Towson University
Department of Economics
**Working Paper Series**

Working Paper No. 2012-03

# Oh Brother! Testing the Etiology of Sibling Effects Using External Cash Transfers

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March, 2012

# Oh Brother! Testing the Etiology of Sibling Effects Using External Cash Transfers[1]

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March 2, 2012

## Abstract

Siblings can slow child development, but distinguishing intrinsic from economic circumstances has been more difficult. The grants of the *Oportunidades* Mexican welfare program allow us to test this linkage. We investigate whether transfers increase firstborn characteristics faster than other children's characteristics, and whether the observed negative effects of being part of a larger set of siblings stem from having to share household resources. We find that firstborn children get larger physical and verbal benefits from transfers, but behavioral improvements are less tied to cash than to program participation. Children in larger households seem resource constrained; there, transfers have larger impacts.

JEL codes: O12, J13, I38

Keywords: PROGRESA, Oportunidades, Mexico, conditional cash transfers, child development, child health, sibling effects, intrahousehold allocation

[1] We would like to thank Ann Weber for research assistance, participants in the Towson University Economics Seminar, and the Mexican Instituto Nacional de Salud Pública. All errors are our own. We are grateful for funding from the Towson University Faculty Development and Research Committee which made this paper possible.

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Proverbs 17:17, New International Version: “A friend loves at all times, and a brother is born for adversity.”

Proverbs 17:17, New Revised Standard Version: “A friend loves at all times, and kinsfolk are born to share adversity.”

## Introduction

Are brothers and sisters “born for adversity” or “born to share adversity”?

Decades of studies indicate that children with the fewest siblings tend to do better on standardized tests and educational outcomes. Downey (2001) reviews 20 papers, concluding that individuals with fewer siblings perform better on a wide range of tests of cognition and achievement. Addressing a closely related topic a quarter century earlier, Zajonc and Markus (1975) review a number of studies dating back to the 1930’s demonstrating negative links between birth order and juvenile delinquency, performance on the Raven Progressive Matrices test of intelligence, and scores on the verbal portion of the Scholastic Aptitude Test (SAT). Looking at a sample of over 386,000 Dutch men, Belmont and Marolla (1973) identify birth order and family size gradients in intelligence. Almost twenty years prior to their work, Anastasi (1956) found 18 studies from prior decades linking an increased number of siblings with decreased cognitive performance as measured by a variety of standardized tests. And long before that, Galton (1874) cited the intellectual advantages of the eldest born child. It has been historically difficult, however, to tell whether the negative implications of having a greater number of siblings are intrinsically associated with having to share limited resources such as parental time or monetary resources, or whether the associations are due to confounding because less educated parents tend to have more children and also tend to have children who do more poorly on the evaluated outcomes.

Theories abound as to the origin of the firstborn advantage. In a concise and convincing piece, Kristensen and Bjerkedal (2007) seem to rule out a biological explanation for the decline in IQ associated with higher birth order. In their data, second-born children average about 3 points of IQ lower than firstborns, and third-born children are about a point and a half below second-borns, differences that are highly significant. However, they find that children whose older siblings died in infancy demonstrate an average level of IQ similar to that normally associated with a child of a higher birth order. Parental resource allocation is another major factor, as noted by Behrman (1988) and Ayalew (2005). However, it has always been difficult to separate out the effects of social class, total resources, resource allocation, and other simultaneous choices made in a household.

By providing access to external grants, the *Oportunidades* Mexican welfare program gives us an opportunity to test the resources-sibling effects link. Using these data we investigate whether cash transferred to the household could counteract the negative effects of siblings on child development. Further, we look at how sibship size (the number of brothers and sisters one has) affects consumption expenditures at the margin. Finally, we explore whether the advantage associated with being the firstborn is intrinsic, i.e. whether it stems from that child's opportunity to monopolize parental attention before the birth of the second child, or whether the advantage lasts longer, affecting household spending patterns and parental behaviors in an ongoing way. The government transfer in *Oportunidades* allows us to test whether transfers increase firstborn characteristics faster than other children's characteristics, and whether the observed negative effects of having a larger sibship size are intrinsic or whether the effects stem from having to share fewer household resources.

## Literature Review

### *I. Operationalizing Child Development*

Child development is a multidimensional and dynamic process. As children mature, they develop physically, mentally, and emotionally, and while the processes are to some extent interdependent they can be analyzed separately. We use two indicators of nutritional status (physical development): height-for-age z-score and body mass index percentile for age, both of which are defined in terms of comparisons to international standards delineated by the World Health Organization (WHO 2009). We also examine cognitive, verbal, and behavioural development.

The first outcome of interest in this paper is height for age. Growth patterns of children under age 5 are similar for all ethnic groups (WHO 2006) and growth charts allow the conversion of child height into z-scores based on observed means and standard deviations for children of a given age and sex based on a reference population. Height for age is often described as an indicator of long-term nutritional status among children (Waterlow et al. 1977, Strauss & Thomas 1998). It is also an indicator of a child's underlying health status, and children showing lower levels of physical development for their age are often delayed in their mental development as well (Hoddinott & Kinsey 2001, Grantham-McGregor et al. 2007). Many studies have evaluated children's growth with reference to such a standardised population in order to estimate the health effects of natural disasters and various policy interventions, (see e.g. Balk et al. 2005, Hoddinott & Kinsey 2001, Goncalves-Silva et al., 2005). After evaluating a number of measures, one study concludes that height for age is the best predictor of human capital (Victora et al. 2008). Early height for age is linked to cognitive and language ability at age 5 and has been linked to psychological functioning during adolescence and the probability of employment at age 20-22 (Walker et al. 2011).

We also consider a variety of other measures of child development. Our second outcome, body mass index for age, is another indicator of nutritional status. Extremes of BMI for age indicate undernutrition or overweight/ obesity. We use two indicators of cognition: indicators of cognitive and verbal development were taken from the Wechsler Abbreviated Scale of Intelligence (Wechsler 1999), a shorter version of the Wechsler Intelligence Scales III adapted for use in Mexico by researchers at the Mexican Perinatal Hospital in Mexico City, Mexico. Finally, to assess behavioral development we use a modified version of the Strengths and Difficulties Questionnaire (Woerner et al. 2004). These questions were put to mothers in regards to their own children. This questionnaire has been used all over the world, and was piloted and adapted as necessary (Fernald et al. 2009). Thus, we are able to compare the importance of resources and siblings on a variety of facets of child development

## *II. Siblings' effects on child development*

A number of studies have looked into the associations between the number of siblings and child development. In developing countries, where families are more likely to be resource-constrained, some researchers have linked larger sibship size to worse nutritional status. Using data from Colombia, Baez (2008) finds an association between family size and a greater prevalence of malnutrition. Horton (1986) finds a similar association in the Philippines. Behrman (1988) describes Indian parents being forced to choose among children during seasons in which households have little food. Glick, Marini, and Sahn (2007) use first birth twins as an exogenous fertility shock and identify strong negative impacts on the nutritional status of subsequently born children.

In the context of Latin American conditional cash transfer programs, Gitter, Manley, and Barham (2010) find that under certain circumstances the presence of older siblings can turn a conditional cash transfer program into a hindrance to child (physical) development rather than a facilitator.

Although their analysis finds that Mexico's CCT showed no such problem, by requiring children to attend school rather than participate in income-generating activities, households participating in some CCTs may not earn enough to compensate for the loss of income. They hypothesize that by capping the amounts of transfers available in an effort to avoid stimulating fertility, programs such as Nicaragua's *Red de Protección Social* may have gone too far in the other direction, inadvertently punishing families with more children.

Other studies find weaker effects, identifying much smaller effects of household environment on cognitive ability. Kirkpatrick, McGue and Ianoco (2009) ascribe 18% of IQ to children's environments, ascribing as much as 60% to genetic influences, while Petrill et al. (2004) find that just 5% of children's verbal skills at ages 3-4 can be traced to the combined effects of socioeconomic status (SES) and chaos in the home.

What exactly is behind the observed relationship of these variables with birth order? A number of proximate and distal factors affect child health. The next section explores some hypotheses about the links between SES, sibship size or birth order, and child development.

## Theory

Downey (2001) refers to two main schools of thought regarding the means by which siblings may affect a child's intellectual development. One theory is called the "confluence" model, and it contends that siblings' negative effects on a child's development are largely inherent and unavoidable. Zajonc and Markus (1975) describe the "intellectual environment" of a household in terms of the average level of intellectual development of the members, and note that a larger share of children in the household implies a lower mean level of intellectual development. One frequent empirical observation that fits with this theory is that parents and teachers speaking to children "tend to regress to the level of their charges" (84). Further, larger gaps between children tend to benefit the intellectual development of younger children but hinder that of older children.

Downey himself is an advocate of the "resource dilution" theory which, he contends, subsumes the confluence theory. While the claims of confluence theorists may or may not be true, he argues, there are other relevant factors to be considered such as the sharing of scarce parental resources ranging from money to pay for educational goods to parental time engaging the child (Downey 1995). While some goods such as books may be shared among siblings, others such as tuition expenses cannot, forcing parents to divide their scarce resources.

The question, then, is the extent to which financial resources are able to compensate for the negative effects of having more siblings.

In this paper we look separately at the effects of being firstborn and that of sibship size. To look at birth order as well as sibship size, we test the effects of a child's being the firstborn in addition to directly including the number of siblings in the regression. Every family with one or more children has an oldest child, and we test the effects of being that oldest child. Confluence theory predicts a level effect: firstborn children should develop better intellectually regardless of resources, since siblings bring down the intellectual atmosphere. Thus, the marginal effect of resources should be the same for a firstborn as for any other child. Resource dilution says that the marginal impact of additional resources is higher for a firstborn because there is a period of time in which the firstborn is the only child, so for some time the benefits are not dispersed. (Our data only include children who were born around the beginning of the program.)

We now consider different development outcomes separately, describing the relevant theory and making predictions about each.

## *I. Physical development*

The most obvious mechanism by which the presence of siblings affects child development is through the need for increased sharing of food, as articulated in models by Horton (1988) and Behrman (1988). Though young children require less food than older children and adults, when resources are limited there is may be at least a small negative impact on available food when another person is at the table. Further, pregnancy and childbirth will increase an expectant mother's food intake. Thus, predictions are clear: we expect more income to mitigate the penalty imposed (even prenatally) by siblings on a child's nutritional status.

With respect to birth order rather than sibship size, Behrman (1988) notes that when resources are restricted, resources are more often directed to older children. Therefore being firstborn should be an advantage. On the other hand, Horton (1988) notes that if the advantages associated with birth order stem from resource constraints, then households should allocate additional resources so as to alleviate the disequilibrium.

An opposing theory is child investment theory. In Gaviria's (2002) update of Becker and Tomes' (1986) model, parental aversion to inequality moderates parents' wealth-maximizing investments in human capital according to the endowments of each child. Thus, the aversion to inequality may dominate or the wealth-maximizing investments may dominate. Gaviria finds in favor of the latter among poor households in his US data, where intragenerational heterogeneity in investments is observed. Since firstborns tend to have higher IQ (though apparently not for any biological reason, as noted by Kristensen and Bjerkedal 2007), wealth-maximizing investments would predict a small advantage to firstborns when resources are allocated. Marginal effects of the exogenous transfers will let us tell whether the firstborn advantage is inherent or ongoing.

**Predictions:** Having more siblings should be negatively correlated with nutritional status. The positive income shock of the CCT should counter the effects to some extent. Being firstborn should be correlated with better nutritional status. Child investment theory predicts that the positive income shock will disproportionately benefit firstborns' physical development, while the hypothesis of parental aversion to inequality (i.e. resource dilution with a binding budget constraint) predicts the opposite.

### *II. Emotional and mental development*

Two theories of parenting would predict positive effects of additional siblings and little to no effect of income on child emotional development. Strohschein et al. (2008) apply resource dilution theory to the case of child psychological development, considering two aspects of parenting behavior. They differentiate parent-child interaction into "positive interaction" and "consistent parenting." "Positive interaction" is the extent to which parents respond to their children's needs by spending time and nurturing them. "Consistent parenting" is establishing and enforcing boundaries for acceptable behavior. Having a low birth order is advantageous for both. However, although additional siblings are competitors for parental attention in terms of "positive interaction," increases in sibship size over time actually increase "consistent parenting." Brannigan et al. (2002) show that "consistent parenting" matters for preventing delinquency, while "positive interaction" does not.

Yeung, Linver, and Brooks-Gunn (2002) and Conger, Conger, and Martin (2010) contrast the resource dilution hypothesis with the family stress perspective. Yeung et al. (2002) contend that mental development is likely tied to the presence of a stimulating learning environment, something that can be "purchased" to some extent either through material goods such as books and toys or through freeing up the mother for increased interaction. Emotional development, on the other hand, depends on how much stress parents are under. The authors show that the marginal contribution of income to stress reduction is small, though larger income shocks cause stress. Conger et al. (2010) cite Yeung et al. (2002) and many others, noting that no evidence has supported resource dilution other than studies performed on cross-sectional data. They call for studies using panel data.

Several works link income to child emotional development, but most contend that the relationship is indirect. A usual argument is that income decreases maternal health which in turn improves child emotional development (Conger et al. 2010, Duncan and Brooks-Gunn 2000). One survey of the early literature finds that income effects explain a larger share of cognitive development than they do of emotional development (Brooks-Gunn and Duncan 1997). Duncan and Brooks-Gunn (2000) disentangle the various pathways through which income can affect child development, and they conclude that about half of the effect comes through improvements in the home environment. This leads them to argue that programs such as Head Start are more effective than direct cash transfers at improving child development.

Effects of birth order on emotional/ behavioral development are summarized by Begué and Roché (2005). Firstborn children are less likely to become delinquent than middle born children, though the effects are small when parental supervision and sibship size are controlled for. The authors are surprised to find no sibship size effects after they control for parental supervision and SES, though that is consistent with Strohschein's hypotheses.

A series of studies by Erika Hoff link linguistic development in particular to birth order and sibship size. Children's verbal activity develops through parental instruction, which may include shared reading or teaching letter-sound knowledge (Duncan and Seymour 2000). For some period parents are able to focus on their oldest child, which may be why Hoff finds that firstborn children tend to develop lexical and grammatical skills more quickly, while later-borns have an advantage in developing conversational skills (Hoff-Ginsburg 1998). High SES children develop productive vocabularies more quickly compared with lower SES children, but most studies to date have only shown correlation, limiting the potential for causal inference. Possibilities include the link between mental and physical development: high SES children could have better genes or be healthier. The effects could also be traceable to differences in language-learning experiences: high SES children's mothers speak in a way that is conducive to children's verbal development. In a study of sixty-three mothers and children, differences in maternal speech "fully accounted for" differences in the size of the children's productive vocabularies (Hoff 2003). Maternal education was strongly correlated with child verbal and cognitive development, and the relationship was moderated more strongly by home environment than by income (Smith, Brooks-Gunn, and Klebanov 1997). This may suggest that improving home environment can be as efficacious as improving income.

**Predictions:** Both being firstborn and having more siblings should be associated with improved behavior and socio-emotional development. Being firstborn is also expected to be associated with verbal development. Confluence theory predicts that more siblings means more limited verbal development.

The effect of income on cognitive and verbal development is disputed: Yeung et al. contend that additional income is likely to improve these measures, where Hoff's study implies that an increase in income without an accompanying change in home environment, such as maternal speech, will not affect verbal IQ (though Hoff looks at productive vocabulary rather than verbal IQ). According to Hoff's hypothesis and to family stress theory in general, we are more likely to see an impact of program participation than an effect of money. Families coming into the program earlier should have experienced less stress during the crucial early, formative years of the child's emotional development. Receiving more money later would relax limits imposed by resource dilution, but families coming in later had to endure for longer without any payments. Thus, from this perspective, program effects are predicted to dominate direct income effects.

## Model

To analyze these issues we begin by modeling human capital development using a function of the set of inputs described in Skoufias' (2005) PROGRESA/ *Oportunidades* evaluation with a small modification.

$$H = h\,(t_c,, t_p, X; Z, S, F, \mu, K)$$

where $t_c$ and $t_p$ represent the time invested by the child and the parents in activities such as school, medical care, and discipline; X represents purchased inputs such as food and medical and educational expenses; Z is the child's stock of observable characteristics such as gender and age; S is the child's siblings (included in the Z variable in Skoufias' original model); F represents the child's birth order (later to be reduced to whether a child is firstborn or not); μ is the set of other child characteristics unobservable to outsiders such as child ability or her health endowment; and K reflects other household or community level characteristics such as knowledge about the production of human capital or parental education (shown as an important interaction variable by Fernald, Gertler, and Neufeld (2009)), or distance to market, health, or education, and other environmental factors.

To evaluate the predictions of the confluence and resource dilution theories we add an interaction term between purchased inputs and siblings such that

$$H = \alpha X + \beta S + \gamma XS + f\,(t_c, t_p; Z, F, \mu, K) + \varepsilon \qquad (1)$$

Comparing the relative size of β and γ at the sample mean level of transfers will enable us to compare the relative effects of the two theories.

Next we add a bit more detail to this picture by separately considering two types of human capital: physical growth and cognitive and emotional development. While the two are certainly related it seems likely that physical development might be less dependent on some inputs, such as the amount of time shared with parents.

Thus we consider two separate production functions, one for physical and mental (denoted b for bodily) and one for emotional development.

$H_b = h_b\ (t_c,\ t_p\ ,X;\ Z,\ F,\ S,\ \mu,\ K)$

$H_e = h_e\ (t_c,\ t_p,\ X;\ Z,\ F,\ S,\ \mu,\ K)$

Each is assumed to take the expanded form given above in (1).

To evaluate the effects of the PROGRESA/ *Oportunidades* program we first consider the effect of an unconditional cash transfer, which would increase X. Let's consider emotional development first. For emotional development, changes in household income are predicted to be less important than program participation. Likewise, changes in time allocation due to the increased income are not important; changes in "positive interaction" may occur but changes in "consistent parenting" are not anticipated.

$$\frac{\partial H_e}{\partial X} = 0$$

For physical and mental capital, an increase of income such as might come from an unconditional cash transfer program would most obviously affect the accumulation of human capital through the X term. Assuming that food, education, doctor visits, and books are normal goods, more income should increase demand and thereby improve physical and mental development. Second order effects are ambiguous, since a household with more funds may choose to allocate more parental time to their children, or they may use the increased funds to invest in livestock production or other microenterprises, as shown by Gertler, Martinez, and Rubio-Codina (2012). In the latter case, the allocation of time to children may in fact decrease. If the added resources matter less than the effects of time spent with parents and/ or the intellectual environment created by the parents and siblings, $\alpha_c$ may not be significantly greater than zero. However, the marginal contribution of parental time to physical outcomes such as BMI and nutritional status should be small relative to the importance of available food. Thus we expect additional income to improve physical capital accumulation. This leaves us with

$$\frac{dH_b}{dX} = \frac{\partial H_b}{\partial X} + \frac{\partial H_b}{\partial t_p}\frac{\partial t_p}{\partial X} > 0$$

Next we consider sibling effects on physical and mental development. If physical development is primarily dependent on food consumption, then siblings and all other household members are substitutes, sharing parental resources. Thus we expect that

$$\frac{\partial H_b}{\partial S} < 0$$

Similarly, for cognitive development, we expect a negative sign. Both confluence and resource dilution predict

$$\frac{\partial H_e}{\partial S} < 0$$

with confluence theory predicting that younger siblings in particular will be damaging to mental capital development.

The story with birth order is similar. Firstborn children should have better nutritional status, and confluence theory says that they will develop more quickly mentally as well. According to the "consistent parenting" analysis, firstborn children should be better behaved.

$$\frac{\partial H_b}{\partial F} > 0$$

$$\frac{\partial H_c}{\partial F} > 0$$

Finally we consider the interaction term of income and siblings. In the development of physical capital, we have no specific prediction. The net effect of resources should be positive, and siblings should not moderate the marginal effects of resources. For cognitive and emotional development, on the other hand, the different theories have different predictions. Resource dilution posits that a main reason siblings negatively affect each other's cognitive development is the lack of resources, so added income should ameliorate negative sib effects. Confluence predicts that the effect of additional resources will be relatively unimportant for the effect of siblings, since the impeding effect of siblings on language development is intrinsic. Thus

$$\frac{\partial H_b}{\partial XS} \stackrel{>}{<} 0\,?$$

$$\frac{\partial H_e}{\partial XS} \stackrel{>}{<} 0\,?$$

So far we have considered only the effects of an unconditional cash transfer. What of the conditionality built into the program? The program strives to improve child development by incentivizing medical care and education. People participating for longer periods of time should show the benefits of that increased engagement. Fernald, Gertler, and Neufeld (2009) show that longer periods of program participation improve height-for-age scores of children of mothers with no education but not for children of mothers with some primary or more education. In the interest of brevity we do not replicate their analysis but as a limited test we include a term indicating whether the child's household is in a community that was randomized to participate in the program as part of the early adoption group in April of 1998 or if they were brought on with the later group in late fall of 1999. Table 1 shows that in regressions without sibling and maternal education interactions, the distinction between early vs. late program groups matters for child behavior but for no other outcome. Thus the remainder of our paper focuses on the transfer effects.

A final concern is the exogeneity of one's set of siblings. Clearly the number of children in a household is a variable that is to some degree controlled by the parents, and one that may to some degree reflect unobserved parental attitudes toward children, parental information about the human capital development process, and parental education, among other relevant characteristics. Uneducated parents may be likely to have more children and they may be less interested in or less able to facilitate the child's physical or intellectual development. As a first step, we control directly for both parents' education and the presence of the father in the household.

Finally and perhaps most importantly we also acknowledge that we cannot interpret sibling effects as causal. (We are more comfortable describing effects of the transfers as causal due to the instrumental variables approach we use for our estimation (described below).) We seek only to describe the impact of the transfers in the different environments characterized by the presence of different numbers of siblings, though the mechanism by which the results obtain may not be directly through the siblings.

## Data

We identified children born between March 1, 1997 and October 31, 1998 whose households participated in rural PROGRESA/ *Oportunidades* surveys in 1997, 2003, and 2007. These children were born into households receiving the program just after the time the program began. Child heights and weights were measured in 2003 and 2007, and were converted to height for age and BMI for age z-scores using international norms coded into free software available from the World Health Organization (WHO 2010). Cognitive development and language ability were assessed using the Wechsler Abbreviated Scale of Intelligence (WASI), a shorter version of the WISC-III (Wechsler Intelligence Scale for Children). These variables are scaled close to traditional IQ scores, with a mean near 100 and a standard deviation of about 15. Child behaviors were assessed by administering the Strengths and Difficulties Questionnaire to children's mothers. A variety of control variables were merged in from other surveys collected on the same households.

Table 2 lists the control variables included in our analysis. The later treatment group contains significantly more firstborns (13% vs. 9% of the respective sample) and access to piped water on a household's land is slightly more common in the later group (the difference is significant at the 10% level) but for the most part the groups do not differ in statistically significant ways.

We control for the sex of the child in question, but we do not consider separately the gender of siblings. This is partly because of the difficulty of controlling for the variety of configurations of families, and partly because our early estimates did not find that to be significant.

## Methods

A first pass consists of an OLS regression of the various outcomes on the total amount of transfers, an indicator for early vs. late treatment, a vector of pre-program household and community level variables, and community random effects. Early vs. late treatment was chosen randomly and the controls pre-date the program. However, as noted by Attanasio, Meghir, and Schady (2009), transfer amounts may be correlated with the error term, since receipt of the transfers is conditional on the household's decisions such as whether to send children to school. To address this problem we use an instrumental variables approach, described below.

To instrument for transfers received by the household we create a variable we call "Potential Transfers." Similar to the approach used by Albarran and Attanasio (2003), we simulate the grants. In each household we look at the number of children and their specific ages, assuming that each child enrolled in school will continue to attend school. This ends up being a maximum amount that households can receive. We start by looking at the 1997 data and use that to describe the first few years of the program. In 2000 households were recertified, so we re-examine their demographics and use those to project 2001-2003 transfer amounts. Finally we reevaluate the demographics in 2003 and project those through the 2007.

We are confident that this is exogenous for a number of reasons. First is the fact that early or late treatment status is a factor, and it was randomized. Second, the number and timing of children is exogenous in many cases as family planning is not commonly practiced. A previous study by

Stecklov et al. (2007) found that the program “had no net effects on fertility.” This is consistent with our observation that in March of 1998 a survey shows that 75% of the households in our data aren’t actively using contraception, and 69% of them say they never have. Third, the nonlinearities imposed by the cap constrain the link between household size and school enrollment on the one hand and transfers on the other. Next, the exact ages of the children in the household cannot be planned, and even a few months’ difference affects transfer sizes. Also, the two-step regression process eliminates the role of endogenous household choices about school enrollment. For example, if a household decides to take a child out of school and have her stay home to help with the housework, they give up the transfer associated with having her in school. That fact will not show up in our instrument and it will be stripped away by the two stage process.

The instrument works well. T-scores on the potential transfers variable in the first stage are well over 20, and the R-squared for the regression is between 0.45 and 0.5.

Another issue of some concern is that our means of looking for birth order effects, the firstborn indicator variable, is correlated with smaller household sizes. Every household has a firstborn, but not every household has a third born, fourth born, etc., so randomly selected children are less likely to be from smaller families than firstborns are. The modal sibship size is four, and thus we repeat each set of regressions on a subsample consisting only of children in households with sibship sizes of 3, 4, or 5.

One last clarification is to note the difference between the sibling variables included as explanatory variables and the potential transfers used as instruments. The potential transfers are a combination of early vs. late treatment status, the transfer cap, the specific ages and initial enrollment status of the children and the associated fee schedule developed by the program, while the sibling variables just count children older than and younger than our target group.

Thus, after running the random effects analysis to replicate Fernald, Neufeld, and Gertler (2009) we estimate effects using an IV approach with results shown in Table 3. Next we move on to including the interaction terms described in the Theory section above.

## Results

The results in Table 2 show the stability of the point estimates, particularly for the cognitive and emotional variables. For these outcomes, shifting from OLS to IV regressions didn't change any coefficient more than one standard error from its initial value. The statistical significance of the estimate of the role of transfers for behavior (the SDQ variable) was lost, but the point estimate has dropped only slightly. The cognitive WASI variable has gone from statistical significance at the 1% level to just significance at the 10% level, and it has dropped by about 20%. For the physical variables, on the other hand, we see some more striking changes. The effect of transfers on child height for age more than doubles, remaining significant at the 1% level.

Next, we replicate all of our analyses with a smaller sample consisting only of children with 3, 4, or 5 siblings, the three most common sibship sizes. This is useful when we look at the marginal effects of siblings and to make sure that our firstborn indicator is not just a proxy for smaller household size.

In Table 3 we add in the indicator for the child's being firstborn. This leads to a few marginal changes in the estimates of the effectiveness of transfers, but perhaps more interesting are the coefficients themselves. Estimates show that a child's height for age and BMI for age increase by about 1/5 of a standard deviation if a child is firstborn. This effect is comparable to the household's receiving 30-40,000 pesos over the child's first 8-10 years of life. This may reflect the fact that for at least part of the child's life, s/he is an only child, receiving parental time and resources without competition. Cognitive and emotional outcomes are also large, with the verbal score in particular increasing at a rate comparable to the receipt of 50,000 pesos. Large variance renders insignificant the effect of being firstborn on a child's cognitive WASI score and on his or her SDQ score, but both point estimates are positive. The effect of being a firstborn is much smaller than anticipated by our theory.

The relative significance of the firstborn variable in these two cases flips with our smaller sample, shown in Table 3b. The coefficient on the cognitive WASI score small in comparison with its standard error while the coefficient on the SDQ is now larger. All signs are as expected except the effect of being firstborn on BMI for age, which has dropped greatly in the limited sample.

When we interact the firstborn variable with transfers in Table 4, a more nuanced picture emerges. In short, being firstborn per se matters much less than being the firstborn when transfers come in. While the average child gains 0.05 of a standard deviation of height for age per 10,000 pesos received by her household, the average firstborn child gains about four times as much as a child with one or more older siblings. For a household receiving the average level of transfers in our dataset, that makes a total increase in height for age of these children of about half a standard deviation. Other children see an increase in BMI for age of an average of 0.01 standard deviations per 10000 pesos (a level that is not significantly different from zero) but firstborn children see a much larger increase, leaving them an average gain of about half a standard deviation in total.

Estimated effects on cognitive and emotional outcomes have large standard errors, but point estimates indicate substantial average impacts. Where the average child's verbal test score improves by 0.77 points per 10,000 pesos of transfers, a firstborn child's test score increases by almost a full point when the household receives that amount. The average increase for a firstborn is around four points overall. Transfer effects on the cognitive score are significantly different from zero at just the 10% level, but around 0.9 per 10,000 pesos for firstborns as opposed to 0.4 for others. The average gain for firstborns is listed at 1.99 but with a standard error of 1.7. Finally on the Strengths and Difficulties Questionnaire, transfers appear to have no effect on any children regardless of birth order.

As we might expect, coefficients tend to be dampened when we restrict the sample to a more homogeneous group. Although we control for household size in all specifications, the correlation between the indicator for "firstborn" and a smaller household size has magnified some of the coefficients in Table 4. Standard errors jump as coefficients drop, meaning that many estimated coefficients cease to be statistically significant. Verbal WASI is the only score for which we see a significant average association with being firstborn.

Next, in Table 5, we replace the firstborn indicator with the number of siblings in the household. These variables are significant in the physical and verbal regressions and are uniformly negative as predicted. This is consistent with our theoretical expectations that siblings compete for scarce resources and/ or that they reduce the quality of the intellectual environment. Across the board, the coefficient on older siblings is larger in absolute value, implying that younger siblings represent a lesser hindrance to child development. Note that to fully evaluate the impact of older siblings, the coefficient on household size should be added to the older sibling coefficient, as older siblings were in the households when our target children were born in 1997 or 1998.

Once sibling controls are included, the transfer coefficients drop somewhat. The effect of transfers on height for age drops from 0.05 to 0.04, while that on BMI stays constant with a statistically insignificant coefficient of 0.01. Transfers have slightly less effect on verbal scores (0.75 – 0.70) and on cognitive WASI scores (0.37 – 0.34) than estimated before. The estimated effect of transfers on cognitive scores also loses statistical significance. In Table 5b, with the limited sample, the only coefficient that retains statistical significance is that on the verbal WASI. The cognitive WASI has plummeted to just 0.13 while the rest are more stable.

Finally, we add the interactions between transfers and siblings. The total transfer effects, seen in the last column of Table 6, are similar to those above, though in many cases the standard errors are larger. A new result is that the larger effects of older siblings (vis a vis younger siblings) are gone. Level effects of younger siblings are larger for the physical outcomes and the cognitive WASI. For physical outcomes, younger siblings still impose negative effects, but transfers nominally worked against them, suggesting that resource dilution may be a contributing factor to the sibling penalty. However, these effects were not statistically significant. For physical outcomes, the interaction between older siblings and transfer effects were negative and insignificant, meaning that the impact of money is not apparently altered by the presence of older siblings. The only significant interacted effects were positive effects of interacted transfers on the verbal WASI score. This suggests that transfers may mitigate but not completely overcome the slowdown in cognitive development associated with the presence of siblings.

Table 6b shows the same regression conducted on the limited sample. Curiously, this largest specification also features the most striking increase in the size and statistical significance of the estimated coefficients. In other words, in a more homogeneous set of households the marginal effect of an additional younger sibling is much stronger across the board, even making a significant change (for the better) in child behavior.

## Conclusion

First we look at the estimated effects of being firstborn. Theory predicts that firstborns have better nutritional status and better behavior, but the effects of transfers on firstborns in particular has not been addressed previously. Point estimates of transfers on tables 3 and 4 show that firstborn children get about twice the height for age benefits of transfers and significant increases in BMI as well. They show greater increases in verbal skills but estimates of cognitive improvements vary. The SDQ is less affected by a child's status as the firstborn. Whether firstborn children benefit from the frequently short period in which they are the only child or whether cultural norms lead to their receiving extra parental resources at all ages is unclear, but the evidence points to their benefitting in terms of faster accumulation of human capital. While our study is not sufficient to assess a causal impact, we can note that each additional sibling is associated with decreased development on physical and cognitive scales.

The indicator for "firstborn" is correlated with a smaller household size, so we investigate this by considering a smaller sample with more homogeneous household size. This cuts the sample size from around 1700 to 1000, expanding standard errors. Tables 3b and 4b show the results: we find that marginal effects of transfers are significant only for the verbal WASI score. On table 4b we see that the firstborn x transfers interaction term has insignificant coefficients in most cases, meaning there is no significant difference between how transfers affect firstborn and later born children. While the point estimates still indicate support for child investment theory (in which firstborns garner a larger share) the standard errors show that there is heterogeneity in use of the transfers, and with the exception of the Verbal score we cannot reject the theory that parental preference for equal distribution of resources dominates. Firstborn children do appear to benefit significantly more (at the 10% level) from transfers on the Verbal scale.

Tables 5 and 6 show that children living with siblings do worse on all measured outcomes. Again we are unable to tell whether the effects associated with siblings is causal, but relationships between the number of siblings and decreases in height for age, BMI for age, and verbal and cognitive IQ are statistically significant. Table 6 shows that drops in verbal and cognitive outcomes associated with siblings are partially ameliorated by transfers that households receive, lending support to the resource dilution theory of sibling influences. Biological outcomes do not exhibit the same pattern of transfers overcoming the difficulties associated with larger sibship sizes, though the effects of transfers are positive and in the case of height for age statistically different from zero at the 5% level.

These findings support research hypotheses that siblings hurt nutritional status and that income can improve conditions with respect to verbal and cognitive development, at least. Unlike some previous findings, we find that income is helpful to improvements in child language even though the causal pathway seems unlikely to go through maternal speech. Further, we could not reject the hypothesis that income appears to have little effect on emotional/ behavioral development. These results are highly coincident with Yeung et al.'s (2002) previous finding that income is more influential for cognitive and verbal development than it is for emotional development.

To review and summarize our estimated impact of cash transfers on child development, we find that the most consistent effects are shown on child height for age and verbal IQ development. Across a dozen specifications, 10,000 pesos of cash transfers to a child's household are associated with a marginal improvement of about 0.05 standard deviations in height, about 0.3

cm for children of this age, and about 1 point of IQ. Since the average household received 46,000 pesos and includes four children, estimates of total program impact on all children together are higher by a factor of 18.

Policy responses to these observations could include paying increased attention to large families as potentially including more needy children. While this work has looked at the implications of increasing household income, other works have found that “paying increased attention” can mean simply increasing each child’s interaction with adults. Dunn (1983) lists studies pointing out “negative correlations between the amount of time children spend with other children and measures of language comprehensions and production.” Since children’s verbal development depends on parental interaction, ensuring a stable stream of income particularly among the poorest allows frees parents to interact more with their children, fostering development (Smith et al. 1997). Maximizing investments in child development requires consideration of this dimension of child life.

Another implication is that transfers alone, while helpful, may not be the most efficient way to improve emotional development (Berger, Paxson, and Waldfogel 2009). Instead, engaging parents to reduce stress and teach parenting skills and/ or exposing children to role models may be a better use of funds.

Finally, the importance of addressing fertility is clear. Some cash transfer programs have deliberately disincentivized fertility (Bouillon and Tejerina 2007) and while that is a worthwhile goal, such incentive structures must be carefully designed so as to avoid further penalizing children in large households.

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## Table 1. Comparison of treatment and control groups

| | Early treatment Mean (se) or % | Late treatment Mean (se) or % | Test for significant difference† |
|---|---|---|---|
| | N = 1093 | N = 700 | |
| Actual transfer amount (10000s of pesos) | 4.81 (2.78) | 4.37 (2.41) | t = 2.17 ** |
| Potential transfer amount (10000s of pesos; IV for actual transfers) | 7.00 (3.55) | 5.97 (2.92) | t = 9.90*** |
| # of older siblings | 2.06 (1.28) | 2.07 (1.20) | t = 0.25 |
| # of younger siblings | 1.42 (1.30) | 1.39 (1.33) | t = 0.35 |
| Household size in 1997 | 6.34 (2.49) | 6.33 (2.36) | t = 0.04 |
| Asset Index (principal components) | -0.41 (0.56) | -0.35 (0.64) | t = 0.99 |
| Hectares of land | 1.49 (2.44) | 1.56 (2.61) | t = 0.26 |
| Child age in months | 116.9 (6.0) | 116.9 (6.3) | t = 0.11 |
| Female | 49% | 49% | $\chi^2$ = 0.00 |
| First born | 9% | 13% | $\chi^2$ = 4.78** |
| Household head speaks indigenous language | 42% | 42% | $\chi^2$ = 0.00 |
| Land has improved water access | 23% | 32% | $\chi^2$ = 2.76* |
| Electricity access in 1997 | 66% | 62% | $\chi^2$ = 0.58 |
| Household owned draft animal(s) in 1997 | 32% | 32% | $\chi^2$ = 0.00 |
| Household owned small animals in 1997 | 79% | 80% | $\chi^2$ = 0.11 |
| Child's father lives in same household | 82% | 81% | $\chi^2$ = 0.21 |
| Child's father attended primary school | 80% | 82% | $\chi^2$ = 0.41 |
| Child's mother attended primary school | 81% | 79% | $\chi^2$ = 0.64 |

†Test statistic is t for continuous variables and $\chi^2$ for dichotomous variables, both clustered at the community level.
*significant at 10% level ** significant at 5% level *** significant at 1% level

## Table 2. Effects of program enrollment & transfers, with and without IV's

| | Treatment | Transfers | N | $R^2$ | | Treatment | Transfers (IV) | N | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|
| | β (se) | β (se) | | | | β (se) | β (se) | | |
| Height for age z | 0.05 (0.05) | 0.03*** (0.01) | 1710 | 0.16 | | 0.04 (0.06) | 0.05*** (0.02) | 1710 | 0.13 |
| BMI for age z | -0.04 (0.06) | 0.00 (0.01) | 1705 | 0.05 | | -0.04 (0.07) | 0.01 (0.02) | 1705 | 0.04 |
| Verbal WASI | 1.13 (1.12) | 0.73*** (0.13) | 1661 | 0.19 | | 1.21 (1.16) | 0.75*** (0.20) | 1661 | 0.19 |
| Cognitive WASI | -1.19 (1.06) | 0.47*** (0.14) | 1661 | 0.09 | | -1.14 (1.05) | 0.37* (0.21) | 1661 | 0.09 |
| SDQ | -0.14** (0.07) | -0.03*** (0.01) | 1751 | 0.05 | | -0.14** (0.07) | -0.02 (0.02) | 1751 | 0.04 |

* significant at 10% level ** significant at 5% level *** significant at 1% level

Results from five OLS and five iv regressions, with community level fixed (non-iv) or random effects (iv). Other explanatory variables in the regressions include child sex, indicators for 6-month birth cohorts, indicators for water and electricity access in 1997, hectares of land owned, whether the household speaks an indigenous language, whether the household owns farm animals, an asset index created using principal components analysis, whether the child's father lives in the household, indicators for the child's mother and father having attended primary school, and dummy variables indicating state of residence.

Table 2b: treatment and transfers on limited sample

| | Treatment | Transfers | N | $R^2$ |
|---|---|---|---|---|
| | β (se) | β (se) | | |
| Height for age z | 0.07 (0.07) | 0.03 (0.20) | 1070 | 0.14 |
| BMI for age z | -0.10 (0.09) | -0.003 (0.02) | 1068 | 0.04 |
| Verbal WASI | 1.60 (1.27) | 0.65 ** (0.26) | 1045 | 0.15 |
| Cognitive WASI | -0.50 (1.20) | 0.08 (0.29) | 1043 | 0.07 |
| SDQ | -0.16** (0.07) | 0.01 (0.02) | 1093 | 0.03 |

## Table 3. Effects of program enrollment, transfers, and being the first born

| | Treatmt | Transfers | First born | N | $R^2$ |
|---|---|---|---|---|---|
| | β (se) | β (se) | β (se) | | |
| Height for age | 0.03 (0.06) | 0.05*** (0.02) | 0.18** (0.07) | 1710 | 0.14 |
| BMI for age | -0.05 (0.07) | 0.02 (0.02) | 0.14 (0.08) | 1705 | 0.04 |
| Verbal WASI | 1.09 (1.15) | 0.78*** (0.20) | 3.58*** (0.89) | 1661 | 0.19 |
| Cog. WASI | -1.17 (1.05) | 0.38* (0.21) | 0.97 (0.97) | 1661 | 0.09 |
| SDQ | -0.14** (0.07) | -0.02 (0.02) | 0.02 (0.08) | 1751 | 0.04 |

* significant at 10% level ** significant at 5% level *** significant at 1% level

Results from five separate iv regressions, with community level random effects. Other explanatory variables in the regressions include child sex, indicators for 6-month birth cohorts, indicators for water and electricity access in 1997, hectares of land owned, whether the household speaks an indigenous language, whether the household owns farm animals, an asset index created using principal components analysis, whether the child's father lives in the household, indicators for the child's mother and father having attended primary school, and dummy variables indicating state of residence.

Table 3b. Firstborn with limited sample

| | Treatmt | Transfers | First born | N | $R^2$ |
|---|---|---|---|---|---|
| | β (se) | β (se) | β (se) | | |
| Height for age | 0.07 (0.07) | 0.03* (0.02) | 0.14 (0.10) | 1070 | 0.14 |
| BMI for age | -0.01 (0.09) | -0.00 (0.02) | -0.02 (0.11) | 1068 | 0.04 |
| Verbal WASI | 1.49 (1.28) | 0.68** (0.26) | 3.08** (1.23) | 1045 | 0.16 |
| Cog. WASI | -0.52 (1.20) | 0.09 (0.29) | 0.49 (1.35) | 1043 | 0.07 |
| SDQ | -0.17** (0.08) | 0.01 (0.02) | 0.10 (0.11) | 1093 | 0.03 |

* significant at 10% level ** significant at 5% level *** significant at 1% level

## Table 4. Effects of program enrollment, transfers, and firstborn with interactions

| | Treatmt | Transfers | Firstborn | Firstborn x Transfers | N | $R^2$ | Avg firstborn effect† |
|---|---|---|---|---|---|---|---|
| | β (se) | β (se) | β (se) | β (se) | | | |
| Height for age | 0.04<br>(0.06) | 0.05***<br>(0.02) | -0.14<br>(0.17) | 0.11**<br>(0.06) | 1710 | 0.14 | 0.39***<br>(0.13) |
| BMI for age | -0.04<br>(0.07) | 0.01<br>(0.02) | -0.22<br>(0.20) | 0.13**<br>(0.06) | 1705 | 0.04 | 0.37**<br>(0.15) |
| Verbal WASI | 1.11<br>(1.16) | 0.77***<br>(0.20) | 3.11<br>(2.06) | 0.17<br>(0.67) | 1661 | 0.19 | 3.90**<br>(1.57) |
| Cog. WASI | -1.12<br>(1.05) | 0.36*<br>(0.21) | -0.57<br>(2.27) | 0.55<br>(0.74) | 1661 | 0.09 | 1.99<br>(1.70) |
| SDQ | -0.14**<br>(0.07) | -0.02<br>(0.02) | 0.07<br>(0.19) | -0.02<br>(0.06) | 1751 | 0.04 | -0.01<br>(0.14) |

* significant at 10% level ** significant at 5% level *** significant at 1% level †adds firstborn level effect to effect of interaction at mean transfer level of about 4.6x $10^4$ pesos

Results from five separate iv regressions, with community level random effects. Other explanatory variables in the regressions include child sex, indicators for 6-month birth cohorts, indicators for water and electricity access in 1997, hectares of land owned, whether the household speaks an indigenous language, whether the household owns farm animals, an asset index created using principal components analysis, whether the child's father lives in the household, indicators for the child's mother and father having attended primary school, and dummy variables indicating state of residence.

Table 4b. Table 4 + limited sample

| | Treatmt | Transfers | Firstborn | Firstborn x Transfers | N | $R^2$ | Avg firstborn effect† |
|---|---|---|---|---|---|---|---|
| | β (se) | β (se) | β (se) | β (se) | | | |
| Height for age | 0.07<br>(0.07) | 0.03<br>(0.02) | 0.00<br>(0.24) | 0.05<br>(0.09) | 1070 | 0.14 | 0.25<br>(0.20) |
| BMI for age | -0.00<br>(0.09) | -0.01<br>(0.02) | -0.30<br>(0.28) | 0.11<br>(0.10) | 1068 | 0.04 | 0.21<br>(0.24) |
| Verbal WASI | 1.51<br>(1.28) | 0.67**<br>(0.26) | 1.39<br>(2.96) | 0.64<br>(1.02) | 1045 | 0.16 | 4.37*<br>(2.43) |
| Cog. WASI | -0.53<br>(1.21) | 0.09<br>(0.29) | 1.72<br>(3.29) | -0.46<br>(1.14) | 1043 | 0.08 | -0.43<br>(2.68) |
| SDQ | -0.16**<br>(0.08) | 0.01<br>(0.02) | -0.20<br>(0.27) | 0.12<br>(0.10) | 1093 | 0.03 | 0.34<br>(0.23) |

## Table 5. Effects of program enrollment, transfers, and siblings

| | Treatment | Transfers | # older siblings | # younger sibs | Household size in '97 | N | $R^2$ |
|---|---|---|---|---|---|---|---|
| | β (se) | β (se) | β (se) | β (se) | β (se) | | |
| Height for age z | 0.04 (0.06) | 0.04*** (0.02) | -0.12*** (0.02) | -0.06*** (0.02) | -0.02 (0.01) | 1710 | 0.17 |
| BMI for age z | -0.04 (0.06) | 0.01 (0.02) | -0.07*** (0.03) | -0.06*** (0.02) | -0.01 (0.02) | 1705 | 0.06 |
| Verbal WASI | 1.20 (1.14) | 0.70*** (0.20) | -0.89*** (0.28) | -0.42* (0.22) | -0.46*** (0.16) | 1661 | 0.20 |
| Cognitive WASI | -1.13 (1.03) | 0.34 (0.22) | -0.59 (0.30) | -0.31 (0.24) | -0.40 (0.17) | 1661 | 0.10 |
| SDQ | -0.14** 0.07) | -0.02 (0.02) | -0.02 (0.02) | 0.00 (0.02) | 0.00 (0.01) | 1751 | 0.04 |

* significant at 10% level ** significant at 5% level *** significant at 1% level

Results from five separate iv regressions, with community level random effects. Other explanatory variables in the regressions include child sex, indicators for 6-month birth cohorts, indicators for water and electricity access in 1997, hectares of land owned, whether the household speaks an indigenous language, whether the household owns farm animals, an asset index created using principal components analysis, whether the child's father lives in the household, indicators for the child's mother and father having attended primary school, and dummy variables indicating state of residence.

Table 5b. Table 5 + limited sample

| | Treatment | Transfers | # older siblings | # younger sibs | Household size in '97 | N | $R^2$ |
|---|---|---|---|---|---|---|---|
| | β (se) | β (se) | β (se) | β (se) | β (se) | | |
| Height for age z | 0.07 (0.07) | 0.03 (0.02) | -0.14*** (0.04) | -0.11*** (0.04) | -0.00 (0.02) | 1070 | 0.15 |
| BMI for age z | -0.00 (0.09) | -0.01 (0.02) | -0.10** (0.05) | -0.12** (0.04) | -0.02 (0.02) | 1068 | 0.05 |
| Verbal WASI | 1.46 (1.28) | 0.70** (0.27) | -1.15** (0.55) | -0.24 (0.50) | -0.30 (0.24) | 1045 | 0.16 |
| Cognitive WASI | -0.59 (1.20) | 0.13 (0.30) | -0.55 (0.60) | 0.14 (0.54) | -0.41 (0.26) | 1043 | 0.08 |
| SDQ | -0.17 ** (0.08) | 0.01 (0.02) | -0.07 (0.05) | -0.03 (0.04) | -0.02 (0.02) | 1093 | 0.03 |

## Table 6. Effects of program enrollment, transfers, siblings, and transfers interacted with sibling effects

| | Treatment | Transfers | # older siblings | # younger sibs | Trans X older sibs | Trans X younger sibs | Household size in '97 | N | $R^2$ | Total transfer effect† |
|---|---|---|---|---|---|---|---|---|---|---|
| | β (se) | β (se) | β (se) | β (se) | β (se) | β (se) | β (se) | | | |
| Height for age z | 0.06<br>(0.06) | 0.06**<br>(0.03) | -0.06<br>(0.05) | -0.10**<br>(0.05) | -0.01<br>(0.01) | 0.01<br>(0.01) | -0.02<br>(0.01) | 1710 | 0.17 | 0.05**<br>(0.02) |
| BMI for age z | -0.03<br>(0.07) | -0.01<br>(0.03) | -0.06<br>(0.06) | -0.14**<br>(0.05) | -0.00<br>(0.01) | 0.02<br>(0.01) | -0.01<br>(0.01) | 1705 | 0.06 | 0.02<br>(0.02) |
| Verbal WASI | 1.10<br>(1.15) | -0.34<br>(0.37) | -2.42***<br>(0.63) | -1.58***<br>(0.56) | 0.32***<br>(0.12) | 0.25 **<br>(0.12) | -0.42<br>(0.16) | 1661 | 0.20 | 0.81***<br>(0.22) |
| Cognitive WASI | -1.04<br>(1.05) | -0.29<br>(0.40) | -1.08*<br>(0.68) | -1.80***<br>(0.61) | 0.09<br>(0.14) | 0.34**<br>(0.13) | -0.38**<br>(0.17) | 1661 | 0.09 | 0.55**<br>(0.24) |
| SDQ | -0.13*<br>(0.07) | -0.03<br>(0.03) | -0.02<br>(0.06) | -0.05<br>(0.05) | -0.00<br>(0.01) | 0.01<br>(0.01) | 0.00<br>(0.01) | 1751 | 0.04 | -0.01<br>(0.02) |

* significant at 10% level ** significant at 5% level *** significant at 1% level †calculates total of transfer level effects for a child with two older and two younger siblings. The average transfer effect for the cognitive WASI just misses significance at the 10% level.

Results from five separate iv regressions, with community level random effects. Other explanatory variables in the regressions include child sex, indicators for 6-month birth cohorts, indicators for water and electricity access in 1997, hectares of land owned, whether the household speaks an indigenous language, whether the household owns farm animals, an asset index created using principal components analysis, whether the child's father lives in the household, indicators for the child's mother and father having attended primary school, and dummy variables indicating state of residence.

Table 6b. Limited sample

| | Treatment | Transfers | # older siblings | # younger sibs | Trans X older sibs | Trans X younger sibs | Household size in '97 | N | $R^2$ | Total transfer effect† |
|---|---|---|---|---|---|---|---|---|---|---|
| | β (se) | β (se) | β (se) | β (se) | β (se) | β (se) | β (se) | | | |
| Height for age z | 0.08<br>(0.07) | 0.01<br>(0.06) | -0.14<br>(0.10) | -0.22**<br>(0.10) | -0.00<br>(0.02) | 0.03<br>(0.02) | 0.00<br>(0.02) | 1070 | 0.15 | 0.06**<br>(0.03) |
| BMI for age z | 0.00<br>(0.09) | -0.06<br>(0.07) | -0.16<br>(0.12) | -0.24**<br>(0.11) | 0.01<br>(0.02) | 0.03<br>(0.02) | -0.01<br>(0.02) | 1068 | 0.05 | 0.02<br>(0.03) |
| Verbal WASI | 1.57<br>(1.28) | -0.85<br>(0.75) | -3.26**<br>(1.29) | -3.18**<br>(1.23) | 0.43*<br>(0.26) | 0.66***<br>(0.25) | -0.26<br>(0.24) | 1045 | 0.16 | 1.36***<br>(0.37) |
| Cognitive WASI | -0.47<br>(1.20) | -1.85**<br>(0.82) | -3.32**<br>(1.43) | -3.60***<br>(1.36) | 0.56**<br>(0.28) | 0.83 ***<br>(0.28) | -0.37<br>(0.26) | 1043 | 0.08 | 0.96**<br>(0.41) |
| SDQ | -0.15*<br>(0.08) | -0.09<br>(0.07) | -0.19 *<br>(0.11) | -0.25**<br>(0.11) | 0.02<br>(0.02) | 0.05**<br>(0.02) | -0.01<br>(0.02) | 1093 | 0.04 | 0.06**<br>(0.03) |