Extended Abstract for NBER: The Determinants of Mortality

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The effects of government-led cash transfer programs on behavioral and health determinants of mortality: evidence from 37 low- and middle-income countries

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INTRODUCTION

Poverty has long been recognized as an important social determinant of health, negatively influencing health outcomes (including mortality)[1-5] through numerous, interconnected pathways — food insecurity, healthcare access and quality, housing stability, neighborhood safety, occupational risk, educational attainment, health behaviors, and social well-being, among others.[6-10] Despite many years of progress, however, in 2018 nearly 10% of the world's population lived in extreme poverty — below $1.90 per day.[11] The Covid-19 pandemic further increased poverty, with an estimated 97 million additional people living in extreme poverty in 2020 (a 12% increase).[12] These pandemic-related impacts make the assessment and implementation of evidence-based strategies to combat poverty and improve health an even more urgent priority.

Large-scale, government-led cash transfer programs that provide money to individuals or households (with or without conditions) have become a vital part of poverty reduction strategies in many countries during the past two decades. Cash transfer programs include unconditional transfers (more common in Sub-Saharan Africa), conditional transfers (more common in Latin America), social pensions, and enterprise grants. Over the past two decades, over 100 low- and middle-income countries (LMICs) have introduced cash transfer programs as components of their poverty-reduction and social-protection strategies.[13] These programs have significantly expanded during the Covid-19 pandemic — it is estimated that during the pandemic period, cash transfers were distributed to 1.36 billion people, or 17% of the world's population.[14]

While there is a large literature on the effects of cash transfers on a wide range of outcomes for beneficiaries (including children's education, nutritional status, healthcare utilization, and subjective well-being),[15-17] until recently there has been limited evidence about the population-wide impact of such programs on overall mortality and other health outcomes.[18-26] Unlike large-scale, multi-country evaluations of major health aid programs like PEPFAR,[27,28] the vast majority of cash transfer evaluations have focused on individual countries and impacts on beneficiaries in those countries. These evaluations have generally used datasets that are not large enough to precisely estimate effects of cash transfers on mortality rates and many other population-wide health outcomes. As a result, there has been inadequate evidence to support rigorous cost-benefit evaluations that may influence policymakers' decisions about whether to expand the coverage or size of cash transfers in LMICs (including whether to embrace approaches such as universal basic income or guaranteed income).

This paper will build on a research paper that our team published in *Nature* last year and examine the association between cash transfer programs and various determinants of mortality among adult women and young children in LMICs.[29] In the previously published paper, we leveraged a newly-created dataset and used a difference-in-differences approach and found that large-scale, government-led cash transfer programs in LMICs led to large reductions in all-cause mortality rates among adult women and children <5 years of age.[29] To do this, we constructed a new dataset that used publicly available information from various sources to list all government-led cash transfer programs in LMICs, including their start and end dates as well as their size in terms of population covered and cash transfer amounts provided.[30] For each cash transfer program, we estimated the most recent impoverished population coverage by dividing the total number of beneficiaries by the number of people living below the international poverty line. Our choice of 5% impoverished population coverage as the threshold for our intervention group was subjective but was initially chosen empirically as the smallest likely coverage with

which we might expect to see population effects, and was also based on prior analyses showing that this threshold was associated with improvements in HIV-related outcomes.[30] This newly-created dataset opens up opportunities to study how public policies can be used to address the determinants of mortality and ultimately reduce mortality rates.

We estimated mortality by generating two individual-level longitudinal datasets — one for adults and one for children — with the Maternal Mortality and Infant Mortality Modules, using previously established methodology and excluding observations earlier than ten years prior to the survey to minimize recall bias.[27,28,31] We included LMICs without pre-existing cash transfer programs at the start of the study period, and included only intervention countries with at least two years of available pre-cash transfer mortality data (N=37 countries. Our analysis included approximately 7 million people with over 46 million person-years and nearly 300,000 deaths.

Using a difference-in-differences approach, we found that government-led cash transfer programs resulted in large and statistically significant reductions in mortality among adult females (adjusted risk ratio 0.80) and children <5 years of age (adjusted risk ratio 0.92), but not among adult males or older children (**Figure 1**). Our approach does not differentiate whether people were beneficiaries of a given cash transfer program, 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.[32,33] Large-scale cash transfer programs may also affect local and regional economies in favorable ways.[34]

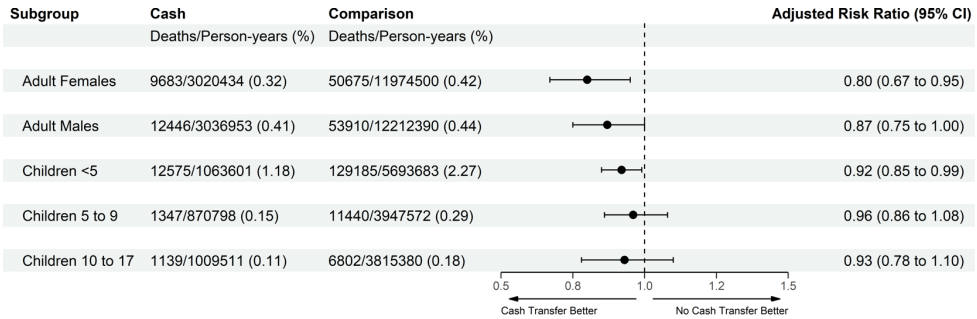


Figure 1. *Forest plot showing the fully adjusted overall associations between cash-transfer programs and mortality among adult females, adult males, and children.*

Our recent finding that cash transfer programs reduce mortality rates among women and young children raises an important question about the pathways by these reductions occur -- this is the central question that our paper will address. To start to address this question, we have adapted a causal framework of plausible individual- and household-level pathways between cash transfer programs and health improvements for young children, with a similar structure for adult women (**Figure 2**).[15] Within this proposed framework, there are *Direct Effects* (i.e., effects on income, expenditures, savings, investment, time and risk preferences, and the psychological consequences of poverty-like mental bandwidth) of cash transfers,[35] downstream *Intermediate Effects* (i.e., behavioral changes that may impact health, including health-seeking behavior), and *Health and Nutrition Outcomes*. Furthermore, large-scale cash transfer programs may also affect local and regional economies in favorable ways, thus affecting non-beneficiaries and contributing to community and public health.[36] Having recently used our large dataset to show that cash transfer programs reduce mortality rates in LMICs, we anticipate that this paper will present the most comprehensive assessment to date of the specific determinants of mortality rates that are affected by such programs.

There are variety of plausible behavioral (intermediate) pathways that are commonly measured in national health surveys that might mediate an effect of cash transfer programs on health (including mortality) among adult females and young children. One potentially important factor is the receipt of antenatal care during pregnancy, through which preventative health care can be provided and pregnancy complications can be identified.[37] Similarly, delivery at a facility by a skilled birth attendant, particularly with the staff and equipment necessary to perform C-sections and respond to other obstetric emergencies, can be associated with improvements in maternal and neonatal health and mortality, although it is important for analyses to account for lagged maternal behavior, selection, and reverse causality.[38-43] After birth, non-breastfed infants have a substantially higher risk of morbidity and mortality in LMICs.[44] Among childhood vaccinations, measles vaccination in particular (which is

typically administered around the first year of life as part of the measles-mumps-rubella [MMR] vaccine) has had large direct (through reductions in measles-related mortality)[45-50] and indirect (through reductions in measles-mediated immunosuppression)[51,52] effects on childhood morbidity and mortality. Finally, fertility behaviors like inter-delivery interval may influence maternal and infant health outcomes.[53] Each of these health behaviors have the potential to be influenced by cash transfer programs.

Similarly, there are important health and nutritional outcomes commonly measured in health surveys that are of considerable interest themselves and might mediate effects of cash transfer programs on mortality among young children. Low birth weight, along with preterm birth and/or intrauterine growth restriction, is an important driver of morbidity and mortality among young children.[54-56] Childhood undernutrition, manifesting acutely (wasting),[57-59] chronically (stunting),[58,59] generally (underweight),[58,59] or in combination, is also associated with illness and increased risk of death. This includes diarrheal illness, one of the top five causes of death among children <5, with over 500,000 deaths attributed to diarrheal disease in this population in 2019.[60]

By combining DHS data with our newly constructed database of cash transfer programs, we propose to use difference-in-differences analyses to examine the association between cash transfer programs and these plausible determinants of mortality among adult women and young children in LMICs.

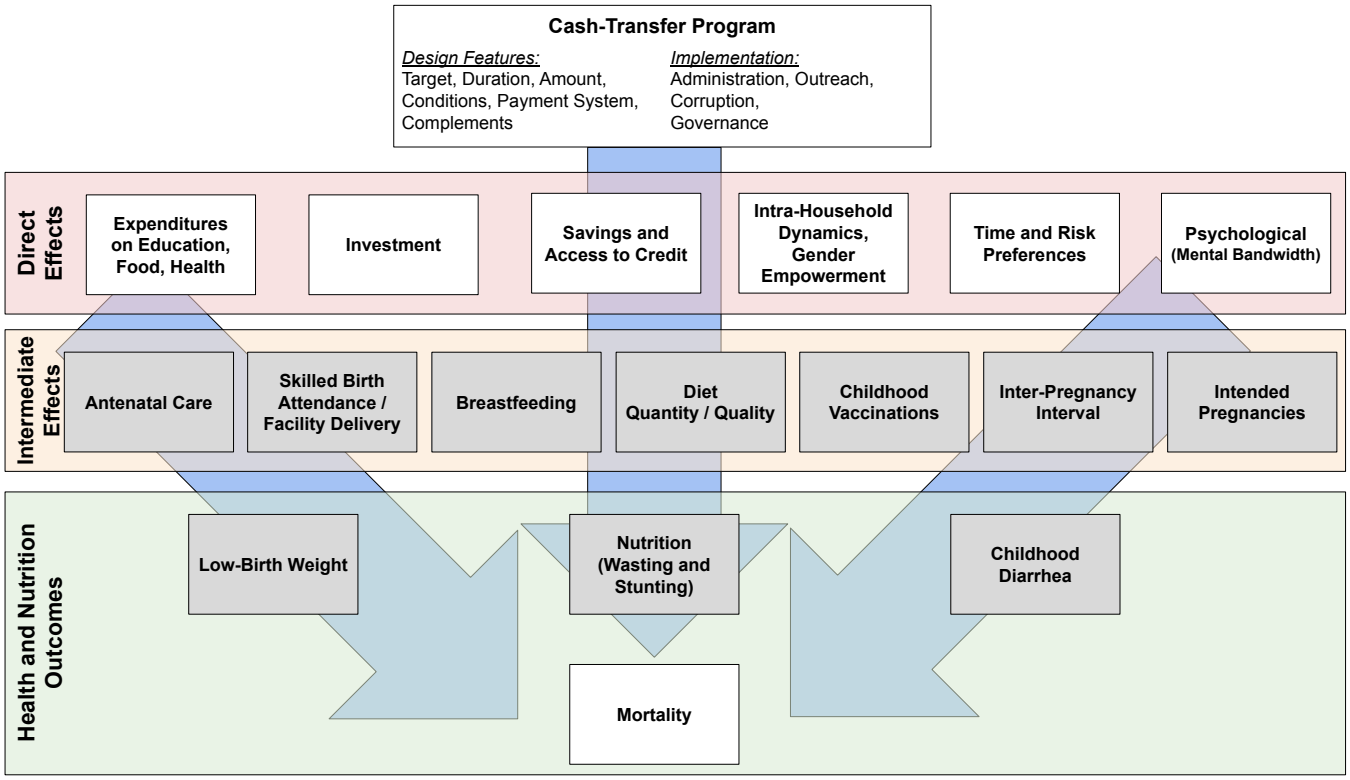


Figure 2. *Conceptual framework outlining potential individual- and household-level pathways between cash-transfer programs and health and nutrition outcomes among children <5 years of age, with a similar structure for women. Dark gray boxes are outcomes measured in the DHS that are considered in the current proposal. Adapted from Bastagli et al.*

STUDY DESIGN

Building on our prior work, we are using difference-in-differences analyses to examine the association between large-scale, government-led cash transfer programs and key behavioral and health and nutrition outcomes that are plausible determinants of mortality for adult females and children aged <5 years in LMICs. As described below, our analyses will include multiple robustness checks to confirm the validity of our difference-in-differences results.

DATA SOURCES

We are relying on two key data sources: Demographic and Health Surveys (DHS) and a newly constructed database of cash transfer programs in LMICs.

Demographic and Health Survey (DHS) Data

The DHS are conducted in many LMICs about every 5 years. The surveys 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.[61] For the purpose of this analysis we will use questionnaires administered to the female respondents, which typically include all female household members of reproductive age (15-49). Procedures and questionnaires for DHS surveys have been reviewed and approved by the ICF Institutional Review Board, and all publicly available data are anonymized. We will include the same countries and DHS surveys used for our mortality analyses — that is, LMICs without pre-existing cash transfer programs at the beginning of the study period that have available DHS with maternal mortality modules — as indicated in **Figure 3**.

In addition to extracting data regarding the outcomes detailed below in the Outcomes section, we have extracted additional data about the primary respondents and/or their children — age, parity, rural/urban setting, wealth quintile, and schooling attainment. Respondents are classified into wealth quintiles using the DHS Wealth Index: a composite measure of households' cumulative living standards 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.[62] Since DHS questionnaires generally do not include questions about whether respondents or their household received benefits from specific social programs, we will not be able to identify beneficiaries and non-beneficiaries of a given cash transfer program. Although it would be ideal to know whether any given individual/household is a cash transfer beneficiary, one positive feature of our analyses and results is that we will be estimating the population-wide, general equilibrium effects of cash transfer programs on various mortality determinants.

Cash-Transfer Program Data

We have previously identified all major, government-led cash transfer programs within included countries during our study period, as well as the years in which they were implemented, target populations, conditionalities, transfer amounts, and the most recent numbers of beneficiaries. Prior to completing the analyses in this proposal, we will update this cash transfer program database to ensure completeness with the most up-to-date information, and to expand the database to collect all available estimates during the study period (for example, changes in the number of beneficiaries, or in the maximum transfer amount). We will also collect additional data, as available, about implementation quality, tax revenue, and funding sources. We do not plan to use these time-varying estimates for the analyses in this proposal, but this additional richness in the dataset may support future studies that explore how specific cash transfer program features (and how these features change over time) affect health-related outcomes.

For each program, we have calculated the percentage of the country's impoverished population that was covered by the cash transfer program by dividing the most recently available estimate of the number of program beneficiaries by the number of individuals in that country with income below the international poverty line of $1.90 per day (2011 Purchasing Power Parity). When calculating program coverage, we use the impoverished population sizes *prior to* program implementation because the number of impoverished people is likely to decrease once cash transfers are provided. In addition to impoverished population coverage, we have also calculated the maximum transfer amounts as percentages of Gross Domestic Product (GDP) per capita in the most recent year the maximum transfer amounts are reported – this will serve as a proxy for the generosity/size of cash transfer programs in a country.

Additional Country-Level Data

For each country and year, we are controlling for additional time-varying covariates that are likely to be associated with both health outcomes and the existence of a cash transfer program. These covariates include Gross Domestic Product (GDP) per capita,[63] domestic government and external health expenditures per capita,[63] President's Emergency Plan for AIDS Relief (PEPFAR) funding budgeted per capita,[64] 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.[63]

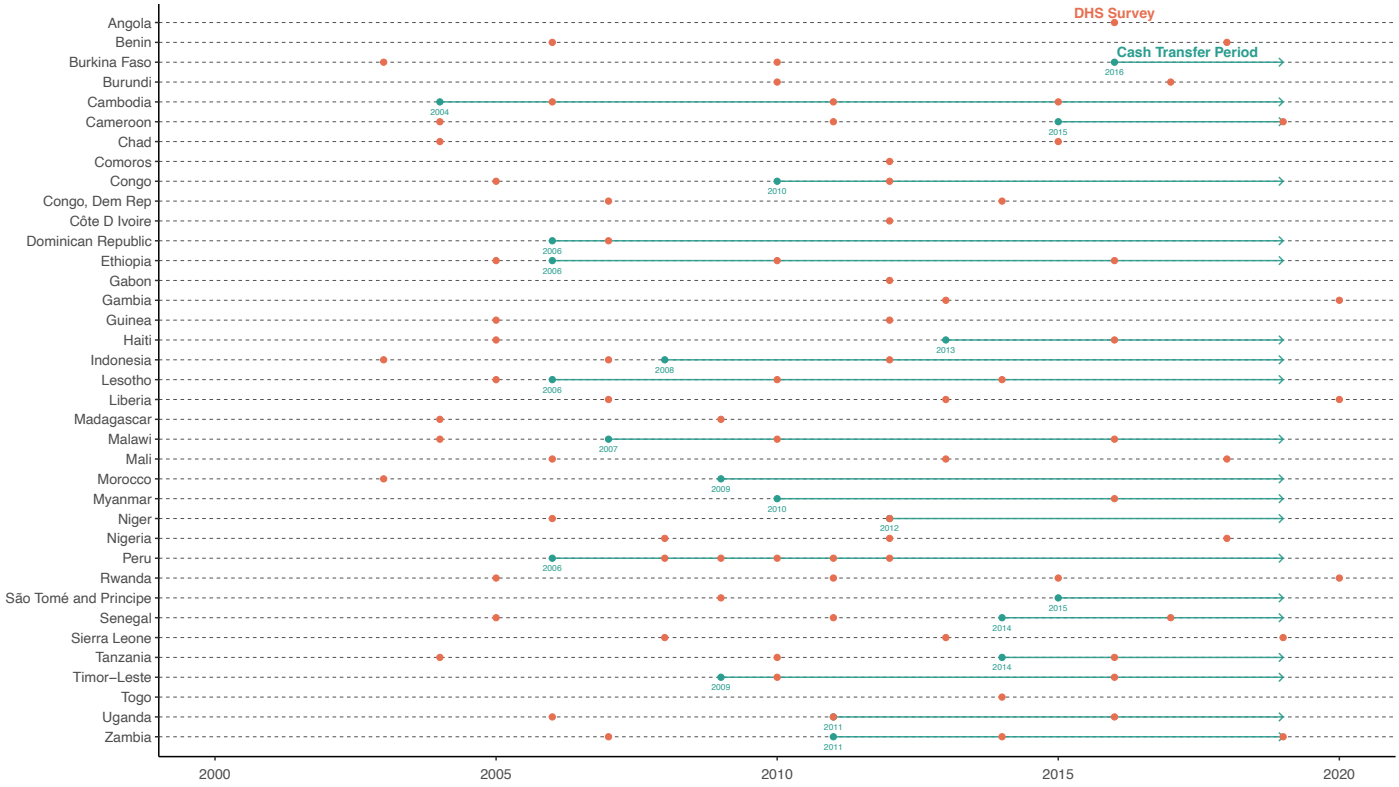


Figure 3. *Timeline of study datasets, with study period (2000-2019) along the x-axis, included countries on the y-axis, orange dots representing DHS surveys, green dots representing the first complete year of cash-transfer program(s) covering >5% impoverished population, and the green line representing the cash-transfer period.*

OUTCOMES

We are considering two categories of outcomes that represent important determinants of mortality and could be affected by cash transfer programs: health behaviors and health and nutrition outcomes.

Health behavior outcomes are summarized in **Table 1.** *We hypothesize that cash transfer programs will be associated with increases in primary outcomes of antenatal care (ever received care, first visit early in pregnancy), facility-delivery, skilled birth attendance, ever-breastfeeding, minimum acceptable diet, longer inter-delivery interval, the likelihood that a pregnancy is intended, and measles vaccination by 12 months of age.*

Table 1. Behavioral Outcomes and Target Population from the DHS.

Behavioral Outcomes	**Target Population**
Antenatal Care	Adult Females (last pregnancy)
Facility Delivery	Adult Females (last 3 pregnancies)
Skilled Birth Attendance	Adult Females (last 3 pregnancies)
Ever breastfeeding	Adult Females (last 3 births)
Minimum Acceptable Diet	Children 6-23 months (youngest in household)
Inter-delivery interval	Adult Females (last 5 births)
Intended pregnancy	Adult Females (last 3 pregnancies)
Measles vaccination	Children of Female Respondents (last 3 births)

While all but one of the outcomes (measles vaccination) apply to the target population of adult females, they have direct implications for children's health as well (e.g., antenatal care use will affect child health). One outcome was asked about the last pregnancy during the past five years (antenatal care), five about the last three pregnancies/births during the past five years (facility delivery, skilled birth attendance, breastfeeding, intended pregnancy, measles vaccination), one about the youngest child in the household (dietary diversity) and one about all births (inter-delivery interval), but we will focus on the last 5 births during the past ten years to minimize recall bias. For each outcome, we will also collect the year during which the outcome occurred for each pregnancy/birth to define the year of the outcome.

For antenatal care, we will consider two outcomes: any antenatal care (vs. no antenatal care) and first visit early in pregnancy. A skilled birth attendant will be defined as a health professional with formal education and proficiency to manage normal pregnancies and childbirth (e.g., physician, nurse, mid-wife). Inter-delivery interval will be considered as a categorical variable (<18 months, 18-36 months, 37-60 months, 61-180 months).[53] Minimum acceptable diet will be defined as meeting the minimum dietary diversity and meal frequency during the day preceding the survey.[65] For the measles-vaccination outcome, this is variably collected either via vaccine

cards and/or via recall. Our outcome will be defined preferentially via vaccine cards, and if not available will use recall. We will conduct sensitivity analyses to see if recall data have significantly different coefficients.

Health and nutrition outcomes are summarized in **Table 2**. *We hypothesize that cash transfer programs will be associated with reductions in low-birth weight, undernutrition (wasting, stunting, and underweight), and recent diarrhea.*

Table 2. Aim 2 Outcomes and Target Population from the DHS.

Aim 2 Outcomes	Target Population
Low-Birth Weight	Children of Female Respondents (last 3 births)
Wasting	Children <5 (all children in household)
Stunting	Children <5 (all children in household)
Underweight	Children <5 (all children in household)
Diarrhea in the last 2 weeks	Children <5 of Female Respondents (last 3 births)

One outcome was asked about the last three births during the past five years (low-birth weight), height and weight measurements were performed for all resident children <5 years of age at the time of the surveys, and questions about diarrhea incidence were asked about the last three children born in the past five years (diarrhea in the last 2 weeks). For the low-birth weight outcome, we will also record the year of birth — this will be defined as the year of the outcome. For the anthropometric and diarrhea outcomes, the year of the outcome will be defined as the year the survey was conducted at that household.

Low-birth weight will be defined in two ways: as a binary variable whereby the primary respondent reports that the child was smaller than average or very small at delivery; and as a binary variable (defined as <2.5 kg), based preferentially on birth certificates and alternatively based on the mothers' recall. For anthropometrics measures, we will consider both moderate and severe undernutrition. Moderate wasting (acute nutritional deficiency) will be defined as weight-for-height z-score $\leq$ -2.0 standard deviations below the mean on the WHO Child Growth Standards for well-nourished children, stunting (chronic nutritional deficiency) will be defined as height-for-age z-score $\leq$-2.0, and underweight (a composite measure of acute and chronic statuses) will be defined as weight-for-age z-score $\leq$ -2.0.[66] Severe undernutrition will be defined similarly, with z-score thresholds $\leq$ -3.0.[66]

For the post-natal outcomes (anthropometrics, diarrhea), we note that since our previous study suggests that cash transfer programs increased post-natal survival,[29] this means that children with more marginal health are likely to be included during intervention country-years. This type of selection may imply that the estimates for these outcomes will be biased towards the null, and therefore we will be obtaining lower-bound estimates of the impacts of cash transfer programs on these outcomes. In alternative estimates we will explore what happens to the impacts of cash transfer programs on observed post-natal outcomes when we include controls for birth weights (often considered summary measures of children's endowments at birth).[67-70]

STATISTICAL ANALYSES

We have just completed compiling all of the DHS data and will soon be initiating statistical analyses to estimate the effects of cash transfer programs. We will employ a difference-in-differences approach with multivariable modified Poisson regression models with the unit of observation being either a given pregnancy, birth, or child depending on the outcome being analyzed (see **Table 1** and **Table 2**).[71] Our primary explanatory variable will be a binary variable set to 1 if a cash transfer program (or combination of programs) that covered >5% of the total impoverished population in a country was active at the beginning of the year . We chose 5% based on our prior analyses showing this threshold was associated with improvements in HIV-related outcomes and overall mortality,[29,30] but we will also use subgroup analyses to explore the associations with different levels of coverage. To optimize our comparison across country-years combinations, we will exclude from our analysis country-year combinations during which cash transfer programs (or combination of programs) were implemented with 2-5% coverage.

We will include country fixed effects to control for time-invariant differences among countries, and year fixed effects to control for secular trends. We will also include time-varying country- and individual-level covariates that likely confound relationships between cash transfer programs and our outcomes. For country-level covariates, we will include GDP per capita, health expenditures per capita, budgeted PEPFAR funding, and the World Bank Worldwide Governance Indicators. For individual-level covariates, we will include age of the mother (and child, as appropriate), and rural/urban setting. We will not include other individual-level variables that are likely to be affected by receipt of cash transfers and/or potentially mediate relationships between cash transfer programs and the outcomes (e.g., wealth quintile, schooling attainment). We will use robust standard errors clustered at the country level to relax the assumption of independently and identically distributed error terms.[72,73] For the facility-delivery and skilled birth attendant outcomes, we will address selection and reverse causality by adjusting for lagged maternal behavior from the first reported pregnancy, excluding this pregnancy from our analyses.[40]

Noting that recent advances in difference-in-differences analyses with variation in intervention timing have shown that estimates may be biased if there is heterogeneity in intervention effects over time,[74-76] we will mitigate this concern and assess the robustness of our results in several ways. First, we will generate dynamic effect estimates by creating a series of binary indicators for each year before and after the cash transfer period began.[77] Second, because this bias tends to be most influenced by later country-years during the intervention period, we will conduct a sensitivity analysis by repeating the primary analysis after excluding country-years after year 5 of the cash transfer program.[78] Third, we will repeat the primary analysis using an alternative estimator that has been proposed that is not vulnerable to this bias.[79]

Because the difference-in-differences design is quasi-experimental and relies on the parallel-trends assumption (i.e., that in the absence of cash transfer programs, trends in outcomes would be similar in intervention and comparison countries), we will assess the validity of this assumption in two ways. We will use the previously described dynamic effect estimates to visualize pre-trends, and we will estimate regression models using only data prior to the cash transfers period in each country and including an interaction term between an indicator of whether the country was in the intervention and a linear time trend. Of note, in our previous study the parallel trends assumption was satisfied for mortality outcomes.

We will also conduct several other secondary analyses. We will conduct sub-group analyses based on wealth quintile, transfer type (unconditional, conditional, or mixed), region, and among four subgroups characterized by impoverished population coverage above or below the median and maximum annual transfer amounts above or below the median. We will assess whether individual countries might be outliers for outcomes by assessing whether estimates change substantially after excluding each country individually.

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