Conditional Cash Transfers to Improve Child Health: Evidence from a Cluster-Randomized Experiment in Zambia

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Abstract

We conducted a cluster-randomized experiment in Zambia to test the effects of cash incentives for health checkups for children of early school-age. We show that treatable infections are highly prevalent in children from households below (69 percent infected) and above the poverty line (52 percent infected). We find that 43 percent of households attend checkups when a US$1 incentive is provided, and attendance increases by 8 percentage points for each additional dollar provided. We observe a strong negative wealth gradient in attendance, likely due in large part to higher time costs among wealthier households. Finally, we find that selection into checkup attendance is only weakly associated with child illness. Our results suggest that the potential welfare gains from incentive programs for routine health checkups for school-age children in developing countries are substantial. (*JEL* I18, I38, J13)

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1 Introduction

In an effort to improve child health, a large number of developing country governments have introduced incentives for regularly timed child health checkups as part of welfare- and poverty-oriented conditional cash transfer (CCT) programs in recent years.[1] Most of these programs share three common features: first, they bundle incentives for health-improving behaviors together with a range of incentives for other human capital investments, most importantly schooling; second, they focus on improving the health of young children, usually ages five and under; and third, they primarily or exclusively target households below certain income or wealth thresholds (Fiszbein and Schady 2009). While bundling incentives makes sense from a programmatic perspective, it is not immediately obvious that targeting only young children and the poor with incentives for checkups is optimal: several recent studies have documented a rather high general burden and impact of infectious disease among school-age children (Baird et al. 2012a, Brooker et al. 2010, Jukes et al. 2006, Miguel and Kremer 2004), and rather little evidence is available on how much this burden varies across socioeconomic groups.[2]

To empirically evaluate the infectious disease burden among school-age children as well as parental responsiveness to financial incentives for health checkups, we conducted a cluster-randomized experiment across 31 geographic clusters in Zambia. As part of the experiment, 535 parents of early school-age children (ages 6 and 7 at the time of the experiment) were provided with an invitation and a randomly assigned incentive of up to around US$3 to bring their child to a nearby health center for a checkup that included screening and treatment for a series of infectious diseases. The design of the experiment closely resembled the health component incorporated in most currently operating CCT programs, but with two main investigative advantages: random variation in incentive level; and universal eligibility regardless of household poverty status.[3] The experiment yielded four main findings. First, the burden of infectious

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[1] Included in the list of countries with such programs are Mexico, Brazil, Colombia, Dominican Republic, Honduras, Guatemala, Jamaica, Nicaragua, Peru, Burkina Faso, Kenya, Turkey, Philippines, and Indonesia. Similar programs are being considered by governments in other developing countries with the support of international institutions, including the World Bank (Fiszbein and Schady 2009).

[2] There are a few examples of CCT programs that target health incentives at school-age children in addition to younger children, including those in Mexico and Guatemala.

[3] The experiment did not evaluate an existing CCT program and while this may introduce some external validity concerns, the study was designed to investigate specific policy-relevant mechanisms that likely underlie the effects of conventional CCT programs. Ludwig et al. has recently argued that such mechanism experiments should play a larger role in policy evaluations (Ludwig et al. 2011).

disease in the studied age range is remarkably high. On average, 73 percent of children that attended the checkup had at least one diagnosable illness; the estimated prevalence of illness in the full study population was 66 percent, with relatively modest differences between households below (69 percent infected) and above the poverty line (52 percent infected). Second, an invitation and relatively small incentives are sufficient to induce a larger fraction of parents to attend health checkups for their children, particularly in rural areas. On average, with an incentive of US$1.00, 43 percent of households attended the checkup; with the highest incentive of US$3.06, attendance increased to 64 percent.[4] Third, responsiveness to incentives is substantially weaker among wealthier households, a result which appears to be driven primarily by higher time costs among the wealthy.[5] Fourth, parents appear to have poor knowledge of the health care needs of their children. Indeed, despite the high infection rate observed in study children, only 16 percent of parents indicated that their child was in poor health. Further, the observed relationship between checkup attendance and child illness is very weak.

From a programmatic perspective, the results from this study suggest that conventional CCT programs may fail to reach a large proportion of children in need of routine health services in settings with a high infectious disease burden such as Zambia, not only because of their restriction to early childhood age but also because of their general restriction to poor households. The results from this study also suggest that poverty-based eligibility thresholds may not be necessary to target the poor in the context of health, since a large fraction of better-off parents appear to be deterred from taking up incentives by the time costs associated with checkup attendance. In terms of program reach, our results suggest that, under an assumption of linear price elasticity, a universally available incentive of around US$16 would be required to achieve universal uptake of child health checkups across the entire socioeconomic spectrum of households in Zambia. A more realistic US$5 incentive would result in 96 percent of households below and 41 percent of households above the poverty line attending a checkup; in total, 64 percent of children with infections would get treated at a cost of around US$7 per sick child treated, not including the cost of treatment.

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4. At the time of the experiment US$1 = 4,900 Zambian Kwacha. In the time since the experiment, the Zambian government has rebased the country's currency. For consistency, we use US$ throughout this paper.

5. In a recent paper, Alatas et al. discuss the role of time costs in screening out non-poor households from a cash transfer program in Indonesia (Alatas et al. 2013). The authors refer to the screening effect of time costs as an "ordeal mechanism."

Other than the disconcertingly high burden of untreated infectious disease among study children, the most striking finding of this study is parents' rather limited knowledge of their children's health care needs. This finding has two important implications. First, in the absence of parental awareness, routine health checkups are likely the only effective way of lowering the burden of untreated infectious diseases in children in developing countries such as Zambia. Rather than waiting for symptoms in children to progress to a level of severity that parents recognize, checkups can circumvent failures in parental recognition and provide children with timely treatment for potentially serious illnesses. Second, poor parental awareness should in theory limit price screening for checkups (Dupas 2012), and we do indeed find evidence of this in our study. While positive pricing for health related goods and services has been found to be beneficial in other settings (Ashraf 2010), similar screening mechanisms appear much less relevant in the context of routine health checkups. In general, combining incentive programs with interventions that improve parental recognition of child illness may increase their efficiency, and furthermore such interventions may obviate the need for incentives entirely.

This paper contributes to a large literature on the optimal design of social transfers in general, and the use of CCTs in particular. While several recent studies have evaluated the effects of CCT programs on child health and development and found positive effects (Aguero et al. 2007, Akresh et al. 2012, Case 2001, Duflo 2003, Fernald et al. 2009, Gertler 2004, Paxson and Schady 2010, Robertson et al. 2013), these evaluations were not designed to isolate the impact of health care use, and the effects they find are likely due to a combination of causes, including improved nutrition (Bassani et al. 2013, Gaardner et al. 2010).[6] Furthermore, because they evaluate existing programs, these studies generally do not investigate the effects of varying aspects of program design, including transfer levels and poverty-related eligibility criteria. This study also adds to recent debates on the appropriateness of placing conditions on transfers, as opposed to providing unconditional cash transfers (UCTs).[7] Recent studies suggest that UCTs can improve child health and development (Baird et al. 2011, Duflo 2003, Edmonds 2006). However, our

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[6] The literature on the effect of incentive programs on schooling outcomes is stronger than it is for health outcomes (Baird et al. 2011, de Brauw and Hoddinott 2011, Kremer and Holla 2009, Schady et al. 2008, Todd and Wolpin 2006).

[7] The World Bank argues that conditionality has three principal advantages: 1) it addresses private underinvestment in child human capital; 2) it increases positive externalities that result from investments in children; and 3) electorates may be more likely to support cash transfers if those receiving cash must demonstrate good behaviors (Fiszbein and Schady 2009).

finding that parents have poor knowledge of the health care needs of their children suggests that households are unlikely to invest a significant portion of cash received as part of UCT programs in health services for their children.

The rest of the paper is structured as follows: Section 2 provides background on the current state of child health and the health system in Zambia, the setting of the experiment. Section 3 describes the experiment and data. We present our main findings in Section 4. In Section 5, we discuss possible mechanisms that might explain key findings, and then we apply our findings to predict the effects of a range of potential incentive policies. Section 6 concludes.

2 Background: child health and health care in Zambia

Zambia is a lower-middle-income country located in southern Africa. In 2010, gross domestic product per capita in the country was estimated to be 2,545 PPP (Heston et al. 2012). The burden of disease among children in Zambia is substantial. According to parental reports, one-in-three children younger than 5 years old suffer from febrile illness and one-in-six have diarrhea in a given two-week period (Zambia Central Statistical Office et al. 2009). According to the latest estimates, nearly one-in-five children are infected with malaria at a given time (Zambia Ministry of Health 2010).

Zambia’s health system follows the multi-tiered, decentralized model present in many countries in sub-Saharan Africa. Most preventive and primary care services are provided at health centers, which are usually staffed with a nurse who provides basic clinical services. Complicated cases are referred to district hospitals where at least one physician is usually on staff. Across Zambia, a major effort has been made over the past few years to increase health care utilization. In 2007, all formal fees associated with care, including consultation fees and pharmaceutical fees, were abolished for services provided at rural facilities. At the time of the study, child health consultations provided at urban public facilities incurred a fee of US$0.51, a cost that covered all pharmaceuticals received during a visit. Time costs for health service use in Zambia are substantial as a result of long travel and waiting times. A recent study found that the average waiting time at urban health centers in the country was nearly two hours (Deo et al. 2012). In addition, more than half of rural residents in Zambia must travel more than 5 kilometers to reach the nearest basically equipped health facility, and most must walk to do so (Gabrysch et al. 2011). Health checkups similar to those provided in this study are ordinarily available in Zambia only to children under the age of five and only during biannually occurring week-long national child health campaigns.

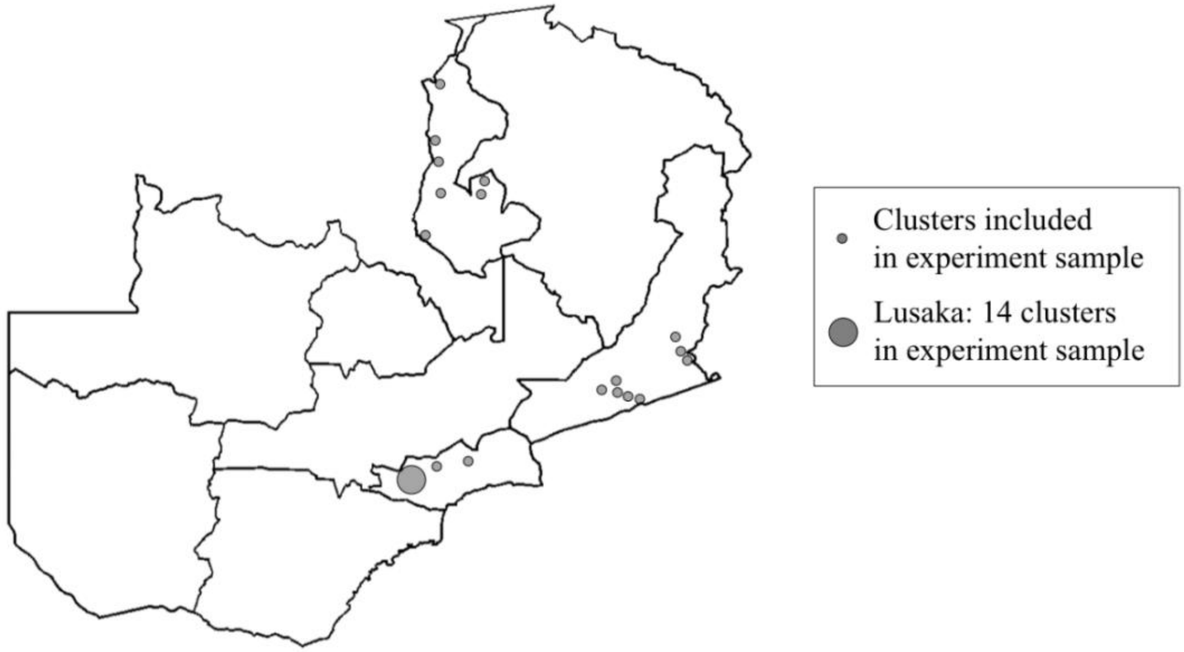
Private health care services are nearly non-existent in rural areas in Zambia, and use of facility-based private care is low even in urban areas. According to data collected as part of the country’s 2007 Demographic and Health Survey (DHS), among parents that sought care for their child for a recent episode of diarrhea, 91 percent visited a public health facility (Zambia Central Statistical Office et al. 2009). While use of private pharmacies is common in urban areas, most households obtain drugs from public health facilities. More than 80 percent of the population obtains antimalarial medications from public health facilities (Zambia Ministry of Health 2010).

3 Experimental design

3.1 Sample

The experiment described in this paper was conducted as part of the Zambia Early Childhood Development Project (ZECDP). The ZECDP is an ongoing multiple-cohort study that aims to assess the effects of early childhood health experiences on developmental and educational outcomes (Fink et al. 2013). Figure 1 shows a map of the locations of experiment clusters.

Figure 1. Map of geographic clusters included in the experiment sample



The baseline sample for the ZECDP was drawn in the summer of 2010, following the two-stage cluster sampling design used in Zambia's 2006 Malaria Indicator Survey (Zambia Ministry of Health 2009). After an initial random selection of 73 clusters in 7 provinces, all children born in 2004 residing in these clusters were listed, and up to 25 children in each cluster were randomly selected for inclusion in the study. The experiment was conducted during the first follow-up for the ZECDP study, in the summer of 2011, in a subsample of 31 study clusters.[8]

3.2 The experiment

The principal intervention or treatment explored in the experiment was an invitation to parents to bring their child to a health checkup. At the end of the ZECDP survey interview, all parents were invited to bring their child to the nearest health center for a comprehensive health checkup during the following week. An invitation sheet was provided that included basic information on the importance of child health services, the name of the nearest health center where the checkup was being provided, and the value of a randomized incentive that would be paid upon attendance at the checkup (see Appendix 1 for an example invitation). Interviewers explained the information on the invitation sheet to study parents and told parents about the specific incentive provided. Clusters were stratified according to urban or rural designation and then randomized with equal probability into four groups: no incentive, an incentive of US$0.41, an incentive of US$1.43, and an incentive of US$3.06. The US$3.06 incentive constituted a full subsidy for the average cost of transportation (for households that use transportation) to and from the nearest health center in Zambia, determined during survey pretesting. The other incentive levels were chosen to provide a near-half and near-zero subsidy on the transportation cost.[9]

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[8] Thirty-four clusters were originally sampled for the experiment. Two clusters were dropped because households from the ZECDP baseline survey could not be located. One cluster was dropped because the sampled community had a recent negative experience with an unrelated cash incentive program. Clusters were defined as urban or rural according to classifications used by the Government of Zambia. During data collection, one cluster that was originally determined to be in a rural setting was identified to be located in an urban setting.

[9] It is difficult to compare the level of the incentives provided in this experiment to those provided in conventional CCT programs because average household income in Zambia is substantially lower than it is in most countries where CCT programs are currently operating. However, a recent study in Burkina Faso provided an incentive of around US$10 per year conditional on both attendance at quarterly child health checkups and school attendance for older children (Akresh et al. 2012). In addition, a recent unconditional cash transfer scheme piloted in Zambia provided households in the lowest wealth decile with US$6 per month (Zambia Ministry of Community Development and Social Services 2007).

To obtain the financial rewards, parents had to bring their child to the clinic within 7 days of the invitation. Payments were made to parents at the health center upon completion of the checkup by a study employee who remained at the facility during normal operating hours throughout the experiment week. The experiment fully relied on existing health services; no additional resources were offered to health center employees. Facility staff were made aware of the project and asked to screen study children for malaria, diarrhea, respiratory infection, and bilharzia. Facility staff also screened children for skin conditions and lice and provided all children with iron and vitamin A supplements as well as any needed vaccinations indicated by parents. These services were recommended to the study team by the Ministry of Health (MOH) and are consistent with the standard checkup provided to children under age 5 in Zambia. To assess malaria infection, all children attending the checkup were administered a rapid diagnostic test (RDT). In accordance with MOH policy, RDTs were already stocked at all health centers at the time of the study. All diagnosed illnesses were treated by health care providers as part of the checkup, in accordance with the country's normal clinical protocols.

3.3 Data

Data were collected from three sources: a standard household interview, a medical record review by study staff placed at health centers, and a survey of study health center staffing and assets. The household survey instrument included information on demographics, household assets, previous health care utilization, and key indicators of the study child's physical and cognitive development. Information pertaining to the checkup itself, including the household identifier and the infections diagnosed and treated, were collected as part of a medical record review conducted by study staff at the health center immediately after each checkup was completed. Finally, information on health center infrastructure, equipment, drug stock, and staffing were collected as part of a survey conducted at each facility by study staff during a randomly-timed visit prior to the start of the experiment. Facility staff was not given advanced warning of this visit.

Household asset information was used to construct measures of wealth and poverty. First, an index of household wealth was created using principal component analysis (PCA) of asset information (Filmer and Pritchett 2001).[10] Then, the full study sample was dichotomized according to a poverty line set at the 61st percentile of the wealth index, in accordance with the most recent national poverty headcount ratio estimated for Zambia (World Bank 2010).[11,12]

4 Results

4.1 Sample characteristics and treatment balance

Of 543 households visited during the ZECDP follow-up, 535 consented to participate in the experiment. Table 1 presents characteristics of the sample population and includes p-values from mean difference tests across the randomized incentive levels.[13] All standard errors were cluster-bootstrapped using 500 replications to account for the design of the study (Cameron et al. 2008). The average age of study children at the time of the checkup was 85 months. All study children were age 7 by the end of the calendar year of the study, and therefore should have been enrolled in school at the time of the study according to official Zambian policy. However, only 59 percent of rural and 66 percent of urban study children were actually enrolled in school at the time of the experiment. Sixteen percent of study parents reported that their child was in poor health at the time of the experiment, with small difference between urban (18 percent) and rural households (14 percent). Urban households were on average substantially wealthier than rural households. The rates of poverty among urban and rural households were 37 percent and 83 percent, respectively. Finally, rural households were on average around 5.6 kilometers from the nearest study health center, while urban households were around 1.5 kilometers from the nearest health center. We find no significant associations between household characteristics and the randomized cash incentive level.

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10. See Appendix 2 for PCA estimates. Ten percent of participants had missing information on one household asset and an additional 2 percent had missing information on more than one household asset. These missing data were estimated prior to running PCA using multiple imputation methods.

11. While the study sample is not representative at the national-level, the proportion rural in the sample (55 percent) is not significantly different from the country as a whole (64 percent). Further, the poverty rates we calculate within urban and rural strata are very close to recent national estimates (34 percent and 80 percent, respectively) (Zambia Ministry of Finance and National Planning 2002).

12. Most CCT programs that are currently operating in developing countries use similar asset indices to identify households that are eligible for enrollment. Alatas et al. has recently shown that asset indices are an effective means for approximating consumption-based wealth (Alatas et al. 2012).

13. By chance, two dropped clusters and a cluster that was reclassified from rural to urban designation were originally randomized to the rural US$1.43 incentive treatment, so that in the final analysis data for this treatment group are sparse.

Table 1. Balance of household characteristics across levels of the randomized cash incentive

	Rural					**Urban**				
Randomized cash incentive (US$)	**0**	**0.41**	**1.43**	**3.06**	**p-value**	**0**	**0.41**	**1.43**	**3.06**	**p-value**
Child's age (months)	84.8	85.0	84.0	85.3	0.49	84.6	84.4	85.5	84.3	0.18
	(0.4)	(0.3)	(0.9)	(0.2)		(0.4)	(0.9)	(0.3)	(0.4)	
Percent of children female	50.0	51.9	53.8	45.3	0.68	38.3	47.4	50.6	38.5	0.14
	(3.5)	(4.0)	(13.9)	(4.2)		(3.3)	(3.0)	(5.0)	(6.1)	
Percent of children enrolled in school	55.3	56.8	60.0	62.0	0.99	55.7	59.5	74.7	69.6	0.44
	(13.5)	(17.0)	(12.3)	(12.1)		(10.0)	(3.0)	(9.8)	(9.9)	
Percent of children in poor health	7.6	29.6	6.7	5.4	0.30	12.3	20.5	18.2	23.2	0.89
	(4.0)	(17.8)	(6.2)	(3.5)		(6.9)	(7.9)	(8.3)	(15.5)	
Total children residing in the household	3.3	3.5	2.9	3.7	0.74	2.3	3.2	2.7	2.1	0.31
	(0.3)	(0.4)	(0.3)	(0.3)		(0.3)	(0.1)	(0.5)	(0.3)	
Percent of households in poverty	81.5	82.7	53.3	88.5	0.60	51.7	23.7	42.9	25.5	0.54
	(8.0)	(14.9)	(12.6)	(2.5)		(6.6)	(12.3)	(17.5)	(19.1)	
Percent of households with 1+ resident that completed primary school	80.0	66.7	66.7	70.5	0.77	91.8	81.6	80.5	82.1	0.85
	(5.6)	(12.3)	(11.9)	(13.1)		(4.5)	(4.3)	(14.2)	(8.6)	
Distance to the study health center (km)	4.7	5.5	2.5	7.8	0.49	1.9	0.6	1.6	1.3	0.59
	(1.7)	(1.4)	(0.0)	(1.9)		(0.6)	(0.3)	(0.7)	(0.5)	
Observations	115	84	15	82		66	39	78	56	
Clusters	6	4	1	4		4	3	5	4	

Notes: Standard errors are in parentheses. All standard errors are cluster-bootstrapped. P-values indicate the probability that at least one group differs from the others based on an ANOVA analysis of means and standard errors. The percent of study children in poor health is determined according to parental reports. Households in poverty are defined as those in the bottom 61 percent of population according to the household asset index.

4.2 Attendance at child health checkups

Table 2 presents ordinary least squares (OLS) estimates of the effect of the randomized cash incentive on checkup attendance. In the absence of financial incentives, no parents in urban areas brought their child to the checkup. In rural areas, uptake was substantial even without incentives, with 53 percent of parents in this group bringing in their child. The average effect of financial incentives on attendance at the checkup was positive as expected, with each US$1 increasing uptake by about 8 percentage points. In column 2 we estimate a non-parametric reduced form model to identify the marginal impact of each incentive level; while attendance increases monotonically with the incentive level, the marginal differences between the two larger incentives are small, and not statistically different.

In columns 3 – 6 we analyze households residing in rural and urban areas separately. This stratification was used during the incentive randomization procedure, and is important for two reasons. First, as mentioned above, in 2007 user fees at all rural health facilities were abolished, while at the time of the experiment utilization of child health services at urban public health facilities in Zambia incurred a US$0.51 fee. Second, the experiences of attending urban and rural facilities in Zambia are quite different, as are the associated time costs; urban facilities require on average longer wait times while rural facilities require longer travel times. While we find substantially lower uptake overall in urban areas, the basic incentive response looks remarkably similar, and none of the incentive effects vary significantly across the two residential areas.

We present estimates within poverty strata in columns 7 – 10. This stratification is important because nearly all currently operating CCT programs target transfers at households below the poverty line. We find that households below the poverty line were substantially more elastic in their responsiveness to incentives, particularly at lower incentive levels. Controlling for a broad set of covariates does not change the estimates presented in Table 2 in a meaningful way (see Appendix 3). However, a few interesting findings emerge when including controls. First, there is a strong negative association between wealth and checkup attendance in the full sample, within urban and rural strata, and within poverty strata. Second, there is a consistent negative relationship between distance from the health center and checkup attendance. Third, in urban and wealthier households, having more resident children is positively associated with checkup attendance.

Table 2. Relationship between the randomized cash incentive and attendance at the checkup
Dependent variable: probability of attending checkup

	Full sample		**Rural**		**Urban**		**Below poverty line**		**Above poverty line**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Incentive (continuous US$)	0.083		0.085		0.081		0.094		0.056	
	(0.030)***		(0.041)**		(0.051)		(0.041)**		(0.041)	
Incentive (ref: US$0)										
US$0.41		0.125		0.136		0.103		0.230		-0.091
		(0.161)		(0.225)		(0.088)		(0.159)		(0.197)
US$1.43		0.268		0.270		0.256		0.395		0.095
		(0.146)*		(0.159)*		(0.151)*		(0.232)*		(0.158)
US$3.06		0.273		0.287		0.250		0.326		0.127
		(0.100)***		(0.130)**		(0.146)*		(0.131)***		(0.135)
Rural	0.521	0.550					0.474	0.523	0.345	0.351
	(0.093)***	(0.085)***					(0.139)***	(0.111)***	(0.136)***	(0.141)***
Constant	0.055	-0.013	0.574	0.530	0.058	0.000	0.140	0.015	0.038	0.070
	(0.059)	(0.070)	(0.103)***	(0.119)***	(0.064)	(0.000)	(0.117)	(0.085)	(0.062)	(0.088)
R-squared	0.297	0.309	0.054	0.064	0.065	0.094	0.239	0.277	0.148	0.163
Observations	535	535	296	296	239	239	329	329	198	198
Clusters	31	31	15	15	16	16	26	26	26	26

Notes: Standard errors are in parentheses. All models are OLS with cluster-bootstrapped standard errors. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

4.3 Child health

Study children that attended the checkup were evaluated for a standard checklist of illnesses, including malaria, diarrhea, respiratory infection, and bilharzia. Frequencies for each of these illnesses, stratified by urban and rural status, are presented in Table 3.[14] There were high levels of illness among children that attended the checkup. Indeed, 71 percent of rural and 84 percent of urban children that received the checkup had at least one of the four illnesses mentioned above, and nearly one-third of children were diagnosed with more than one illness. Respiratory infection was highly prevalent among both urban (63 percent) and rural children (35 percent), and the same was true for diarrhea, found in 47 percent of urban and 36 percent of rural children. Malaria parasitemia was found in 28 percent of rural and 5 percent of urban children that attended the checkup. In addition to chronic infections, a small percent of children were diagnosed with minor skin conditions or hair lice.

Table 3. Child illness diagnosed at study checkups

	Rural (N = 191)	**Urban (N = 38)**
Diagnosis		
Malaria	28.3%	5.3%
Diarrhea	36.1%	47.4%
Respiratory infection	35.1%	63.2%
Bilharzia	4.7%	0.0%
Number of diagnoses		
0	28.8%	15.8%
1	42.9%	52.6%
2	23.6%	31.6%
3	4.7%	0.0%

In order to investigate whether there are any significant health differentials between poor and non-poor households, we regress the probability of having at least one diagnosable illness on household wealth in Table 4. In column 1, we show basic OLS results, which suggest a strong negative wealth gradient, with each standard deviation in wealth lowering the probability of diagnosed infection by 11 percentage points. However, illness data were only collected for children that attended the checkup, and given that selection into attending the health checkup was likely correlated with health, the OLS estimate of the wealth gradient is likely biased. To

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[14] Illness data were not collected for five study children who resided in the same rural cluster and attended the checkup at a facility where staff refused to allow medical record reviews.

address this concern, we show the results of standard Heckman models in columns 2 – 6, using the randomly assigned incentive level as an instrument for attendance in the first stage. As expected, the wealth gradient increases after accounting for selection. Overall, the Heckman estimates suggest that 66 percent of children in the study population had at least one infection at the time of the experiment.[15] Based on estimates from columns 3 and 4, we predict that rural children had a lower probability of illness (60 percent) than did urban children (74 percent). Using estimates from columns 5 and 6, we predict that children residing in households in poverty had a 69 percent probability of illness while children residing in households above the poverty line had a 52 percent probability. Finally, for all Heckman models presented in Table 4, we find that lambda, a measure of household propensity to attend the checkup due to unmeasured factors, is not significantly associated with the study child's probability of illness.[16]

We present estimates from several Heckman models with disease-specific dependent variables in Appendix 5. Predictions based on these estimates provide insight into the particular health care needs of study children, and also can be compared to published estimates of child illness in Zambia as a check on the validity of the Heckman specification that we employ. The predicted overall prevalence of malaria parasitemia in the rural study population (20 percent) is consistent with the findings of the recent Malaria Indicator Survey conducted in Zambia (Zambia Ministry of Health 2010). Further, the predicted prevalence of respiratory infection in the rural study population (26 percent), is consistent with the estimated prevalence of cough among rural children in the country according to the recent DHS (Zambia Central Statistical Office et al. 2009). Also consistent with recent surveys, we find almost no malaria among children in urban areas. While we estimate a relatively high rate of respiratory infection among urban children (70 percent), this may be explained by the fact that data were collected during the coldest climatologic season in Zambia, a period in which respiratory infections traditionally spike. The prevalence of diarrhea that we predict among rural (36 percent) and urban children (31 percent) is higher than the estimated prevalence according to the DHS (15 and 17 percent, respectively).

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15. The validity of predictions based on estimates from Heckman models rests on the assumption that the error term in the selection equation is normally distributed in the population. There is limited evidence to validate this assumption as it applies to this analysis. Decision making processes around the use of health care for children are complex and not well understood. Future research should aim to clarify these processes. If the assumptions of the Heckman model can be validated, this method may constitute a relatively inexpensive approach to estimating population-level illness prevalences.

16. We present probabilities of illness among children that attended the checkup stratified by the randomized incentive levels in Appendix 4.

Table 4. Child illness at the time of the experiment
Dependent variable: probability of having at least one illness

	Full sample		**Rural**	**Urban**	**Below poverty line**	**Above poverty line**
	OLS	**Heckman**	**Heckman**	**Heckman**	**Heckman**	**Heckman**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Household wealth (z-score)	-0.108	-0.135	-0.134	-0.191	-0.121	0.070
	(0.055)**	(0.066)**	(0.091)	(0.102)*	(0.088)	(0.268)
Child is female	0.078	0.084	0.093	0.035	0.073	0.225
	(0.068)	(0.057)	(0.068)	(0.113)	(0.063)	(0.161)
Children in household	-0.036	-0.032	-0.026	-0.055	-0.024	-0.127
	(0.016)**	(0.018)*	(0.020)	(0.038)	(0.018)	(0.082)
1+ resident completed primary school	-0.032	-0.041	-0.051	-0.024	-0.061	0.009
	(0.054)	(0.066)	(0.075)	(0.146)	(0.070)	(0.282)
Distance to study health center (km)	0.027	0.026	0.025	0.009	0.025	0.023
	(0.011)***	(0.008)***	(0.009)***	(0.042)	(0.009)***	(0.027)
Rural	-0.295	-0.249			-0.285	0.237
	(0.099)***	(0.112)**			(0.131)**	(0.254)
Constant	0.903	0.792	0.470	0.976	0.792	0.549
	(0.088)***	(0.187)***	(0.193)**	(0.250)***	(0.196)***	(0.640)
Lambda (inverse mills ratio)		0.091	0.213	0.033	0.178	0.292
		(0.128)	(0.199)	(0.151)	(0.148)	(0.268)
Uncensored observations	222	222	185	37	188	34
Censored observations		297	103	194	135	162
Clusters	20	30	14	16	26	26

Notes: Standard errors are in parentheses. For the OLS model in column 1, standard errors are cluster-bootstrapped. All Heckman models use the randomized cash incentive as an instrument for attendance in the first stage. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

This discrepancy may be explained by the fact that the DHS estimates prevalence according to parents' reporting of symptoms, and parents may have poor knowledge of diarrhea in older children. Further, recent studies have shown that methods that depend on recall for illness reporting, like those used in the DHS, may suffer from various forms of bias (Das et al. 2012, Manesh et al. 2008).

4.4 Child development

To illustrate the importance of infectious disease exposure on child welfare, we estimate associations between infections found in study children and four domains of child development: height, fine motor skills, verbal skills, and school enrollment. The heights of all study children were measured during the ZECDP interview using height boards consistent with UNICEF recommended specifications (Fink et al. 2011). To measure fine motor skills, interviewers administered an instrument that asked children to complete a series of 10 tasks, including copying letters, numbers, and recognizable shapes from a sample sheet to a blank piece of paper; placing beads on a string; buttoning a shirt; and picking beans from a surface and placing them in a cup. Children's verbal skills were measured using the Peabody Picture Vocabulary Test (PPVT), an instrument frequent employed in tests of child cognitive development (Naglieri and Pfeiffer 1983). The motor skills instrument and PPVT instrument were validated in the Zambian setting by the ZECDP study team prior to data collection. Data on fine motors skills and verbal skills were collected at the ZECDP baseline one year prior to the experiment, and therefore were not influenced directly by illness at the time of the experiment. For analysis, the number of motor skill tasks the child was able to complete and the child's score on the PPVT were normalized across the study population. Finally, parents provided information on child school enrollment during the household interview.

In Table 5, we explore within-cluster variation in diagnosed child infections, and show the estimated associations between infections and child development. The basic model we estimate is given by:

$$child\ development\ outcome_i = \alpha + \beta \cdot illness_i + \gamma_k \cdot controls_{i,k} + \delta_j \cdot cluster_j + \varepsilon_i$$

Where for individual i residing in cluster j, *illness* indicates alternatively the number of illnesses or the probability of malaria, and *controls* is a vector of k variables that include household

Table 5. Associations between illness at the checkup and child development

	Height (cm)		**Fine motor skills (z-score)**		**Verbal skills (z-score)**		**Enrolled in school**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Number of diagnoses	-1.312		-0.133		-0.097		-0.091	
	(0.498)***		(0.114)		(0.094)		(0.032)***	
Diagnosed with malaria		-1.088		-0.069		-0.284		-0.154
		(1.221)		(0.150)		(0.178)		(0.053)***
Household wealth (z-score)	-0.867	-0.848	0.423	0.430	0.154	0.136	0.099	0.092
	(1.105)	(1.206)	(0.154)***	(0.156)***	(0.147)	(0.144)	(0.082)	(0.089)
Child is female	-0.011	-0.164	0.089	0.074	0.064	0.043	-0.037	-0.047
	(0.567)	(0.585)	(0.181)	(0.182)	(0.095)	(0.091)	(0.065)	(0.066)
Children in household	-0.452	-0.383	-0.064	-0.058	0.053	0.059	0.020	0.024
	(0.287)	(0.287)	(0.045)	(0.045)	(0.049)	(0.053)	(0.023)	(0.022)
1+ resident completed primary school	0.671	0.796	0.219	0.239	0.243	0.207	0.129	0.117
	(1.189)	(1.108)	(0.110)**	(0.112)**	(0.171)	(0.169)	(0.057)**	(0.066)*
Constant	117.041	115.652	0.035	-0.114	-0.334	-0.361	0.552	0.486
	(1.855)***	(1.897)***	(0.323)	(0.302)	(0.281)	(0.299)	(0.112)***	(0.116)***
R-squared	0.182	0.165	0.329	0.322	0.596	0.601	0.438	0.435
Observations	192	192	222	222	222	222	197	197
Clusters	18	18	20	20	20	20	19	19

Notes: Standard errors are in parentheses. All models are OLS with cluster-bootstrapped standard errors. All models include cluster fixed effects. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

wealth, the child’s gender, the number of children residing in the household, and the education level of household residents. Finally, all models include cluster fixed effects.

The estimates show a consistent negative association between illness and measures of child development. For each illness, the child was on average 1.31 centimeters shorter, had 0.13 SD lower fine motor skills and 0.10 SD lower verbal skills, and was 9 percentage points less likely to be enrolled in school. There was a particularly strong relationship between malaria and school enrollment, with infected children 15 percentage points less likely to be enrolled. While access to health care at school may affect illness, these findings are consistent with a large body of evidence that finds that chronic infections are detrimental to child development (Walker et al. 2007).

5 Discussion

5.1 Possible mechanisms

The empirical estimates presented above have yielded three results that require further consideration: study parents’ poor knowledge of their children’s health and health care needs; the strong negative wealth gradient in checkup attendance; and the difference in attendance between urban and rural households.

We find that parents have poor knowledge of their children’s health care needs. In addition to parents reporting poor health in only 16 percent of study children, we find that households did not strongly select into attending the checkup based on child illness. One explanation for this finding is that parents do a poor job of recognizing illness present in their children. A recent study in Nigeria finds that mothers fail to recognize fever in their children in up to half of all cases (Rockers and McConnell 2013). Alternatively, it is possible that parents’ subjective definitions of what constitutes illness in their children are incongruous with the objective definition of illness that we employ in this study. In particular, parents may define only severe symptoms as illness, while the diagnosis-based criteria we use do not discriminate mild and severe forms of illness. From a policy perspective, parents’ subjective definitions of child illness and need for care may be less important than objective measures. If governments are to intervene to improve the health of children, verifiable health outcomes should constitute the core of welfare considerations.

We find a strong negative wealth gradient in checkup attendance within and across urban and rural strata. We also estimate a considerably more elastic response to increasing transfers among households below the poverty line, a finding that is supported by a large literature on the price elasticity of demand for health care (Asfaw et al. 2004, Dupas 2012, Gertler et al. 1987, Sahn et al. 2003). We have shown evidence of a negative wealth gradient in child illness that may account, at least in part, for the gradient in attendance. However, we also find that parents did not strongly consider their children's health when deciding whether to attend the checkup.

It is very likely that higher time costs associated with traveling to and waiting at health facilities among higher income parents contributes to the wealth gradient in attendance. The effect of time cost on attendance is difficult to estimate, however, because it is highly correlated with wealth. We do find evidence suggestive of the time cost explanation, including a negative effect of distance from the facility on attendance. We also find that among wealthier households the number of resident children is positively associated with checkup attendance, which may indicate older siblings rather than parents bringing children for checkups, a substitution that presumably lowers time costs. The experiment was conducted during an off-period in Zambia's agricultural cycle, so that the time costs for parents working in agricultural professions were likely very low.

It is possible that the negative wealth gradient in checkup attendance may be explained in part by greater substitution of private health care among wealthier households. However, the availability of private health services in Zambia is limited, and almost non-existent in rural areas. Through the 1990s, the private market for health care in Zambia was activity discouraged by the government in response to a strongly nationalist political climate, and only recently have policies been liberalized to allow a private market to begin to grow (Mudenda et al. 2008).

Finally, we find that rural households are more likely than urban households to attend checkups. Four factors may explain this discrepancy: user fees, time costs, facility quality, and responsiveness to the checkup invitation independent of incentives. At the time of the experiment, use of child services at urban health centers incurred a US$0.51 user fee while rural health centers charged no fee. In addition to levying user fees, urban facilities in Zambia have substantially longer waiting times than do rural facilities. This fact, coupled with the fact that urban participants are on average wealthier than rural participants, suggests that time costs are substantially higher among urban households.

Urban health centers in Zambia must respond to much higher population demand for services, and as a result their infrastructure and staffing are scaled up relative to rural health centers. Table 6 summarizes characteristics of study health centers, assessed during a randomly-timed visit to each.

Table 6. Characteristics of study health centers

	Rural (N = 15)	**Urban (N = 16)**
Clinical staff present at random visit		
Physicians and clinical officers	0.067	3.125
	(0.067)	(0.464)
Nurses	1.000	13.250
	(0.258)	(1.704)
Facility infrastructure and equipment		
Electricity	0.600	1.000
	(0.131)	(0.000)
Running water	0.400	0.938
	(0.131)	(0.063)
Examination rooms	1.733	5.188
	(0.228)	(0.853)
Working stethoscopes	1.867	5.063
	(0.389)	(0.668)
Pharmacy stock at random visit		
Rapid diagnostic test (RDT) to assess malaria parasitemia	1.000	1.000
	(0.000)	(0.000)
Artimisinin-based combination therapy	1.000	1.000
	(0.000)	(0.000)
Oral rehydration therapy	0.933	0.938
	(0.067)	(0.063)
Penicillin	1.000	0.938
	(0.000)	(0.063)
Amoxicillin	1.000	1.000
	(0.000)	(0.000)

Notes: Standard errors are in parentheses. Clinical officers are a cadre of non-physician clinicians trained and employed in Zambia.

As expected, urban health centers have substantially more clinicians, infrastructure, and equipment. Both urban and rural facilities have a good stock of essential medicines, with more than 90 percent of facilities in both settings having artimisinin-based combination therapy for malaria treatment, oral rehydration therapy for diarrhea treatment, and penicillin and amoxicillin for treatment of respiratory infections. There is very little variation in facility characteristics within urban and rural strata, making it difficult to isolate their effect on attendance. However, if these characteristics have an effect, it is likely that they contribute to increased attendance at urban facilities relative to rural, rather than the other way around.

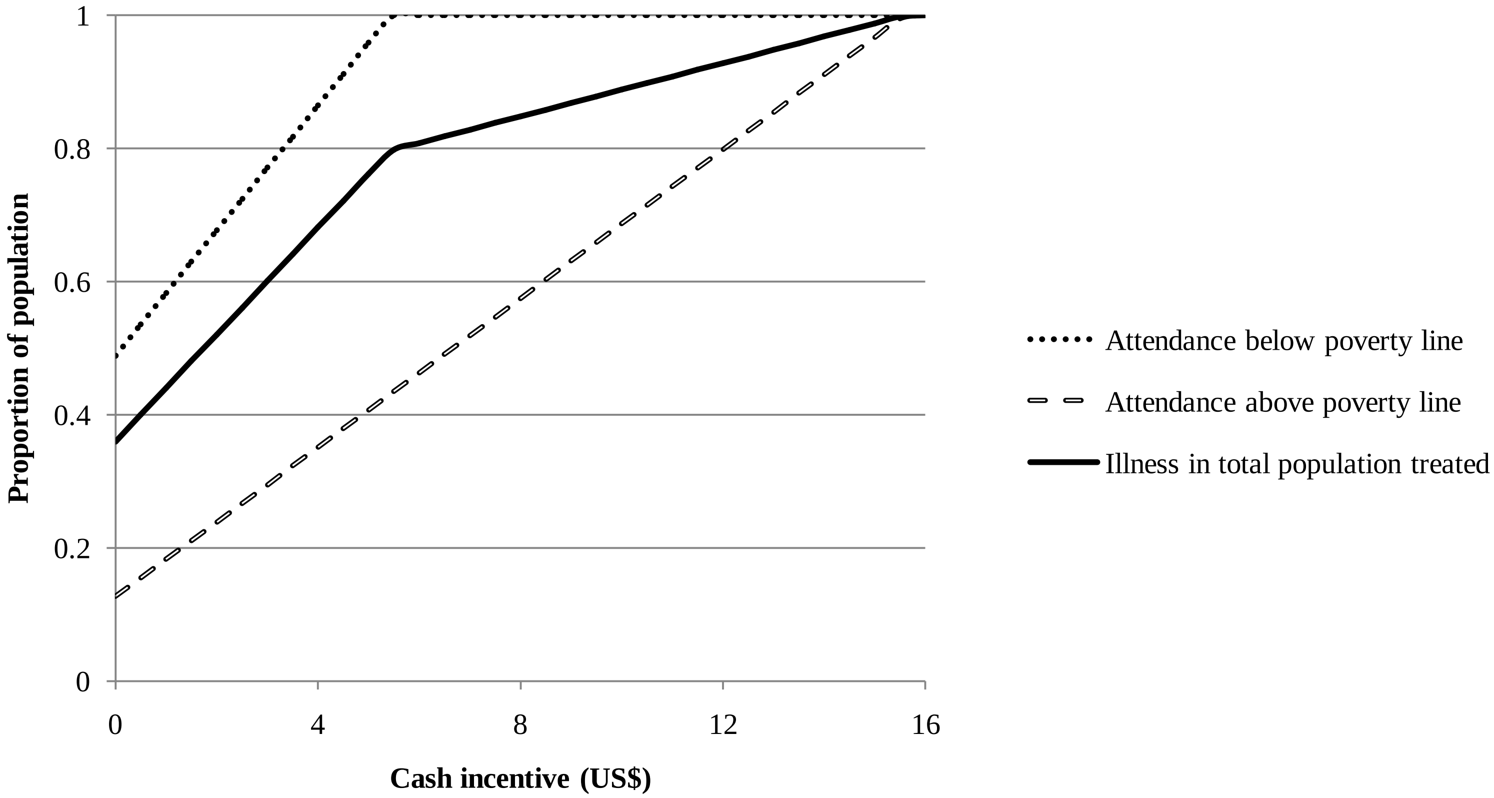
Among rural households, information and an invitation without incentives is sufficient to induce many parents to bring their children to checkups. We do not observe the same effect among urban households. While part of the differential effect between these settings is likely due to the cost considerations discussed above, it is also possible that the psychological effect of an invitation on urban and rural parents is different. There is evidence from previous research that behavioral nudges can have measurable effects on utilization of preventive health care services, particularly vaccinations (Banerjee et al. 2010, Milkman et al. 2011). The information and invitation presented to study parents were in many respects similar to nudges implicit in CCT programs currently operating in many developing countries.

5.2 Policy considerations

In order to provide a sense of population-level coverage achievable through various incentive schemes, we estimate uptake statistics for a range of incentives. Given that only four price points are available, further parametric assumption is needed to identify the full demand function; in Figure 2 we show the demand functions for households both above and below the poverty line in their simplest linear form, based on estimates presented in columns 7 and 9 in Table 2. In the figure we also show the proportion of child illness in the total population that is treated at various incentive levels, based on estimates presented in Table 4.

There are two important findings presented in Figure 2. First, a transfer of around US$16 is required to achieve full attendance at checkups in Zambia. However, when basing predictions on non-parametric estimates of responsiveness, much larger incentives are required to reach full attendance due to diminishing marginal effects. Second, given that there is minimal selection into attendance based on child illness, the proportion of illness treated in the full population is roughly equal to the total proportion of households that attend the checkup. For all incentive levels, the cost per sick child treated is equal to around 135 percent of the incentive, reflecting the fact that around one-third of children that attend the checkup are not sick. For an incentive of

Figure 2. Predicted impact of a range of incentives on checkup attendance and illness treated



Notes: Attendance predictions are based on estimates presented in columns 7 and 9 in Table 2. Predictions of illness treated are based on estimates presented in Table 4.

US$5, potentially affordable for a developing country like Zambia when administered quarterly, 96 percent of households below and 41 percent of households above the poverty line attend the checkup; in total, 64 percent of children with infections are treated at a cost of around US$7 per sick child treated, not including the cost of treatment.

6 Conclusions

Governments in developing countries are increasingly targeting incentives for routine health checkups at young children in poor households as part of large-scale CCT programs. In this paper we use data from a cluster-randomized experiment conducted in Zambia to investigate parental responsiveness to cash incentives for health checkups for children of early school-age. Our analysis yields four key findings. First, there is a substantial amount of untreated infection among school-age children in Zambia, both below and above the poverty line. Second, an invitation and small incentives induce substantial uptake of checkups, particularly in rural areas. Third, there is a strong negative wealth gradient in checkup attendance, likely due to higher time costs among the wealthy. Fourth, parents have poor knowledge of their children's health care needs.

These findings have important implications for policy in developing countries such as Zambia. While governments generally focus health programs on children under the age of five, we show in this study that the need for these programs clearly extends beyond age five. Children in this study were 6 and 7 years old at the time of the experiment, and this paper is one of the first to document the disease burden for this population. There is strong evidence that parents in developing countries often fail to seek treatment for sick children (Stallings 2004), and parental efforts appear to be particularly limited for older children, who are generally more independent and may be perceived to be less in need of medical attention. Early treatment of highly prevalent diseases such as diarrhea, malaria, hookworms, pneumonia and other respiratory infections has been shown to reduce the risks of malnutrition, stunting, impaired cognitive development, and in some cases mortality (Grantham-McGregor et al. 2007, Miguel and Kremer 2004, Thwing et al. 2011, Walker et a. 2007, UNICEF and WHO 2009, WHO and UNICEF 2004). While mortality risks among older children are reduced, recent evidence suggests that adversity experienced after age five can have as much of a detrimental impact on physical and cognitive development as adversity experienced during early childhood (Crookston et al. 2013, Fink and Rockers 2013).

The potential welfare gains from incentive programs for routine health checkups for school-age children in developing countries appear substantial.

We show that children residing in non-poor households in Zambia are in need of health improving interventions. Wealthier households may have more resources to invest in the health of their children, but parental failures in recognizing illness appear to limit the benefits that wealth affords sick children. While expanding conventional CCT programs to include non-poor households may reduce their redistributive impact, doing so could significantly improve child health. However, even universal incentive programs may only reach a portion of non-poor children because time costs appear to implicitly screen wealthier households out of attending checkups. If redistribution is the primary goal of cash transfer programs, wealth-based eligibility thresholds and the administrative costs required to enforce them may not be necessary in the context of health. Furthermore, additional redistribution may be achieved through unconditional transfers implemented alongside incentives for checkups.

Finally, the fact that parents are generally unaware of their children's health care needs underscores the advantages of a checkup model of care that does not require parents to recognize illness. However, in the absence of price screening the efficiency of programs that provide incentives for checkups is limited, as many households with perfectly healthy children end up receiving benefits. Partly as a result of this, we find that relatively large incentives are required to address a majority of the disease burden among children in Zambia. Interventions that aim to improve parental recognition of child illness may make incentive programs more efficient and may even obviate the need for blunt incentive instruments entirely.

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Appendix 1. Invitation for child health checkup

CHILD MEDICAL CHECK-UPS
ARE IMPORTANT
FOR YOUR CHILD'S HEALTH

Your child may be infected or infested even if they aren't sick:

- Malaria even if they don't have fever.
- Parasites or worms in their intestines.
- Harmful bacteria in their stomach that causes diarrhea.
- Harmful bacteria in their lungs that causes cough.
- Lice in their hair or bed bugs on their body.
- Bad hygiene that can lead to tooth and nail problems

Your child needs help to fight possible future health problems:

- Receive all vaccinations.
- Vitamins & nutrients they need to be healthy.

TAKE THE CHILD TO A VOLUNTARY CHECK AT:
KAPARA CLINIC
NEXT WEEK:
MONDAY, AUGUST 8 –
SUNDAY, AUGUST 14
BETWEEN 8:00 AND 17:00

AT THE FACILITY, WE WILL GIVE YOU:
2,000 KWACHA
BRING THE CHILD AND THIS PAPER

ASK FOR THESE CHILD HEALTH SERVICES

Physical exam & treatment if the child has any of the following:

- Parasites, worms, harmful bacteria, lice, bed bugs, lung infection

Test for malaria & treatment if the child has malaria
Any vaccinations the child still needs
Vitamin A Supplements
Education on good hygiene

Appendix 2. Principal component analysis of household assets

Table A2.1. Summary of household asset ownership

	Proportion of households with asset			**First principal component**
Asset	**Full sample**	**Rural**	**Urban**	**Full sample**
Television	0.38	0.25	0.55	0.33
Stove	0.22	0.08	0.41	0.37
Electricity	0.30	0.16	0.48	0.35
Running water	0.20	0.06	0.37	0.33
Flush toilet	0.16	0.07	0.27	0.33
Automobile	0.03	0.02	0.04	0.12
Child has 4+ sets of clothes	0.74	0.69	0.79	0.16
Child has shoes	0.71	0.58	0.87	0.24
Radio	0.65	0.69	0.60	0.15
Child sleeps in own bed	0.69	0.70	0.68	0.14
Cement or tiled floors	0.53	0.36	0.75	0.29
Bicycle	0.45	0.64	0.20	-0.12
Cell phone	0.63	0.48	0.82	0.25
Field plough	0.11	0.17	0.03	-0.08
Animals	0.32	0.47	0.13	-0.18
Farming land	0.48	0.73	0.15	-0.27

Notes: the first principal component explains 33 percent of the total sample variation

Appendix 3. Attendance at the checkup

Table A3.1. Relationship between the randomized cash incentive and attendance at the checkup with full set of controls
Dependent variable: probability of attending checkup

	Full sample		**Rural**		**Urban**		**Below poverty line**		**Above poverty line**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Incentive	0.102		0.088		0.119		0.112		0.087	
(continuous US$)	(0.029)***		(0.054)*		(0.048)***		(0.050)**		(0.031)***	
Incentive (ref: US$0)										
US$0.41		0.121		0.154		0.046		0.180		-0.057
		(0.124)		(0.200)		(0.183)		(0.164)		(0.144)
US$1.43		0.280		0.293		0.261		0.374		0.189
		(0.126)**		(0.159)*		(0.192)		(0.224)*		(0.134)
US$3.06		0.328		0.297		0.349		0.362		0.225
		(0.101)***		(0.215)		(0.202)*		(0.177)**		(0.104)**
Household wealth	-0.150	-0.154	-0.179	-0.190	-0.134	-0.136	-0.170	-0.150	-0.151	-0.157
(z-score)	(0.045)***	(0.049)***	(0.056)***	(0.067)***	(0.092)	(0.098)	(0.119)	(0.113)	(0.068)**	(0.076)**
Child is female	0.034	0.028	0.058	0.057	0.016	0.007	0.064	0.055	-0.015	-0.021
	(0.039)	(0.037)	(0.061)	(0.058)	(0.040)	(0.036)	(0.047)	(0.043)	(0.052)	(0.053)
Children in household	0.025	0.023	0.018	0.018	0.041	0.038	0.002	-0.003	0.071	0.073
	(0.013)*	(0.013)*	(0.019)	(0.018)	(0.016)***	(0.016)**	(0.015)	(0.015)	(0.027)***	(0.025)***
1+ resident completed	-0.067	-0.052	-0.012	0.006	-0.159	-0.141	-0.106	-0.096	0.002	0.021
primary school	(0.045)	(0.052)	(0.061)	(0.065)	(0.066)**	(0.083)*	(0.055)*	(0.059)*	(0.133)	(0.135)
Distance to study health	-0.025	-0.024	-0.023	-0.022	-0.017	-0.021	-0.027	-0.025	-0.022	-0.016
center (km)	(0.013)**	(0.014)*	(0.016)	(0.024)	(0.049)	(0.076)	(0.020)	(0.022)	(0.021)	(0.022)
Rural	0.437	0.462					0.496	0.545	0.325	0.310
	(0.105)***	(0.105)***					(0.171)***	(0.163)***	(0.112)***	(0.121)***
Constant	0.135	0.071	0.537	0.465	0.141	0.116	0.163	0.076	0.034	0.027
	(0.086)	(0.112)	(0.165)***	(0.195)**	(0.138)	(0.221)	(0.147)	(0.145)	(0.149)	(0.180)
R-squared	0.392	0.401	0.179	0.193	0.234	0.249	0.296	0.318	0.343	0.362
Observations	519	519	288	288	231	231	323	323	196	196
Clusters	31	31	15	15	16	16	26	26	26	26

Notes: Standard errors are in parentheses. All models are OLS with cluster-bootstrapped standard errors. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Appendix 4. Incentive level and illness

Table A4.1. Probability of illness among children that attended the checkup stratified by randomized incentive level

	Incentive level (US$)				
	0	**0.41**	**1.43**	**3.06**	**p-value**
At least one illness	60.714	85.000	71.875	74.074	0.80
	(9.997)	(4.250)	(11.754)	(7.406)	
Malaria	23.314	31.667	9.375	25.926	0.92
	(9.005)	(11.825)	(2.559)	(5.916)	
Diarrhea	17.857	63.333	37.500	33.333	0.78
	(7.429)	(4.961)	(14.284)	(8.204)	
Respiratory infection	33.929	35.000	43.750	45.679	0.36
	(8.263)	(8.543)	(11.962)	(10.625)	
Bilharzia	1.786	13.333	0.000	0.000	0.05
	(1.959)	(4.461)	(0.000)	(0.000)	
Observations	56	60	32	81	
Clusters	5	5	4	6	

Notes: Standard errors are in parentheses. All standard errors are cluster-bootstrapped. P-values are from OLS regression of illness on linear incentive level variable.

Appendix 5. Types of illness in study children

Table A5.1. Child illness at the time of the experiment in rural children

	Malaria		**Diarrhea**		**Respiratory infection**		**Bilharzia**	
	OLS	**Heckman**	**OLS**	**Heckman**	**OLS**	**Heckman**	**OLS**	**Heckman**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Wealth (z-score)	-0.076	-0.104	-0.095	-0.092	0.021	-0.038	-0.055	-0.080
	(0.044)*	(0.085)	(0.066)	(0.098)	(0.061)	(0.095)	(0.034)*	(0.044)*
Child is female	-0.036	-0.028	0.109	0.108	0.085	0.102	-0.009	-0.001
	(0.055)	(0.064)	(0.044)***	(0.073)	(0.065)	(0.071)	(0.039)	(0.033)
Children in household	0.009	0.011	-0.031	-0.031	-0.011	-0.006	-0.020	-0.018
	(0.020)	(0.019)	(0.026)	(0.021)	(0.015)	(0.021)	(0.012)	(0.010)*
1+ resident completed primary school	-0.322	-0.325	-0.003	-0.003	-0.069	-0.075	0.037	0.035
	(0.104)***	(0.070)***	(0.066)	(0.080)	(0.069)	(0.078)	(0.044)	(0.036)
Distance to study health center (km)	0.016	0.015	0.001	0.002	0.041	0.039	-0.007	-0.008
	(0.011)	(0.008)*	(0.018)	(0.010)	(0.011)***	(0.009)***	(0.005)	(0.004)*
Constant	0.355	0.286	0.357	0.363	0.192	0.046	0.100	0.038
	(0.085)***	(0.181)	(0.188)*	(0.207)*	(0.095)**	(0.201)	(0.054)*	(0.093)
Lambda (inverse mills ratio)		0.095		-0.009		0.201		0.085
		(0.188)		(0.216)		(0.208)		(0.096)
Uncensored observations	185	185	185	185	185	185	185	185
Censored observations		103		103		103		103
Clusters	14	14	14	14	14	14	14	14

Notes: Standard errors are in parentheses. For OLS models, standard errors are cluster-bootstrapped. All Heckman models use the randomized cash incentive as an instrument for attendance in the first stage. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Table A5.2. Child illness at the time of the experiment in urban children

	Malaria		**Diarrhea**		**Respiratory infection**	
	OLS (1)	**Heckman (2)**	**OLS (3)**	**Heckman (4)**	**OLS (5)**	**Heckman (6)**
Wealth (z-score)	-0.132	-0.188	-0.172	-0.174	-0.050	-0.042
	(0.106)	(0.063)***	(0.148)	(0.133)	(0.133)	(0.143)
Child is female	-0.119	-0.127	0.088	0.087	-0.205	-0.204
	(0.057)**	(0.072)*	(0.202)	(0.147)	(0.119)*	(0.159)
Children in household	-0.004	0.005	0.027	0.027	-0.091	-0.092
	(0.042)	(0.024)	(0.057)	(0.049)	(0.088)	(0.053)*
1+ resident completed primary school	0.105	0.047	-0.439	-0.441	-0.038	-0.029
	(0.104)	(0.093)	(0.112)***	(0.189)**	(0.131)	(0.204)
Distance to study health center (km)	0.015	0.013	0.012	0.012	-0.072	-0.072
	(0.072)	(0.027)	(0.521)	(0.054)	(0.389)	(0.058)
Constant	0.033	-0.091	0.669	0.666	1.156	1.175
	(0.254)	(0.157)	(0.442)	(0.324)**	(0.461)***	(0.349)***
Lambda (inverse mills ratio)		0.135		0.004		-0.021
		(0.093)		(0.195)		(0.211)
Uncensored observations	37	37	37	37	37	37
Censored observations		194		194		194
Clusters	6	16	6	16	6	16

Notes: Standard errors are in parentheses. For OLS models, standard errors are cluster-bootstrapped. No urban study children who attended the checkup had bilharzia. All Heckman models use the randomized cash incentive as an instrument for attendance in the first stage. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.