.

Our effect measure of interest was the risk ratio denoting the association between the cash transfer programme exposure and mortality. In addition to overall estimates, we also evaluated the temporal relationship between cash transfer programmes and mortality by creating a series of binary indicators for each year before and after the cash transfer period began.

We included in the models country- and individual-level covariates that were likely to confound relationships between cash transfer programmes and mortality. For country-level covariates, we included GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: control of corruption, political stability and absence of violence, and voice and accountability. The other three Worldwide Governance Indicators were left out of the models because they displayed substantial multicollinearity with the other covariates as evidenced by variance inflation factors >5. We also considered inclusion of health expenditures per capita, but this variable was not available for all years and adding it to the models minimally impacted the effect estimates.

For individual-level covariates, we included age and rural or urban setting in all analyses. In the child analyses, we also included sex, mother's age, and birth order. We did not include other individual-level variables that were likely to be affected by receipt of cash transfers and/or potentially mediate relationships between cash transfer programmes and mortality (for example, wealth quintile, schooling attainment).

We included country fixed effects to control for time-invariant differences among countries, and year fixed effects to control for secular trends in mortality. We used robust standard errors clustered at the country level to relax the assumption of independently and identically distributed error terms[65,66].

We stratified the adult mortality analysis by sex because of previously identified sex-specific effects of cash transfers[26,43,44,56], and the child mortality analysis by age (<5 years, 5–9 years, 10–17 years) because of highly varying mortality rates by child age[67].

We explored heterogeneity of the effect of cash transfer programmes using subgroup analyses based on the beneficiary, cash transfer programme design, and country factors. For the beneficiary, we considered wealth quintile (of the sibling for the adult analysis and the mother for the child analysis), age (for the adult analysis, categorized as 18–40, 41–60, and >60 years), educational attainment (of the sibling for the adult analysis, and the mother for the child analysis), rural or urban setting, and cause of death among women (pregnancy-related versus not pregnancy-related). For cash transfer design features, we considered conditionality (unconditional, mixed, or conditional), and four subgroups characterized by most recent impoverished population coverage above or below the median (30%) and maximum annual transfer above or below the median (11% of GDP per capita). For country factors, we considered subgroups characterized by being above or below the median at the start of the cash transfer period for the following: each of the Worldwide Governance Indicators, current annual healthcare expenditures per capita (US$118 purchasing power parity), and life expectancies at birth (62 years). We also stratified by region (sub-Saharan Africa versus outside of sub-Saharan Africa). Finally, we generated country-specific estimates for adult women to allow for informal evaluations of heterogeneity across a range of dimensions.

We also conducted additional sensitivity analyses. First, we assessed the validity of the parallel trends assumption in two ways. We used the previously described temporal analysis to visualize pre-trends, and we estimated regression models using only data prior to the cash transfer period in each country and including an interaction term between an indicator of whether the country was in the intervention group and a linear time trend.

Second, while we used modified Poisson regression models based on conceptual justifications and to be consistent with prior literature assessing changes in mortality using DHS datasets[36,37,53], we assessed for robustness of the results when using logistic and linear models.

Third, recent advances in difference-in-differences analyses with variation in intervention timing have shown that estimates may be biased particularly if there is heterogeneity in intervention effects over time[38,39,63]. When there is effect heterogeneity only in time since the intervention, this concern can be mitigated through use of temporal analysis with dynamic effect estimates (as described above), although there can still be bias present if there are heterogeneous treatment effects over overall calendar time[68]. To address this, we assessed whether a proposed alternative linear estimator not vulnerable to this bias was consistent with our primary findings[41]. In addition, this bias tends to be influenced by later country-years during the intervention period, so to assess the possible magnitude of this bias we conducted a sensitivity analysis by repeating the primary analysis after excluding country-years after year 5 of the cash transfer programme[69].

Fourth, we assessed whether individual countries might be outliers for key outcomes by assessing whether estimates for women changed substantially after excluding each country individually.

Fifth, we repeated our primary analyses with inclusion of the respondent's wealth quintile and educational attainment.

We did not use statistical methods to predetermine sample size. We performed statistical analyses using SAS V.9.4, R V.3.5.2 using the ggplot2 and forester packages, and STATA V.17 using the did2s package.

Reporting summary

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

Data availability

The analysed data can be requested from the DHS Program website (individual recode datasets from the included countries from https://www.dhsprogram.com/Data/) or are publicly available from the World Bank (GDP per capita, total health expenditures per capita, life expectancies at birth, and Worldwide Governance Indicators datasets from https://data.worldbank.org/data-catalog/) or PEPFAR (PEPFAR Operating Unit Budgets by Financial Classifications FY04-FY20 dataset from https://data.pepfar.gov/financial). The cash transfer programme dataset is available in the Supplementary Information.

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Acknowledgements A.R. was supported by the National Institute of Mental Health of the National Institutes of Health under Award Number K23MH131464.

Author contributions The study was conceptualized by A.R., H.T., C.M., G.J., J.C.D.S. and J.R.B. Methodology design was led by A.R., H.T., E.F.B. and J.R.B., and the data curation and formal analyses were conducted by A.R. under the supervision of H.T. Figures were created by A.R. The first draft of the manuscript was written by A.R. and all authors provided critical inputs into the final draft.

Competing interests The authors declare no competing interests.

Additional information

Supplementary information The online version contains supplementary material available at https://doi.org/10.1038/s41586-023-06116-2.

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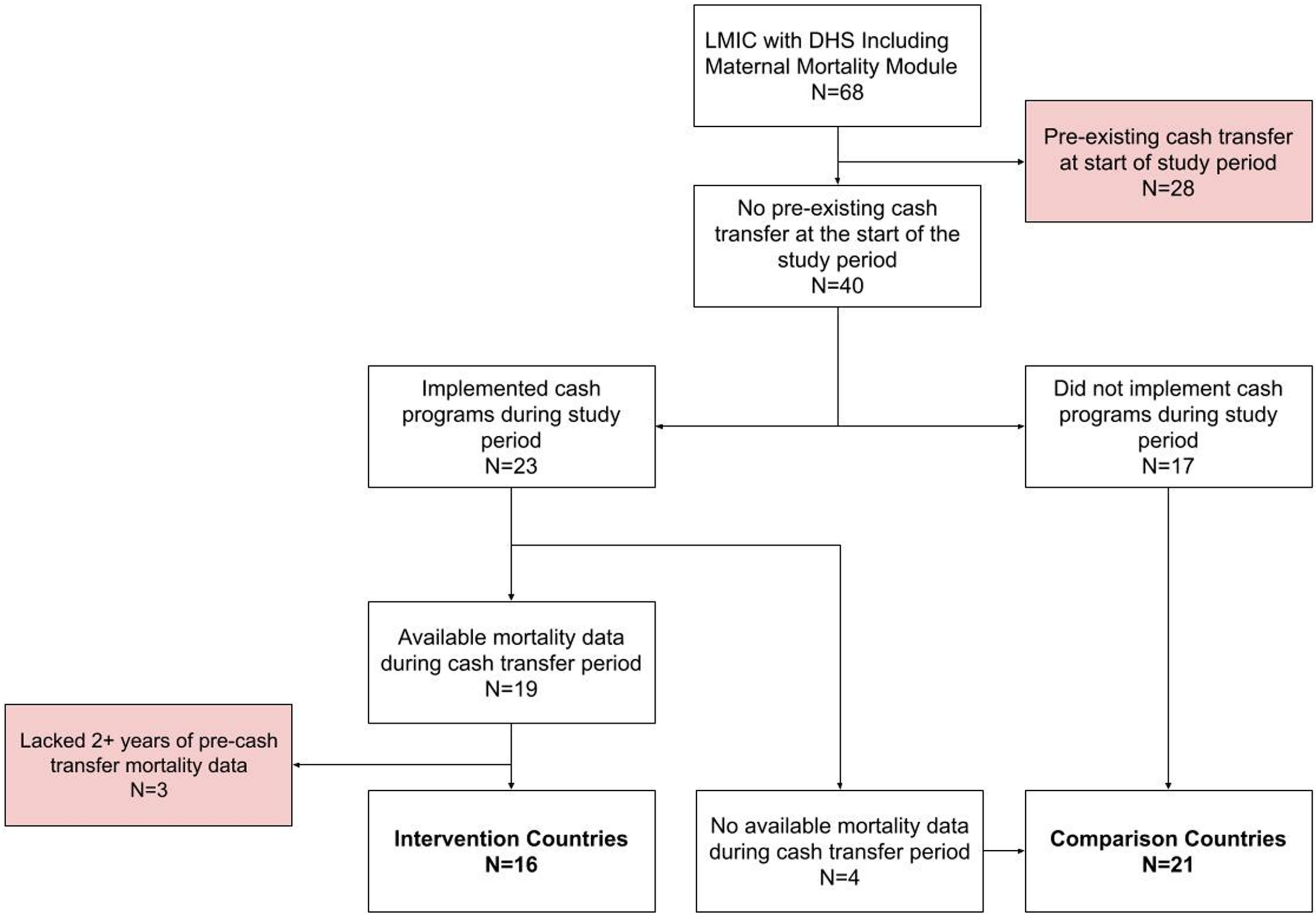
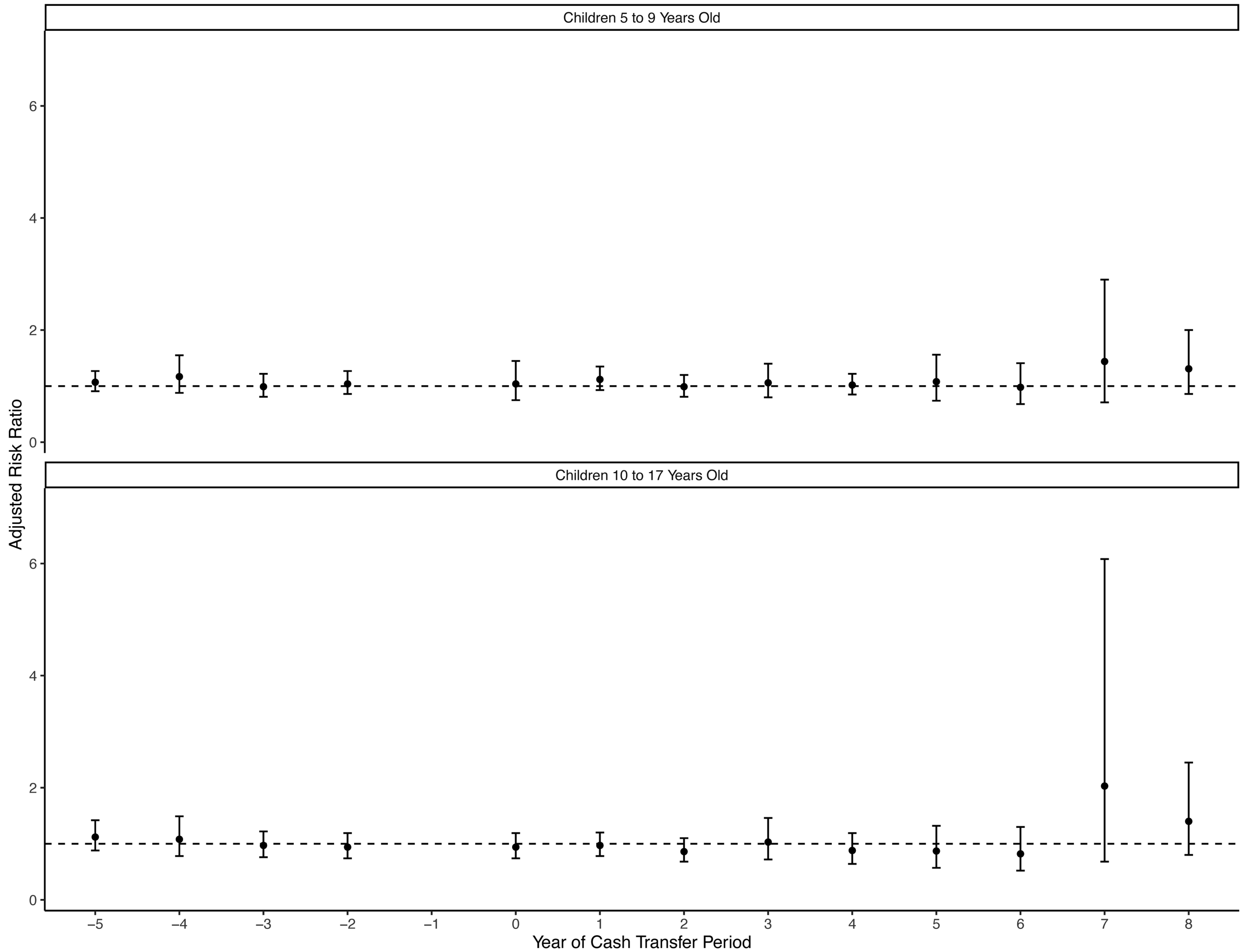
Peer review information *Nature* thanks Till Bärnighausen, Davide Rasella and the other, anonymous, reviewer(s) for their contribution to the peer review of this work. Peer reviewer reports are available.

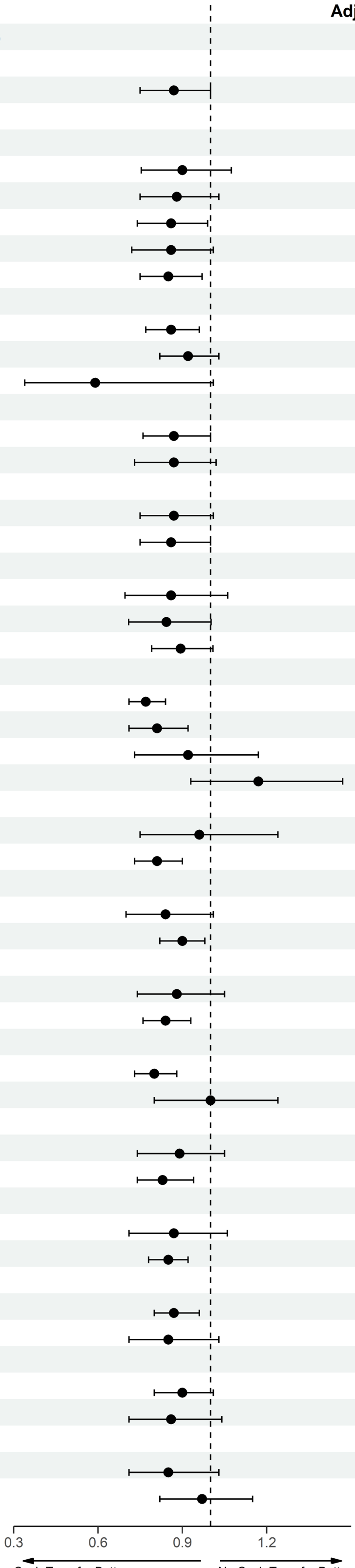


Extended Data Fig. 1 | Country inclusion flow diagram. Flow Diagram showing selection of intervention (N = 16) and comparison (N = 21) countries during our study period of 2000–2019, and reasons for exclusion (red boxes).



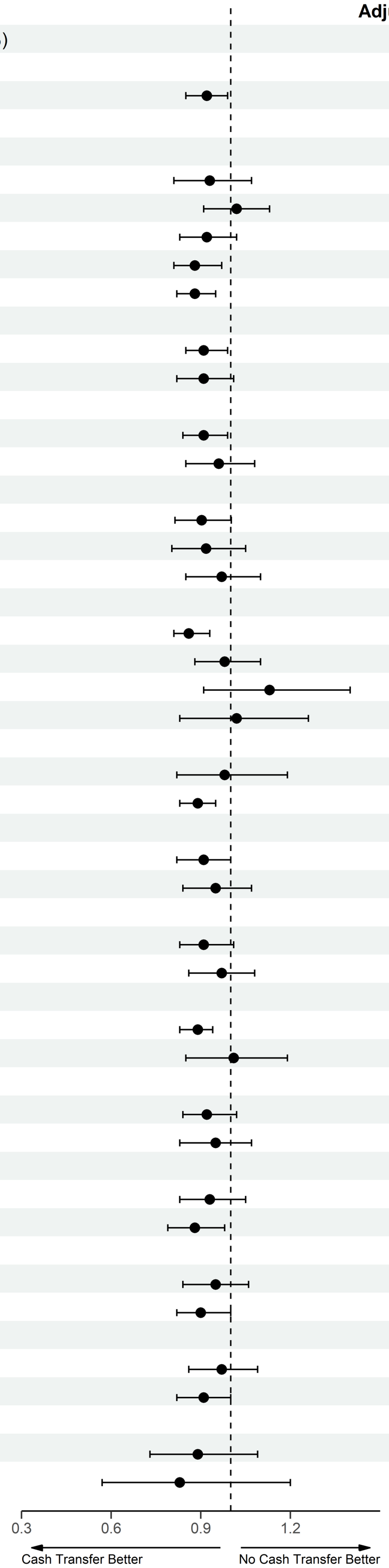
Extended Data Fig. 2 | Temporal plots of the effects of cash transfer programs on mortality for children aged 5 to 17 years. Temporal plots showing the associations between cash transfer programs and mortality as a function of the year of the cash transfer period. Effect estimates are adjusted risk ratios and error bars are 95% confidence intervals. Estimates were generated using multivariable modified Poisson models with country and year fixed effects, country-level covariates (GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: Control of Corruption, Political Stability and Absence of Violence, and Voice and Accountability), and individual-level covariates (age and rural/urban setting in all models; sex, age of mother, and birth order in child analyses). We used robust standard errors clustered at the country level. The top panel shows estimates for children aged 5 to 9 years (N = 4,818,370 person-years), the bottom panel shows estimates for children aged 10 to 17 years (N = 4,824,891 person-years).

Subgroup	Cash Deaths/Person-years (%)	Comparison Deaths/Person-years (%)	Adjusted Risk Ratio (95% CI)
Adult Males (Overall)	12446/3036953 (0.41)	53910/12212390 (0.44)	0.87 (0.75 to 1.00)
Wealth (sibling)			
Quintile 1 (richest)	2701/602066 (0.45)	10996/2564658 (0.43)	0.90 (0.75 to 1.07)
Quintile 2	2511/590675 (0.43)	10648/2427419 (0.44)	0.88 (0.75 to 1.03)
Quintile 3	2361/619084 (0.38)	10654/2430685 (0.44)	0.86 (0.74 to 0.99)
Quintile 4	2417/621377 (0.39)	10557/2380299 (0.44)	0.86 (0.72 to 1.01)
Quintile 5 (poorest)	2456/603751 (0.41)	11055/2409329 (0.46)	0.85 (0.75 to 0.97)
Age			
18-40	8113/2450697 (0.33)	39478/10488886 (0.38)	0.86 (0.77 to 0.96)
41-60	4168/552631 (0.75)	13450/1595262 (0.84)	0.92 (0.82 to 1.03)
>60	165/33625 (0.49)	982/128242 (0.77)	0.59 (0.34 to 1.01)
Education			
Less than secondary	7969/1607952 (0.50)	38345/7886395 (0.49)	0.87 (0.76 to 1.00)
Secondary or higher	4274/1376937 (0.31)	14996/4191674 (0.36)	0.87 (0.73 to 1.02)
Setting			
Rural	7993/1742817 (0.46)	33591/7221730 (0.47)	0.87 (0.75 to 1.01)
Urban	4256/1242166 (0.34)	19752/4857225 (0.41)	0.86 (0.75 to 1.00)
Transfer Type			
Unconditional	6929/962892 (0.72)	539100/12212390 (0.44)	0.86 (0.70 to 1.06)
Mixed	362/147443 (0.25)	539100/12212390 (0.44)	0.84 (0.71 to 1.00)
Conditional	5155/1926618 (0.27)	539100/12212390 (0.44)	0.89 (0.79 to 1.01)
Coverage/Amount			
High/High	2905/516788 (0.56)	539100/12212390 (0.44)	0.77 (0.71 to 0.84)
Low/High	594/117045 (0.51)	539100/12212390 (0.44)	0.81 (0.71 to 0.92)
High/Low	1720/1113260 (0.15)	539100/12212390 (0.44)	0.92 (0.73 to 1.17)
Low/Low	7227/1289860 (0.56)	539100/12212390 (0.44)	1.17 (0.93 to 1.47)
Voice and Accountability			
High	5238/1592682 (0.33)	539100/12212390 (0.44)	0.96 (0.75 to 1.24)
Low	6969/1326596 (0.53)	539100/12212390 (0.44)	0.81 (0.73 to 0.90)
Political Stability			
High	7760/1302611 (0.60)	539100/12212390 (0.44)	0.84 (0.70 to 1.01)
Low	4447/1616667 (0.28)	539100/12212390 (0.44)	0.90 (0.82 to 0.98)
Gov't Effectiveness			
High	7978/1304851 (0.61)	539100/12212390 (0.44)	0.88 (0.74 to 1.05)
Low	4229/1614427 (0.26)	539100/12212390 (0.44)	0.84 (0.76 to 0.93)
Regulatory Quality			
High	7316/2040416 (0.36)	539100/12212390 (0.44)	0.80 (0.73 to 0.88)
Low	4891/878862 (0.56)	539100/12212390 (0.44)	1.00 (0.80 to 1.24)
Rule of Law			
High	8175/1356821 (0.60)	539100/12212390 (0.44)	0.89 (0.74 to 1.05)
Low	4032/1562457 (0.26)	539100/12212390 (0.44)	0.83 (0.74 to 0.94)
Corruption Control			
High	7759/1999245 (0.39)	539100/12212390 (0.44)	0.87 (0.71 to 1.06)
Low	4448/920033 (0.48)	539100/12212390 (0.44)	0.85 (0.78 to 0.92)
Health Expenditures			
High	3936/1565911 (0.25)	539100/12212390 (0.44)	0.87 (0.80 to 0.96)
Low	8271/1353367 (0.61)	539100/12212390 (0.44)	0.85 (0.71 to 1.03)
Life Expectancy			
High	5177/1934748 (0.27)	539100/12212390 (0.44)	0.90 (0.80 to 1.01)
Low	7030/984530 (0.71)	539100/12212390 (0.44)	0.86 (0.71 to 1.04)
Region			
Sub-Saharan Africa	7354/1104593 (0.67)	46343/9135424 (0.51)	0.85 (0.71 to 1.03)
Not Sub-Saharan Africa	5092/1932360 (0.26)	7567/3076966 (0.25)	0.97 (0.82 to 1.15)



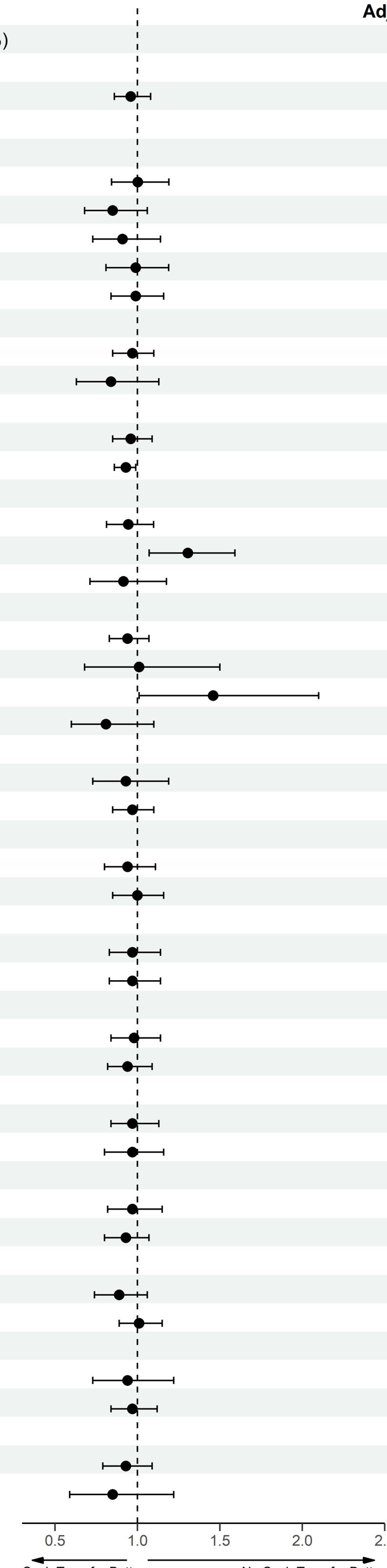
Extended Data Fig. 3 | Heterogeneity analyses for adult males. Forest plot showing subgroup analyses among adult males (N = 15,249,343 person-years), with fully adjusted risk ratios of mortality with 95% confidence intervals generated using multivariable modified Poisson models with country and year fixed effects, country-level covariates (GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: Control of Corruption, Political Stability and Absence of Violence, and Voice and Accountability), and individual-level covariates (age and rural/urban setting). We used robust standard errors clustered at the country level. Effect estimates are adjusted risk ratios and error bars are 95% confidence intervals.

Subgroup	Cash Deaths/Person-years (%)	Comparison Deaths/Person-years (%)	Adjusted Risk Ratio (95% CI)
Children <5 (Overall)	12575/1063601 (1.18)	129185/5693683 (2.27)	0.92 (0.85 to 0.99)
Wealth (mother)			
Quintile 1 (richest)	1263/154774 (0.82)	12435/838150 (1.48)	0.93 (0.81 to 1.07)
Quintile 2	1907/177896 (1.07)	20495/1009896 (2.03)	1.02 (0.91 to 1.13)
Quintile 3	2413/208665 (1.16)	25913/1149547 (2.25)	0.92 (0.83 to 1.02)
Quintile 4	3022/239735 (1.26)	32150/1261240 (2.55)	0.88 (0.81 to 0.97)
Quintile 5 (poorest)	3970/282531 (1.41)	38192/1434850 (2.66)	0.88 (0.82 to 0.95)
Mother's Education			
Less than secondary	9535/698156 (1.37)	112306/4465710 (2.51)	0.91 (0.85 to 0.99)
Secondary or higher	3039/365411 (0.83)	16875/1227525 (1.37)	0.91 (0.82 to 1.01)
Setting			
Rural	9804/727987 (1.35)	99812/3926222 (2.54)	0.91 (0.84 to 0.99)
Urban	2771/335614 (0.83)	29373/1767461 (1.66)	0.96 (0.85 to 1.08)
Transfer Type			
Unconditional	7340/466144 (1.57)	129185/5693683 (2.27)	0.90 (0.81 to 1.00)
Mixed	630/65064 (0.97)	129185/5693683 (2.27)	0.92 (0.80 to 1.05)
Conditional	4605/532393 (0.86)	129185/5693683 (2.27)	0.97 (0.85 to 1.10)
Coverage/Amount			
High/High	2360/186772 (1.26)	129185/5693683 (2.27)	0.86 (0.81 to 0.93)
Low/High	909/52035 (1.75)	129185/5693683 (2.27)	0.98 (0.88 to 1.10)
High/Low	1674/281851 (0.69)	129185/5693683 (2.27)	1.13 (0.91 to 1.40)
Low/Low	7632/542943 (1.41)	129185/5693683 (2.27)	1.02 (0.83 to 1.26)
Voice and Accountability			
High	4438/478358 (0.93)	129185/5693683 (2.27)	0.98 (0.82 to 1.19)
Low	7698/533380 (1.44)	129185/5693683 (2.27)	0.89 (0.83 to 0.95)
Political Stability			
High	7662/532088 (1.44)	129185/5693683 (2.27)	0.91 (0.82 to 1.00)
Low	4474/479650 (0.93)	129185/5693683 (2.27)	0.95 (0.84 to 1.07)
Gov't Effectiveness			
High	7825/556147 (1.41)	129185/5693683 (2.27)	0.91 (0.83 to 1.01)
Low	4311/455591 (0.95)	129185/5693683 (2.27)	0.97 (0.86 to 1.08)
Regulatory Quality			
High	8099/728124 (1.11)	129185/5693683 (2.27)	0.89 (0.83 to 0.94)
Low	4037/283614 (1.42)	129185/5693683 (2.27)	1.01 (0.85 to 1.19)
Rule of Law			
High	8160/577640 (1.41)	129185/5693683 (2.27)	0.92 (0.84 to 1.02)
Low	3976/434098 (0.92)	129185/5693683 (2.27)	0.95 (0.83 to 1.07)
Corruption Control			
High	7957/692954 (1.15)	129185/5693683 (2.27)	0.93 (0.83 to 1.05)
Low	4179/318784 (1.31)	129185/5693683 (2.27)	0.88 (0.79 to 0.98)
Health Expenditures			
High	4160/463313 (0.90	129185/5693683 (2.27)	0.95 (0.84 to 1.06)
Low	7976/548425 (1.45)	129185/5693683 (2.27)	0.90 (0.82 to 1.00)
Life Expectancy			
High	4620/535279 (0.86)	129185/5693683 (2.27)	0.97 (0.86 to 1.09)
Low	7516/476459 (1.58)	129185/5693683 (2.27)	0.91 (0.82 to 1.00)
Region			
Sub-Saharan Africa	8135/526845 (1.54)	119126/4736046 (2.52)	0.89 (0.73 to 1.09)
Not Sub-Saharan Africa	4440/536756 (0.83)	10059/957637 (1.05)	0.83 (0.57 to 1.20)



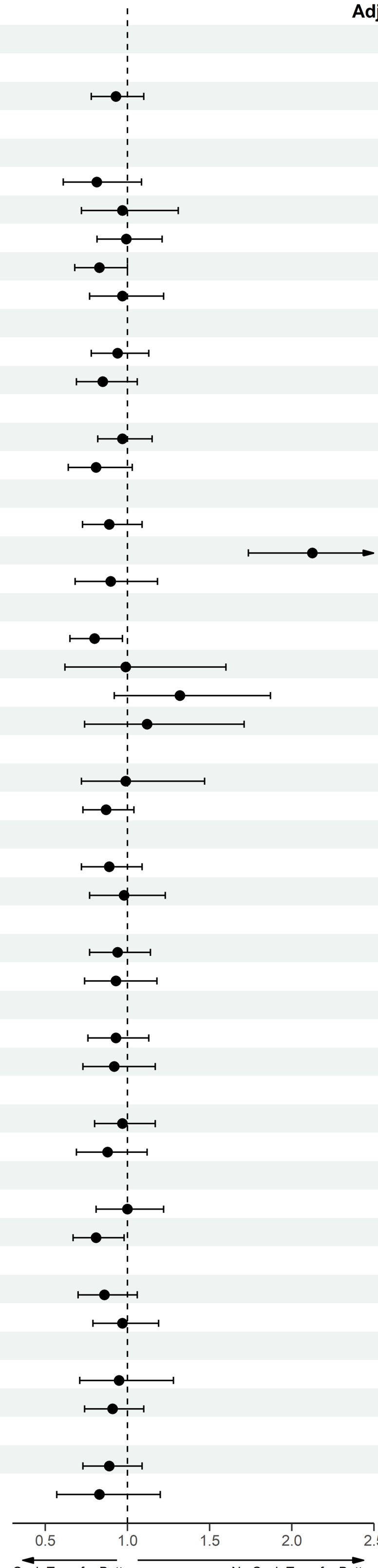
Extended Data Fig. 4 | Heterogeneity analyses for children aged <5. Forest plot showing subgroup analyses among children aged <5 years (N = 6,757,284 person-years), with fully adjusted risk ratios of mortality with 95% confidence intervals generated using multivariable modified Poisson models with country and year fixed effects, country-level covariates (GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: Control of Corruption, Political Stability and Absence of Violence, and Voice and Accountability), and individual-level covariates (age and rural/urban setting). We used robust standard errors clustered at the country level. Effect estimates are adjusted risk ratios and error bars are 95% confidence intervals.

Subgroup	Cash Deaths/Person-years (%)	Comparison Deaths/Person-years (%)	Adjusted Risk Ratio (95% CI)
Children 5-9 (Overall)	1347/870798 (0.15)	11440/3947572 (0.29)	0.96 (0.86 to 1.08)
Wealth (mother)			
Quintile 1 (richest)	141/130308 (0.11)	1195/601084 (0.20)	1.00 (0.84 to 1.19)
Quintile 2	175/151219 (0.12)	1821/718991 (0.25)	0.85 (0.68 to 1.06)
Quintile 3	221/171363 (0.13)	2225/803107 (0.28)	0.91 (0.73 to 1.14)
Quintile 4	329/193533 (0.17)	2776/864392 (0.32)	0.99 (0.81 to 1.19)
Quintile 5 (poorest)	481/224375 (0.21)	3423/959998 (0.36)	0.99 (0.84 to 1.16)
Mother's Education			
Less than secondary	1127/611804 (0.18)	10318/3156823 (0.33)	0.97 (0.85 to 1.10)
Secondary or higher	220/258969 (0.08)	1118/790483 (0.14)	0.84 (0.63 to 1.13)
Setting			
Rural	1052/593490 (0.18)	8668/2676224 (0.32)	0.96 (0.85 to 1.09)
Urban	295/277308 (0.11)	2772/1271348 (0.22)	0.93 (0.86 to 0.99)
Transfer Type			
Unconditional	761/355782 (0.21)	11440/3947572 (0.29)	0.94 (0.81 to 1.10)
Mixed	87/57159 (0.15)	11440/3947572 (0.29)	1.31 (1.07 to 1.59)
Conditional	499/456857 (0.11)	11440/3947572 (0.29)	0.92 (0.71 to 1.18)
Coverage/Amount			
High/High	244/159970 (0.15)	11440/3947572 (0.29)	0.94 (0.83 to 1.07)
Low/High	110/39313 (0.28)	11440/3947572 (0.29)	1.01 (0.68 to 1.50)
High/Low	178/246710 (0.07)	11440/3947572 (0.29)	1.46 (1.01 to 2.10)
Low/Low	815/424805 (0.19)	11440/3947572 (0.29)	0.81 (0.60 to 1.10)
Voice and Accountability			
High	456/402851 (0.11)	11440/3947572 (0.29)	0.93 (0.73 to 1.19)
Low	829/420985 (0.20)	11440/3947572 (0.29)	0.97 (0.85 to 1.10)
Political Stability			
High	794/420527 (0.19)	11440/3947572 (0.29)	0.94 (0.80 to 1.11)
Low	491/403309 (0.12)	11440/3947572 (0.29)	1.00 (0.85 to 1.16)
Gov't Effectiveness			
High	823/434475 (0.19)	11440/3947572 (0.29)	0.97 (0.83 to 1.14)
Low	462/389361 (0.12)	11440/3947572 (0.29)	0.97 (0.83 to 1.14)
Regulatory Quality			
High	877/587785 (0.15)	11440/3947572 (0.29)	0.98 (0.84 to 1.14)
Low	408/236051 (0.17)	11440/3947572 (0.29)	0.94 (0.82 to 1.09)
Rule of Law			
High	864/453846 (0.19)	11440/3947572 (0.29)	0.97 (0.84 to 1.13)
Low	421/369990 (0.11)	11440/3947572 (0.29)	0.97 (0.80 to 1.16)
Corruption Control			
High	824/564964 (0.15)	11440/3947572 (0.29)	0.97 (0.82 to 1.15)
Low	461/258872 (0.18)	11440/3947572 (0.29)	0.93 (0.80 to 1.07)
Health Expenditures			
High	449/388436 (0.12)	11440/3947572 (0.29)	0.89 (0.74 to 1.06)
Low	836/435400 (0.19)	11440/3947572 (0.29)	1.01 (0.89 to 1.15)
Life Expectancy			
High	500/460288 (0.11)	11440/3947572 (0.29)	0.94 (0.73 to 1.22)
Low	785/363548 (0.22)	11440/3947572 (0.29)	0.97 (0.84 to 1.12)
Region			
Sub-Saharan Africa	864/403319 (0.21)	10613/3146867 (0.34)	0.93 (0.79 to 1.09)
Not Sub-Saharan Africa	483/467479 (0.10)	827/800705 (0.10)	0.85 (0.59 to 1.22)



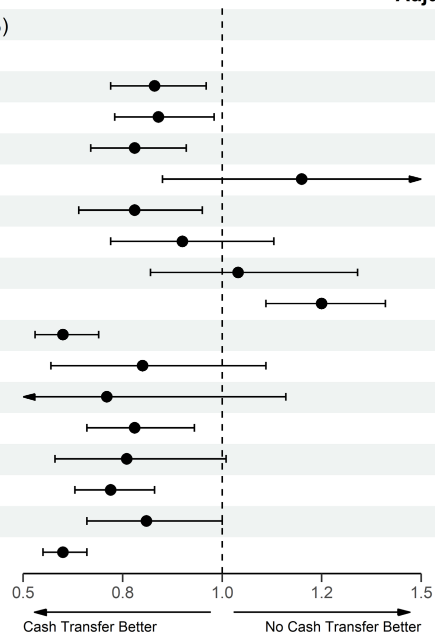
Extended Data Fig. 5 | Heterogeneity analyses for children aged 5 to 9. Forest plot showing subgroup analyses among children aged 5 to 9 years (N = 4,818,370 person-years), with fully adjusted risk ratios of mortality with 95% confidence intervals generated using multivariable modified Poisson models with country and year fixed effects, country-level covariates (GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: Control of Corruption, Political Stability and Absence of Violence, and Voice and Accountability), and individual-level covariates (age and rural/urban setting). We used robust standard errors clustered at the country level. Effect estimates are adjusted risk ratios and error bars are 95% confidence intervals.

Subgroup	Cash Deaths/Person-years (%)	Comparison Deaths/Person-years (%)	Adjusted Risk Ratio (95% CI)
Children 10-17 (Overall)	1139/1009511 (0.11)	6802/3815380 (0.18)	0.93 (0.78 to 1.10)
Wealth (mother)			
Quintile 1 (richest)	118/156970 (0.08)	727/607669 (0.12)	0.81 (0.61 to 1.09)
Quintile 2	177/182451 (0.10)	1139/717341 (0.16)	0.97 (0.72 to 1.31)
Quintile 3	247/205952 (0.12)	1418/788604 (0.18)	0.99 (0.81 to 1.21)
Quintile 4	239/224668 (0.11)	1608/826292 (0.19)	0.83 (0.68 to 1.00)
Quintile 5 (poorest)	358/239470 (0.15)	1910/875474 (0.22)	0.97 (0.77 to 1.22)
Mother's Education			
Less than secondary	927/732845 (0.13)	6084/3089240 (0.20)	0.94 (0.78 to 1.13)
Secondary or higher	212/276653 (0.08)	717/725967 (0.10)	0.85 (0.69 to 1.06)
Setting			
Rural	866/663899 (0.13)	5011/2513063 (0.20)	0.97 (0.82 to 1.15)
Urban	273/345612 (0.08)	1791/1302317 (0.14)	0.81 (0.64 to 1.03)
Transfer Type			
Unconditional	499/353144 (0.14)	8017/4504405 (0.18)	0.89 (0.73 to 1.09)
Mixed	116/56333 (0.21)	8017/4504405 (0.18)	2.12 (1.74 to 2.60)
Conditional	524/600034 (0.09)	8017/4504405 (0.18)	0.90 (0.68 to 1.18)
Coverage/Amount			
High/High	269/171170 (0.16)	6802/3815380 (0.18)	0.80 (0.65 to 0.97)
Low/High	76/41017 (0.19)	6802/3815380 (0.18)	0.99 (0.62 to 1.60)
High/Low	262/341910 (0.08)	6802/3815380 (0.18)	1.32 (0.92 to 1.87)
Low/Low	532/455414 (0.12)	6802/3815380 (0.18)	1.12 (0.74 to 1.71)
Voice and Accountability			
High	468/506585 (0.09)	6802/3815380 (0.18)	0.99 (0.72 to 1.47)
Low	575/457644 (0.13)	6802/3815380 (0.18)	0.87 (0.73 to 1.04)
Political Stability			
High	536/452104 (0.12)	6802/3815380 (0.18)	0.89 (0.72 to 1.09)
Low	507/512125 (0.10)	6802/3815380 (0.18)	0.98 (0.77 to 1.23)
Gov't Effectiveness			
High	590/452459 (0.13)	6802/3815380 (0.18)	0.94 (0.77 to 1.14)
Low	453/511770 (0.09)	6802/3815380 (0.18)	0.93 (0.74 to 1.18)
Regulatory Quality			
High	705/681774 (0.10)	6802/3815380 (0.18)	0.93 (0.76 to 1.13)
Low	338/282455 (0.12)	6802/3815380 (0.18)	0.92 (0.73 to 1.17)
Rule of Law			
High	626/471492 (0.13)	6802/3815380 (0.18)	0.97 (0.80 to 1.17)
Low	417/492737 (0.08)	6802/3815380 (0.18)	0.88 (0.69 to 1.12)
Corruption Control			
High	692/658918 (0.11)	6802/3815380 (0.18)	1.00 (0.81 to 1.22)
Low	351/305311 (0.11)	6802/3815380 (0.18)	0.81 (0.67 to 0.98)
Health Expenditures			
High	455/494990 (0.09)	6802/3815380 (0.18)	0.86 (0.70 to 1.06)
Low	588/469239 (0.13)	6802/3815380 (0.18)	0.97 (0.79 to 1.19)
Life Expectancy			
High	528/603023 (0.09)	6802/3815380 (0.18)	0.95 (0.71 to 1.28)
Low	515/361206 (0.14)	6802/3815380 (0.18)	0.91 (0.74 to 1.10)
Region			
Sub-Saharan Africa	562/400266 (0.14)	6073/2900635 (0.21)	0.89 (0.73 to 1.09)
Not Sub-Saharan Africa	577/609245 (0.09)	729/914745 (0.08)	0.83 (0.57 to 1.20)



Extended Data Fig. 6 | Heterogeneity analyses for children aged 10 to 17. Forest plot showing subgroup analyses among children aged 10 to 17 years (N = 4,824,891 person-years), with fully adjusted risk ratios of mortality with 95% confidence intervals generated using multivariable modified Poisson models with country and year fixed effects, country-level covariates (GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: Control of Corruption, Political Stability and Absence of Violence, and Voice and Accountability), and individual-level covariates (age and rural/urban setting). We used robust standard errors clustered at the country level. Effect estimates are adjusted risk ratios and error bars are 95% confidence intervals.

Country	Cash Deaths/Person-years (%)	Comparison Deaths/Person-years (%)	Adjusted Risk Ratio (95% CI)
Cambodia	1121/463028 (0.24)	27698/6478992 (0.43)	0.83 (0.72 to 0.96)
Cameroon	341/63367 (0.54)	29739/6697400 (0.44)	0.84 (0.73 to 0.98)
Republic of Congo	110/21454 (0.51)	28372/6494363 (0.44)	0.78 (0.67 to 0.91)
Dominican Republic	145/53386 (0.27)	27632/6584946 (0.42)	1.20 (0.85 to 1.68)
Ethiopia	197/51970 (0.38)	29191/6648879 (0.44)	0.78 (0.64 to 0.95)
Haiti	400/88924 (0.45)	29237/6645390 (0.44)	0.90 (0.72 to 1.13)
Indonesia	1030/286390 (0.36)	30708/7354979 (0.42)	1.04 (0.82 to 1.34)
Lesotho	1352/91305 (1.48)	29612/6544414 (0.45)	1.25 (1.11 to 1.41)
Malawi	2447/384361 (0.64)	31235/6757250 (0.46)	0.60 (0.53 to 0.69)
Myanmar	654/112428 (0.58)	28582/6510798 (0.44)	0.80 (0.57 to 1.11)
Peru	690/826870 (0.08)	29502/7594353 (0.39)	0.71 (0.44 to 1.16)
Senegal	201/90295 (0.22)	29714/6950850 (0.43)	0.78 (0.66 to 0.93)
Tanzania	123/29768 (0.41)	30223/6852072 (0.44)	0.76 (0.58 to 1.01)
Timor-Leste	239/117675 (0.20)	28553/6585689 (0.43)	0.72 (0.63 to 0.83)
Uganda	983/154678 (0.64)	30804/6769325 (0.46)	0.81 (0.66 to 1.00)
Zambia	1580/214939 (0.74)	31234/6748196 (0.46)	0.60 (0.55 to 0.66)



Extended Data Fig. 7 | Country-specific effects of cash transfer programs on mortality among adult females. Forest plot showing country-specific effects of cash transfers on mortality among adult females (N = 14,994,934 person-years). Estimates were generated using multivariable modified Poisson models with country and year fixed effects, country-level covariates (GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: Control of Corruption, Political Stability and Absence of Violence, and Voice and Accountability), and individual-level covariates (age and rural/urban setting in all moels; sex, age of mother, and birth order in child analyses). We used robust standard errors clustered at the country level.

Extended Data Table 1 | Characteristics of adult mortality dataset

	Intervention	Comparison
Total person-years (row %)	6,057,387 (20)	24,186,890 (80)
Age, median (IQR)	33 (27-41)	33 (28-40)
Female	3,020,434 (50)	11,874,500 (50)
Rural	3,472,801 (58)	14,274,234 (60)
Sibling's (respondent's) Education (N=5,957,425; N=23,929,541)		
None	683,359 (11)	7,785,550 (33)
Primary	2,531,411 (43)	7,840,367 (33)
Secondary	2,096,119 (35)	6,681,587 (28)
Higher	646,536 (11)	1,622,037 (7)
GDP ($1000s) per capita, median (IQR)	3.3 (2.0-8.0)	2.2 (1.3-4.9)
Worldwide Governance Indicators (percentile), median (IQR)		
Control of Corruption	35 (14-49)	22 (12-38)
Political Stability and Absence of Violence	22 (19-39)	19 (7-39)
Voice and Accountability	44 (25-51)	35 (22-44)
Government Effectiveness	34 (20-41)	24 (13-39)
Regulatory Quality	39 (31-52)	28 (19-42)
Rule of Law	31 (15-43)	27 (13-38)
PEPFAR funding ($5) per capita, median (IQR)	0 (0-0.3)	0 (0-0.03)
Region (column %)		
sub-Saharan Africa	2,201,343 (36)	18,088,745 (75)
Latin America / Caribbean	1,924,186 (32)	3,284,291(14)
Asia / Pacific	1,931,858 (32)	2,584,602 (11)
Northern Africa	0 (0)	229,252 (1)

Data were generated using information about siblings from respondents to Demographic and Health Surveys (N=30,244,277 person-years). Categorical variables are presented as N (%), and continuous variables are presented as medians (interquartile ranges).

Extended Data Table 2 | Characteristics of the child mortality dataset

	Intervention	Comparison
Total person-years (row %)	2,943,910 (18)	13,456,635 (82)
Age, median (IQR)	9 (5-14)	10 (7-15)
Female	1,456,657 (49)	6,647,592 (49)
Rural	1,985,376 (67)	9,115,509 (68)
Mother's (respondent's) Education (N=2,943,838; N=13,455,748)		
None	570,850 (19)	6,177,038 (46)
Primary	1,471,955 (50)	4,534,735 (34)
Secondary	728,783 (25)	2,325,686 (17)
Higher	172,250 (6)	418,289 (3)
GDP per capita, median (IQR)	3.0 1.9-7.4)	2.1 (1.2-4.4)
Mother's (respondent's) age, median (IQR)	33 (27-38)	31 (26-36)
Birth order, median (IQR)	2 (1-4)	2 (1-4)
Worldwide Governance Indicators (percentile), median (IQR)		
Control of Corruption	35 (15-48)	21 (12-37)
Political Stability and Absence of Violence	27 (20-42)	19 (7-40)
Voice and Accountability	43 (28-51)	34 (21-43)
Government Effectiveness	34 (20-40)	22 (12-37)
Regulatory Quality	35 (28-47)	27 (17-41)
Rule of Law	31 (15-45)	24 (12-38)
PEPFAR funding ($5) per capita, median (IQR)	0 (0-0.7)	0 (0-0.04)
Region (column %)		
sub-Saharan Africa	1,330,430 (45)	10,783,548 (80)
Latin America / Caribbean	758,034 (25)	1,361,657 (10)
Asia / Pacific	855,446 (29)	1,240,597 (9)
Northern Africa	0 (0)	70,833 (1)

Date were generated using information about birth history from respondents to Demographic and Health Surveys (N=16,400,545 person-years). Categorical variables are presented as N (%), and continuous variables are presented as medians (interquartile ranges).

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Last updated by author(s): 03/31/2023

Reporting Summary

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For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed	
☐	☒	The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒	A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☐	☒	The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☐	☒	A description of all covariates tested
☐	☒	A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒	A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☐	☒	For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐	For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☐	☒	For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐	Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	We conducted a secondary analysis of publicly available survey data collected by the DHS Program. We used SAS V.9.4 to manage and merge the individual datasets.
Data analysis	We performed statistical analysis using SAS V.9.4, R V.3.5.2 using the ggplot2 (V 3.4.1) and forester (V 0.3.0) packages, and STATA V.17 using the did2s package.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio guidelines for submitting code & software for further information.

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Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
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Analyzed data can be requested from the DHS program website (https://www.dhsprogram.com/Data/) or are publicly available from The World Bank (https://data.worldbank.org/data-catalog/) or PEPFAR (https://data.pepfar.gov/financial). These links are included in our data availability statement.

Human research participants

Policy information about studies involving human research participants and Sex and Gender in Research.

Reporting on sex and gender	We consider only sex in this analysis, and specify this terminology. We stratify our adult analyses by sex.
Population characteristics	There were 4,325,484 people in the adult dataset, with a total of 30,244,277 person-years (6,057,387 during intervention years) and 126,714 deaths. There were 2,867,940 people in the child dataset, with a total of 16,400,545 person-years (2,943,910 during intervention years) and 162,488 deaths. In the adult dataset, 50% of participants were female, and the median age was 33 (IQR 28-40). In the child dataset, 49% of participants were female, and the median age was 10 (IQR 7-15).
Recruitment	Participants were recruited by the DHS Program, which conducts nationally representative surveys in many LMICs about every 5 years. They use a two-stage cluster sampling design — the first stage involves systematic selection of Enumeration Areas drawn from census files with probability proportional to population size, and the second stage involves a random sampling of households from each Enumeration Area. Study staff would then directly approach selected households to recruit for the survey.
Ethics oversight	Procedures and questionnaires for DHS surveys have been reviewed and approved by the ICF Institutional Review Board. All analyzed data were anonymized.

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

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Behavioural & social sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	We performed analyses of changes in adult and child mortality associated with implementation of cash transfer programs between 2000 to 2019
Research sample	Siblings and children of respondents of national Demographic and Health Surveys.
Sampling strategy	There was no pre-determined sample size. We included data from all low- and middle-income countries that met our inclusion criteria.
Data collection	This was a secondary data analysis using publicly available datasets. Survey data was collected in accordance with ICF International procedures, and was generally done using a complex clustered sampling design.
Timing	Data included in this study were collected between 2000 and 2020.
Data exclusions	We excluded countries with pre-existing cash transfer programs at the beginning of the study period, as this was our primary explanatory variable of interest. To optimize our comparison country-years, we excluded country-years during which cash-transfer programs (or combination of programs) were implemented with coverage between 2-5%. We also excluded intervention countries that lacked at least 2 years of mortality data prior to the cash transfer period, given that the difference-in-differences study design requires pre-intervention data. We excluded incomplete person-years (i.e., the year of the survey). To minimize recall bias, we exlcuded person-years earlier than 10 years prior to a given survey. For the adult dataset, we excluded person-years during which a sibling was <18 years old, and for the child dataset, we excluded person-years during which the child was 18 years of age or older.
Non-participation	This is a secondary data analysis and therefore this is not applicable.
Randomization	This study was not randomized. In our models, we included country fixed effects to control for time-invariant differences among countries, and year fixed effects to control for secular trends in mortality. We also included country- and individual-level covariates that were likely to confound relationships between cash-transfer programs and mortality. For country-level covariates, we included GDP per capita, PEPFAR funding budgeted, and three Worldwide Governance Indicators: Control of Corruption, Political Stability and Absence of Violence. The other three Worldwide Governance Indicators were left out of the models because they displayed multicollinearity with the other covariates as evidenced by variance inflation factors >5. We also considered inclusion of health expenditures per capita, but this variable was not available for all years and adding it to the models minimally impacted the effect estimates. For individual-level covariates, we included age and rural/ urban setting in all analyses. In the child analyses, we also

included sex, mother's age, and birth order. We did not include other individual-level variables that were likely to be affected by receipt of cash transfers and/or potentially mediate relationships between cash-transfer programs and mortality (e.g., wealth quintile, schooling attainment, parity).

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study	
☒	☐	Antibodies
☒	☐	Eukaryotic cell lines
☒	☐	Palaeontology and archaeology
☒	☐	Animals and other organisms
☒	☐	Clinical data
☒	☐	Dual use research of concern

Methods

n/a	Involved in the study	
☒	☐	ChIP-seq
☒	☐	Flow cytometry
☒	☐	MRI-based neuroimaging