The Medium Term Impact of *Oportunidades* on Child Development in Rural Areas

Final Report (Fourth draft)

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I. EXECUTIVE SUMMARY

In this report we examine the medium term impact (3 to 6 years) of the *Oportunidades* Program on the cognitive, motor, and socio-emotional development of young children. *Oportunidades* is an anti-poverty program that is, in part, designed to improve the circumstances in which children from poor families begin their lives. *Oportunidades* combines a traditional cash transfer program with financial incentives for positive behavior in health, education and nutrition. Specifically, cash transfers are disbursed conditional on the household engaging in a set of behaviors designed to improve health and nutrition, including prenatal care, well baby care and immunization, nutrition monitoring and supplementation, preventive checkups, and participation in educational programs regarding health, hygiene and nutrition. An additional cash transfer is given to households with school age children if the children are enrolled in and attend school.

We investigate the extent to which the *Oportunidades* investments in health and nutrition that began during the prenatal period improved the overall developmental status of children after three to six years of benefits in rural areas. We focus on cognitive, motor, and socio-emotional development indicators of child development for 3 to 6 year olds, and on a subset of those measures for 2 year olds. This age range captures child development in the period just before kids start school, and tells us something not only about their overall development but also their school readiness.

Our objectives are to estimate the medium-term (3 to 6 year exposure) net impact of the program on the various indicators of child development and to test whether starting the intervention in the prenatal period yields larger effects than starting the program in the first two years of life. We test these hypotheses by comparing the outcome of three different groups. The first group starting receiving benefits in the spring of 1998 (original treatments) and has been on the program about 5 and one half years. A second group started receiving benefits about a year and a half after the first cohort (original controls). Finally, the third group has never received benefits (new controls). In order to test the overall program impact we compare the combined outcomes of original treatments and controls to the new controls. In this case, the first original treatments and controls comprise the new treatment group and the last group (new controls) is our control group. In order to test the second hypothesis, we exploit the variation induced by the fact that the original control group started the program a year and a half later. This gives us children of the same age today who started the program at different times. We also use multivariate regression and matching methods to control for observed differences in individual, household and community characteristics across the study groups that might confound and bias the estimated impacts.

Overall, we find large and lasting impacts of *Oportunidades* on motor and behavioral development. Specifically, we find

- A 15 percent improvement in motor skills averaged across the eight skills tests in boys and a 10 percent average increase across the eight skills tests in girls,

- An improvement of about 9 percent in the socio-emotional development of girls and a positive but non-significantly improvement in boys.

These results are important and suggest that effects of the program are large and significant over the medium term of 3 to 6 years. The results not only imply that children are healthier and better developed, but also that they are better prepared to enter school and to absorb the lessons taught. The implications of these findings are that these children are starting off life better because of *Oportunidades.*

However, the analyses also highlighted one critical area in which the *Oportunidades* program could be strengthened. Our analyses highlighted the finding that there are very low levels of cognitive development of children in these poor rural communities, and that there appears to be little impact of *Oportunidades* on these levels. Cognitive development of young children is critically important, not just as an outcome measure in itself, but as an important condition for children to be able to benefit from school. Indeed, this idea is central to the lifecycle and health-nutrition-education complementary framework on which *Oportunidades* is based. Hence, improvements in the cognitive abilities of children of preschool age would likely have large effects on school entry, completion and performance.

Our result suggests that while the brain may be more prepared for cognitive development biologically due to the better nutrition, there may be the lack of necessary stimulation to develop cognitive skills in the home and environment. *Oportunidades* may want to consider some programmatic changes to provide more stimulation for these children.

1. At a minimum, the pláticas could be expanded to include teaching skills to parents about how to stimulate their children, including how to make simple toys, how to interact with children at various developmental levels, and what milestones to look for in the development of language and cognition.

2. *Oportunidades* could also consider introducing more intensive activities to promote child stimulation such as preschool or organized developmental play, establishing a toy and book lending library, or training community health aides to visit homes and teach parents one-on-one how to interact with and educate their children.

Finally, we found no advantage in terms of child development to starting benefits in the prenatal period as opposed to the first two years of life. This finding suggests that *Oportunidades* helps kids catch up from insufficient nutrition and illness during the prenatal period. However, we would not recommend dropping the prenatal interventions as they could have large effects on maternal health, help prevent short run health and nutrition that affect the quality of life of young children, and create a change of behavior towards getting regular preventive care and better nutrition habits.

II. INTRODUCTION

A large number of children in Mexico start out life at a disadvantage. Seven percent of babies are born low birth-weight and 22 percent of children under age 5 are stunted.[1] In an effort, in part, to improve the circumstance in which children from poor families start out life, the Mexican government has spent considerable resources to develop a unique anti-poverty program, *Oportunidades*.

Oportunidades combines a traditional cash transfer program with financial incentives for positive behavior in health, education and nutrition. Specifically, cash transfers are disbursed conditional on the household engaging in a set of behaviors designed to improve health and nutrition, including prenatal care, well baby care and immunization, nutrition monitoring and supplementation, preventive checkups, and participation in educational programs regarding health, hygiene and nutrition. An additional cash transfer is given to households with school-aged children if the children are enrolled and attend school.

Oportunidades began providing benefits to families living in extreme poverty in rural areas in 1997 and recently has expanded to urban areas. Today *Oportunidades* provided benefits to some 4.2 million families. An early evaluation demonstrated that *Oportunidades,* then called *PROGRESA*, had significant short run impacts on young children. Specifically, after one year of benefits, *Oportunidades* children had significantly lower child morbidity rates, better growth in terms of height, and lower anemia rates.[2]

We are now in a position to learn whether the gains observed shortly after the program began have been sustained and possibly expanded.   In this report, we investigate the extent to which the *Oportunidades* investments in health and nutrition that began during the prenatal period improved the overall developmental status of children after three to six years of benefits in rural areas. We focus on cognitive, motor, and socio-behavioral development indicators of child development for 3 to 6 year olds, and on a subset of those measures for 2 year olds. This age range captures child development in the period just before kids start school, and tells us something not only about their overall development but also their school readiness.

In this report we examine the medium term impact (3 to 6 years) of the *Oportunidades* Program on the cognitive, motor, and socio-behavioral development of young children. Specifically, we evaluated the following specific questions:

1. Did *Oportunidades* improve children's **_cognitive development_** along the following dimensions:

    o Long-term and short-term memory and visual integration measured by the The Woodcock-Johnson tests (3-6 year olds);

    o Language development measured by The Peabody Picture Vocabulary Test language (3-6 year olds);

    o Language development in 2 year olds children using the The MacArthur Communicative Development Inventories (Inventario del

Desarrollo de Habilidades Comunicativas: Palabras y Enunciados

in Spanish);

2. Did *Oportunidades* improve ***motor development*** along the following

dimensions:

   o Motor development as measured by the McCarthy scale (3-6 year

   olds),

3. Did *Oportunidades* improve **socio-*emotional and behavioral***

development measured by the Achenbach Child Behavior Checklist?

4. Did *Oportunidades* program participation have a greater impact on all

dimensions of child development if the benefits began in the prenatal

period versus in the first two years of life?

III. THE INTERVENTION

Oportunidades began in 1997 as a national program designed to address the

immediate needs of extreme poverty and break its intergenerational

transmission. Over its first three years, *Oportunidades* extended benefits to

almost all eligible families living in rural areas. Starting in 2001, the program

expanded to urban areas. By 2004, *Oportunidades* covered approximately 5

million families in 31 states.   In this evaluation, we focus on the medium term

impact (3 to 6 years on the program) in rural areas.

In rural areas, *Oportunidades* determined household eligibility in two

stages, first by identifying underserved communities and then by choosing low-

income households within those communities. Selection criteria for underserved

communities were based on the proportion of households living in poverty identified by using data from a 1995 survey (General Census of Population and Housing: Conteo de Población y Vivienda) very similar to a census.

Oportunidades then identified low-income households in these communities by using a proxy means test (PMT), which is an index of easily observed characteristics that proxy for poverty such as housing materials, water and sanitation facilities, education, and family structure. In order to construct the index, *Oportunidades* conducted a census of households in each eligible community to collect the proxy characteristics.

The weights used to aggregate the household characteristics into an index were constructed based on the analysis of an in-depth survey of a sample of households from the eligible communities, which collected consumption information in addition to the proxy characteristics. Using per capita consumption as a gold standard measure of poverty, these data were used to estimate a regression of per capita consumption against the proxy characteristics and to select the households that were eligible to receive benefits. The regression coefficients were then used as weights to construct the index for each household. The variables used in the model and the estimated coefficients have not been made public in order to prevent future gaming during the re-certification of eligibility process. On average, 78% of the households in selected communities were classified as eligible for program benefits.[3]

All eligible households living in treatment localities were offered *Oportunidades* and almost all (97%) enrolled in the program.[3] After

Oportunidades certified eligibility in a community, eligible households were offered enrollment for a limited period of time. Once enrolled, households received benefits conditional on meeting the health care requirements. Eligibility was determined every three years and new households were not able to enroll until the next certification period. This prevented households from migrating into the communities for *Oportunidades* benefits.

Every 2 months *Oportunidades* families received cash transfer typically worth about 20 to 30 percent of household income if:

I. Children age 0-23 months were immunized and attended nutrition monitoring clinics every 2 months where they received well baby care, were measured, obtained nutrition supplements worth 100 percent of daily recommended micronutrients and 20 percent of protein, and their parents received education on nutrition, health and hygiene.

II. Children age 24 to 60 months attended nutrition monitoring clinics every 4 months where their growth was measured, they obtained nutrition supplements worth 100 percent of daily recommended micronutrients and 20 percent of protein if their growth was assessed to be poor, and parents received education on nutrition, health and hygiene.

III. Pregnant women visited clinics to obtain prenatal care, nutritional supplements worth 100 percent of daily-recommended micronutrients and 20 percent of protein, and health education. They were required to have 5 prenatal care visits starting in their first trimester.

IV. Lactating women visited clinics to obtain postpartum care, growth monitoring, nutrition supplements, and education about health, nutrition and hygiene.

 V. Other family members visited clinics once a year for physical checkups. During these checkups special attention was paid to family planning, the detection and treatment of parasites, the detection and treatment of arterial hypertension and diabetes mellitus, and the detection and treatment of cervical cancer. The visits also included education about health habits, hygiene accident prevention, and first aid treatment.

VI. All adult family members participated in regular meetings at which health, hygiene, and nutrition issues and best practices were discussed. Female head of households had to attend bi-monthly meetings, whereas other adults had to attend once a year. Physicians and nurses specially trained in these topics conducted these sessions.

In order to transfer the cash, *Oportunidades* had to verify that households actually completed the required health care visits by having medical providers at public clinics that administered the required services certify that households actually completed the requirements. A similar procedure was followed for the cash transfer associated with school attendance. About 1 percent of households were denied the cash transfer for non-compliance.[3]

IV. CONCEPTUAL FRAMEWORK

Children born into resource-poor environments suffer from a myriad of deprivations and disadvantages that are detrimental to intellectual and behavioral

development.[4] These conditions include poor physical resources, such as over-crowded homes with poor sanitation and lack of water supply, few household possessions and low income. Parents may have limited education and intelligence, low skilled occupations and little knowledge of child development and the importance of play, and they may also suffer from anxiety or depression. Stimulation in the home is generally poor, with few toys or books, and infrequent participation by the parents in play activities. As a result of several factors, including lack of stimulation in the environment, children who grow up in poverty often do not reach their potential, or the "basic capabilities" they will need to be successful in society.[5]

Health and nutrition in the formative years are significantly related to physical and cognitive development.[6-11] Healthier children start school earlier,[12] receive more years of schooling, and do better in school than unhealthy children. [13-16] In addition, healthier adults have substantially higher wages.[17-23]

In situations of poverty, children are more likely to be born low birthweight (LBW, defined as less than 2500g at birth) and LBW children generally have poorer levels of development than normal birth weight infants.[24] LBW babies tend to be shorter and lighter than normal birth weight babies,[25] and they are at greater risk of neurological dysfunction, hyperactivity, clumsiness and poor school performance,[26] neonatal and infant mortality, severe diarrhea, and pneumonia,[27, 28] poor cognitive development,[29] and impaired immune function.[30-34]

Children living in poverty are also more likely to experience growth retardation during childhood. Stunted children face a host of challenges in life,

including behavioral problems and delayed cognitive development.[4] Significant

associations exist between height-for-age and children's cognitive development

c.f.[14, 16, 35, 36-46] Significant associations have also been found between stunting

and poor psychomotor development in young children c.f.[38, 43, 47, 48] Stunting has

also been associated with poor fine motor skills in children [37, 49] and with altered

behavior.[50]

These negative consequences of poverty have prompted many

governments in the world to intervene and try and improve outcomes for people

living in poverty.   Health and nutrition interventions early in life could be the key

for children from poor families to be able to lead better lives. Interventions

generally fall into two categories: 1) general direct cash transfers and 2)

improving the provision of healthcare and nutritional services (**Figure 1**).
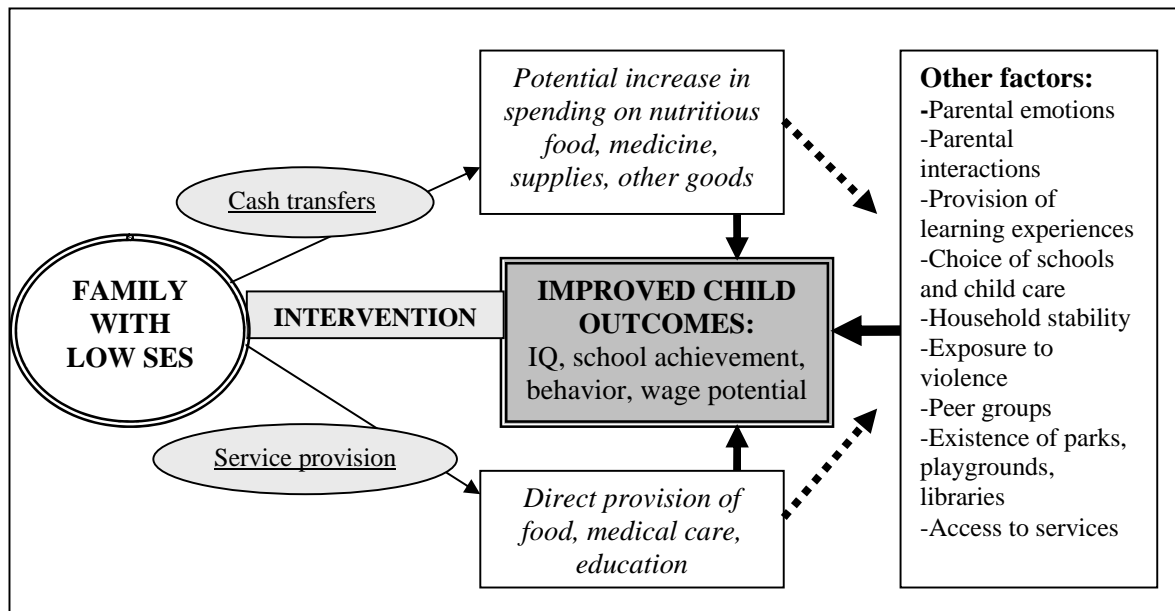
Figure 1: Theoretical model showing possible outcomes for children if resource-poor families are offered either cash transfers or direct service provision.

Direct cash transfer refers to money that is given out as assistance with no "strings" attached – the recipient can spend it in whatever way s/he wants. The direct cash transfer approach assumes that parents are income-constrained, and thus simply do not have the money to spend to meet their children's most pressing needs (e.g. nutritious food or medical treatment). Providing purchasing power permits parents to choose what goods they want to buy, and allows them choices about quantity and quality of their purchases. The risk is that parents may not understand the benefits of some health interventions and coupled with competing priorities (e.g. adult health and nutrition, housing, leisure time activities), they many not use the cash for its intended purpose.

Unlike direct cash transfers, direct provision of healthcare and nutritional services seems to be better at targeting interventions to child health. In the United States, the Supplemental Food Program for Women, Infants and Children (WIC), for example, has shown a reduction in rates of iron deficiency anemia in infancy,[51] infant mortality,[52] babies born small for gestational age,[53] and height-for-age in childhood.[54] Some small improvements in diets and behaviors of pregnant women have been reported, and may improve the diets of one- to four-year-old children.[55]

A crucial problem with these programs, however, is the overall low participation, with families in greatest need often at the lowest participation rates. For instance, in the WIC program, the positive impact on iron deficiency anemia only occurred in women who participated in the program and met with a health professional.[56] Prenatal care and nutrition monitoring and supplementation

programs only benefit those women and children who actually choose to attend prenatal care visits.[57, 58] Similarly, pregnant women who already have children are less likely to attend nutritional counseling through the WIC program.[59, 60] While there have been a large number of government run nutrition programs targeted to poor populations in developing countries, there has been little formal evaluation of the impact on health outcomes. The results of those few in the developed world that have been rigorously studied are mixed at best.[55, 61]

Oportunidades is unique in the way that it combines these two approaches. When a family living at low socioeconomic status (SES) receives cash transfers from Oportunidades, there is the potential that there is a subsequent increase in spending on goods that could directly improve child outcomes – just as there is the possibility that direct service provision will result in directly improved child outcomes. However, there is also the possibility that either one of these interventions will result in other factors, which could then indirectly improve child outcomes. The other factors could be family characteristics (e.g. provision of learning experiences or parental interactions), or community and neighborhood characteristics (e.g. exposure to violence, peer groups, or school characteristics).[62]

Understanding how poverty, inadequate nutrition, and the quality of health care interact to result in poor health status for children in the developing world is a critical public health issue. The complicated mechanisms whereby low income, poor health, and low cognitive capacity are jointly determined make it particularly

desirable to find examples where, by design, it is possible to carefully isolate the impact of a specific policy intervention on child health and development.

V. METHODS

Our objectives are to estimate the medium-term (3 to 6 year exposure) net impact of *Oportunidades* on various indicators of child development and to test whether starting the intervention in the prenatal period yields larger effects than starting the program in the first two years of life. We test these hypotheses by comparing the outcomes of three different groups. The first group started receiving benefits in the spring of 1998 (original treatments) and has been on the program about five and one half years. A second group started receiving benefits about a year and a half after the first cohort (original controls). Finally, the third group has never received benefits (new controls). In order to test the overall program impact we compare the combined outcomes of original treatments and controls to the new controls. In this case, the first original treatments and controls comprise the new treatment group and the last group (new controls) is our control group. In order to test the second hypothesis, we exploit the variation induced by the fact that the original control group started the program a year and a half later. This gives us children of the same age today who started the program at different times.

The original treatment and control groups were generated as part of the original evaluation designed to get at the short-run impacts (an 12 to 18 month exposure). At the inception of the *Oportunidades* program, and with the purpose

of conducting a rigorous evaluation, subsets of eligible communities in rural areas were randomly assigned to treatment and control groups. Information on all households (eligible and non-eligible) in treatment and control communities was collected in the ENCEL *Encuesta de Evaluacion de los Hogares,* or Evaluation Surveys, including detailed information on consumption, assets, labor supply and time use, household demographic composition, health, nutrition, education, migration and so on. The original ENCEL sample consisted of a panel of approximately 24,000 households in 506 communities (320 original treatments and 186 original controls), collected in six rounds of data between 1998 and 2000.

Figure 2 shows take up rates for eligible households in the original treatment and control villages over time. Eligible households in the original treatment villages began receiving benefits immediately (spring 1998) [2], while benefits for eligible households in original control villages were postponed for over a year and a half. Take-up in this first year of the program was almost universal as some 97 percent of households certified as eligible from the original treatment group were incorporated right away. In 2001 and again in 2002, *Oportunidades* re-evaluated households through a process called "densification" and two new groups of households became eligible. A number became eligible because their economic status deteriorated since 1997 and *Oportunidades*

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[2]The lower take up rates in treatment communities at the beginning of the program can be explained in part by the adoption of a new scoring method referred to as "densification". The original scoring system classified about 50% of households as eligible, and the densification process incorporated an additional 25% of households. For a number of treatment communities, households classified as eligible under the new scoring system did not begin receiving cash transfers until later dates.
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changed the eligibility criteria to allow families who were less disadvantaged into the program and another large group from the original treatment villages was incorporated into the program. We exclude the group of households incorporated after 2000 from the analysis in order to work with the households that had at least three years exposure to program benefits.

In localities assigned to the original control group, none of the households received *Oportunidades* benefits nor were they informed that *Oportunidades* would provide benefits to them at a later date. The original control villages were incorporated into *Oportunidades* beginning in the winter of 1999, and again enrollment of eligible households was almost universal. Similar to the original treatments, additional families from the original control areas were incorporated because *Oportunidades* re-evaluated households, through "densification" and changed the eligibility criteria. Again, we exclude the set of households incorporated after 2000 from the analysis in order to work with the households that had at least three years exposure to program benefits.

Because almost all eligible households in the original 506 evaluation communities were incorporated into the program, we needed to generate a new set of comparable controls that had not yet been incorporated into the program. In 2003, the evaluation added a new control group, which was surveyed along with the original 506 evaluation communities. The 151 new "control" communities were selected from the same original 7 evaluation states where the original 506 communities exit[3]. They were selected by matching the new community

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[3] The new control sample actually included 152 villages, but there was universal non-response in one village which leaves us with 151 new control villages.

characteristics to the old ones using information from the 2000 General Census of Population and Housing (Censo General de Población y Vivienda 2000) in order to select new controls that resemble the old ones close as possible [63]. An additional questionnaire was applied to these households to collect retrospective pre-program information from 1997.

The new control communities are likely somewhat better off than the original evaluation communities because of the way *Oportunidades* incorporated communities into the program. *Oportunidades* used census to stratify all rural villages based on their marginality, i.e. an index of poverty based on census data, and then incorporated the poorest villages with 500 to 2500 households that had access to schools and basic health care. Therefore, the villages left to be chosen as new controls in the these states were ones that were slightly better off or had less access to infrastructure. Since the new control households are drawn from different villages and therefore may experience different local area effects, and since the program was first incorporated in the poorest areas (targeting), new control localities tend to have fewer poor. If these differences in individual, household and environmental characteristics are correlated with child development outcomes, then straight comparisons of the means of the new control and new treatment groups would be biased estimates of the true program impact. Therefore, we need to control for these differences in the analysis.

We will rely on multivariate regression and matching techniques to control for individual, household and environmental differences that could bias the estimated program impacts. We will try to find a control sample that best matches

the treatment group in terms of individual, household and community characteristics. Specifically, we would like to restrict the sample to treatment households that have similar controls and controls that have similar treatments along an array of characteristics.

We begin by filtering out the richest households in the richest new control communities by using household assets and characteristics in 2003. We also filter out all households in communities with a high concentration of rich households (more than 40%). The idea behind the use of these hard filters is to select out of the control sample those households with a level of wealth above the typical *Oportunidades* household in the context of rural Mexico. The hard filters used here are housing quality, car and tractor ownership, durable goods ownership and ownership of large expensive animals. Using these filters we dropped 979 households from new control communities.

We then use propensity score methods to select those new control households that look as similar as possible to the new treatment households from the original evaluation sample. This involves pairing families enrolled in the program (new treatments) with families from the new control areas that have similar observed attributes i.e. families that are on same common support of characteristics.[64, 65]

The objective is to construct a control group by finding controls that have similar observed characteristics as the treatments. Rosenbaum and Rubin,[66] show that to match treated and untreated units on the basis of characteristics is equivalent to match them using an aggregate index of the characteristics that

balances the treatment and control sample. The coarsest balancing index is the

propensity score which gives the conditional probability of receiving treatment

given the pre-treatment values of the vector characteristics. This result is very

important in practice since it reduces the potential problem of matching on a high

dimensional vector of characteristics to matching on a scalar.

We estimate propensity scores from a logit model of the probability that a

family living in a treatment area is enrolled in *Oportunidades* as a function of the

pre-intervention individual, household and village characteristics listed in Tables

1, 2 and 3. These models are then used to predict the propensity (probability)

that a family is enrolled in the program in treatment areas and would be enrolled

in comparison areas if the program were offered there. We then define the

common support sample as observations that have a propensity score greater

than the first percentile of the new treatment propensity score distribution and

less than the 99 percentile of the new control distribution.

We estimate the impact of the program using data on children age 24 to

71 months after having eliminated the wealthy households using the hard filters.

We also exclude treatment households who have been on the program less than

three years i.e, they were incorporated mostly in 1999, but all before the end of

2000, and evaluated in 2003. We estimate program impact on the development

outcomes using multivariate regression controlling for individual, households and

village characteristics first using the whole sample and then again restricting the

analysis to the common support sample. In order to test the hypothesis that

beginning program benefits in the prenatal period has a larger impact than

beginning in the first two years of life, we add a dummy variable to the multivariate regressions indicating if the family was incorporated into the program prior to birth. We conduct all of the analyses separately by gender and adjust the standard errors for inter-cluster correlation at the community level.

VI. DATA

We use the 2003 ENCEL socio-economic, community and biological surveys to estimate the program impact models. The surveys collected detailed individual, household and community indicators which can be used to compare the characteristics of communities and households in the various treatment and control groups. The outcomes analyzed were collected in the biological survey conducted in rural areas. From the children enrolled in the study, we obtained measurements of motor development, cognitive development and socio-emotional health. All outcome measures are described in further detail below. The individual and household characteristics that are used to control for potential bias were collected in the socio-economic survey and the village characteristics were collected in the community survey. We begin by describing the outcome measures.

We measure the cognitive development of young children using the Woodcock-Johnson-Munoz III tests, the MacArthur Communicative Development Inventories, and the Spanish version of the Peabody Picture Vocabulary Test (PPVT), the Test de Vocabulario en Imagines Peabody (TVIP), all of which are described in greater detail below.

The Woodcock-Johnson-Munoz III is a co-normed set of tests for measuring general intellectual ability, specific cognitive abilities, and scholastic aptitude. The scales have previously been translated into Spanish and adapted for Latin American contexts and have been used to evaluate effects of early childhood nutritional interventions and early health insults on cognitive development in infants [67] and older children. [68, 69] The Woodcock-Johnson tests have shown sensitivity to an income intervention in low income families [70], and can pick up differences between children who were born low birth weight when compared with normal weight children.[71, 72] Many other investigators have documented the changes in scores on the Woodcock-Johnson tests to interventions, such as changing eating patterns at home, including the increased intake of milk and other animal products.[73] Specifically, we use this protocol to measure children's long term memory ability, short memory ability, and visual integration ability for children 36 to 71 months.

We measure language ability using the The MacArthur Communicative Development Inventories (CDIs, or Inventario del Desarrollo de Habilidades Comunicativas: Palabras y Enunciados in Spanish) for children 24 to 35 months, the Test de Vocabulario en Imagines Peabody (TVIP) [74] for children age 36 to 71 months. The CDIs are parent report forms for assessing language and communication skills in infants and young children which have been shown to provide valid assessments of early language milestones in young Spanish-speaking children,[75] and have been linked with important biological outcomes.[76] The TVIP contains 125 translated items to assess the vocabulary of spanish-

speaking and bilingual students. Items have been carefully selected through rigorous item analysis for their universality and appropriateness to Spanish-speaking communities. The TVIP is frequently used to evaluating the language development of Spanish-speaking preschool children, and older students.[77, 78]

We measure *motor development* using the <u>McCarthy Scales of Children's Abilities</u>, a comprehensive battery that offers a broad picture of a child's abilities with attractive materials and carefully designed game-like tasks suitable for children of both sexes and from various ethnic, regional and socio-economic backgrounds.[79]

In order to assess s*ocio-emotional and behavioral development* , we used the <u>Achenbach Child Behavior Checklist</u>, which the parent or guardian uses to rate a child's problem behaviors and competencies.[80] It is designed to assess in a standardized format the behavioral problems and social competencies of children as reported by parents and includes questions relating to aggression, hyperactivity, bullying, conduct problems, defiance, and violence at home and at school, and has been used in low-income Spanish-speaking populations.[81-83]

VII. RESULTS

Using data from a rural survey conducted in the fall of 2003, some five and one-half years after the program first began in study areas, we find that there are large impacts of the program on all dimensions of motor development in both boys and girls. We also find an impact on socio-emotional development in girls. However, the analysis raises a major concern for policy, because we found little

evidence of impact on the cognitive development. We also find little evidence that the benefits were larger for those who started receiving benefits in the ante-natal period.

VII.A. Balance of Control and Treatment Groups

We begin by assessing the extent to which the three analysis groups are balanced in terms of individual, household and community characteristics. Table 1 compares community characteristics of the original treatment and control groups in part A, and compares original evaluation groups (original treatment plus original control) with new control communities in part B. Table 2 and 3 do the same but for household demographic characteristics and household economic characteristics, respectively. All baseline data for the new controls corresponds to information collected in a retrospective questionnaire (new control households were asked about 1997 household characteristics in 2003). For households in the original evaluation groups, information was collected prior to program implementation, in 1997.

Panel A in Tables 1, 2 and 3 represents tests of means on the original treatment and original control samples for all eligible households. They show that treatment status is uncorrelated with any observed heterogeneity. Panel B in each of these tables shows the means and the T-statistic of significance of difference in means for between the original evaluation groups and the filtered new control group. Panel B of Tables 1, 2 and 3 shows the need to statistically control for heterogeneity in the analysis, even once the hard filters have been applied.

New controls appear to have smaller household sizes, an older household composition (although they also seem to have younger and less educated heads and spouses) and lower dependency and crowding ratios. They report fewer farm assets (draft and production animals) but more use of land for productive purposes. With respect to dwelling characteristics and non-farm assets they appear better off according to certain variables (water, land, car) and worse off according to some others (refrigerator, bathroom). Concerning community characteristics, new control communities have higher female agricultural wages, are less indigenous, have better drainage systems and receive more government assistance. It is clear that there are important differences which call for the use of econometric techniques that account for the lack of randomization in the sub-sample selection.

VII.B. Descriptive Statistics

We now turn to the results for the development outcome indicators. Our analysis uses data from the biological survey attached to the socio-economic survey. Sample sizes by child development indicator are presented in Table 4. The indicators are split into rows starting with cognitive measures, motor measures, and ending with socio-behavioral measures. The first column reports the age range for which the measure was collected. The next three columns report the sample sizes for the treatment group (original 1997 treatment and control groups) split by boys and girls, and the last three columns report the sample sizes for the (new) control group. For the measures that cover the age

range 36-71 months, we have about 4000 treatments and about 1000 controls split about evenly between boys and girls. For the two measures that cover the 24-35 month age range, we have about 800 treatments and 250 controls. The exact sample sizes vary by test due to differences in response rates and data capture errors.

In Tables 5 and 6 we compare the treatment and control averages of each of the development measures for boys and girls, respectively. Tables 7 and 8 perform the same comparison using the common support sample. In the first panel of each table, we present the results for the cognitive measures. We report the Woodcock Johnson measures and the Peabody test both in terms of raw scores and in terms of where scores fall into the distribution of outcomes for a standardized Spanish-speaking population. The percentile representation of the scores allows us to compare this population to a more generalized Spanish-speaking population.

Figure 3 presents the percentiles for these four tests by gender and by control and treatment. Remarkably, the *Oportunidades* population has very low levels of cognitive development compared with a normed population across all measures and groups. These delays are evident in all groups, regardless of treatment status, and are in no way reflective of any aspect of the *Oportunidades* intervention. Due to poor socioeconomic conditions, the children place on average in about the 15th percentile for long term memory, the 22nd percentile for short term memory, the 7th percentile for visual integration and 17th percentile for vocabulary. These results suggest substantial cognitive delay, which suggests

that these children will be at a severe disadvantage when they enter school in the next few years in terms of their ability to learn. It is important to note that the reference population used for norming the Woodcock-Johnson test was a sample of 802 children from Costa Rica, Mexico, Peru and Spain.[84] In spite of this limitation, the tests are still important for assessing this population in reference to children in other Spanish-speaking countries. The Peabody test was normed on a Spanish-speaking Mexican population, but one that was of a higher socio-economic status than the children tested in *Oportunidades.*

Starting with cognitive development, we find that 3 to 6 year old boys in the treatment group score 18 percent higher on the vocabulary test in the whole sample and 16 percent in the common support sample. We also find that 2 year olds score 14 percent high on the McArthur Words and Sentences test using the whole sample and 22 percent higher when we restrict the sample to the common support. We find no other significant differences at the 5 percent or better level for boys and no significant difference in cognitive development indicators for girls. These same results are evident when we restrict the sample to the common support.

However, we find that both boys and girls in the treatment group have significantly better motor skills than those in the control groups and the orders of magnitude are the same for the results using the whole sample and the common support sample. Boys in the treatment group score about 10 percent higher than those in the control group across the 8 motor skill development tests in the

common support sample. Girls in the treatment group score about 15 percent higher than girls in the control group in the same sample.

VII.C. Estimates of Program Impact

We now turn to the estimated program impacts from the multivariate regressions on the whole sample and on the common support sample. In Table 9, we report the estimated coefficient on the treatment dummy variable indicator, the associated t-statistics for the hypothesis that the coefficient is significantly different from zero, and the implied percentage change in the outcome measured by dividing the coefficient by the mean of the control group times 100. While we included the individual, household and community variables listed in Tables 1, 2, and 3, we do not report those results in the interest of space and readability. The results are remarkably consistent for the analyses using the whole sample and using the common support sample. Therefore, we will only discuss the common support results here.

There does not appear to be any effect of the program on the cognitive development of boys or girls. Only one of the 12 impact coefficients is significantly different from zero. The point estimates for boys suggest that the treatment group scores about 5 percent better across all of the tests, but our sample sizes are too small to determine if this is a statistically meaningful effect. For girls, we get both positive and negative signs, again with magnitudes of about a 5 percentage difference.

We do, however, find large, significant and robust positive impacts on the motor development measures for both boys and girls, and socio-emotional development for girls. We see an improvement of about 15 percent on average across the eight motor skills tests for boys, and about 10 percent on average for girls across the eight skill tests.

We also find that the program improved socio-emotional development for girls and possibly for boys. We find that the program reduced socio-emotional problems by about 9 percent for girls and that difference was statistically significant. We did find a reduction in socio-emotional problems among boys but the point estimate was not significantly different from zero.

In Table 10, we report the results for the regression models used to test the hypothesis that there are larger program impacts if the child begins to receive benefits in the prenatal period as opposed to the first two years of life. For each development indicator we report the coefficient from the treatment dummy variable indicator and the dummy variable indicating whether the benefits began in the prenatal period. The sign and significance of the coefficient on the second variable is the test of whether beginning in the prenatal period matters. Examining Table 10, we find no consistent evidence that starting benefits in the prenatal period leads to greater program effects than starting the program in the first two years of life.

VIII. DISCUSSION AND RECOMMENDATIONS

Our main objective in this report was to evaluate the medium term impact of *Oportunidades* on child development. Specifically, using data for a survey in the fall of 2003, some 5 and one-half years after the program began in study areas, we evaluated the impact of the program on motor development and cognitive and socio-emotional development of children 2-6 years old at the time of survey. We compared a treatment group of children whose families had been receiving benefits for at least three years.

Overall, we find large impacts of *Oportunidades* on motor development. Specifically, we find a 15 percent improvements in motor skills across eight motor skill tests for boys and a 10 percent improvement for girls. We also find an improvement in the socio-emotional development of girls and possibly for boys. These results are important and suggest that effects of the program are substantial over the medium term of three to six years. The results not only imply that children are healthier and better developed, but also that they are better prepared to enter school and to absorb the lessons taught. The implications of these findings are that these children are starting off life better because of *Oportunidades.*

However, the analyses also highlighted a critical area in which the *Oportunidades* program could be strengthened. Our analyses highlighted the finding that there are very low levels of cognitive development of children in these poor rural communities, and that there appears to be little impact of *Oportunidades* on these levels. Cognitive development of young children is critically important, not just as an outcome measure in itself, but as an important

condition for children to be able to benefit from school. Indeed, this idea is central to the lifecycle and health-nutrition-education complementary framework on which *Oportunidades* is based. Hence, improvements in the cognitive abilities of children of preschool age would likely have large effects on school entry, completion and performance.

These results suggests that while the brain may be more prepared for cognitive development biologically due to the better nutrition, there may be the lack of necessary stimulation to develop cognitive skills in the home and environment. *Oportunidades* may want to consider some programmatic changes to provide more stimulation for these children. Integrating early childhood stimulation into primary care for children has been shown to result in significant improvements in developmental quotient, hearing and speech, hand and eye coordination, and other performance measures [85, 86]. These programs have been shown to be most effective when they are integrated into existing services for young children.

Another supplementation study aimed specifically at stunted children was conducted with Jamaican children aged 9 to 24 months.[87] On enrolment the stunted children's development was already poorer than a matched non-stunted group. The stunted children received nutritional supplementation for two years with or without psychosocial stimulation. Supplementation and stimulation produced independent benefits to the children's mental and motor development. The benefits from a combination of supplementation and stimulation were additive, and only the children receiving both treatments caught up to the non-

stunted control group in developmental levels. The implications of these findings are that at least part of the deficit in the development of stunted children is due to poor nutrition. However, both stimulation and supplementation are necessary to improve the development of stunted children to culturally appropriate levels.

Given the importance of stimulation during childhood, the *Oportunidades* pláticas could be expanded to include teaching skills to parents. These lessons could be about how to stimulate their children, including how to make simple toys, how to interact with children at various developmental levels, and what milestones to look for in the development of language and cognition. *Oportunidades* could also consider introducing more intensive activities to promote child stimulation such as preschool or organized developmental play, establishing a toy and book lending library, or training community health aides to visit homes and teach parents one-on-one how to interact with and educate their children.

Our results raise important questions as to why we are finding a positive impact on motor skills but not finding an impact on cognitive skills. Other studies have shown that interventions have an impact on motor but not cognitive development[88]. However, similar studies have found small cognitive benefits of early supplementation. In three early studies of preventive supplementation, similar to *Oportunidades,* in Guatemala,[40] Colombia,[89] and Mexico,[90] pregnant women were given nutritional supplements and then their offspring were supplemented for three or more years. The supplemented children in all studies showed concurrent gains in height and cognition compared with non-

supplemented children. All three studies have followed up the children. The Mexican study was extremely small and the supplemented groups were separated by time. However at follow up at age 18 years the supplemented group boys had significantly higher scores on a test of cognition (Raven's Matrices) than non-supplemented boys there was no difference in the girls.[91] In Bogota, Colombia, the children were studied at 7 years of age and the supplemented children had higher scores on tests of reading readiness but not in arithmetic and basic knowledge.

The Guatemalan study had the most in-depth follow up.[92] The children were reassessed at 11 to 24 years old, and the supplemented children were found to have small but wide ranging benefits in tests of numeracy, knowledge, vocabulary and reading achievement. Benefits were greatest in children from the poorest homes. In this study, benefits from supplementation were not apparent at seven years but were present at adolescence, suggesting that there may be long term effects of the *Oportunidades* intervention that do not appear until later in life.

Biological theory argues that a solid nutritional background and good health status is necessary for development along both dimensions. However, the brain and body must be exercised and stimulated to develop cognitive and physical skills. Whereas children must walk from place to place and are engaged in physical activity as a part of play, it is not clear how much mental stimulation there is in their environments. Indeed, most parents of these children have not completed primary school. This result suggests that while the brain may be more

prepared for cognitive development biologically due to the better nutrition, there maybe a lack of the stimulus needed to fully develop cognitive skills in the home and environment. This may change when kids start school or *Oportunidades* may want to consider some programmatic changes to stimulate the brain. This could at minimum be an addition to the platicas in terms of teaching skills to parents about how to stimulate kids, to more intensive activities such as preschool or organized developmental play.

Finally, we found no advantage in terms of child development to starting benefits in the prenatal period as opposed to the first two years of life. This finding suggests that the program helps kids catch up from insufficient nutrition and illness during the prenatal period. However, we would not recommend dropping the prenatal interventions as they could have large effects on maternal health, they help prevent short run health and nutrition outcomes that could affect the quality of life of young children, and they could create a change of behavior towards getting regular preventive care and better nutrition habits. In addition, several other studies have shown positive impact of early interventions in the first two years of life. [93, 94]

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Table 1: Means of Community Characteristics for Treatment and Controls Groups

Community Characteristics	Panel A. Original (1997) Evaluation Groups			Panel B. Original Group vs New Controls		
	Original Treatments	Original Controls	T-Statistic for Test of Difference	Treatment (Original Groups)	New Controls	T-Statistic for Test of Difference
Indigenous Community =1	35.05	34.00	0.188	38.24	22.37	2.785
Electricity =1	68.27	76.72	-1.846	68.88	64.11	0.743
Drainage =1	12.36	8.02	1.189	10.05	26.49	-2.364
Telephone =1	77.50	82.87	-1.361	79.85	75.69	0.840
Pre-school =1	94.19	92.89	0.647	94.26	91.60	1.283
Primary School =1	98.75	97.18	1.230	98.21	97.20	1.003
Telesecundaria =1	28.64	37.46	-1.568	32.33	30.22	0.283
Junior High School (Secundaria) =1	3.88	1.35	1.257	2.72	2.71	0.004
Prepa =1	4.67	5.26	-0.208	4.31	1.85	1.383
Health Center =1	79.36	83.82	-1.135	81.46	70.60	1.818
Mobile Health Center =1	71.80	70.74	0.208	70.54	52.51	2.589
Abarrotes Shop =1	39.86	36.18	0.653	38.24	39.56	-0.184
Diconsa Shop =1	31.33	21.70	1.894	27.62	20.97	1.209
Community Receives Desayunos =1	73.80	71.00	0.540	72.89	72.10	0.122
Community Receives Despensas =1	37.59	36.88	0.135	36.66	55.53	-2.735
Formal Credit Institution =1	2.70	1.15	1.145	1.95	1.39	0.472
Informal Credit Institution =1	11.53	5.95	1.884	9.13	10.26	-0.270
Minimum Distance to Secundaria (in Km)	4.13	4.42	-0.730	4.21	4.09	0.330
Minimum Distance to Preparatoria (in Km)	16.18	16.14	0.020	15.94	15.15	0.321
Minimum Distance to a Formal Credit Insitution (in Km)	31.04	30.98	0.025	31.29	31.15	0.054
Minimum Distance to an Informal Credit Institution (in Km)	25.62	24.70	0.239	25.32	27.37	-0.544
Monthly Agricultural Male Wage	1552.86	1511.97	0.534	1510.74	1795.22	-1.449
Monthly Agricultural Female Wage	1338.31	1377.95	-0.330	1332.75	1603.54	-2.265
Monthly Agricultural Children Wage	1081.96	1056.49	0.153	1071.87	1025.21	0.363
Number of Villages	320	186		506	151	

SE clustered at the Community Level

Table 2: Means of Household Demographic Characteristics for Treatment and Controls Groups

Household Characteristics –Demographics	A. Original (1997) Evaluation Groups			B. Original Evaluation Group vs New Controls		
	Original Treatments	Original Controls	T-Statistic for Difference	Treatment (Original Groups)	New Controls	T-Statistic for Difference
Age Household Head*	49.92	50.49	-1.212	48.93	46.75	3.633
Female Head =1*	13.29	13.78	-0.662	13.32	13.70	-0.376
Indigenous Head =1*	35.55	34.78	0.156	39.03	23.90	2.915
Head's Education (Years)	4.27	4.11	1.644	4.17	4.62	-3.759
Age Spouse of Head*	44.31	44.77	-1.106	43.30	40.85	4.686
Spouse's Education (Years)	4.32	4.25	0.814	4.25	4.65	-3.584
Presence of Children 0 to 7 =1 *	66.95	67.62	-0.550	72.19	58.62	8.973
Presence of Children 0 to 7 =1 *	73.64	74.27	-0.677	76.69	53.88	20.163
Presence of Adults 18 to 54 =1 *	92.90	93.07	-0.300	93.16	90.30	2.635
Presence of Adults Older than 55 =1 *	44.42	45.93	-1.242	41.06	33.45	5.170
Presence of Disable in the Household =1 *	5.24	5.58	-0.811	5.64	5.27	0.799
Number of 5 to 15 Not Enrolled in School =1 *	1.28	1.30	-0.423	1.26	1.25	0.367
Number of 8 to 15 Working for Wage =1 *	1.24	1.21	0.772	1.23	1.28	-1.034
Household Size*	5.29	5.37	-1.117	5.50	4.63	10.448
Dependency Ratio* (Nb workers/nb non-workers)	2.01	2.03	-0.485	2.15	1.74	12.569
Crowding Index* (Nb people/nb rooms)	3.52	3.57	-0.475	3.85	3.58	3.376
Number of Villages	320	186		506	151	
Number of Households	12,432	7,731		20,163	6,689	

*Baseline Information (November 1997)

SE clustered at the Community Level

Table 3: Means of Household Asset Ownership Characteristics for Treatment and Controls Groups

Household Characteristics -Asset Ownership	A. Original 1997 Evaluation Sample			B. Original 1997 Evaluation Sample and New Controls		
	Original Treatment	Original Control	T-Statistic for Difference	Treatment (Original Sample)	New Control	T-Statistic
Water in the land =1 *	39.95	31.83	1.957	33.88	41.04	-1.559
Water in the house =1 *	7.46	5.98	1.342	5.53	13.29	-4.365
Dirt floor =1 *	59.19	59.83	-0.216	66.12	71.56	-1.910
Bathroom =1 *	58.85	59.63	-0.259	57.44	51.27	2.143
Electricity =1 *	71.89	76.70	-1.486	70.04	66.46	0.948
Waste walls =1*	16.15	19.89	-1.337	19.60	17.97	0.536
Wood walls =1 *	23.49	22.78	0.227	25.59	28.16	-0.641
Adobe walls =1 *	21.81	18.03	1.177	20.06	16.14	1.092
Concrete walls =1 *	38.24	39.04	-0.230	34.56	37.11	-0.670
Waste roof =1 *	72.12	73.56	-0.530	76.06	76.37	-0.095
Concrete roof =1 *	27.88	26.44	0.530	23.94	23.63	0.095
Blender =1 *	31.38	36.67	-2.106	26.55	21.11	2.453
Fridge =1 *	14.48	16.05	-0.996	9.78	8.34	1.354
Gas Heater =1 *	28.94	31.19	-0.712	22.81	23.23	-0.128
Boiler =1 *	2.94	2.79	0.349	2.30	2.10	0.634
Radio =1 *	63.41	66.21	-1.661	60.35	48.02	6.013
Stereo =1 *	4.96	5.21	-0.493	3.85	3.15	1.604
TV =1 *	44.91	50.18	-1.974	40.23	30.35	3.439
Washer =1 *	4.40	4.62	-0.240	2.67	1.44	2.978
Fan =1 *	6.93	9.04	-1.301	5.05	5.48	-0.380
Car =1 *	1.93	2.11	-0.504	0.37	1.28	-3.559
Van =1 *	6.84	7.39	-0.585	1.43	1.93	-1.393
No Agricultural Assets =1*	8.09	9.18	-1.102	9.05	29.96	-6.530
Draft Animals Ownership =1*	40.07	38.56	0.661	37.03	24.22	5.526
Production Animals Ownership =1*	84.04	84.10	-0.043	83.53	58.70	7.441
Number Hectares Used for Productive Purposes**	3.23	3.48	-1.252	2.97	4.78	-4.080
Number of Villages	320	186		506	151	
Number of Households	12,432	7,731		20,163	6,689	

*Baseline Information (November 1997); SE clustered at the Community Level

Table 4: Age Ranges and Sample Sizes For Child Development Outcome Measures

Outcome Measure	Age Range	Treatment Group			Control Group		
		Boys	Girls	Total	Boys	Girls	Total
Cognitive Development							
Woodcock Johnson 1: Long Term Memory Test	36-71 months	2063	1962	4025	550	564	1114
Woodcock Johnson 2: Short Term Memory Test	36-71 months	1970	1888	3858	521	535	1056
Woodcock Johnson 5: Visual Integration Test	36-71 months	1724	1635	3359	439	452	891
Peabody Picture Vocabulary Test (PPVT)	36-71 months	1649	1558	3207	424	445	869
MacArthur Communication Dev. Inventory	24-35 months	394	391	785	137	119	256
Macarthur Sentences Test	24-35 months	397	396	793	143	123	266
Motor Development							
McCarthy 1: Walking Backwards	36-71 months	2097	1996	4093	578	576	1154
McCarthy 2: Standing on right foot	36-71 months	1984	1896	3880	553	556	1109
McCarthy 3: Walking on Tiptoes	36-71 months	2048	1944	3992	567	570	1137
McCarthy 4: Standing on left foot	36-71 months	1952	1883	3835	552	556	1108
McCarthy 5: Walking Straight Line	36-71 months	2089	1984	4073	571	573	1144
McCarthy 6: Skipping	36-71 months	1895	1791	3686	540	548	1088
McCarthy 2b: Seconds Standing on Right Foot	36-71 months	2039	1952	3991	563	565	1128
McCarthy 4b: Seconds Standing on Left Foot	36-71 months	2020	1931	3951	566	568	1134
Socio-Behavioral Development							
Achenbach Child Checklist	36-71 months	2039	1945	3984	564	555	1119

Table 5: Comparison of Boy's Development Indicator Averages Using the Whole Sample

Outcome Measure	Treatment Sample			Control Sample			Treatment – Control		
	N	Mean	Std Dev	N	Mean	Std Dev	Difference	% Difference	T-Statistic
Cognitive Development									
Woodcock Johnson 1: Long Term Memory Test	2063	13.01	11.66	550	11.81	11.13	1.20	10.16%	1.59
Woodcock Johnson 2: Short Term Memory Test	1970	22.38	9.80	521	20.98	10.02	1.40	6.67%	1.82
Woodcock Johnson 5: Visual Integration Test	1724	11.71	5.59	439	10.93	5.44	0.78	7.14%	1.69
Woodcock Johnson 1 Percentile	2063	16.08	20.82	550	16.28	21.02	-0.20	-1.23%	-0.16
Woodcock Johnson 2 Percentile	1970	21.54	24.81	521	20.96	25.68	0.59	2.81%	0.26
Woodcock Johnson 5 Percentile	1724	7.15	13.39	439	6.85	12.75	0.30	4.38%	0.31
Peabody Picture Vocabulary Test (PPVT)	1649	14.14	11.62	424	11.94	10.21	2.20	18.43%	2.37
PPVT Percentile	1594	18.86	20.75	401	17.67	20.24	1.19	6.73%	0.69
MacArthur Communication Dev. Inventory	394	65.06	29.31	137	63.15	29.23	1.91	3.02%	0.53
Macarthur Words & Sentences Test	397	0.71	0.46	143	0.62	0.49	0.09	14.52%	2.00
Motor Development									
McCarthy 1: Walking Backwards	2097	1.21	0.49	578	1.03	0.47	0.18	17.48%	3.91
McCarthy 2: Standing on right foot	1984	1.13	0.65	553	1.00	0.65	0.14	14.00%	2.87
McCarthy 3: Walking on Tiptoes	2048	1.07	0.58	567	0.88	0.54	0.19	21.59%	4.04
McCarthy 4: Standing on left foot	1952	1.10	0.67	552	0.98	0.68	0.11	11.22%	2.22
McCarthy 5: Walking Straight Line	2089	1.15	0.52	571	0.98	0.49	0.16	16.33%	4.23
McCarthy 6: Skipping	1895	1.10	0.94	540	0.85	0.86	0.25	29.41%	4.19
McCarthy 2b: Seconds Standing on Right Foot	2039	6.63	4.48	563	5.81	5.47	0.82	14.11%	2.41
McCarthy 4b: Seconds Standing on Left Foot	2020	6.52	4.53	566	5.70	5.58	0.81	14.21%	2.32
Socio-Behavioral Development									
Achenbach Child Checklist	2039	10.75	5.38	564	11.38	5.27	-0.63	-5.54%	-1.87

Table 6: Comparison of Girl's Development Indicator Averages Using the Whole Sample

Outcome Measure	Treatment Sample			Control Sample			Treatment – Control		
	N	Mean	Std Dev	N	Mean	Std Dev	Difference	% Difference	T-Statistic
Cognitive Development									
Woodcock Johnson 1: Long Term Memory Test	1962	12.23	10.81	564	11.80	10.46	0.43	3.64%	0.56
Woodcock Johnson 2: Short Term Memory Test	1888	22.55	9.74	535	21.10	9.92	1.45	6.87%	1.63
Woodcock Johnson 5: Visual Integration Test	1635	11.32	5.28	452	10.92	5.46	0.39	3.57%	0.70
Woodcock Johnson 1 Percentile	1962	14.85	19.36	564	15.49	19.11	-0.64	-4.13%	-0.54
Woodcock Johnson 2 Percentile	1888	23.12	25.27	535	21.72	25.96	1.39	6.40%	0.55
Woodcock Johnson 5 Percentile	1635	7.12	13.40	452	7.74	15.30	-0.63	-8.14%	-0.58
Peabody Picture Vocabulary Test (PPVT)	1558	13.08	10.95	445	12.17	11.09	0.91	7.48%	0.98
PPVT Percentile	1495	17.68	20.00	427	18.99	21.28	-1.31	-6.90%	-0.86
MacArthur Communication Dev. Inventory	391	68.13	27.28	119	66.45	27.54	1.67	2.51%	0.49
Macarthur Sentences Test	396	0.70	0.46	123	0.68	0.47	0.02	2.94%	0.32
Motor Development									
McCarthy 1: Walking Backwards	1996	1.19	0.50	576	1.07	0.41	0.12	11.21%	2.13
McCarthy 2: Standing on right foot	1896	1.13	0.64	556	1.02	0.63	0.11	10.78%	2.02
McCarthy 3: Walking on Tiptoes	1944	1.09	0.56	570	0.96	0.50	0.13	13.54%	2.28
McCarthy 4: Standing on left foot	1883	1.12	0.65	556	1.02	0.66	0.10	9.80%	2.09
McCarthy 5: Walking Straight Line	1984	1.15	0.52	573	1.01	0.45	0.14	13.86%	3.08
McCarthy 6: Skipping	1791	1.08	0.94	548	0.92	0.88	0.16	17.39%	2.59
McCarthy 2b: Seconds Standing on Right Foot	1952	6.72	4.77	565	5.92	4.05	0.79	13.34%	2.56
McCarthy 4b: Seconds Standing on Left Foot	1931	6.66	4.82	568	5.92	4.67	0.74	12.50%	1.98
Socio-Behavioral Development									
Achenbach Child Checklist	1945	10.46	5.44	555	11.03	5.34	-0.57	-5.17%	-1.66

Table 7: Comparison of Boy's Child Development Indicator Averages Using the Sample on the Common Support

| Outcome Measure	Treatment Sample			Control Sample			Treatment – Control		
	N	Mean	Std Dev	N	Mean	Std Dev	Difference	% Difference	T-Statistic
Cognitive Development									
Woodcock Johnson 1: Long Term Memory Test	1300	12.46	11.31	467	12.22	11.40	0.24	1.96%	1.59
Woodcock Johnson 2: Short Term Memory Test	1235	22.25	9.87	440	21.44	9.93	0.80	3.73%	1.82
Woodcock Johnson 5: Visual Integration Test	1071	11.42	5.65	378	11.15	5.45	0.27	2.42%	1.69
Woodcock Johnson 1 Percentile	1300	15.60	20.27	467	16.38	21.10	-0.78	-4.76%	-0.16
Woodcock Johnson 2 Percentile	1235	22.16	25.22	440	21.29	25.83	0.87	4.09%	0.26
Woodcock Johnson 5 Percentile	1071	6.94	13.01	378	6.98	13.12	-0.04	-0.57%	0.31
Peabody Picture Vocabulary Test (PPVT)	1024	13.98	11.65	368	12.09	10.19	1.89	15.63%	2.37
PPVT Percentile	1024	19.24	21.16	368	17.64	20.13	1.59	9.01%	0.69
MacArthur Communication Dev. Inventory	256	66.92	27.97	104	62.79	29.66	4.13	6.58%	0.53
Macarthur Sentences Test	255	0.73	0.45	110	0.59	0.49	0.13	22.03%	2.00
Motor Development									
McCarthy 1: Walking Backwards	1368	1.18	0.50	490	1.08	0.42	0.09	8.33%	2.13
McCarthy 2: Standing on right foot	1297	1.13	0.64	470	1.03	0.63	0.10	9.71%	2.02
McCarthy 3: Walking on Tiptoes	1330	1.07	0.56	485	0.96	0.51	0.11	11.46%	2.28
McCarthy 4: Standing on left foot	1285	1.13	0.64	470	1.02	0.65	0.10	9.80%	2.09
McCarthy 5: Walking Straight Line	1362	1.13	0.52	487	1.02	0.46	0.11	10.78%	3.08
McCarthy 6: Skipping	1221	1.04	0.93	463	0.94	0.89	0.10	10.64%	2.59
McCarthy 2b: Seconds Standing on Right Foot	1335	6.60	4.31	479	5.95	4.10	0.65	10.92%	2.56
McCarthy 4b: Seconds Standing on Left Foot	1320	6.52	4.33	482	5.94	4.80	0.59	9.93%	1.98
Socio-Behavioral Development									
Achenbach Child Checklist	1286	10.79	5.35	474	11.34	5.20	-0.54	-4.76%	-1.87

Table 8: Comparison of Girl's Child Development Indicator Averages Using the Sample on the Common Support

Outcome Measure	Treatment Sample			Control Sample			Treatment – Control		
	N	Mean	Std Dev	N	Mean	Std Dev	Difference	% Difference	T-Statistic
Cognitive Development									
Woodcock Johnson 1: Long Term Memory Test	1342	11.18	10.09	482	12.15	10.75	-0.96	-7.90%	0.56
Woodcock Johnson 2: Short Term Memory Test	1293	22.25	9.76	459	21.10	9.99	1.15	5.45%	1.63
Woodcock Johnson 5: Visual Integration Test	1116	10.84	5.03	384	11.18	5.42	-0.33	-2.95%	0.70
Woodcock Johnson 1 Percentile	1342	13.31	18.25	482	15.54	19.20	-2.23	-14.35%	-0.54
Woodcock Johnson 2 Percentile	1293	22.88	25.30	459	20.73	25.12	2.16	10.42%	0.55
Woodcock Johnson 5 Percentile	1116	6.40	11.98	384	7.78	15.30	-1.38	-17.73%	-0.58
Peabody Picture Vocabulary Test (PPVT)	1078	12.31	10.36	384	12.38	11.14	-0.07	-0.01%	0.98
PPVT Percentile	1035	16.84	18.82	368	18.53	21.39	-1.69	9.12%	-0.86
MacArthur Communication Dev. Inventory	263	68.74	26.15	96	66.25	27.56	2.49	3.76%	0.49
Macarthur Sentences Test	265	0.73	0.44	100	0.68	0.47	0.05	7.35%	0.32
Motor Development									
McCarthy 1: Walking Backwards	1314	1.21	0.49	487	1.05	0.47	0.16	15.23%	3.91
McCarthy 2: Standing on right foot	1248	1.12	0.65	464	1.01	0.64	0.11	10.89%	2.87
McCarthy 3: Walking on Tiptoes	1286	1.06	0.59	476	0.91	0.54	0.15	16.48%	4.04
McCarthy 4: Standing on left foot	1227	1.08	0.66	464	0.99	0.68	0.09	9.09%	2.22
McCarthy 5: Walking Straight Line	1310	1.15	0.53	480	1.00	0.49	0.14	14.00%	4.23
McCarthy 6: Skipping	1197	1.09	0.96	450	0.87	0.87	0.21	24.14%	4.19
McCarthy 2b: Seconds Standing on Right Foot	1281	6.51	4.29	474	5.96	5.71	0.55	9.22%	2.41
McCarthy 4b: Seconds Standing on Left Foot	1269	6.44	4.48	476	5.79	5.82	0.65	11.23%	2.32
Socio-Behavioral Development									
Achenbach Child Checklist	1286	10.79	5.35	474	11.34	5.20	-0.54	-4.76%	-1.87

Table 9: Estimated Impact of *Oportunidades* on Child Development Indicators

|	Boys Whole Sample			Boys Common Support			Girls Whole Sample			Girls Common Support		
	Coef.	T-Stat	%	Coef.	T-Stat	%	Coef.	T-Stat	%	Coef.	T-Stat	%
Cognitive Development												
Log (Long Term Memory Test)	0.00	0.06	0.00%	0.05	0.12	4.87%	-0.05	-0.98	-.5.04%	-0.04	-0.69	-.3.83%
Log (Short Term Memory Test)	0.01	0.26	1.01%	0.03	0.43	3.32%	0.06	1.59	6.33%	0.05	1.34	5.24%
Log (Visual Integration Test)	-0.03	-0.62	-2.70%	0.04	-0.56	3.76%	-0.06	-1.47	-5.58%	-0.04	-0.97	-3.63%
Log (Peabody Picture Vocabulary Test)	**0.10**	**1.97**	**10.03%**	0.05	1.60	4.88%	0.00	-0.06	0.00%	-0.44	-0.80	-3.55%
Communication Dev. Inventory	3.97	1.14	6.29%	3.60	0.83	5.73%	4.13	1.13	6.22%	3.70	1.04	5.58%
Sentences Test	**0.11**	**2.11**	**16.13%**	**0.04**	**2.11**	**6.78%**	0.06	1.00	8.82%	0.06	0.94	8.82%
Motor Development												
Walking Backwards	**0.21**	**4.23**	**20.39%**	**0.24**	**4.54**	**21.95%**	**0.12**	**2.46**	**11.21%**	**0.13**	**2.72**	**12.38%**
Standing on right foot	**0.09**	**1.69**	**9.00%**	**0.11**	**1.98**	**10.60%**	**0.11**	**2.46**	**10.78%**	**0.12**	**2.62**	**11.88%**
Walking on Tiptoes	**0.18**	**3.82**	**20.45%**	**0.20**	**4.08**	**20.60%**	**0.11**	**2.25**	**11.46%**	**0.11**	**2.56**	**12.09%**
Standing on left foot	0.08	1.36	8.16%	0.08	1.46	**8.13%**	**0.11**	**2.58**	**10.78%**	**0.1**	**2.12**	**10.10%**
Walking Straight Line	**0.18**	**4.11**	**18.37%**	**0.19**	**4.41**	**19.11%**	**0.14**	**2.99**	**13.86%**	**0.15**	**3.28**	**15.00%**
Skipping	**0.21**	**3.77**	**24.71%**	**0.21**	**3.68**	**22.25%**	0.05	0.93	5.43%	0.04	0.75	4.60%
Seconds Standing on Right Foot	**0.48**	**1.6**	**8.26%**	**0.56**	**1.88**	**9.44%**	**0.66**	**2.45**	**11.15%**	**0.64**	**2.4**	**10.74%**
Seconds Standing on Left Foot	**0.62**	**1.88**	**10.88%**	**0.71**	**2.2**	**12.10%**	0.51	1.41	8.61%	0.47	1.33	8.12%
Socio-Behavioral Development												
Achenbach Child Checklist	-0.49	-1.45	0.00%	0.31	-1.57	-2.73%	**-1.16**	**-3.09**	**-10.52%**	**-1.04**	**-2.83**	**-9.17%**

Table 10: Testing Whether Starting *Oportunidades* in the Prenatal Period Has a Larger Impact on Child Development Indicators

	Boys Using the Common Support Sample				Girls Using the Common Support Sample			
	Treatment		Started in Prenatal Period		Treatment		Started in Prenatal Period	
	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
Cognitive Development								
Log (Long Term Memory Test)	-0.02	-0.25	0.04	0.58	-0.04	-0.58	-0.02	-0.29
Log (Short Term Memory Test)	0.01	0.51	-0.01	-0.42	0.05	1.22	0.01	0.48
Log (Visual Integration Test)	0.01	0.19	**-0.08**	**-2.23**	-0.03	-0.78	-0.04	-1.15
Log (Peabody Picture Vocabulary)	0.08	1.21	0.02	0.37	-0.01	-0.12	0.01	0.12
Communication Dev. Inventory	1.74	0.27	2.64	0.44	-0.48	-0.06	6.73	0.86
Works & Sentences Test	0.10	0.80	0.01	0.10	0.14	0.94	-0.03	-0.24
Motor Development								
Walking Backwards	**0.21**	**3.90**	0.00	-0.12	**0.12**	**2.26**	-0.01	-0.34
Standing on right foot	**0.13**	**1.98**	-0.05	-1.26	**0.14**	**2.33**	-0.05	-0.85
Walking on Tiptoes	**0.20**	**3.79**	-0.04	-1.04	**0.11**	**2.11**	-0.03	-0.62
Standing on left foot	**0.11**	**1.66**	-0.05	-1.12	**0.14**	**2.49**	-0.05	-1.04
Walking Straight Line	**0.21**	**4.16**	-0.05	-1.40	**0.15**	**2.61**	-0.01	-0.18
Skipping	**0.27**	**3.69**	**-0.10**	**-1.84**	0.01	0.20	0.07	0.96
Seconds Standing on Right Foot	0.61	1.56	-0.22	-0.78	**0.89**	**2.55**	-0.35	-1.32
Seconds Standing on Left Foot	**0.82**	**1.83**	-0.37	-1.19	0.62	1.42	-0.19	-0.55
Socio-Behavioral Development								
Achenbach Child Checklist	-0.63	-1.55	0.22	0.61	-0.84	**-2.00**	-0.59	-1.53

Figure 2: *Oportunidades* Program Take Up -Percentage of Actual Take Up Over Time
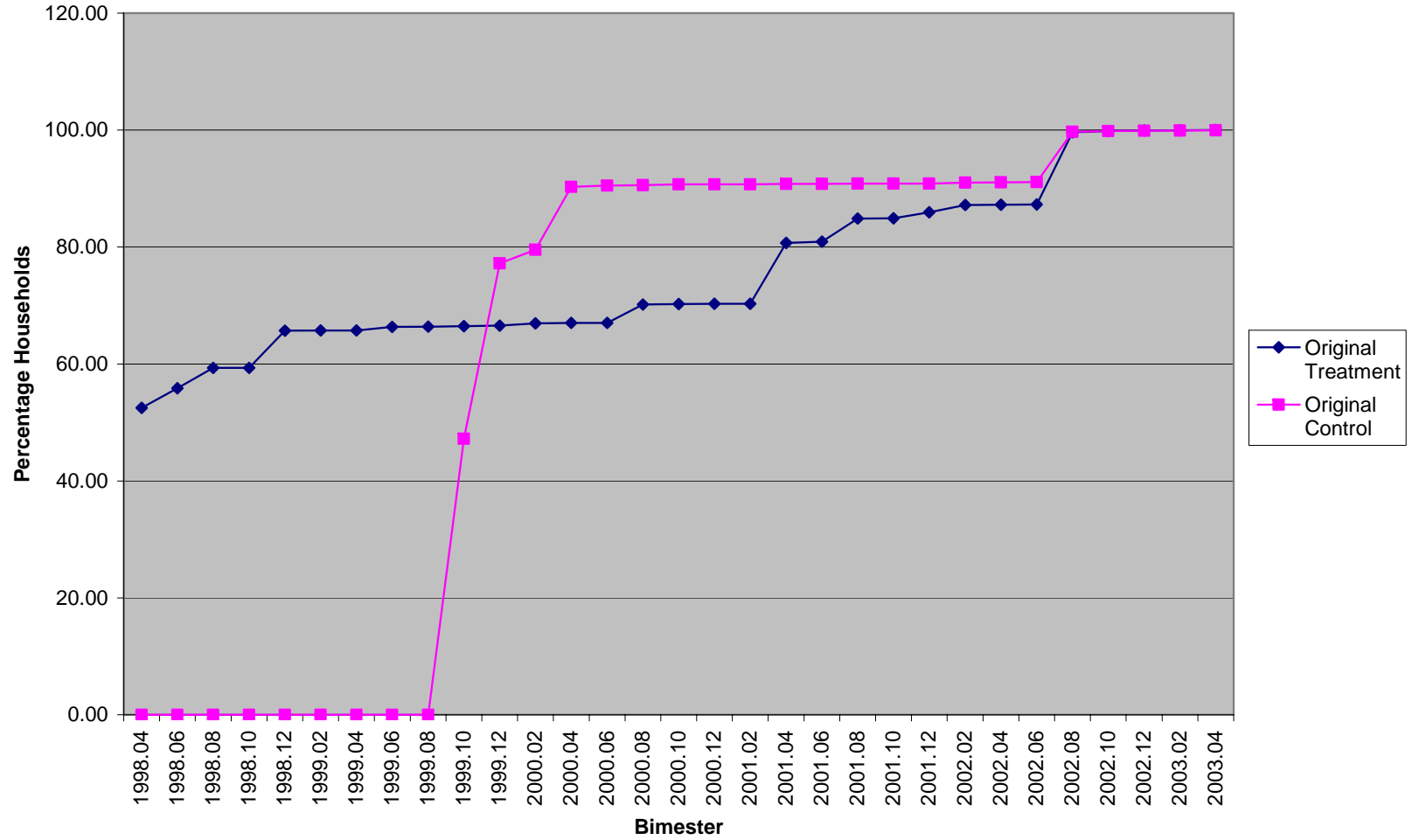
Figure 3: Cognitive Test Score Percentiles
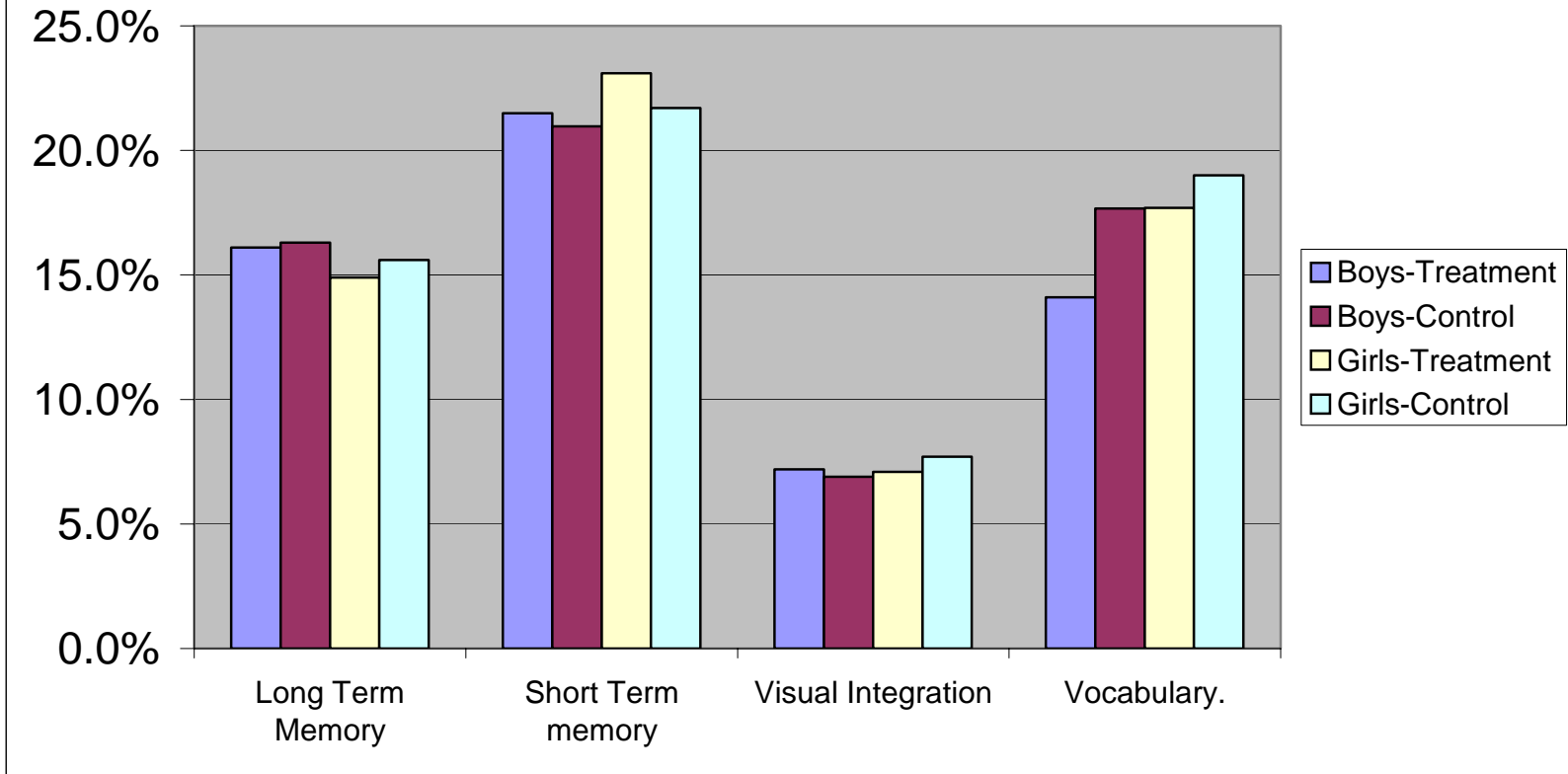
Percentile scores in comparison with a normed population.[84]