CAN FATHERS’ EDUCATION LEVEL MODERATE RELATIONS BETWEEN LOW BIRTH WEIGHT AND CHILD COGNITIVE DEVELOPMENT OUTCOMES?

A Thesis

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By

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ABSTRACT

Low birth weight has considerable short-term and long-term consequences and leads to high costs to the individual and to society. Very little information exists that can provide insights into how fathers can impact cognitive development in children born with low birth weight. Does education afford the father with skills to buffer his child from poor cognitive development? I used Coleman’s (1988) social theory as a guide to the conceptualization of resources that fathers invest in the next generation - human capital, financial capital, and social capital. Using baseline and three year data from The Fragile Families and Child Wellbeing Study, I explored the possibility that fathers' education level may buffer against poor cognitive development in low birth weight infants. I further examined whether father involvement mediated the relation between father education and child cognitive development. My findings suggest educated fathers may potentially have the ability to protect child cognitive development but the effect is not greater for children with low birth weight than normal birth weight children.

Additionally, after controlling for household income, child gender, and birth weight, I found no significant association between father involvement and child cognitive development. Spending time with the child, independent of education, was not found to impact child cognitive outcomes for this sample.
This Masters thesis is dedicated to the memory of my parents, Saraswathi and Professor Chidambaraswamy Jayanthi. To my Father, who exemplified the meaning and value of education and who instilled in me a love of learning that still burns brightly today. And to my mother whose love and affection had no bounds. I think of you every day and I know what this day would mean to you.
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Field of Study

Major Field: Human Ecology
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CHAPTER 1

INTRODUCTION

Medical advances in recent years have improved the care for infants born with low birth weight. Babies born weighing less than 5 pounds, 8 ounces (2,500 grams) are considered low birth weight (LBW). The availability and utilization of neonatal intensive care units coupled with the development of newer and more powerful drugs have greatly improved the odds of survival for the smallest of infants. These successful rescue efforts, however, are often associated with significant long-term health and developmental problems among survivors (Kliegman, 1995).

LBW is a large public health problem in the United States, contributing both to infant mortality and to later negative childhood outcomes. Low birth weight infants are more likely to experience long-term disability or to die during the first year of life than are infants of normal weight (Martin & Hamilton, 2002). The consequences continue beyond the newborn period and include growth and developmental problems in childhood as well as an increased risk of disorders in adulthood, including obesity, non-insulin-dependent diabetes, coronary heart disease, and neuropsychological
disorders, (Hack, Taylor, Drotar, Schluchter, Cartar, Andreias, et al., 2005; Oken & Gillman, 2003). Low birth weight children are at greater risk for poor cognitive development than children born with normal weight, with adverse outcomes increasing as birth weight decreases (Reichman, 2005). Using data from the Panel Study of Income Dynamics, Conley and Bennett (2000) found that children born with low birth weight were 74% less likely to finish high school than their normal weight siblings.

The principal reason for low birth weight in the United States is preterm delivery. Preterm delivery is more common in the United States than in many other industrialized nations, and is responsible for the relatively high infant mortality rate in the United States (Frank, 1989; Paneth, 1995).

Within the United States, Asian populations experience the lowest preterm delivery rates, while Hispanic and Native American populations experience slightly higher preterm delivery rates than the white population. African Americans, however, have much higher rates of preterm delivery than any of the other major ethnic groups (Martin et al., 2002).

Socioeconomic factors have been linked to poor health (Olafsdottir, 2007), and low birth weight is strongly associated with socioeconomic status (Lawrence, Bennett, & Jaili., 1996; Shenkin, Starr, Deary, & Shenkin, 2004; Yliharsila, Kajantie, Forsen, Barker, & Erikson, 2007).
This association is seen across different ways of measuring socioeconomic status, including occupation of either parent, income, or education (Moutquin, 2003). Women who live in poverty, who have low levels of education, who work in low-wage jobs, and who have few other social resources are more likely to suffer adverse birth outcomes than are more advantaged women. In the United States, women from lower socioeconomic levels have been found to be at significantly higher risk of preterm delivery, even when controlling for other known risk factors such as pre-pregnant weight, weight gain, smoking, alcohol consumption, race, and source of prenatal care (Elbourne, Pritchard, & Dauncey, 1986). How these risk factors lead to preterm delivery is not clearly understood. What is clear is that there are long-term effects for the child and therefore for the community (Gaylord, Greer, & Botti, 2008). In the United States, one of the most striking and consistent patterns in the distribution of illness and poor health is its relationship to poverty (Wagstaff, 2002). The death and disease rates vary inversely with social class. Although it has been documented for decades that the poor in the United States suffer from more disease than others, how poverty influences health is not fully understood. Recent research has noted that the relationship between social class and health is still prevalent today (Adler, Boyce Chesney et al., 1994). Whether the increase in illness and poor health among the poor is a result of access to health and health information or perhaps a result of living conditions in not fully understood.
Lin, Liu, and Chou (2007) showed in their work that parents’ educational level might in fact have a positive effect by offsetting some of the negative effects of LBW. Their findings indicate that low birth weight is significantly and negatively associated with academic achievement. They also found that having highly educated parents could offset the negative effects of LBW by as much as 40%. These findings suggest that parents may alter the outcomes for cognitive development in children born with low birth weight. This is extremely important information in the US because the incidence of LBW has been steadily increasing over the past two decades (National Center for Health Statistics, 2007).

This study utilizes the data from the Fragile Families and Child Well-Being Study to examine the relations between low birth weight, fathers’ education level and child cognitive development outcomes. This is an important factor to consider with the Fragile Families dataset which includes many low-income couples, who are most at risk for Low Birth Weight. Nationally, LBW occurs at a rate of 8.2 % (CDC birth data, 2005) whereas it occurred at a rate of 10% within Fragile Families study sample.

Specifically, can fathers’ level of education impact the cognitive development of low birth weight infants? Low birth weight has been shown to have detrimental effects on infants throughout their lifetimes. This is especially the case for infants from low socioeconomic backgrounds. Is it possible, as Lin et al. (2007) suggest that a father with more education has the mental and emotional acuity to find the resources
to help his child regardless of his own poor economic status? Is it possible to prevent, or at least thwart, the harmful effects of LBW?
CHAPTER 2

REVIEW OF LITERATURE

Influence of Parent Education

Knowledge combined with experiences provides the foundation upon which we process our thoughts and actions. These elements, often referred to as human capital, are defined as the skills and traits that promote achievement in society. We accumulate these skills over a lifetime from cultural and social experiences. Nettles and Millett (1999) suggest that as individuals progress through life, they accumulate human capital through their level of educational achievement. This idea leads to the conclusion that the higher an individual's level of education, the greater their human capital. At the same time, Amato (1998) suggests children's development is directly affected by the quality and quantity of human capital that parents possess. Parents provide the resources from which children can develop skills, such as work habits and communication skills that allow them to be successful, and develop their own level of human capital. A good measure of human capital is the level of parent education. Parents with higher educational levels are better able to foster their children’s
cognitive skills and socioeconomic attainment. Children from educated parents enter school better prepared, they have been read to at least three times a week, and have greater self-control (Purcell-Gates, 1996; Jordan, Snow, & Porche, 2000). Research on achievement has consistently shown that parent education is an important factor in predicting children’s achievement (Bradley & Corwyn, 2002), although pathways for this influence have not been well documented or studied.

The economic returns to education are relatively easily understood as the result of the human capital formed in the education process. The health effects of education are much broader in scope, reflecting a much wider set of outcomes with an equivalently wider set of mechanisms. Human capital is an important channel but other personal resources are also important and must be explored.

There is large body of empirical evidence to support the claim that there is a positive relation between education and health (Wolfe & Zuvekas, 1997). Epidemiologists have long observed a direct correlation between education level and health outcomes. Educated individuals have been shown to be more likely to wear seat belts, exercise, eat low fat diets, and utilize preventive care and are less likely to smoke, consume excessive alcohol and use illegal drugs (Hammond, 2002). The relationship between education and health is seen across national boundaries; as average education increases, life expectancy improves (UN, 2003).
What are the possible links between education and health? One possibility is that poor health may lead to lower educational attainment. Quite simply stated, a person of poor health is less likely to achieve higher levels of education. For example, children that are born with low birth weight obtain less schooling than those with normal birth weight (Black, Devereux, & Salvanes, 2005). This has been found to be consistent when examined with twin births as well (Behrman & Rosenzweig, 2004; Royer, 2009). Royer (2009) makes the added claim that if a mother was born with low birth weight, her child is significantly more likely to be low birth weight, even when comparing mothers who are sisters, suggesting a cyclical process unfolding. Low birth weight has been identified as a predictor for poor health later in adulthood (Hack et al., 2005; Oken & Gillman, 2003).

Can the reverse be stated then? Can more or better education lead to better health? Looking from a historical perspective, at the turn of the century, when some states in the US increased the number of years children were required to attend school, life expectancy increased as well (Lleras-Muney, 2005). Can education itself be a predictor of better health outcomes, and more specifically, can education be the vehicle to improve one’s own health and the health of one's child? If more education leads to better health and better health leads to more education, then the argument presents itself with greater clarity.
Perhaps education itself as a process is a protective barrier to poor health outcomes.

Education may improve health outcomes simply because education provides greater resources, but is there any other mechanism in place? Could it be that the more educated individuals are simply better at learning and processing information? Does the process of education allow individuals to learn to be better problem solvers? Can this ability to problem solve be the means that an educated father may be better able to seek out resources for his child with LBW? This effect has not been sufficiently investigated.

The direct effect of fathers’ level of education on child perceptions of efficacy and ‘locus of control’, a belief that they can control much of what happens to them in life (Pleck & Masciadrelli, 2004), has been found to be significant. This is relevant to children’s cognitive outcomes, since ‘better functioning’ in life in general tends to enable better functioning in an educational/achievement sense. Cabrera, Shannon & Tamis-LeMonda, (2007) noted that fathers’ education (more than high school) was significantly related to children’s scores on cognitive ability tests at age 3.

However, fathers’ behaviors may also be critically important to examine when attempting to understand the pathways between parental education levels and their expectations for their children.
For example, Samba, dePee, Sun, and Bloem (2008) showed that high levels of both maternal and paternal education were associated with protective care-giving behaviors. As such, fathers with higher levels of education may build their children’s human capital, and thus buffer them from adverse outcomes, though their direct interactions with their children.

**Fathers’ Involvement**

There has been much discussion about the role of fathers in child development. Pleck and Pleck (1997) reported that the role of father has been emerging as that of coparent rather than the historical role of distant, aloof breadwinner. Michael Lamb argues in his book, *The Role of Fathers in Child Development* (2004), that in the 19th century, fathers were involved in every aspect of family life - from holding the wife’s hand during childbirth to playing with and nurturing his children. Lamb goes on to suggest that men had the support and encouragement of religious organizations to be intimately involved with the daily lives of their children. But with the onset of the industrial revolution, there was a decline in father involvement. The economic and social standards of the time emphasized that men and women take on different roles. The female role was focused on home and family whereas the role of the man became one of breadwinner. Specifically, a father’s role became exclusively one of earning a living – a role that often kept him apart from his family.
In recent years, research on fathers has shown consistently positive associations between father involvement and child outcomes (Cabrera, Shannon, Vogel, & Tamis-LeMonda, 2004). These findings hold true for nonresident and low-income fathers as well. The amount of time and quality of time that fathers invest in their children has been linked to better social, emotional and cognitive outcomes (Cabrera et al., 2004; Cabrera, et al., 2007).

Considering that greater father involvement has been documented to foster higher infant weight gain for preterm infants (Moore & Kotelchuck, 2004), improved language skills, higher cognitive skills and higher academic achievement (McBride, Schoppe-Sullivan, & Ho, 2005), and improved social and adaptive behavior (Volling & Belsky, 1992; Flouri & Buchanan, 2003), there is a strong argument to look more closely at the processes that are behind these events.

The subject of fatherhood and the role of fathers in general have taken on a new level of interest of among researchers. As family structures become redefined, the roles within families are also being reexamined. This new interest in fathering is part of a 30-year societal shift in family life. In the past thirty years, there have been extraordinary demographic changes in the American family (Doherty, Kouneski, & Erickson, 1998). More than fifty percent of mothers work outside the home, and one-third of new births are to single women, and more than half of the marriages are ending in divorce. Although the concept of father as wage earner and head of the
household is deeply ingrained for many people, the demographic changes that have occurred in the United States over the past three decades mean that a physically present father who acts as the breadwinner has become an foreign concept for many American families (Doherty, 1998).

Cabrera, Fitzgerald, Bradley and Roggman (2007) noted that the fathers’ rearing history, cultural history and biological history all play a role in the level of father involvement. They developed a heuristic model to identify variables that will predict father involvement, as well as the consequences for father involvement for children.

Figure 1: Cabrera Model
The Cabrera model, (Cabrera et al. 2007), assumes that there will be changes over time and provides a framework to observe these changes. Cabrera et al. propose that parenting is a learned concept and that many factors play a role in how one will parent. The model incorporates contextual factors such as fathers’ education, and brings it into his interactions with the child, suggesting that level of education has a direct impact on how fathers parent their children. This concept provides the framework for the idea that more highly educated fathers are more engaged fathers, thus, better able to buffer their LBW children against negative cognitive development outcomes.

Figure 2: Father Involvement Mediation

Bowlby (1973), in his classic work on attachment theory, stated that father involvement revolved around greater emphasis on play, mentorship and encouragement of the child in the face of challenges rather than on an emphasis on nurturing that mothers provide. It has been reported that fathers’ encouraging support
of their children may contribute to the child’s sense of autonomy later in life (Grossman, Grossman, Fremmer-Bombik, Scheuerer-Englisch, & Zimmerman, 2002). Grossman et al. make the point that with the father’s role as playmate and mentor, they are uniquely positioned to help the child as they begin to explore the world around them.

Numerous studies in the 1990’s explored various forms of father involvement. One way in which fathers contribute to their children is through economic support. Many researchers have documented that economic hardships have tremendously negative effects on children (Brooks-Gunn & Duncan, 1997; Mayer, 1989) including poor nutrition, health problems and behavioral issues. Another way that fathers contribute to their children’s development is through the quality of their interactions. Studies have shown that it is not the amount of time a father is with the child but how they interact during that time that has the greatest impact (Young, Miller, Norton, & Hill, 1995). In particular, the study by Young et al. (1995) suggests that even nonresident fathers can have a positive impact on child outcomes, if they exercise authoritative parenting styles (Baumrind, 1991).

Public interest has grown recently in understanding and promoting fathers. Fathers themselves have become more politically active to insure greater access to their children. This new focus on fathers is spearheading the charge for greater
knowledge of fathers. Empirical studies lag behind community interest and activism; clearly, there is a need for more empirical research in this area. As family life continues to be redefined, as in the fragile families study, the role of fathers must also be redefined and better understood. This is especially true in the context of how fathers may be able to effect positive change for their LBW children.

A Case for Resiliency

It has been noted that children from adverse family situations don’t always have negative outcomes. Luthar, Cicchetti, and Becker (2000) point to studies done with children of schizophrenic mothers who thrived despite every indication to do otherwise. They argue that in the past, researchers have looked to the children for “protective factors” within the child for answers. Luthar et al. suggest that perhaps there may in fact be “protective processes” in play. What exactly is resilience and how does it come into effect? Masten, Best, and Garmezy (1990) define and categorize it as a phenomenon when (1) at-risk individuals show better than expected outcomes, or (2) the individual is able to adapt, despite adverse experience, and (3) the individual is able to recover from traumatic events. Are there protective processes in some family environments and is it possible that fathers’ education can trigger this process?
HYPOTHESIS

In this study, I will test whether fathers’ educational level moderates the association between LBW and child cognitive outcomes. Studies have shown (Currie & Hyson, 1999) that parents from high socioeconomic background are able to buffer their infants from negative health effects, but those from lower socioeconomic backgrounds were unable to thwart the negative effects.

Lin et al., (2007) make the case in their work that parents’ educational level might in fact have a positive effect by offsetting some of the negative effects of LBW. Using birth certificate records for all children born in Taiwan between September 1978 and August 1982, the researchers were able to gather information on birth weight, gender and educational levels of both parents. Based on the normal educational pathways in Taiwan, the researchers knew that this birth cohort would take their college entrance examinations in 1997 and 2000. They matched birth records against college entrance examination files and were able to identify who entered college. What they found was notable. Their findings indicate that low birth weight is significantly and negatively associated with academic achievement. They also found
that having highly educated parents could offset the negative effects of LBW by as much as 40%. But, these buffering effects were significant for only male children, indicating that perhaps, those highly educated parents discriminate against low birth weight daughters, perhaps indicating a cultural bias towards sons. Additionally, they discovered that the positive effect was not felt by those children who had been designated as very low birth weight. What their study also indicates however, is that parents may alter the outcomes for cognitive development in children born with low birth weight.

Using the Fragile Families dataset, which has data through age three, I will test whether fathers’ education interacts with LBW in the prediction of child cognitive development at age 3. I expect that: (a) for children with less well-educated fathers, there will be a negative association between LBW and cognitive outcomes; (b) but, this association will be weakened or non-existent for children whose fathers have higher levels of education. I will further examine whether the expected buffering effect of fathers’ education can be explained by (is mediated by) fathers’ direct involvement with their young children.
Figure 3: Low Birth Weight and Child Cognitive Outcomes
CHAPTER 3

METHODS

Data Source

This study uses the data from the Fragile Families and Child Well-Being Study as well as data from a collaborative study, the In-Home Longitudinal Study of Pre-School Aged Children. The studies address areas of great interest to policy makers, community leaders and scientists. The Fragile Families study was developed to provide information about unmarried parents and their children, welfare reform, and the role of fathers in child well being. The title of “Fragile Families” indicates that there is an increased risk of breaking up or living in poverty amongst this population (Reichman, Teider, & McLanahan, 2001). The larger sample is made up of 4898 new births between 1998 and 2000 in 20 cities. Although the study was designed to follow the lives of children born to unmarried parents, the study also collected data on a comparison group of married parents. There were 3673 couples that were unmarried and 1198 were marital births. The study primarily examined four questions: (1) What are the conditions and capabilities of new unmarried parents, especially fathers?
(2) How many of these couples are involved in stable relationships? (3) What is their relationship stability and (4) How are these families affected by changes in social policies?

Data were collected in over 20 cities with populations over 200,000. The data are representative of all unmarried births in each of the cities and the full sample is representative of all non-marital births in large cities in the United States. While still in the hospital, new mothers were interviewed within 48 hours after giving birth and screened for eligibility. A mother was eligible if she and the baby’s father were 18 years of age, if she was able to complete the questionnaires in English or Spanish, if the father was still living, and if they did not intend to put the baby up for adoption. The fathers were interviewed either at the hospital or elsewhere as soon as possible after the birth. Extensive information was collected on the demographic characteristics of both parents as well as on their health, their relationships, and on child well-being. Three follow-up interviews, at ages 1, 3 and 5 were conducted over the telephone. There are plans to interview these participants again when the child is age 9. A significant contribution of the Fragile Families study is that it provides data to allow scientists the opportunity to examine birth outcomes within a high-risk population of unmarried mothers.
The Longitudinal Study of Pre-School Aged Children involves the collection of data from a subset of the Fragile Families Core respondents at the three- and five-year follow-ups. Information on child environment, such as living conditions, nutrition, health care, and parenting domains such as discipline, attachment and cognitive stimulation was collected. Additionally, the researchers also collected information about child behavior and cognitive ability. This information was collected through observations as well as interviews with the child’s primary caregiver.

Characteristics and Validation

*Birth weight.* Low birth weight is defined as less than 2500 grams or 5lbs., 8ozs. Birth weights were obtained from mothers’ reports and were validated against birth-weight records by hospital staff. The correlation of birth weights from the two sources was 0.98 (Reichman et al., 2001). The rate of low birth weight in the baseline sample was slightly higher (10%) than the rate found for the 100 largest cities in the US (8.9%, in 2000). The rate of LBW in the study sample was 9%. Since the cut-off weight for low birth weight is defined as 5lbs. 8ozs. cases that reported weight as 5lbs. 0 ozs. were coded as missing data and were not included in the report. Low birth weight was coded as either ‘yes’ or ‘no’ with “0” representing normal birth weight (NBW) and “1” representing low birth weight (LBW). Gestational age was not available.
Parent education. Information on paternal education level was obtained through interviews with the fathers after the birth of their child, either at the hospital or wherever they could be located. Mothers’ reports of fathers’ education were used for fathers who were not interviewed at baseline or did not report their own education. Level of education was divided into four groups: (1) Less than high school diploma, (2) High school graduate, (3) Some college, (4) College graduate or greater. To test the hypothesis of this study, father education groups were condensed into two categories: high school graduate or less vs. some college or greater. The groups were designated as “1” for low education, high school graduate or less, and “0” representing high education, meaning some college or greater. The same coding was used for Mothers’ education as well.

Cognitive ability. Children’s cognitive ability was measured using the Peabody Picture Vocabulary Test (PPVT), which is an untimed, individual assessment of receptive vocabulary that allows for detection of the range of words that the child understands Dunn and Dunn (1997). Examinees are shown four pictures and are read a word. The examinee must either point to the picture most closely depicting the correct word or state the number of the correct picture. The PPVT evaluates children aged 2 years or older based on a nationally stratified reference sample. PPVT scores are strongly correlated \( r \geq 0.90 \) with verbal and full-scale intelligence quotient on the Wechsler Intelligence Scale for Children-III. The TVIP was used in evaluating the
language development of Spanish-speaking preschool children. The *Test de Vocabulario en Imagenes Peabody* (TVIP) is a measure of hearing vocabulary for Spanish-speaking children and adolescents. The test is a parallel form of the PPVT, using the most appropriate items for the Spanish population. The tests were administered as part of the 3-year in-home visit.

*Father involvement.* Due to large numbers of missing data in the fathers’ reports, the measure of father involvement was taken from Mothers’ reports from Year 1 and Year 3 data. Although Mickelson (2008) recommends using both father and mother reports of involvement, I used only mothers’ reports due to the small available sample of fathers’ reports (N = 2843 for mothers and N= 713 for fathers). The five items used from the one year data included sing songs, read stories, tell stories, play inside with toys and play peek-a-boo. These five items are based on a scale with responses ranging from 0 (no days) to 7 (7 days per week). The items used from year 3 data included sing songs, read stories, tell stories, play inside with toys and play imaginary games. A composite father involvement score was created by summing the responses to the five items. Cronbach’s alpha for the year 3-father involvement measure was .887 and .847 for the year 1 measure.

*Other control variables.* The Household Income measure was from the baseline data as reported by the mother as total income earned before taxes. Approximately 25% of data on this variable were missing for the baseline sample.
Child Gender information was obtained from the mothers’ baseline reports. Child gender was coded as “1” for boys and “2” for girls. Two questions were used to determine parent marital and residence status, “Are you married to birth father” with possible responses being: ‘Yes’, No’. The second question was “Are you and birth father living together now” with possible responses being: ‘Yes’, No’.

Analytical Plan

The study population was from the Fragile Families Study. At baseline, there were 4898 infants in the study sample. At year 3, there were 3288 children still participating in the study but only 2511 of them had a PPVT score reported. Thus, the main sample for the present study consisted of 2511 children and their parents. The following steps were taken to explore the associations within the data.

First, mean scores, standard deviations, and ranges were calculated for household income, fathers’ and mothers’ age as well as PPVT scores of all children in the study. Additionally, the frequencies of fathers’ and mothers’ educational levels and fathers’ and mothers’ race, as well as child gender were determined. Table 1 shows the characteristics of the larger Fragile Families sample versus the subsample that completed the in-home assessment at child age 3, versus the subsample of children
that completed the PPVT. Overall, the composition of the sample considered for the present study was very similar to that of the larger Fragile Families sample.

Second, an analysis of covariance was conducted to determine if expected associations exist. It was expected that fathers’ education level would be positively associated with the PPVT scores of children born with low birth weight. Specifically, it was expected that low birth weight children whose fathers had higher levels of education would have higher PPVT scores than LBW children with less educated fathers. This was expected regardless of other variables including household income, parent race, and mothers’ education. If the interaction between LBW and fathers’ education is significant, then fathers’ education is differentially protective for the cognitive development of LBW children, consistent with my hypothesis.
CHAPTER 4

RESULTS

Preliminary analysis

Means, standard deviations, and ranges for study variables are presented in Table 1. The mean age for fathers in the selected sample is 28 years and 25 for the mothers. The mean household income, as reported by Mothers, is just under $32,000 per year at baseline data collection and $30,645.43 for the subset at year three with PPVT scores.

The initial analysis of the data showed that children born with low birth weight (less than 5 lbs., 8 oz. or 2500 grams), accounted for approximately 10% of the sample (see Table 1). Approximately 3% of the sample had missing values for this variable. The sample was made up of approximately 52% boys and 48% girls. The actual birth weight of each child is only available under restricted terms and thus was not available for this study. The gestational age was also not available.
The sample of fathers was approximately 54.6% African American, 16.3% White, 25.2% Hispanic and 3.6% designated as ‘other’. The sample of mothers was approximately 52.2% African American, 19.2% White, 25.1% Hispanic and 3.3% designated as ‘other’. Approximately 65% of the mothers and 68% of the fathers had a high school diploma or less and approximately 35% of the Mothers and 32% of the fathers had some college or greater.

Correlations, chi-square tests, and ANOVAs were conducted to determine whether the primary variables of interest (fathers’ education, low birth weight and PPVT scores) varied as a function of demographic characteristics (fathers’ and mothers’ race, child gender, and household income as reported by mothers). Intercorrelations are presented in Table 2. Using chi-square analysis, I was able to show that fathers’ race and education were strongly associated, $X^2(3) = 417.65, p < .01$; White fathers had greater educational attainment than African American, Hispanic, and “Other” fathers.

Household income, as reported by mothers, was also found to have a significant correlation to LBW ($r = -.05, p < .01$) as well as Child PPVT scores ($r = .23, p < .01$), such that children in higher-income households were less likely to have LBW and more likely to have higher PPVT scores. For both Mothers’ and Fathers’ race, children who were African American, Hispanic, or “Other” performed more
poorly than White children on the PPVT, $F(3, 2501) = 72.43, p < .01$ (see Table 3). Moreover, African American children also performed more poorly than Hispanic or “Other” children.

Of relevance to my hypothesis, fathers’ education was found to be significantly correlated with low birth weight ($r = .06, p < .01$), which means that fathers with higher education are less likely to have children with low birth weight. Fathers’ education was also significantly correlated to children’s standardized score on the PPVT, ($r = -.22, p < .01$); meaning that as father education increases, so do child PPVT scores (see Table 2). PPVT scores were found to be significantly correlated with LBW ($r = -.09, p < .01$), meaning that as NBW children scored higher on the PPVT than did children born with LBW. Child gender was also found to be significantly correlated with PPVT scores, ($r = .07, p < .01$). This is in agreement with previous studies that have found that girls have higher vocabulary test scores than boys (Wolf & Gow, 1986).

Mother and father education levels were also found to be significantly correlated ($r = .50, p < .01$), meaning that educated mothers tended to pair with educated fathers.

Parent marital and relationship status at year 3 from mothers’ reports, were
determined to be 28.7% married, 26% romantically involved, 19.1% friends, 5.8% separated, 19.3% had no relationship and 1% reported the father was deceased or of “unknown” status. Of those that were married or romantically involved, 48.6% were reported to be living together ‘all or most of the time’. Additionally, 70% of the fathers whose children’s mothers reported on father involvement were living together ‘all or most of the time’.

In Figure 4, I show the means for PPVT scores of children by father’s education level and birth weight status. The graph clearly shows that an educated father may have a direct or main effect on the cognitive development of his child.

Having at least some education beyond high school appears to provide the greatest buffering for poor cognitive outcomes in children regardless of birth weight. This pattern was confirmed by an ANCOVA analysis, which tested fathers’ education, child LBW, and their interaction as predictors of child PPVT scores. This analysis also controlled for the following variables: mother’s education, family income (reported by mothers), and child gender. Results revealed that the overall model was significant, $F(6, 2348) = 42.17, p < .01$, as were each of the individual main effects predictors (see Table 4). Consistent with Figure 4, however, the interaction between fathers’ education and LBW was not significant, $F(1, 2438) = .04, p = .84$. 


For comparison purposes, analysis was done to determine the association between mothers’ level of education and cognitive development in LBW children (Figure 5). The pattern that was noted with level of father education was also noted with level of mothers’ education. Specifically, higher level of education for the parents is associated with higher cognitive scores for children. This held true for normal weight births as well as low weight births.

Given that Lin et al. (2007) found child gender to be an important factor in relations among LBW, parents’ education, and child outcomes, I further tested whether child gender interacted with LBW and fathers’ education in relation to child PPVT scores. The graphs clearly show (Figures 6 and 7) that parent education plays a strong role in the cognitive development of boys and girls, regardless of birth weight. Figure 5 also showed what appeared to be a stronger association between fathers education and cognitive development of LBW boys. To further test this observation, ANCOVA analysis was done including additional interactions between LBW, fathers’ education, and child gender (see Table 5). Results revealed that the overall model was significant, $F(9, 2345) = 28.21, p < .01$; however, the three-way interaction between fathers’ education, low birth weight, and child gender was not significant, $F(1, 2345) = 45.10, p < .50$. 
Since previous research has shown that father involvement was found to be significantly associated to child cognitive development (Cabrera 2004, Cabrera 2007, McBride, et al., 2005), I tested the association between father involvement and child cognitive outcomes. Father involvement measures were available for 66% of the sample (N= 1658) with roughly one third of the sample having missing data. Across the 5 questions used at year 3 to create the father involvement composite variable, approximately 24% were missing data because of a “valid skip”, meaning that the mothers were allowed to skip the question. Mothers were allowed to skip the involvement questions if they indicated that the child had NOT seen their father more than once during the past month. Additionally, 3 to 7% had missing values because of “don’t know” responses to the various questions (sing songs, play games, etc.).

Based on the model described in Fig. 2, the first step is this analysis was to determine if father education is associated with father involvement. The t-test analysis revealed that in fact, educated fathers tended to be more involved with their children, $t(2799) = 8.19$, $p < .01$. I then examined the association between father involvement and child cognitive outcomes. Others have noted (Fagan & Palkovitz, 2007) that the first year following the child’s birth was critical for the father-child relationship, because this is the period of time that unmarried non-resident fathers are at risk for becoming less
involved with their child. So, I examined father involvement and PPVT scores at both Year 1 and Year 3. At year 1, I found no significant association between fathers involvement and child cognitive outcomes ($r = .043, p < .05$). At year 3, the analysis revealed a significant but very modest possible association between father involvement and child outcomes, $r = .05, p < .05$.

Further, using regression to test whether father involvement at age 3 predicted child cognitive outcomes after controlling for gender, house-hold income, low birth weight, father education and mother education, I determined that in fact, father involvement did not have a predictive association with child cognitive outcomes ($\beta = .003, p = .897$). So, further tests of mediation were precluded because there was no robust association between father involvement and child cognitive outcome in this sample.
Chapter 5

Discussion

The impetus for this investigation was a study conducted in Taiwan. Lin et al. (2007), using a sample of 300,000 births between September 1978 and August 1979, examined the results of the college entrance examinations taken by this cohort in 1997. Their findings suggest that together, educated parents can offset the negative effects of LBW by approximately 40%. This figure implies that being born with LBW does not necessarily indicate poor outcomes. The goal of this study was to determine if this could also hold true for a population such as the Fragile Families, and to see whether fathers’ education in particular, and thus their human capital, could make a difference.

This study provides evidence that the education of both mothers and fathers may impact child cognitive outcomes. In particular, findings from this study suggest that education beyond high school may have a protective effect on child cognitive development. These findings are important because children with LBW are vulnerable to a myriad of poor health and developmental issues and may need additional protective buffering from their parents (Reichman, 2005).
As expected PPVT scores at age three for LBW children were significantly lower than the PPVT scores for NBW children. When the scores of children with LBW and NBW were examined in relation to fathers’ education level, there was a significant association noted between high level of father education and higher PPVT scores for both groups, LBW as well as NBW children. I did not, however, find that fathers’ level of education had any greater effect among LBW children than in the normal weight population. Fathers’ level of education matters overall to all children’s cognitive development. Based on this finding, I looked further at mothers’ education level to determine if it provided a buffering effect for children with LBW. Again, my findings suggest that educated mothers are similar to educated fathers in their ability to potentially protect child cognitive development but the effect is not greater for children with LBW than NBW. In conclusion, based on this dataset, I did not find that father education had a differential effect on cognitive development among the LBW children.

Family economic conditions have been found to impact children because they affect the material and social resources available to children as well as family processes such as parental emotional well-being and parenting styles (Holzer, Schanzenbach, Duncan & Ludwig, 2007). When PPVT scores were examined in relation to household income, there was a positive correlation. As income increased,
child cognitive outcomes also increased. PPVT scores were also found to be associated with race with African American children having lower PPVT scores.

Much has been written on the subject of father involvement and its effects on child development. Greater father involvement has been documented to increase infant weight gain for preterm infants (Moore et al. 2004), as well as improve language and higher cognitive skills as well as higher academic achievement (McBride et al., 2005). Based on my analysis however, the association between father involvement and child PPVT scores was very modest, in this sample. After controlling for other variables (i.e., household income, child gender, and birth weight), this small association disappeared. Spending time with the child, independent of education, was not found to impact child cognitive outcomes for this sample.

In this study, I wanted to explore the idea that education could be a vehicle for creating a protective buffer for LBW children’s cognitive development. I believe that I have been successful in the quest. Although I was unable to determine that father education had a differential effect on cognitive development among the LBW sample, education itself seems to provide parents with the ability to impact the cognitive development of their children, whether they are born with NBW or LBW. This is true regardless of the amount of father involvement with the child. As others have noted in previous research (Wolfe et al., 1997), education does appear to be a predictor of
better health outcomes. The process by which educational attainment provides this buffering ability is unclear, but what is clear, is that education matters a great deal in the parenting process (Amato, 1998, Purcell-Gates, 1996). Human capital, as defined in the literature (Nettles, 1999) is the accumulated knowledge and experiences that individuals gain that allows them seek out resources for themselves and their children. Education itself appears to be the vehicle that begins a cyclical process, whereby an individual changes their life outcomes thereby changing the outcome of their progeny. It can be argued that the process of education itself, learning to overcome obstacles, challenges and set backs that renders individuals the ability to become better problem solvers and be more resourceful.

Lin et al., (2007), showed that educated parents working together can provide a substantial buffering effect on their LBW children (40%). Although their study methods and study sample differed from mine, both clearly show the relevance of parent education to child cognitive outcomes. Education may in fact be the vehicle for creating a protective buffer for all children, including a vulnerable population such as those born with LBW.

Some limitations also need to be recognized. As mentioned earlier, the basis for this proposal was a study conducted in Taiwan and published in Demography (Lin et al., 2007) where they found a strong association between parents level of education
and cognitive development in LBW children (mainly sons). Their study differs from mine in that (1) they had a very large sample, and (2) they had access to the actual birth weights of all the children and were able to tease out the more nuanced effects and (3) they measured academic success at older ages. In particular, relevant to point 2, the Taiwan study found that the cognitive development of children with moderate low birth weight (5lbs. 8 oz. or 2500 grams) was positively associated with parental education levels, whereas the cognitive development of children born with very low birth weight (3 lbs. 4oz. or 1500 grams) was not. Thus, there may be a limit on the buffering effect of parent education. Without use of the restricted data from the Fragile Families study, such nuances, although potentially present, were not discernable.

Additionally, this is an exploratory study using a secondary data set of high-risk fathers and children and it may not be appropriate to generalize these findings to the general public. Had the study examined a sample more representative of the general population, I believe that we may find that fathers’ education may protect LBW children from poor cognitive outcomes. A more representative sample would have provided more variability in education levels of fathers. The Fragile Families data set is such that the vast majority of the sample is poorly educated with a very small number of college graduates (<10%). It must be noted that the children from the Fragile Families sample experience numerous risk factors and the more nuanced effects may not be evident at age 3.
Keeping in mind that previous research has found significant associations between father involvement and child cognitive outcomes, it must be noted that in the Fragile Families study, the measures of father involvement were in regards to the amount of time fathers spent with the child. Studies have shown that the quality of interactions have the greatest impact on child development (Young et al. 1995). The quality of the interactions was not available for this study. Additionally, of the mothers who reported father involvement, 30% did not live with the father bringing into question their reliability as accurately reporting the information.

I believe future research should first replicate the findings of Lin et al. (2007) in a larger sample. Also, due to the stronger associations indicated by the study conducted by Lin et al., I believe there is enough support to suggest that there must be something linking parent education and lifelong child outcomes. Perhaps as the Fragile Families study continues to collect data on these children, the questions addressed in my study should be re-examined at age 5, age 9, and perhaps beyond. It is possible that because this study examined the children at age 3, there wasn’t adequate time for nuanced effects to yet take hold. It would be interesting to see how this population of children functions throughout their education in the coming years and decades.
Despite some limitations, this study is informative and provides a compelling argument for further research. As in Lins’ study (2007), it was found that fathers’ education plays a significant role in the cognitive development of LBW children. It was however, not a differential effect for only LBW children. All children of educated fathers, regardless of birth weight had higher PPVT scores than children whose fathers had less education. The mechanisms for this effect need to be more clearly defined. Thus, interventions can be designed to foster greater cognitive development for children of less educated parents.
PROTECTION OF CONFIDENTIALITY

This project relies on the use of secondary data. The original study group at Princeton University and Columbia University has protected the identities and personal information of the participants. Given that participant identities are protected in the publicly available data, I received exemption status from the IRB on 2/2009.
LIST OF REFERENCES


National Center for Health Statistics. Home page.
http://www.cdc.gov/nchs/births.htm


APPENDIX A

FIGURES
Figure 4: Fathers’ Education and Child PPVT Scores
Figure 5: Mother and Father Education vs PPVT Scores
Figure 6: Mean PPVT Scores of Boys by Birth Weight and Parental Education
Figure 7: Mean PPVT Scores of Girls by Birth Weight and Parental Education
Table 1: Characteristics of Fragile Families Baseline vs. Selected Sample

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
<th>N (%)</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>3 year in-home</td>
<td>PPVT at year 3</td>
</tr>
<tr>
<td>Total</td>
<td>4898</td>
<td>3288</td>
<td>2511</td>
</tr>
<tr>
<td>Mother</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>1030 (21.0)</td>
<td>714 (21.7)</td>
<td>481 (19.2)</td>
</tr>
<tr>
<td>Black</td>
<td>2326 (47.5)</td>
<td>1604 (48.8)</td>
<td>1311 (52.2)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1336 (27.3)</td>
<td>845 (25.7)</td>
<td>630 (25.1)</td>
</tr>
<tr>
<td>Other</td>
<td>194 (4.0)</td>
<td>116 (3.5)</td>
<td>82 (3.3)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than High School</td>
<td>1942 (36.9)</td>
<td>1283 (39.0)</td>
<td>1019 (40.6)</td>
</tr>
<tr>
<td>High School Graduate</td>
<td>1237 (25.2)</td>
<td>832 (25.3)</td>
<td>643 (25.6)</td>
</tr>
<tr>
<td>Some College</td>
<td>1189 (24.3)</td>
<td>819 (24.9)</td>
<td>616 (24.5)</td>
</tr>
<tr>
<td>College Graduate</td>
<td>524 (10.7)</td>
<td>350 (10.6)</td>
<td>229 (9.1)</td>
</tr>
<tr>
<td>Father</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>894 (18.2)</td>
<td>623 (18.9)</td>
<td>410 (16.3)</td>
</tr>
<tr>
<td>Black</td>
<td>2407 (49.1)</td>
<td>1672 (50.9)</td>
<td>1370 (54.6)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1354 (27.6)</td>
<td>862 (26.2)</td>
<td>632 (25.2)</td>
</tr>
<tr>
<td>Other</td>
<td>216 (4.4)</td>
<td>118 (3.6)</td>
<td>90 (3.6)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than High School</td>
<td>1520 (31.0)</td>
<td>1018 (31.0)</td>
<td>819 (32.2)</td>
</tr>
<tr>
<td>High School Graduate</td>
<td>1697 (34.6)</td>
<td>1164 (35.4)</td>
<td>905 (36.0)</td>
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<td>Some College</td>
<td>988 (20.2)</td>
<td>681 (20.7)</td>
<td>508 (20.2)</td>
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<tr>
<td>College Graduate</td>
<td>492 (10.0)</td>
<td>324 (9.9)</td>
<td>206 (8.2)</td>
</tr>
<tr>
<td>Child Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2568(52.4)</td>
<td>1722 (52.4)</td>
<td>1296 (51.6)</td>
</tr>
<tr>
<td>Female</td>
<td>2329 (47.6)</td>
<td>1566 (47.6)</td>
<td>1216 (48.4)</td>
</tr>
<tr>
<td>Low Birth Weight</td>
<td>484 (9.9)</td>
<td>311 (9.5)</td>
<td>226 (9.0)</td>
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Table 1 Continued

<table>
<thead>
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<th>M (SD)</th>
<th>M(SD)</th>
<th>M(SD)</th>
</tr>
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<td></td>
<td>Baseline</td>
<td>3 year in-home</td>
<td>PPVT at age 3</td>
</tr>
<tr>
<td>Mother’s Age*</td>
<td>25.28 (6.04)</td>
<td>25.13 (6.04)</td>
<td>24.93 (5.87)</td>
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<tr>
<td>Father’s Age*</td>
<td>27.92 (7.16)</td>
<td>27.90 ( 7.12)</td>
<td>27.95 (7.18)</td>
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<tr>
<td>Child PPVT Standard Score</td>
<td>N/A</td>
<td>N/A</td>
<td>88.40 (16.68)</td>
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<tr>
<td>PPVT for NBW</td>
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<td>N/A</td>
<td>87.00 (16.53)</td>
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<td>PPVT for LBW</td>
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<td>N/A</td>
<td>81.73 (17.07)</td>
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<td>Household income**</td>
<td>31994.04 (31567.17)</td>
<td>31710.35 (31024.93)</td>
<td>30645.43 (30150.14)</td>
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*Age at Baseline
**As reported by Mother
Table 2: Intercorrelations for Low Birth Weight and Father Education with Demographic Variables

<table>
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<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fathers’ Education</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Low birth weight</td>
<td>.064**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. PPVT Standard Score</td>
<td>-.215**</td>
<td>-.092**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Child gender</td>
<td>-.029*</td>
<td>.035*</td>
<td>.071**</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Household income (Cm1hhinc)</td>
<td>-.406**</td>
<td>-.052**</td>
<td>.234**</td>
<td>.001</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>6. Mothers’ Education</td>
<td>.500**</td>
<td>.048**</td>
<td>-.247**</td>
<td>.001</td>
<td>-.415**</td>
<td>1.00</td>
</tr>
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</table>

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).
Table 3: *Child PPVT Scores and Parent Race*

<table>
<thead>
<tr>
<th>Fathers’ Race</th>
<th>Mean PPVT Scores</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. White</td>
<td>96.25</td>
<td>17.04</td>
</tr>
<tr>
<td>2. Black</td>
<td>83.13</td>
<td>15.51</td>
</tr>
<tr>
<td>3. Hispanic</td>
<td>86.68&lt;sub&gt;a&lt;/sub&gt;</td>
<td>16.31</td>
</tr>
<tr>
<td>4. Other</td>
<td>89.67&lt;sub&gt;a&lt;/sub&gt;</td>
<td>16.53</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mothers’ Race</th>
<th>Mean PPVT Scores</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. White</td>
<td>95.50</td>
<td>16.48</td>
</tr>
<tr>
<td>2. Black</td>
<td>82.96</td>
<td>15.50</td>
</tr>
<tr>
<td>3. Hispanic</td>
<td>86.29&lt;sub&gt;b&lt;/sub&gt;</td>
<td>16.53</td>
</tr>
<tr>
<td>4. Other</td>
<td>88.80&lt;sub&gt;b&lt;/sub&gt;</td>
<td>17.53</td>
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</table>

*Note.* Groups with corresponding subscripts are not significantly different from each other. All other groups are significantly different from each other.
Table 4: *Analysis of Covariance Testing Interaction between Fathers’ Education and LBW in Relation to Children’s PPVT Scores.*

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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<td>Mothers’ Education</td>
<td>10650.52</td>
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<td>10650.52</td>
<td>42.26</td>
<td>.000</td>
</tr>
<tr>
<td>Fathers’ Education</td>
<td>1264.67</td>
<td>1</td>
<td>1264.67</td>
<td>5.02</td>
<td>.025</td>
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<tr>
<td>Low Birth Weight</td>
<td>2440.10</td>
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<td>2440.10</td>
<td>9.68</td>
<td>.002</td>
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<td>Household Income*</td>
<td>9039.88</td>
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<td>9039.88</td>
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<tr>
<td>Child Gender</td>
<td>3225.82</td>
<td>1</td>
<td>3225.81</td>
<td>12.80</td>
<td>.000</td>
</tr>
<tr>
<td>Father Ed and LBW</td>
<td>10.37</td>
<td>1</td>
<td>10.375</td>
<td>.04</td>
<td>.839</td>
</tr>
<tr>
<td>Error</td>
<td>591809.01</td>
<td>2348</td>
<td>252.05</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* As reported by mother

Table 5: *Analysis of Covariance Testing Interactions between Fathers’ Education, LBW, and Child Gender in Relation to Children’s PPVT Scores.*

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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<tr>
<td>Mothers’ Education</td>
<td>10635.32</td>
<td>1</td>
<td>10635.32</td>
<td>42.16</td>
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<td>9055.53</td>
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<td>Child Gender</td>
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<tr>
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<td>2345</td>
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* As reported by mother