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ASSESSING THE COGNITIVE DEVELOPMENT OF
A SAMPLE OF INFANTS IN PARAGUAY

by

Shannon Peairson

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Family, Consumer, and Human Development

UTAH STATE UNIVERSITY
Logan, Utah

2006

ABSTRACT

Assessing the Cognitive Development of
a Sample of Infants in Paraguay

by

Shannon Pearson, Master of Science

Utah State University, 2005

Major Professor: Dr. Ann M. Berghout Austin
Department: Family, Consumer, and Human Development

There is very little research to date on infant development in developing countries, including Paraguay. The present study aimed to determine the effects of Pastoral del Nino, an ECD program, in rural Paraguay by assessing two groups of infants. Group 1 ($n = 50$) was receiving no intervention and group 2 ($n = 58$) was participating in Pastoral del Nino. Both groups were matched for SES and age of infant. Results indicate that group 2 performed better on the Bayley Scales of Infant Development Mental Development Index. Group 1 had a mean MDI score of 77.96 and group 2 had a mean score of 85.07 ($t = -3.143, 104 \text{ df}, p = .002$). Group 2 also scored significantly higher on the Home Observation for Measurement of the Environment (HOME; $t = -5.373, 105 \text{ df}, p = .001$). More research is needed to determine exactly which variables have the greatest impact in infant development in rural Paraguay.

(65 pages)

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Shannon Peairson

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CHAPTER I

STATEMENT OF THE PROBLEM

All children have the right to reach their full potential no matter where they are born. However, there are many places in the world where this does not happen. A question that many social scientists and humanitarians ask themselves is, "what can we do to improve the likelihood that children born into circumstances that place them at high risk will reach their full potential?" One factor that can improve a child's chances of a healthy development is participation in a program designed to improve health, nutrition and the psychosocial condition of the child (Myers, 1992b). This thesis will focus on developmental issues for very young children in Paraguay. The need for quality early child development (ECD) programs is great. As the child survival rate increases, as it has over the past several years in Latin America, more children are living in the same difficult situations that put them at risk of death in the first place (Myers, 1992a). Furthermore, the number of women working outside of the home has increased, as has the number of families migrating from rural locations where they can rely on extended family to urban centers which creates a need for alternative forms of child care (Myers, 1992a).

From an ecological perspective, interaction between organism and environment known as *proximal processes* are the primary mechanisms producing human development (Bronfenbrenner & Morris, 1998). From this, one can infer that various environmental factors such as economic stress and parental inexperience can have adverse effects on the development of a young child (Baumrind, 1994). Many families in

Latin America, especially in the rural areas, lack the resources to adequately feed their children, much less the knowledge and energy to provide them with a stimulating and nurturing environment. Although the vast majority of parents want the best for their children, poverty and family difficulty often go hand in hand increasing the likelihood that young children will suffer the loss of the close nurturance, stimulation, and care that are necessary for healthy development (UNICEF, 2001). According to UNICEF statistics, 19% of Paraguayans survive on less than \$1 a day and only 71% of students enrolled in primary school complete Grade 5. These circumstances have the potential to put many Paraguayan children at risk.

Evidence suggests that quality ECD programs can increase the social competence and school readiness performance of the child (Myers, 1992a). These factors can then create a more highly educated and thus, more productive population which increases the standard of living in the next generation. The High/Scope Perry Preschool project demonstrated this by showing that the preschool participants grew up to be better educated and successful in life than their no program counterparts (Schweinhart, Barnes, & Weikart, 1993).

According to Myers (1992a), increasing children's access to health care, proper nutrition, and cognitive and psychosocial stimulation benefits not only the child, but also the family, community and country. He cites the Brazilian *Programa de Alimentacao de Pre-escolar* (PROAPE) program as an example. The PROAPE program provides health services, nutritional supplementation, and preschool to poor children ages 4-6 years in rural areas of Brazil. Myers points out that the total cost of schooling (including PROAPE costs) per second-grade student was 11% less for PROAPE participants than

for those who had not participated in PROAPE. One of the main reasons cited for this difference in cost is the less need for remediation among the PROAPE children.

Cuba has also implemented an ECD program that has been linked to significant improvements in children's school performance (UNICEF, 2001). The program provides nutrition and child development information to mothers and fathers who are expecting a baby. Families with children under age two receive weekly or twice weekly home visits and are guided through activities that will enhance their baby's development. Children aged 2-4 and their families go on weekly or semi-weekly outings to cultural events, parks, and sports centers with counselors trained in child development. An estimated 600,000 children are reached by this program. In 1998 a comparative study of 11 Latin American countries showed that Cubans scored much higher in third-grade math and in third- and fourth-grade Spanish than their Latin American counterparts (UNICEF). However, this study does not mention what the scores were before the intervention in Cuban students compared to those of students in the other Latin American countries. It also does not show what other academic subjects were tested, and how those scores compared.

Much of the research suggests that it is important to determine the condition of children in a particular area in order to define the areas or groups that are in most need of intervention (Landers, 1990). Because funding for ECD programs is limited, it is important to determine which group needs the most help and what kind of help they need. In this way, the program can service as much of the at-risk population as possible. Indicators for country analysis on early child development include survival, growth, and

health status indicators; child development indicators and measures; and economic, social, political, and demographic indicators.

One of the most common and cost effective ways to measure a child's health status is to ask the parent about any illness and to weigh and measure the child (Rose, 1994). Weighing and measuring the child will show whether or not the child is growing as he or she should. One widely accepted measure of child cognitive development is the Mental Development Index of the Bayley Scales of Infant Development Second Edition (Bayley, 1993). The Bayley Scales MDI can assess a child's mental development as well as assist in diagnosing developmental delays. The problem with using the Bayley Scales with developing country populations is that it has not been standardized for this population. However, it is used widely for international samples, so for purposes of the present study, the BSID-II MDI is appropriate. Demographic information was obtained via questionnaire, interview, or a combination of the two.

The purpose of this study was to determine the impact of an ECD program by looking at the condition of a sample of rural Paraguayan children ages 0-24 months deemed at-risk by the Paraguayan nongovernmental organization (NGO) Pastoral del Nino (personal communication, May 21, 2003). The first group were children from families who were not participating in any ECD intervention program and the other group were children from families who were participating in the Pastoral del Nino program. Pastoral del Nino provides ECD programs including parental education courses, home visits, growth monitoring, and nutritional supplementation of children as well as pregnant and lactating women. This study measured infant mental development and correlated it with anthropometric measures, measures of the home environment and demographic

information obtained on the child's family. It also compared these variables across the two groups. The sample consisted of children currently living in rural areas in Paraguay and considered at-risk by virtue of extreme poverty and lingualism. The results of this study begin to establish a baseline of infant cognitive development over the first two years of life and suggest external factors that affect child development. Further, the present study compared infant cognitive outcomes and home environment between the sample receiving ECD benefits from Pastoral del Nino and the control sample. This provides information that can be used when planning an intervention strategy, or strengthening an existing intervention program providing services to Paraguayan children and their families.

The following questions guided this study: Does the physical condition of the child (weight, health history, current health) affect infant development in Paraguay? Do family circumstances (sanitation practices, access to clean water, economic conditions, education) affect infant development in Paraguay? Does participation in the Pastoral del Nino program affect infant development in Paraguay? The following hypotheses (stated in the null) guided the research:

1. There will be no significant relationship between infant health and MDI scores.
2. There will be no significant relationship between household variables and MDI scores.
3. There will be no significant relationship between infant age and MDI scores.
4. There will be no significant relationship between participation in the Pastoral del Nino program and infant health, MDI scores and HOME scores.

CHAPTER II

REVIEW OF LITERATURE

In order to develop effective intervention programs it is important to understand the variables that affect cognitive and motor development in developing countries. It has been well documented that intervention programs targeted at the most vulnerable children are the most effective in terms of putting more disadvantaged children on equal footing with their more affluent counterparts (Myers, 1992a; Sen, 1999). Carefully designed intervention programs have been shown to benefit the child, the family, the community and the country (Myers; Sen; UNICEF, 2001). One way to design an effective intervention program is to determine what variables affect children's development in a particular area (Myers). It is important to know what aspects that affect cognitive development are unique to a particular culture. It is also important to establish a baseline of how children in particular places develop. However, there is very little information available on what variables affect children's development in developing countries. There is only one known study at present that focuses attention on critical processes that characterize cognitive development in Paraguay (Austin, 2003). Studies of at-risk children in industrialized and developing countries have examined the following variables in relation to childhood cognitive and motor development: malnutrition, birth weight and gestational age, breastfeeding, socio-economic status (SES), the home environment, and participation in an early child development (ECD) program.

Effects of Malnutrition

According to UNICEF (2001), 17% of Paraguayan children younger than five years of age suffer from moderate to severe malnutrition. MRI images taken from infants suffering from malnutrition show various abnormal structural changes associated with cerebral shrinkage (UNICEF). Children who are born to malnourished mothers have a 33% greater chance of having a disability than children born to adequately nourished mothers. Furthermore, infants who are poor and malnourished are at greater risk for contracting diarrhea, respiratory illnesses, measles and other preventable diseases (UNICEF).

According to Sternberg, Grigoreko and Nokes (1997), undernutrition leads to cognitive impairment in three ways. First, undernutrition can cause direct and indirect permanent changes in the brain. Second, undernutrition can cause a reduction in activity, search for stimulation and exploration; and third, undernutrition can cause a lack of responsiveness, acceptance, and attachment. Scientists are unsure how exactly undernutrition affects cognition, but two hypotheses have been proposed (Sternberg et al.). First, if the behavior associated with undernutrition (reduced activity, search for stimulation and exploration) persists over time, it can result in developmental delays. Second, severe malnutrition can result in permanent, irreversible brain damage. Vitamin and mineral deficiencies are associated with malnutrition in that the greater the degree of malnutrition, the greater the deficiencies in essential vitamins and minerals. Iodine

deficiency is the most common cause of mental retardation in the world, and vitamin A deficiency poses serious risks of childhood illnesses and mortality.

In a study of the effects of zinc supplementation during pregnancy, weight-for-age (which measures acute [current] nutritional status) was significantly positively correlated with BSID mental and motor scores. Thus, there is evidence of a link between brain development and nutrition in this study despite several major limitations of the study. For example, the study, which consisted of a subsample of 168 infants from a slum area of Dhaka, also found zinc supplementation during gestation to be negatively correlated with BSID scores. However, it should be noted that the nutritional status of the mothers was poor and they were given twice the daily recommended allowance of zinc. Another limitation of the study was that the infants in the placebo group were better nourished than the infants in the zinc group. Therefore, it is difficult to conclude if it was the over-supplementation of zinc that was responsible for the variation in BSID scores, or if it was better nourishment of the placebo group (Hamadani, Fuchs, Osendarp, Huda, & Grantham-McGregor, 2002).

Another study by Rose (1994) examined the relation between physical growth and information processing in infants born in India. This study investigated 183 infants ages 5-12 months born in Bombay, India. Infant physical growth was assessed using standard techniques in measuring length, weight and head circumference; information processing was measured by performance on three visual recognition memory problems and four cross-modal transfer problems. Among the results, Rose found that maternal and paternal education levels were lower for underweight infants. She also found that, except for 5-month-olds, underweight infants failed to show evidence of visual recognition memory.

The 5- and 6-month-old underweight infants showed some familiarization effect after 60 seconds of exposure to an object. Infants were considered underweight if their weight-for-length score was more than one standard deviation below the mean. Rose further analyzed the data by eliminating the underweight infants whose weight was more than 2.5 standard deviations below the mean, however the results were unaffected indicating that even moderate growth deficits are associated with poor cognitive performance.

This study addressed the question of the appropriateness of using anthropometric variables (weight and length) as a measure of nutritional status. Rose (1994) had suggested that genetic factors are the principal determinants of ethnic differences in growth and that it may be inappropriate to compare the growth of children in developing countries to those of the reference populations used as standards. She addressed this concern by stating that "under conditions of chronic poverty, genetic effects appear to be relatively small; differences in growth among preschool children are far more strongly associated with social class and poverty than with ethnic factors" (p. 899).

Hamadani and colleagues (2002) pointed out that it is very difficult to study the effects of malnutrition because it is not possible to randomize such a study. They pointed out that the environments of malnourished children are very often plagued by many other disadvantages that could also put the child at risk. However, despite the limitations of studies on the effects of malnutrition, there is strong and consistent evidence that malnutrition is linked to poor cognitive outcomes. The present study assessed nutritional status by weighing and measuring the infant using techniques recommended by the World Health Organization. Further, measurements were compared with growth charts for Paraguayan infants.

Effects of Birthweight and Gestational Age

Approximately 5% of Paraguayan infants born between 1995 and 1999 weighed less than 2500 grams at birth. This figure is quite low considering that 17% of infants born in developing countries during that same period were of low birthweight (UNICEF, 2001). Several studies have found a link between birthweight and/or gestational age and childhood outcomes (Molfese, DiLalla, & Lovelace, 1996; Morris, Grantham-McGregor, Lira, Assuncao, & Ashworth, 1999; Resnick, Eyler, Nelson, Eitzman, & Bucciarelli, 1987; Rose, 1994; Widmayer et al., 1990).

Rose (1994) found that, in her study, infants' current weight, length and head circumference were all lower in infants who had been born underweight. This finding indicates that low birthweight infants remain at a disadvantage throughout their first year, and perhaps beyond. However, from what the UNICEF (2001) statistics indicate, Paraguayan infants are generally born at a normal weight, but then decline during the first 5 years of life, such that by that time, 17% are malnourished.

It seems to be widely accepted that the lower the birthweight and gestational age, the higher the incidence of developmental delay and handicapping. A study by Resnick and colleagues (1987) indicated that carefully planned intervention could mediate the effects of low birthweight and low gestational age. In their study of 225 low birthweight infants in Florida, 124 were randomly assigned to the experimental group and 131 to the control group. The experimental group participated in an ECD program in the hospital and at home over the first two years of life along with counseling and parent education. The control group received traditional care. The study found that the experimental group

had significantly lower incidence of developmental delay and scored significantly higher than the control group on mean mental and physical indices as measured by the BSID at 12 and 24 months.

In another study of 94 Caucasian children of diverse SES recruited at birth for a longitudinal study, gestational age was found to be a significant predictor of 3-year IQ and 4-year IQ and verbal scores as measured by the Stanford-Binet Composite score (IQ) and the Verbal Reasoning subscale (Molfese et al., 1996). However, birthweight was not found to be a significant predictor of either 3- or 4-year IQ or verbal scores.

Similarly, a study on Haitian-American infant development looked at predictors of infant development at 12 months using a sample of 66 infants of Haitian descent living in south Florida (Widmayer et al., 1990). The study found a significant correlation between birthweight and BSID MDI scores. However, this study did not find gestational age to be predictive of infant development at 12 months.

A study of 131 low birthweight term infants and 131 normal birthweight infants in Brazil found a negative association between infant development and low birthweight (Morris et al., 1999). Low birthweight was found to be negatively associated with BSID scores. The study also found that low birthweight was significantly related to sickness. Specifically, low birthweight infants had a higher prevalence of diarrhea and respiratory illness than normal birthweight infants. Further, the study revealed that diarrhea among low birthweight infants was related to lower BSID scores, whereas in normal birthweight infants, diarrhea had no significant effect on BSID scores.

Many of these studies suggest that the effects of birthweight and gestational age can be reversed through quality interventions; however, it is important to establish a baseline, which is what this study intends to do.

Effects of Breastfeeding

It is widely accepted that breastfeeding is associated with positive infant outcomes especially among infants in developing countries. According to UNICEF (2001), 7% of Paraguayan mothers exclusively breastfeed their infants from 0-3 months of age, 59% still breastfeed with complementary food from 6-9 months, and 15% are still breastfeeding from 20-23 months. The percentage of women exclusively breastfeeding for the first 3 months is significantly lower than the 44% of women in developing countries in general who exclusively breastfeed for the first 3 months (UNICEF). If every baby was exclusively breastfed from birth to six months, an estimated 1.5 million lives would be saved each year (UNICEF, 2000a). Breastmilk provides all the nutrients that babies need to be healthy and grow. Furthermore, it protects babies from diarrhea, and acute respiratory infections, two leading causes of infant death. The main benefit of breastfeeding is the health of the infant, but other positive outcomes of breastfeeding include money saved by not having to purchase infant formula, reduced health care spending, saved resources and breastfeeding helps families with child spacing (UNICEF, 2000a).

The Morris et al. (1999) study mentioned earlier, found an association between frequency of breastfeeding over the first month of life with BSID MDI and Physical Developmental Index (PDI) scores. The study found no association between

breastfeeding intensity during weeks 5-26 and Bayley scores. These findings were consistent in both the low birthweight term infants and the normal birthweight infants.

Golding, Rogers, and Emmett (1997) reviewed several studies on the association between breastfeeding and child development in developing and industrialized countries. They found that 8 out of 10 population studies and all 3 studies reviewed on low birthweight infants showed that children who have been breastfed are generally more intellectually able than formula fed infants. In general the longer the child has been breastfed, the more pronounced the effects. This is in contrast to the previous study that found no association between breastfeeding after one month and cognitive outcomes (Morris et al., 1999). Golding et al. also pointed out that it is very difficult to control for confounding variables in breastfeeding studies such as parental ability and parental IQ that may explain the findings.

In another study of 846 Scottish children, the researchers found breastfeeding to be significantly related to BSID MDI scores at 18 months (Florey, Leech, & Blackhall, 1995). The authors of this study acknowledged the possibility that there could be confounding variables that make it impossible to draw conclusions. The findings of the effects of breastfeeding on child development are summed up by saying, "Two recurring themes appear: (1) that breast feeding is related in a statistical sense to children's mental development, and (2) that no author has been willing to be committed to the conclusion that bottle feeding is likely to be a disadvantage to the child's intellectual development" (p. S25).

Effects of Socioeconomic Status

According to UNICEF (2003) the GNP per capita in Paraguay was \$1300 in 2001. Also, 19% of Paraguayans from 1990-1999 made less than \$1 a day, compared with the figures in the United States where the GNP per capita in 2001 was \$34,870. UNICEF (2001) has spoken out against poverty by stating:

When poverty engulfs a family, the youngest are the most affected and most vulnerable – their rights to survival, growth and development at risk. A child born today has a 4 out of 10 chance of living in extreme poverty. This poverty defines every aspect of the child's existence, from malnutrition, lack of clean water, inadequate sanitation, to life expectancy. It is the main underlying cause of millions of preventable deaths and the reason why children are malnourished, miss out on school or are abused and exploited. And it is at the core of a pervasive violation of children's rights. (p. 32)

Poverty can be defined as the deprivation of capabilities including income, education, health care, and a lack of available alternatives, the lack of which can lead individuals to limit their expectations to existing realities (Sen, 1999). Poverty and family dysfunction are very often related, with young children suffering from a lack of nurturance, stimulation, and care (UNICEF, 2000b). Poverty is the main cause of millions of preventable deaths each year, as well as the cause of tens of millions of children going hungry, missing school, and being exploited annually (UNICEF). Poverty in early childhood can be a handicap for life and very often continues into the next generation. Malnourished girls often grow up to be malnourished mothers who give birth to low birthweight babies and so on. However, according to UNICEF (2000b) an investment of only \$80 billion per year – less than a third of 1% of global income, would eradicate the worst manifestations of poverty in less than a generation.

In the Widmayer et al. (1990) study mentioned previously, a significant association was found between household crowding and BSID PDI scores. This study did not use a separate measure for SES, instead they used a household crowding score and the HOME score as an indicator of SES. Household crowding was measured by dividing the number of rooms in the house by the number of people in the house.

Education levels are very often associated with poverty with people, especially women, in poor countries receiving inadequate and low quality education. Low levels of education also tend to be intergenerational because illiterate parents cannot support children in the learning process. Furthermore, infants born to mothers with no formal education are twice as likely to die before age 1 than are children of mothers with post-secondary school education (UNICEF, 2001).

In a study by Austin (2003), only 5.5% of fathers surveyed and 4% of mothers surveyed had completed elementary school. Austin's sample was taken from a rural area in Paraguay. Austin further found that, in this sample, maternal education positively correlated with the the BSID II mental development index.

A study on 191 healthy Costa Rican children found maternal education to be positively related to IQ scores at 5 years (Lozoff, Park, Radan, & Wolf, 1995). Maternal education was also related to HOME scores, with less education predicting lower HOME scores. However, the study did not find maternal education to be related to Bayley MDI scores in infancy.

Although many studies only measure maternal education, there have been links found between paternal education and child outcomes as well. Richter and Grieve (1991) sampled 305 healthy children aged 2-30 months living in South Africa. Their study

found that both maternal and paternal education were significantly positively correlated with HSQ scores. The HSQ is derived from the HOME and is given in interview form only. However, neither maternal nor paternal education levels predicted infant BSID scores. In their discussion, Richter and Grieve pointed out that “although no direct relationships were found between parental educational and occupational indices of SES and BSID measures of psychological development, home environment showed a significant correlation with mental development that was influenced, but not determined, by the SES measure” (p. 97). Thus, SES indices may have indirectly affected BSID scores in this study.

An evaluation of psychomotor development in Argentinean children found maternal education to be the variable most frequently associated with indices of psychomotor development especially after the first year (Lejarrage et al., 2002). Their sample consisted of 3,573 children aged 0-6 years. They also found a positive association between social class and early attainment of items. Psychomotor development was measured using 78 items in the areas of personal-social (18 items), fine motor (19), language (18), and gross motor (23). Moreover, in the Rose (1994) study mentioned earlier, maternal and paternal education were lower for underweight infants. Underweight infants are at risk for several developmental problems thus perpetuating the cycle of poverty and low education.

UNICEF (2000b) pointed out that poverty is difficult to quantify. Several terms are mentioned that reflect the complex nature of poverty, such as income poverty, basic needs poverty, lack of sustainable livelihood, social exclusion, absolute and relative poverty, hopelessness, and vulnerability. Most studies that use poverty or SES as a

variable, use income poverty as an indicator. However, while this is important, basic needs poverty is also important to look at in many populations. Basic needs poverty can be defined as the lack of basic capabilities needed to live in dignity. UNICEF further points out that in several cases, income poverty has been reduced while basic needs poverty has been increased and visa versa. Therefore it is insufficient to rely on income poverty as the sole indicator of poverty in an area. The present study measured both types of poverty identified, with a stronger emphasis on basic needs poverty such as type of dwelling and animal ownership. The present study measured parental education by asking the parents to report on how many years of school they attended. However, it should be pointed out that the effects of poverty and SES are difficult to measure in any study because of a lack of randomization.

Effects of the Home Environment

Many studies have linked measurements of the home environment with cognitive outcomes (Lozoff et al., 1995; Molfese et al., 1996; Richter & Grieve, 1991; Weisglas-Kuperus, Baerts, Smrkovsky, & Sauer, 1993; Widmayer et al., 1990). The effects of the home environment appear to be more significant after the first year. The present study measured the home environment using the Home Observation for Measure of the Environment (HOME).

Molfese and colleagues (1996) used three subsets of the HOME in their study. They found that the academic stimulation subset positively correlated with IQ at 3 years, IQ at 4 years, and verbal scores at 4 years. Language stimulation was positively correlated with IQ at 3 years, IQ at 4 years, and verbal scores at 4 years. The third subset

used, learning materials, was not significantly related to either outcome. Three and four year IQ and verbal scores were measured using the Stanford-Binet Composite score (IQ) and the verbal reasoning subscale.

A study of the effects of biological and social factors on the cognitive development of very low birthweight children found that HOME scores were positively correlated with BSID MDI scores at 2 years and 3 years (Weisglas-Kuperus et al., 1993). Their study is part of a larger longitudinal study on 79 very low birthweight infants in the Netherlands. They concluded that children at high biological risk were able to catch up on their cognitive delays in a highly stimulating home environment.

In the Richter and Grieve (1991) study, HSQ scores were significantly positively correlated with Bayley MDI scores and PDI scores. They concluded that the HSQ makes a significant contribution to variations in the MDI over and above the effects of maturation. They said:

The robustness of the relationship between home environment and cognitive development, at least as demonstrated in this African sample, suggests that cultural factors, which result in differences in child-rearing attitudes and behaviors, do not have marked effects on this relationship. (p. 99)

Thus, there are home factors which contribute to IQ that are generalizable beyond cultures.

The Widmayer et al. (1990) study found a significant positive correlation between the total HOME score and Bayley MDI scores. However, HOME scores were not significantly related to Bayley PDI scores in this study.

The Lozoff et al. (1995) study sought to ascertain the usefulness of the HOME in Costa Rica. They compared the HOME scores they obtained from a Costa Rican sample

to HOME scores from a Little Rock sample. They found that only on the third and fourth scales (origination of environment and appropriate play materials) was the Costa Rican sample significantly lower than the Little Rock sample. Furthermore, the study found no significant correlation between the HOME and the Bayley MDI for the Costa Rican sample, but they did for the Little Rock sample. However, they did find a significant positive correlation between 5 year WPPSI (Wechsler Preschool and Primary Scale of Intelligence) and HOME scores in the Costa Rican sample. The HOME was also positively correlated with breastfeeding.

Participation in an ECD Program

There are few studies that demonstrate of the effects of participation in an Early Child Development (ECD) program in developing countries. However, the studies from the United States as well as the few studies from developing countries indicate that participation in an ECD program has many benefits for children and their families. Young (2002) points out that ECD programs worldwide have been shown to be effective in improving later school performance especially for poor, at-risk children. However, Evans (2002) discusses six reasons that the effectiveness of an ECD program is often difficult to assess: (1) effectiveness can not be agreed upon in terms of a universally agreed upon truth, (2) effectiveness is not a static concept, (3) effectiveness cannot be placed on a linear scale, (4) effectiveness resides in an organization and varies within an organization, (5) effectiveness takes time to identify and understand, and (6) effectiveness is the result of experience.

An ECD program in Bolivia called PIDI has reported a significant increase in participants' enrollment in school at all levels (Van der Gaag & Tan, 1997). Children in the PIDI program receive two meals per day, are fully immunized, receive basic health care and daily engage in a program of games and age-specific exercises designed to stimulate their cognitive development. According to a study conducted comparing children enrolled in the PIDI program with children who were not, there was a 75% increase in primary school enrollment among PIDI participants, a 50% increase in middle school enrollment, a 40% increase in secondary school enrollment and a 20% increase in higher education enrollment among PIDI participants. This information coupled with the data that shows that a primary school graduate earns 42% more than someone with no schooling and a college graduate earns 276% more than someone with no schooling, shows that the families of PIDI participants have a greater chance of coming out of poverty (Myers, 1992a).

Myers (1992b) discusses several ECD programs and the positive effects they have had on children in developing countries. One such program is the Integrated Child Development Service (ICDS) in India. The ICDS was started by the Indian government in 1975. It provides early education and supplementary feeding for children ages 0-6 years. The program is primarily run out of centers called *anganwadi*. The workers not only provide early education and supplementary feeding, but they also are charged with growth monitoring, distributing vitamin A, maintaining immunization records, and sometimes educating mothers. Benefits attributed to the program include reductions in infant mortality, severe malnutrition, morbidity, and school repetition (Myers).

A nutrition recuperation center located within the Tropical Metabolism Research Institute in the West Indies started a program of educating attendants and providing them with incentives for improving the amount and quality of interaction with malnourished children. As a result of this program, the children recovered more rapidly in terms of weight gain and cognitive development (Myers, 1992b).

In Ethiopia, a program administered by the Children's Affairs Committee established a preschool to care for children age 45 days to 6 years and provide basic health services and family life education. A reduction in disease related deaths among children ages 1-5 has been credited to this program (Myers).

In Peru, the PRONEOI program has served as a catalyst for community development efforts such as school gardens, and water and sanitation projects (Myers, 1992b). The PRONEOI program brings about 30 children ages 3-6 together for 3-4 hours 4-5 days a week and provides activities designed to improve the children's physical, mental, and social development. A snack is also provided for the children.

UNICEF (2003) cites an ECD program in the Philippines called the Parent Effectiveness Services program. This program teaches families how to listen to and understand what their child is trying to communicate. Parents learn, among other things, the importance of reading stories to their children and of watching educational programs with them. According to UNICEF, the program has improved children's nutrition and reduced child abuse and excessive punishment.

Darlington (1991) reviewed the findings of a longitudinal study of several preschool experiments in the United States that were conducted in the 1960s. The study followed up on participants from the Early Education Department of Temple University

study, New York University's Institute for Developmental Studies study, the Florida Parent Education Program, the Gray and Klaus study, the University of Illinois study, the Verbal Interaction Project, the University of Louisville study, the Harlem Research Project, the Perry Preschool Project, and the Bank Street College of Education study. The participants from the studies ranged in age from 9-18 at the time of the 1976-1977 follow-up. Overall, about 76% of the subjects sought were found and only 3% refused to participate. The study used three variables to measure the long-term effects of the preschool programs; grade retention, special education placement, and failure to meet school standards. Of the subjects who participated in one of the preschool programs, there was an 18% reduction in the rate of grade retention, a 25% reduction in special education placement, and a 26% reduction in failure to meet school requirements. These findings indicate that participation in an ECD program has positive effects on later school performance.

The High/Scope Perry Preschool Study is one of the most noteworthy studies that has demonstrated the positive long-term effects of a quality preschool program (Schweinhart et al., 1993). At its onset, poor African-American children in the neighborhood of the Perry Elementary School in Ypsilanti, Michigan were divided into two groups: a program group and a no-program group. The program group received a high quality active learning preschool program, and the no-program group received no preschool program. The researchers have assessed the participants several times over the past several years, the most recent assessment being when the participants were 27 years of age. Just a few of the positive outcomes of the program group at age 27 were significantly higher earnings, significantly higher percentages of home ownership and

second car ownership, a significantly higher level of schooling, and significantly fewer arrests. This study also demonstrates the positive effects of a quality ECD program.

The present study measured each of the variables reviewed previously: malnutrition, birthweight and gestational age (where possible), breastfeeding, SES, home environment, participation in the Pastoral del Nino program, and mental development. The present study examined the parents' level of education and ability to read, monthly income, ownership of farm animals, housing materials, access to clean water, television ownership, practices for waste disposal, and vehicle ownership. These variables are assumed to be a fairly accurate measure of SES in Paraguay (Austin, 2003; UNICEF, 2001). At present, only one known study has measured the relationships between these variables in a Paraguayan sample, however, the sample size was relatively small (Austin). According to Myers (1992a) the search for a sound intervention program strategy in any country should begin with a careful and comprehensive assessment of the condition of children.

The comparison of non-Pastoral del Nino participants with Pastoral del Nino participants was done at the request of Pastoral program administrators who wanted to determine what effects, if any, their program has had on the children in Paraguay. The present study addressed this interest on a small scale.

The following questions guided this study: (1) Does the physical condition of the child (weight, health history, current health) affect infant development in Paraguay? (2) Do family circumstances (sanitation, access to clean water, economic conditions, education) affect infant development in Paraguay? (3) Does participation in the Pastoral

del Nino program affect infant development in Paraguay? The following hypotheses (stated in the null) guided the research.

1. There will be no significant relationship between infant health and MDI scores.
2. There will be no significant relationship between household variables and MDI scores.
3. There will be no significant relationship between infant age and MDI scores.
4. There will be no significant relationship between participation in the Pastoral del Nino program and infant health, MDI scores and HOME scores.

CHAPTER III

METHOD

Sample

One hundred and eight young children and their families were included in a purposive sample for this study. The strength of a non-probability purposive sample is that it is an easy and cost effective sampling technique. However, the major problem is that the sample is not random and, therefore, the results cannot be generalized to the total population. Because we were interested in infant development from birth to 24 months, to be eligible for this study, families must have had an infant between the ages of 2 weeks and 24 months living with them. For purposes of this study, the term "family" referred to any group of people living in the same household.

Infants and their families were located in various villages in Paraguay. Data was collected from several departamentos (states) recommended by Pastoral del Nino rather than from just one area. Humanitarian workers from Pastoral del Nino, who assisted with the study, explained the study to the village leaders. The village leaders then recommended families who met our criteria, thus potentially introducing an unknown degree of bias in the sample. The study was explained to the families with the help of an interpreter. Although the researcher has knowledge of Spanish, the families were Guaraní speakers. The use of interpreters also potentially introduced an unknown degree of bias.

Because this was a cross-sectional study, the infants were put into groups based on their ages at the time of the study. Our intention was to include 10 infants in each of

the age groups for both of the Pastoral del Nino and non-Pastoral del Nino samples which will be: 0-4 months, 5-9 months, 10-14 months, 15-19 months, and 20-24 months. Table 1 shows the age breakdown for Pastoral del Nino participants and Table 2 shows the age breakdown of non Pastoral del Nino participants.

All of the participants were living in poverty since the villages that we recruited our sample from were poor rural villages. Poverty status was also verified through discussion with Pastoral del Nino personnel. Because Pastoral del Nino only works with families in poverty, it was expected that all of the families participating in that program were families in poverty. All participants were Paraguayan nationals speaking Guarani as their first and potentially only language.

The families had been deemed at-risk due to their extreme poverty, rural location, low parent education, limited access to medical attention and other social services and almost exclusive use of Guarani while Spanish is the language of commerce in Paraguay and was used exclusively in the schools until just a few years ago (Austin, 2003).

The focus of this study was how infants from age 0-24 months develop in Paraguay and how various home, health and demographic variables interact with that development. Therefore, infants with an obvious biological handicap or delay were excluded from this study. Children born pre-term were excluded from the present study.

Table 1

Age (in months) of Infants in Pastoral del Nino

Age	Frequency	Age	Frequency	Age	Frequency	Age	Frequency
1	2	7	2	13	2	19	2
2	5	8	0	14	3	20	0
3	2	9	3	15	3	21	5
4	2	10	2	16	1	22	0
5	3	11	5	17	2	23	2
6	1	12	3	18	5	24	3

Table 2

Age (in months) of Infants Not in Pastoral del Nino

Age	Frequency	Age	Frequency	Age	Frequency	Age	Frequency
1	0	7	2	13	0	19	1
2	2	8	1	14	2	20	3
3	3	9	5	15	3	21	1
4	5	10	3	16	4	22	2
5	1	11	3	17	2	23	3
6	1	12	2	18	0	24	1

Instruments

*Bayley Scales of Infant Development
Second Edition*

The BSID-II is an individually administered examination designed to assess the current developmental functioning of infants and children ages 1-42 months. The BSID-II includes three scales: Mental Development (MDI), Motor Development (PDI), and Behavioral Rating Scale (BRS). The three scales are considered complimentary and can be used together and separately in the evaluation of the child (Bayley, 1993). The present study used only the MDI. The MDI includes items that assess memory, habituation, vocalizations, cross modal transfer and social skills. For example, "Eyes Follow Ring" is

number 15 of the Mental Scale. For this item, the examiner holds a suspended ring above the infant who is in the supine position and moves it from the midline of the infant to the right, left and back to the center; the infant receives credit if his/her eyes follow the ring for one complete excursion (Bayley).

The BSID-II specifies sets of items to administer to a child depending on his or her chronological age. There is an average of 23 items per set in the Mental Scale. The average amount of time needed to test a child under 24 months is 25-35 minutes. Each item includes instructions for the examiner with specific directions on what position the infant should be in, presenting stimulus material, timing and scoring the infant's response (Bayley, 1993).

The BSID-II was standardized using a stratified random sample of 1,700 infants aged 1-42 months. The sampling plan was developed to ensure that each demographic group in the United States was represented proportionately (Bayley, 1993).

In this study, the infants being tested using the BSID-II range in age from 2 weeks to 24 months. Therefore, the reliability and validity information included will be what is most relevant to this age group. Reliability coefficients for the BSID-II Mental Scale are between $r = .86$ and $r = .88$ (Bayley, 1993).

Test-retest reliability was obtained in a study of 175 children who were tested twice. The intervals between the two testings ranged from 1-16 days with a median of 4 days. The test-retest reliability coefficients are $r = .83$ for the MDI (Bayley, 1993).

No interrater reliability is given for the sample, however there is interscorer reliability calculated from a sample of 51 children aged 2-30 months. The interscorer reliability on the MDI is $.96$ (Bayley, 1993).

According to Bayley (1993) many studies have provided evidence of construct validity for the BSID (and BSID-II), by elucidating the underlying emergent cognitive structures it assesses through factor analyses and other statistical approaches. The research also suggests that the constructs measured by the BSID (and BSID-II) become more differentiated with age; research supports the claim that certain constructs present at earlier ages are related to constructs that appear at later ages (Bayley).

Content validity of the BSID-II Mental and Motor Scales was established by asking a set of experts to identify ability domains relevant to developmental assessment. Once these domains were identified, the same experts reviewed each of the items on the BSID-II to ensure that all of the domains were adequately covered (Bayley, 1993).

The strongest predictive validity for the BSID (and BSID-II) has been found when specific ability domains are used to predict later performance on a test of related functioning (Bayley, 1993). According to Bayley there are a number of studies that show the BSID (and BSID-II) to be effective in identifying infants and children who will demonstrate developmental delay on school-age ability or achievement measures. Past research studies also show that the later in the preschool period a child is tested using the BSID (or BSID-II) the stronger the correlations are between BSID scores and later childhood functioning (Bayley). Predictive validity of the BSID (and BSID-II) is enhanced when used with a measure of the environment (Bayley).

Discriminant validity has been shown in studies where researchers found high correlations between BSID (and BSID-II) scores and a clinician's classification of an infant as normal or at risk. Studies have also shown that healthy full-term infants score

higher on the BSID (and BSID-II) than infants born premature or who are at-risk for developmental delays (Bayley, 1993).

The BSID-II was chosen for this study for its ability to measure several aspects of development. The main purpose of the BSID-II is to diagnose developmental delay and plan intervention strategies (Bayley, 1993). This was helpful for our sample of Paraguayan infants as an indication of general strengths or weaknesses in the sample. Because there is very little information available on how rural Paraguayan infants develop, it is helpful to look at any distinctions in performance that may be unique to rural Paraguayan infants and toddlers. Those are the main reasons the BSID-II was chosen for this study rather than the Denver Developmental Screening Test-II. The Denver-II uses a nominal classification system and is primarily a screening tool. However, the BSID-II and the Denver-II tend to classify children similarly (Bayley).

If Spanish was the language spoken at home, the examiner engaged the infant in Spanish when necessary. If the native language, Guarani, was spoken at home, the mother was asked, via an interpreter, to engage the infant in vocalization when necessary. Although, the BSID-II has not been standardized using a Paraguayan sample, it is acceptable for purposes of this study as discussed earlier. The BSID-II is the instrument of choice for Pastoral del Nino in assessing infant development. Pastoral del Nino is aware of the standardization problems.

The BSID-II has been used in several studies to assess at-risk infants and children. Some of the studies reviewed have determined low birth weight and low SES to be risk factors in their studies (Kuperus, Baerts, Smrkovsky, & Sauer, 1993; Molfese et al., 1996). The BSID-II has also been used in correlational studies to relate infant mental

development as measured by the BSID-II to factors such as later preschool scores (Molfese & Acheson, 1997), preschool abilities, the home environment, SES and other risk factors (Molfese et al.), and infant characteristics and their mothers' behaviors (Seegmiller & King, 2001).

Home Observation for Measurement of the Environment

The HOME is administered in an interview/observation style and is intended to provide a measure of the infant's home environment. The Infant/Toddler HOME includes 45 items divided into six categories: responsiveness, acceptance, organization, learning materials, involvement, and variety (Caldwell & Bradley, 2001). The HOME was translated into Spanish several years ago for Pastoral use. The translators were U.S. Peace Corps volunteers for whom Spanish is a second language and Pastoral workers for whom Spanish is a first language. The translated version of the Infant/Toddler HOME used in this study is also used to evaluate families who participate in the Pastoral del Nino intervention program.

In an effort to prevent examiner bias, separate examiners administered the HOME and the BSID-II. An examiner living in Paraguay who is familiar with local languages and customs administered the HOME.

The information needed to score the HOME is obtained during a visit to the infant's home at a time when the infant and the primary caregiver are present and awake (Caldwell & Bradley, 2001). The responsiveness category consists of 11 items that measure the caregiver's speech and the caregiver's responsiveness to the infant. For example, item 3 says, "parent responds verbally to child's vocalizations or verbalizations"

(Caldwell & Bradley). The examiner either enters a plus sign indicating that the behavior was observed, or a minus sign indicating that the behavior was not observed. The acceptance category consists of 8 items that measure the caregivers acceptance of less than optimal behavior in the child. The organizational category consists of 6 items that measure regularity and predictability in the families schedule. The learning materials category consists of nine items measuring the extent of available learning materials in the home. For example, item 26 says "muscle activity toys or equipment" (Caldwell & Bradley). For this kind of item, the examiner can either mark the item with a + by observing the item, or can ask the caregiver if there is such an item in the home and then mark the item accordingly. The involvement category consists of 6 items that measure the extent to which the caregiver is actively involved in the child's learning. Finally, the variety category consists of 5 items that measure the inclusion of people and events that bring variety into the child's life without creating disorganization (Caldwell & Bradley).

The alpha coefficients for the total scores are all above .90, and the interscorer reliability is 90% or higher. The HOME has been used throughout North and South America, several European and Asian countries, in Australia and in at least two African nations (Caldwell & Bradley, 2001). The HOME has been shown to correlate significantly with the BSID-II in at-risk samples of infants (Kuperus et al., 1993; Molfese et al., 1996).

In order to provide information for the implementation of intervention programs, it is beneficial to show the various strengths and weaknesses of the home environment. Because the HOME has been used with at-risk populations as well as in developing countries, it was an appropriate measure for this study.

Demographic Questionnaire

Because of the difficulty in creating a demographic questionnaire appropriate for a sample of rural Paraguayans, the one used in this study was a modified form of the demographic questionnaire used by Pastoral del Nino. Their demographic questionnaire was modified because it is used along with an interview, so there are questions that have been added to the questionnaire for this study that are used on the interview implemented by Pastoral del Nino. The version of the demographic questionnaire used for this study included 20 questions intended to measure SES, basic infant health, gender, and breastfeeding. SES was measured by asking questions such as mother's education, what animals the family has, whether the mother is employed outside the home, type of latrine, housing materials and access to clean water. Basic infant health was measured by questions such as birthweight, illnesses, immunizations, complications at birth, and food intake. Breastfeeding information was measured by questions about duration and exclusivity of breastfeeding.

The questionnaire was translated into Spanish. In cases where Spanish was not the primary or secondary language, the questionnaire was administered in interview form with the aid of a translator. The questionnaire was also administered in interview form in cases where there was not anybody in the family who could read the questionnaire in order to fill it out.

Anthropometric Measures

Anthropometric measures were also taken as part of the demographic information. To obtain these measures, the researcher weighed the infant on a digital infant scale to the

closest ounce. The scale we used was the Tanita 1584 Digital Infant Scale. It weighs from 0-20 pounds to the nearest 0.5 ounce and from 20-40 pounds to the nearest ounce. The infant was lying down on the scale while weight measurements were taken. The researcher took length measurement while the infant was lying down on a measuring mat with an attached head board and a moveable foot board. The measuring device that we used was the Seca 210 Infant Measuring Device. This device measures up to 39 inches. The researcher placed the infant on his/her back with the head touching the head board, the infants legs were extended and the foot board brought up against the sole of the foot. Length measurements were taken to the nearest $\frac{1}{4}$ inch. Head circumference was also measured using a non-stretchable measuring tape. We used the Seca 402 Measuring Tape, which measures up to 22 inches. Head circumference measures were taken to the nearest $\frac{1}{4}$ inch. Each of the previously mentioned measuring devices were purchased from Quick Medical. The U.S. Department of Health and Human Services Health Resources and Services Administration recommends these methods for collecting anthropometric data on infants and children under 36 months old. The instruments we used were selected because of their portability. Using these measurements the following ratios were calculated: weight-for-length, weight-for-age, length-for-age, and head circumference-for-age. These ratios were then compared to the standardized growth charts from the Paraguayan Ministry of Health.

Procedures

The first thing we did was to determine whether or not the child could be included in our study. To be in the Pastoral del Nino sample, the family had to have been

participating in Pastoral del Nino for at least half of the child's life beginning from conception to the time of assessment. In order to be in the non Pastoral del Nino group, the family must not have been participating in any kind of ECD program.

The present researcher and Dr. Ann M. B. Austin, assisted by a native Paraguayan translator, administered the Mental Development Index of the Bayley Scales of Infant Development 2nd Ed. (Bayley, 1993). Each of the infants in the sample was awake and alert at the time of testing and the mother (or other primary caregiver) was present. Informed consent was collected at the beginning of each visit. If the primary caregiver was not literate, Hugo de Aquino a native Paraguayan or a Pastoral community leader read the consent form and answered any questions.

If the only language spoken in the house was Guarani, the translator was asked to assist with the vocalizations directed at the infant because the present researcher was not fluent enough in Guarani to accurately pronounce the necessary words. This session lasted between 25-35 minutes depending on the age and temperament of the infant. The present researcher was trained on the BSID-II and was determined to be a reliable administrator of the BSID-II before arriving in Paraguay. Once in Paraguay, the present researcher administered the BSID-II to several infants under the guidance of Dr. Ann Austin before beginning the data collection for the present study.

After the BSID-II was completed, the infant was weighed using a portable baby scale and the weight was recorded on the demographic questionnaire. The infant was also measured using standardized techniques and that measurement was also recorded on the demographic questionnaire. These measurements were recorded as part of the health information on the demographic questionnaire.

At a time other than when the BSID-II was being administered, another trained researcher fluent in Guarani and Spanish administered the Home Observation for Measurement of the Environment Infant and Toddler Version (Caldwell & Bradley, 2001). The HOME was administered at a time when the mother (or primary caregiver) was at home and the infant was awake and alert. Either Cyle Nielson or Hugo de Aquino, both of whom have been trained to administer the HOME by Belinda Belvine-Kanabe at the University of Arkansas, administered the HOME. Nielson and de Aquino both work with Pastoral del Nino and are familiar with Paraguayan language and culture. Nielson, a former Peace Corps volunteer has lived in Paraguay for 9 years and de Aquino is a native Paraguayan. The HOME took about 60 minutes to complete. During the administration of the HOME, the demographic questionnaire was administered in interview form.

CHAPTER IV

RESULTS

This chapter will begin by giving descriptive statistics for several of the dependent and independent variables measured. Next, correlations and regression models between dependent and independent variables are given. Finally, the hypotheses are restated and the results summarized.

Sample Demographics

The total sample for the present study included 108 infants. Fifty were not in Pastoral del Nino and 58 were participating in Pastoral del Nino at the time of the study. Of the children not in Pastoral del Nino, there were 10 children in each of the following age groups: 0-4 months, 5-9 months, 10-14 months, 15-19 months, and 20-24 months. Of the children in Pastoral del Nino, there were eleven 0-4 month olds, nine 5-9 month olds, fifteen 10-14 month olds, thirteen 15-19 month olds and eleven 20-24 month olds. The sample was gathered from five different locations in Paraguay.

Infant Health

The following variables were used to measure infant health: birthweight, length-for-age ratios, weight-for-age ratios, currency of vaccinations, if the infant had suffered from a serious illness, if the infant had been ill in the past two weeks, and whether or not the infant was pale or had a cold at the time of testing. Length-for-age and weight-for-age ratios were obtained for 107 of the infants tested.

Standardized means were taken from infant growth charts published by the Paraguayan Ministry of Health. The infants were given a score based on their ratios; 0 = more than two standard deviations below the standardized mean, 1 = between one and two standard deviations below the standardized mean, and 2 = less than one standard deviation below the standardized mean.

Other infant health variables were measured via a demographic questionnaire with yes or no answers (vaccines 0 = no, 1 = yes; serious illness 0 = yes, 1 = no; ill in past two weeks 0 = yes, 1 = no; pale at test 0 = yes, 1 = no; and cold at test 0 = yes, 1 = no) and were available for each of the 108 infants with the exception of whether or not the infant was pale at the time of testing, which was available for 107 of the infants because for some reason the question was not obtained for one of the infants. The means and standard deviations for total infant health variables, as well as means and standard deviations of the non-Pastoral and Pastoral groups are found in Table 3.

Household Circumstances

Poverty was measured by dividing the total household income by number of people in the house (income is measured in Guaranis earned per month; at the time of research the exchange rate was G6,000 to \$1); coding the kind of roof that was on the house (0 = palm, 1 = zinc or tile); coding the type of floor that was in the house (0 = dirt, 1 = cement or tile); type of excreta disposal (0 = latrine, 1 = modern); whether or not the family owned a vehicle (0 = no vehicle, 1 = any motorized vehicle); whether or not the family owned a television set; farm animals owned by the family including chickens, a pig, a dog, a cat, a cow, a horse, and an ox (0 = no, 1 = yes).

Table 3

Means (Standard Deviations) for Infant Health Variables

Variable	Non-Pastoral <i>n</i> = 50	Pastoral <i>n</i> = 58	Total
Length-for-age ratio	1.50 (.81)	1.47 (.80)	1.49 (.81)
Weight-for-age ratio	1.70 (.58)	1.70 (.60)	1.70 (.59)
Vaccines	.78 (.42)	.93 (.26)	.86 (.35)
Serious illnesses	.80 (.40)	.83 (.38)	.81 (.39)
Ill in the past 2 weeks	.50 (.51)	.43 (.50)	.46 (.50)
Pale at test	.94 (.24)	.97 (.18)	.95
		<i>n</i> = 57	
Cold at test	.54 (.50)	.62 (.49)	.58

The following variables were used to measure the home and caregiving environment: crowding was measured by dividing the number of rooms by the total number of people, total number of women over age 13 in the house, total number of children under age 13 in the house, and whether or not the grandparents live in the house (0 = no, 1 = yes). Mother and father education levels were measured in number of years of school completed. Mother's reading level was assessed via questionnaire (0 = cannot read, 1 = can read with difficulty, 2 = can read easily). Number of children the mother had lost was measured via questionnaire (0 = 2 or more children had died, 1 = one child had died, 2 = no children had died). Interaction between mother and child was measured by asking the mother if she sings to her child and if she teaches her child (0 = no, 1 = yes); the HOME subsets and the total HOME scores. Means and standard deviations for

total household poverty, as well as means and standard deviations of household circumstances for both the non-Pastoral and Pastoral sample are found on Table 4. Means and standard deviations for total the total household environment are found on Table 5. The lower the score, the more impoverished the circumstances.

Bayley Scales of Infant Development-II (BSID-II)

Mean MDI score for infants in Pastoral del Nino was 85.07 ($SD = 13.03$). Mean MDI score for infants not in Pastoral del Nino was 77.96 ($SD = 14.80$). The standardized

Table 4

Means (Standard Deviations) for Household Poverty

Variable	Non-Pastoral <i>n</i> = 50	Pastoral <i>n</i> = 58	Overall
Income/person	64,517.61 (52,824.37)	83,980.50 (118,324.54)	74,394.30 (91,920.57)
Roof	.70 (.46)	.65 (.48)	.68 (.47)
Floor	.24 (.43)	.46 (.50)	.36 (.48)
Bathroom	.14 (.35)	.16 (.37)	.14 (.36)
Vehicle	.12 (.33)	.16 (.37)	.14 (.35)
Television	.38 (.49)	.53 (.50)	.46 (.50)
Chickens	.96 (.20)	.95 (.22)	.95 (.21)
Pig	.70 (.46)	.59 (.50)	.64 (.48)
Cow	.32 (.47)	.47 (.50)	.38 (.49)
Ox	.02 (.14)	.03 (.18)	.25 (.44)
Horse	.30 (.46)	.21 (.41)	.03 (.17)

Table 5

Means (Standard Deviations) for Household Environment

Variable	Non-Pastoral <i>n</i> = 50	Pastoral <i>n</i> = 58	Overall
People/rooms	.29 (.16)	.34 (.18)	.32 (.17)
Women in house	1.82 (1.26)	2.12 (1.18)	1.98 (1.21)
Children in house	3.62 (2.07)	3.81 (1.97)	3.72 (2.01)
Grandparents	.20 (.40)	.33 (.47)	.27 (.45)
Mother's education	5.00 (3.05)	5.31 (2.67)	5.17 (2.84)
Father's education	5.02 (1.98)	5.12 (2.38)	5.10 (2.19)
Mother's reading	1.46 (.76)	1.62 (.64)	1.54 (.70)
Children lost	1.72 (.50)	1.76 (.51)	1.74 (.50)
Sing to child	.80 (.40)	.81 (.40)	.81 (.40)
Teach child	.68 (.47)	.86 (.35)	.78 (.42)
HOME responsivity	5.32 (1.89)	6.70 (2.04)	6.06 (2.01)
HOME acceptance	6.70 (.86)	7.04 (.87)	6.88 (.88)
HOME organization	2.78 (1.04)	3.33 (1.12)	3.07 (1.11)
HOME toy	2.28 (1.58)	3.30 (2.04)	2.82 (1.90)
HOME involvement	1.92 (1.24)	3.04 (1.22)	2.51 (1.35)
HOME variety	2.14 (.88)	2.49 (.78)	2.32 (.84)
HOME total	21.14 (4.26)	25.89 (4.78)	23.67 (5.12)

mean for the MDI = 100 (*SD* = 15).

*Correlations of Independent and
Dependant Measures*

Correlations were run for independent and dependent variables using combined data from both the Pastoral and non-Pastoral groups and for each group separately. Correlations among infant health variables, MDI, infant age, and participation in Pastoral del Nino are found in Table 6. Correlations among household variables and MDI scores, infant age, and participation in Pastoral del Nino are found in Table 7. Correlations among household environment and BSID-II scores, infant age, and participation in Pastoral del Nino are found in Table 8. Finally, correlations among participation in Pastoral del Nino, infant age, and BSID-II scores are found in Table 9.

Two statistically significant correlations are found between infant health and MDI scores. Both length-for-age, $r(108) = .238, p = .014$, and weight-for-age, $r(108) = .241, p = .013$, ratios positively correlated with BSID-II scores indicating that the children who were taller and heavier for their age had better cognitive outcomes. Length-for-age and weight-for-age are also significantly correlated with infant age $r(108) = -.389, p = .000$ and $r(108) = -.406, p = .000$, respectively, indicating that length and weight-for-age ratios decrease with age. Participation in Pastoral del Nino was significantly correlated with whether the child was up to date on his/her vaccinations, $r(108) = .218, p = .024$. However, there were no significant correlations between participation in Pastoral del Nino and length-for-age or weight-for-age ratios.

There were seven statistically significant correlations between household variables and MDI scores. While mother and father education levels were not

Table 6

Correlations Between Infant Health Variables, MDI, Child Age and Pastoral del Nino Status

Variable	MDI	Infant age	Pastoral del Nino
Length-for-age ratio	.238*	-.389**	-.016
Weight-for-age ratio	.241*	-.406**	.002
Vaccines	-.013	.160	.218*
Serious illnesses	.027	-.091	.035
Ill in the past 2 weeks	.051	-.109	-.069
Pale at test	.108	-.109	.059
Cold at test	-.007	.010	.082

$n = 108$

* $p < 0.05$

** $p < 0.01$

significantly correlated with BSID-II scores, the mother's reading level was statistically significant, $r(108) = .217, p = .024$. The number of children the mother had lost also correlates with MDI scores, $r(108) = .219, p = .024$, indicating that the fewer children the mother had lost, the higher the BSID-II score. The HOME responsivity, $r(108) = .275, p = .004$; organization, $r(108) = .197, p = .043$; involvement, $r(108) = .450, p = .000$; variety, $r(108) = .224, p = .021$; and the total HOME, $r(108) = .397, p = .000$ also correlated significantly with the MDI, while the HOME toy and acceptance subscales did not significantly correlate with the MDI.

Table 7

Correlations Among Household Poverty and BSID-II

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Income/person													
2. Roof	.198												
3. Floor	.211*	.315**											
4. Bathroom	.184	.177	.175										
5. Vehicle	.279**	.321*	.390**	.030									
6. Television	.143	.365**	.307**	.136	.366**								
7. Chickens	-.039	.036	.074	.092	-.130	.028							
8. Pig	.000	.015	.084	-.121	.194*	.195*	.201*						
9. Cow	.008	.240*	.452**	.193*	.194*	.345**	.179	.100					
10. Ox	-.112	-.003	-.010	-.070	-.065	.069	.037	.127	.093				
11. Horse	.135	.080	.189*	.060	.091	.236	.127	.167	.404	-.098			
12. BSID-II	.084	-.032	.175	-.011	-.009	.131	.086	-.023	.088	.043	-.100		
13. Infant Age	.015	-.101	.011	.006	-.134	-.040	-.117	-.022	.069	-.018	.077	-.266**	
14. Pastoral	.074	-.048	.234*	.048	.039	.154	-.028	-.118	.148	.044	-.107	.250**	.012

* $p < .05$ ** $p < .000$

Table 8

Correlations Among HOME Scores, Caregiving Environment, Pastoral, Infant Age, and MDI

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1. Crowding																				
2. Women	.073																			
3. Children	-.432**	.151																		
4. Grandparents	.192*	.424**	-.010																	
5. Mom's ed	.352**	-.047	-.102	.274**																
6. Dad's ed	.132	-.025	-.191	.014	.580**															
7. Mom's literacy	.267**	-.054	-.183	.124	.609**	.404**														
8. Lost child	.015	.023	-.147	.232*	.175	.191	.194*													
9. Sing	.166	.089	-.138	.139	.003	-.066	-.018	-.021												
10. Teach	.162	.029	-.074	.233*	.132	-.052	.035	-.055	.075											
11. Responsivity	.209*	.009	-.174	.179	.433**	.091	.352**	.095	.093	.274**										
12. Acceptance	.189	.189	-.013	.180	.286**	.351**	.230*	.206*	.012	-.152	.128									
13. Organization	.182	.123	-.219*	.154	.088	-.033	.146	.129	.158	.192*	.091	-.072								
14. Toy	.228*	.189	-.151	.304**	.296**	.106	.165	.070	.128	.353**	.287**	.038	.085							
15. Involvement	.290**	.122	-.266**	.253**	.446**	.194	.347**	.170	-.025	.489**	.523**	.221*	.158	.440**						
16. Variety	.092	.087	-.069	.274**	.259**	.000	.143	.159	.164	.263**	.365**	.003	.167	.425**	.444**					
17. Total HOME	.332**	.176	-.243*	.361**	.514**	.189	.384**	.201*	.148	.435**	.752**	.283**	.339**	.698**	.784**	.629**				
18.MDI	-.008	.099	-.092	.147	.207*	.135	.217*	.219*	-.138	.098	.275**	.170	.230*	.153	.445**	.224*	.339**			
19. Infant age	.077	.109	.100	.066	-.062	-.176	-.081	-.172	.125	.375**	.114	-.177	-.095	.467**	-.051	.165	.182	-.266**		
20. Pastoral	.128	.124	.047	.144	.106	.027	.115	.039	.013	.218*	.333**	.192*	.222*	.269**	.424**	.209*	.464**	.250**	.012	

Table 9

Regression Analysis of HOME Involvement and MDI Scores

Variable	B	SE B	Beta
HOME involvement	4.702	.914	.450**

** $p < 0.01$, $R^2 = .203$

There were two statistically significant correlations between household variables and infant age. Whether or not the mother teaches her child, $r(108) = .370, p = .000$; and the HOME toy subscale, $r(108) = .471, p = .000$ correlated with infant age. There were nine statistically significant correlations between household variables and participation in Pastoral del Nino. The type of floor correlated with participation in Pastoral del Nino $r(108) = .234, p = .015$, although the type of roof, number of rooms, crowding and type of bathroom did not. Whether or not the mother teaches her child also correlated with participation in Pastoral del Nino $r(108) = .218, p = .023$. Finally, each of the HOME subscales (responsivity, $r(107) = .333, p = .000$; acceptance, $r(107) = .192, p = .048$; organization, $r(107) = .249, p = .010$; toy, $r(107) = .269, p = .005$; involvement, $r(107) = .415, p = .000$; and variety, $r(107) = .209, p = .031$) and the total HOME, $r(107) = .466, p = .000$ correlated with participation in Pastoral del Nino. Finally, MDI scores correlated with infant age, $r(107) = -.278, p = .004$; and participation in Pastoral del Nino, $r(107) = .250, p = .009$.

*Regression Analyses of Independent
and Dependent Variables*

Independent variables that were significantly correlated with the dependent variable, and were not highly intercorrelated with each other (less than .6) were used in regression analyses. The highest correlate among household variables and the MDI was the involvement subcategory of the HOME. The results are summarized in Table 9.

A regression analysis was run using both the involvement subcategory of the HOME and participation in Pastoral del Nino as the independent variables and the MDI as the dependent variable. The results of this analysis are summarized in Table 10.

Table 10

Regression Analysis of HOME Involvement and Pastoral del Nino, and MDI Scores

Variable	<i>B</i>	SE <i>B</i>	Beta
Pastoral del Nino	2.853	2.708	.101
HOME involvement	4.265	1.003	.409**

** $p < 0.01$, $R^2 = .211$

Table 11

Regression Analysis of Infant Age and Pastoral del Nino, and MDI Scores

Variable	<i>B</i>	SE <i>B</i>	Beta
Infant age	-.586	.192	-.278**
Pastoral del Nino	7.143	2.590	.251**

** $p < 0.01$, $R^2 = .13$, Adj $R^2 = .12$

A regression analysis was performed using infant age and participation in Pastoral del Nino as the predictor variables and the MDI as the dependent variable. The results of this regression analysis are found in Table 11.

Another regression analysis was done using infant age, HOME involvement, weight category and participation in Pastoral del Nino to predict MDI scores. The results are summarized in Table 12.

A final regression analysis was done using infant age, maternal education level and participation in Pastoral del Nino to predict the total HOME scores. The results are summarized in Table 13.

Results of Hypotheses Testing

Hypotheses one and three were analyzed using Pearson correlation coefficient. Hypotheses two and four were analyzed using Pearson correlation coefficient and regression analyses. The hypotheses are stated in the null. Statistical significance was set at $p < .05$.

H1: *MDI scores will not correlate significantly and positively with infant health.* The data partly supported the rejection of the null. Because several variables were used to evaluate infant health, there was some inconsistency in how they correlated with the MDI. The only health variables that significantly correlate with the MDI are the length-for-age ratios and weight-for-age ratios. Statistically significant correlations were not formed between the other health variables and MDII scores.

Table 12

Regression Analysis of HOME Involvement, Weight Category, Pastoral del Nino, and Infant Age, and MDI Scores

Variable	B	SE B	Beta
HOME involvement	3.909	.981	.375**
Pastoral del Nino	3.160	2.630	.112
Weight category	2.713	2.260	.113
Infant age	-.433	.193	-.209*

** $p < 0.01$, $R^2 = .285$

Table 13

Regression Analysis of Infant Age and Pastoral del Nino, and HOME scores

Variable	B	SE B	Beta
Home Involvement	3.909	.981	.375**
Pastoral del Nino	3.160	2.630	.112
Weight Category	2.713	2.260	.113
Infant age	-.433	.193	-.209*

** $p < 0.01$, $R^2 = .477$

H2: *MDI scores will not correlate significantly and positively with household variables.* Again, the rejection of the null is partly supported by the data. Only seven out of the 30 household variables significantly correlated with the MDI scores. The seven statistically significant household variables that support this hypothesis are the mother's

reading level, the number of children the mother had lost, indicating that the fewer children the mother had lost, the higher the MDI score. The HOME responsivity, organization, involvement, variety, and the total HOME also correlated significantly with the MDI. The other household variables (see Table 4) did not significantly correlate with MDI scores. In a regression analysis type of floor, whether or not the mother sings to the child and HOME acceptance and involvement subcategories were significant with MDI scores.

H3: *MDI scores will not decrease significantly as the infant gets older.*

The data supports rejection of the null. Infant age negatively correlated with the MDI. Also, in the regression analysis in Table 11, when controlling for weight category, participation in Pastoral del Nino and the HOME involvement score, age becomes a significant predictor of the MDI.

H4: *Participation in the Pastoral del Nino program will not correlate significantly and positively with infant health, MDI scores and HOME scores.*

The data partly supports the rejection of the null in this hypothesis. Participation in Pastoral del Nino significantly correlated with birthweight and whether or not the child was up to date on vaccinations. However, participation in Pastoral del Nino did not correlate with the other infant health variables. Participation in Pastoral del Nino did correlate with each of the HOME subscales (responsivity, acceptance, organization, toy, involvement and variety), the total HOME and MDI scores. In a regression analysis with MDI scores as the independent variable, participation in Pastoral del Nino was significant. However, in the regression analysis in Table 11, when controlling for infant age, weight category and HOME involvement; participation in Pastoral del Nino is no

longer a significant variable in predicting MDI scores. In a regression analysis predicting the HOME, participation in Pastoral del Nino is a statistically significant.

CHAPTER V

DISCUSSION

The purpose of this study was twofold; first, to begin to establish baseline measures of infant development in rural Paraguay among poor people who are not receiving any outside services. The second purpose of the study was to examine the effectiveness of Pastoral del Nino, an ECD program in Paraguay. Research questions include the following: Does the physical condition of the child (weight, health history, current health) effect infant development in Paraguay? Do family circumstances (sanitation, access to clean water, economic conditions, education, and the home environment) effect infant development in Paraguay? Does participation in the Pastoral del Nino program effect infant development in Paraguay?

Because low weight-for-age and length-for-age ratios are related to malnourishment, it can be inferred from these results that the malnourished children did not score as well on the MDI as their better nourished counterparts. These findings are consistent with previous research that shows the ill effects of malnutrition (Hamadani et al., 2002; Rose, 1994; Sternberg et al., 1997; UNICEF, 2001).

It is interesting that mother's education is not related to infant development in this study, but mother's reading ability is. This finding may suggest that in Paraguay quantity of education may not be as important as quality of education. It is important to also note that even though maternal education did not correlate directly with infant cognitive development, it was significant in predicting the total HOME score which was a statistically significant correlate with the MDI. The involvement category of the HOME

was the highest correlate with MDI scores predicting just over 20% of the variance in MDI scores. The involvement category of the HOME was significant even after controlling for participation in Pastoral del Nino. The statistically significant correlations between the HOME and MDI replicate findings in other studies (Lozoff et al., 1995; Molfese et al., 1996; Richter & Grieve, 1991; Weisglas-Kuperus et al., 1993; Widmayer et al., 1990).

Age of infant was also a significant predictor of MDI scores. Age of infant was negatively correlated with MDI scores indicating that the older the infant, the lower the score. Infant age was also significant in predicting MDI scores in regression analyses, even when controlling for factors such as weight ratio, participation in Pastoral del Nino, HOME involvement, and in Table 11, participation in Pastoral del Nino and mother's education. This finding may indicate that negative aspects of the environment have a stronger effect as the child increases in age (Bradley & Caldwell, 1984).

Participation in Pastoral del Nino was also a statistically significant predictor of MDI scores and HOME scores. These findings also support the literature that indicates that quality ECD programs yield positive outcomes (Evans, 2002; Myers, 1992a, 1992b; UNICEF, 2003; Van der Gaag & Tan, 1997; Young, 2002). Because Pastoral del Nino offers a variety of services to young children and families, it is impossible from these findings to determine the specific services that are the most beneficial, but it is very encouraging to know that their program is making a measurable difference.

This study has been important to Pastoral del Nino in showing that they are reaching many of the goals they have for the children and families they serve. One of their goals is to improve the health status of young children in Paraguay. The data show

that children in Pastoral del Nino are more likely to be caught up on their vaccinations than children not in Pastoral del Nino. While improving vaccination rates is extremely important, more must be done to improve the nutritional status of many of the children both participating in and not participating in Pastoral del Nino. Another of Pastoral del Nino's goals is to make parents aware of how important positive interaction and experiences are for their child. The data show that families in Pastoral del Nino have significantly higher HOME scores; and that mothers of children in Pastoral del Nino are more likely to purposely teach their child. Higher HOME scores indicate that for Pastoral children there is more positive mother/child interaction, there are more stimulating materials for the child, the child has a wider variety of experiences, the child is accepted by the mother, the child is more involved in family activities and togetherness, and there is more organization and consistency in the environment. Because no significant differences were found in family wealth and household crowding, it can be assumed that there is no significant difference between Pastoral del Nino and non Pastoral del Nino families as far as their resources or leisure time is concerned. The higher HOME scores and higher incidence of mothers teaching their child cannot be attributed to additional wealth or time. A third goal of Pastoral del Nino that this study addresses is to encourage stimulation and brain development among the children they serve. This study found that children in Pastoral del Nino have significantly higher MDI scores than children not in Pastoral del Nino.

The limitations of the present study included threats to internal validity such as history effects, maturation, demand characteristics, experimenter expectancy, and diffusion of treatment. Events outside of the study such as the possibility of some

families in the non-intervention group being exposed to the benefits of intervention programs in the area could affect the results. This threat was believed to be minimal because the families recruited for the non-intervention sample were families who do not participate in the Pastoral del Nino program. However, they were families living in areas suggested by Pastoral del Nino.

Maturation could have affected the study because some of the infants were irritable during assessment because of hunger or fatigue. However, the assessments on the infants were done at a time when the infant appears to be alert and content. If the state of the infant was determined to be unusual the assessment was postponed. Finally, some of the families could have been alerted to the purposes of the study and prepped the infant to try to enhance their performance during the assessment. This threat was also believed to be minimal because we began assessments once we had obtained consent. Also, we were only collecting data for a period of about 1 month, which may not have been sufficient time to significantly change the performance of the infant during assessment.

Experimenter expectancy effects were a possible limitation because there were obvious instances of extreme poverty that the researcher noticed even without measuring. Therefore, there was the possibility that the researcher may have seen what she expected to see. In an attempt to try to control for the effects of this threat to internal validity, a different researcher administered the HOME, while the author administered the MDI and obtained infant anthropometric measures. Also, infant anthropometric measures were taken after the MDI was complete. Finally, every effort was made to ensure that the

researcher was ignorant of what families were participating in the Pastoral del Nino program and which were not.

Finally, diffusion of treatment was a limitation of the present study. Pastoral del Nino offers several components to their intervention, which made it impossible to determine what the most effective components were. However, this threat was acceptable for purposes of this study.

It can be argued that families participating in Pastoral del Nino are participating because of a desire to improve the lives of their children ; and therefore it is this desire rather than Pastoral del Nino's services that account for the higher scores. Additional research is needed to determine whether the length of time a child or family has been in Pastoral del Nino makes a significant difference in the variables measured. If families who had been participating in Pastoral del Nino the longest had the highest scores, it would strengthen the argument that it is the services of Pastoral del Nino that account for the better outcomes.

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