AN ABSTRACT OF THE DISSERTATION OF

Carol A. Leitschuh for the degree Doctor of Philosophy in Human Performance presented on July 8, 1996. Title: Factors Contributing to the Performance of Fundamental Motor Skills in Young Children Prenatally Exposed to Cocaine/Polydrugs.

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John M. Dunn

This study was designed to assess the relationship of selected factors to the developmental outcome of fundamental motor skill performance in young children ages 3 to 6 years residing in foster or adoptive care, and have a documented history of prenatal exposure to cocaine and other drugs. Using an ecological theory of child development and the person-process-context model, the study focused on the child's development in selected gross motor skills. Through multiple regression analysis, the study considered the contributions of the following on motor skill performance as measured by the Test of Gross Motor Development: child effortful control as measured by the Children's Behavior Questionnaire, the nonbiological mother's parental attitude as measured by the adapted Parent Attitude Survey, the amount of early intervention services as recorded in the child's medical chart. Participants included 28 children (15 males and 13 females) and their foster or adoptive mother.

There is suggestive but inconclusive evidence for the hypothesis that fundamental motor skill performance is predicted by the interaction of the child's effortful control, the nonbiological mother's understanding and confidence, and

the amount of early intervention service the child received, [F (7, 20) = 2.24, p < 0.07]. Trends in the data suggest gross motor performance increases with high levels of early intervention, given children with low effortful control and low levels of parental confidence and understanding. In addition, early gross motor scores did not predict fundamental motor skills, r = .10. Despite a 38% rate of identified early gross motor delay, no child was delayed in fundamental motor skill at ages 3 to 6 years. Fundamental motor skill performance ranged from average to superior, M = 121.54. Motor performance was assessed in a clinical setting and caution is recommended when considering skill performance within group settings. Based on this study, children with prenatal exposure to cocaine/polydrugs are viewed as variable in temperamental control and gross motor performance, but perform at an average to above average level in gross motor skill. Further research is needed to validate trends, specifically regarding the interactive effects of child effortful control, parental attitude, and the amount of early intervention service received.

Factors Contributing to the Performance of Fundamental Motor Skills in Young Children Prenatally Exposed to Cocaine/Polydrugs

by

Carol A. Leitschuh

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I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

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Carol A. Leitschuh, Author

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In closing, I offer these words that repeatedly come to mind as I remember those mentioned herein:

for you have been my help:
in the shadow of your wings I rejoice...
your right hand holds me fast.

Psalm 63

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CHAPTER 1

INTRODUCTION

One of the most significant contemporary problems for clinicians and educators in the United States is prenatal cocaine exposure. Little is known about the developmental status of those exposed nor the long-term outcome given exposure, yet their numbers have significantly increased over the last 15 years (Volpe, 1992). According to the National Institutes of Drug Abuse 1990 Household Survey, approximately 739,200 women between the ages 12-34 used one or more illegal substance during their pregnancy (Gomby & Shiono, 1991). Of this population approximately 158,400 infants were born prenatally exposed to cocaine.

Several factors contribute to the disturbing nature of child development and prenatal drug exposure. For one, the popular press has depicted a negative prognosis for children exposed in utero to cocaine. They are described as: unlovable, unteachable, brain injured, unreclaimable, and unadoptable (Kandall, 1991) exhibiting high activity levels, sudden mood swings, low frustration tolerance, and problems with attention and impulsivity (Blakeslee 1989; Chira 1991). Labels such as "crack babies", "crack addicted", and "crack infants" have been attached to these children. This

labeling has been described as offensive by clinical personnel (Kandall, 1991; Weston, Ivins, Zuckerman, Jones & Lopez, 1989; Zuckerman, 1990). Others describe the inappropriateness of such labeling given that a "cocaine syndrome" has yet to be described (Young, Vosper & Phillips, 1991).

Another major issue contributing to the perplexing nature of prenatal cocaine exposure has been with the implementation of the research itself. The "crack baby myth" perpetuated in the early research of these children produced a poor conceptualization of the research problem by declaring prenatal cocaine exposure as the sole correlate of adverse outcome (Coles, 1993; Frank & Zuckerman, 1993; Koren, 1993; Hutchings, 1993; Neuspiel, 1993). This myth ignored the fact that many variables can influence negative developmental outcome. In addition to this myth, early investigators were accused of being in a "rush to judgement" (Mayes, Granger, Bornsein & Zuckerman, 1993). Their research protocols were weak and results were tentative and contradictory (Coles, 1993). Consequently a review of the current research offers scant information for answering questions regarding developmental outcome for children exposed to cocaine.

The first clinical study of newborns exposed to cocaine in utero was published in 1985 (Chasnoff, 1991). Studies followed, in part, responding to the increase in the number

of pregnant women using cocaine and other drugs (McCance-Katzi, 1991). During the last 10 years, methodological problems plagued the design and execution of these studies. Specific problems have been identified with: the polydrug use of the mothers (Chasnoff, 1991); the inability to match control groups for nutritional status, tobacco and alcohol consumption (Young, Vosper & Phillips, 1992); nonblind examinations of the infants; and inadequate control for other confounding variables (Neuspiel, 1993). In addition, the pattern (episodic or continual) of cocaine use during pregnancy is difficult to determine (Chasnoff, 1991; Young et al, 1992). Urine screens performed close to the time of delivery are not necessarily available for serial data throughout pregnancy, and patient recall tends to under-report drug usage. Thus, determining the effect of cocaine on the developing fetus is difficult.

The research has been hampered by a bias against reporting research findings that indicate no significant cocaine effect (Koren, Shear, Graham & Einarson, 1989). Koren and colleagues found that numerous studies were rejected for publication because of "no cocaine effect" despite quality research methodology that sought to include control groups and the assessment of participants by clinicians in blind review. Therefore, the early published research is limited in scope and biased toward "cocaine effects". Since this realization, additional studies have

been published reporting no significant differences between groups exposed and non-exposed. The contribution of this work will be described in the review of literature for the present study.

In an attempt to adequately address research questions regarding children prenatally exposed to cocaine, Coles (1993) advocates for research focusing on known facts about substance abuse and child development. These studies would explore more carefully the postnatal environment (Frank & Zuckerman, 1993). According to Neuspiel (1993), "the confounding effects of the child's social environment need special consideration" (p.305). After nearly a decade of research on the effects of cocaine, there is much work still to be done (Coles, 1993, 1991; Chasnoff, 1993). Zuckerman (1991) considers the research preliminary. The long term outcome is speculative since the children studied are still very young (Church, 1993). During the next decade, research questions need to be asked within the context of the postnatal environment (Coles, 1992).

Statement of the Problem

Motor development during early childhood for children prenatally exposed to cocaine has not been adequately addressed (Hawley, 1994). The present study was designed to test the hypothesis that fundamental motor skill in young children prenatally exposed to cocaine/polydrugs would be predicted by the interaction of specific contextual

variables representative of the child within the postnatal environment. Measurement of fundamental motor skill was made along with an assessment of the child's temperament, the parental attitude of the nonbiological mother (foster or adoptive), and the early intervention services the child received. Data were collected to explore the status of fundamental motor skill in children ages 3, 4, 5, and 6 years who had been prenatally exposed to cocaine/polydrugs. This exploration included the variables of child temperament, parental attitude and early intervention service. The specific hypotheses tested will be detailed.

Research Hypothesis

The significance of the present study is emphasized by the limitations of past studies which have yet to determine fundamental motor skill development in the present study population, or to determine the effect of the context of temperament, parental attitude and early intervention service on the fundamental motor skill performance. This study directs attention to children prenatally exposed to cocaine/polydrugs who reside in foster or adoptive care. The extended aim of the present study is to explore the context of the child's development and the interactive effect of the independent variables on the outcome measure of fundamental motor skill. Current research on these

children is extremely limited in such multivariate data. Thus, the following research exploration is proposed:

Hypothesis 1: Child temperament will be associated with children's motor skill.

Hypothesis 2: Parenting will be associated with children's motor skill.

Hypothesis 3: Early intervention will be associated with children's motor skill.

Hypothesis 4: The interaction of parenting and early intervention will be associated with children's motor skill.

Hypothesis 5: The interaction of parenting and temperament will be associated with children's motor skill.

Hypothesis 6: The interaction among temperament, parenting and early intervention will be associated with children's motor skill.

Hypothesis 7: There is a relationship between an early motor score and the motor score at ages 3-4-5-6 years.

Thus, the present study is to provide insight regarding young children ages 3, 4, 5, 6 years prenatally exposed to cocaine/polydrugs and the predicted motor skill associated with levels of parental attitude, child temperament, and early intervention.

Statistical Hypotheses

The statistical hypotheses for the research hypotheses are:

Hypothesis 1:

Ho: B(temperament) = 0

Ha: B(temperament) ≠ 0

Hypothesis 2:

Ho: B(parenting) = 0

Ha: B(parenting) ≠ 0

Hypothesis 3:

Ho: B(early intervention) = 0

Ha: B(early intervention) ≠ 0

Hypothesis 4:

Ho: B(parenting x early intervention) = 0

Ha: B(parenting x early intervention) ≠ 0

Hypothesis 5:

Ho: B(parenting x temperament) = 0

Ha: B(parenting x temperament) ≠ 0

Hypothesis 6:

Ho: B(temperament x parenting x early intervention) = 0

Ha: B(temperament x parenting x early intervention) ≠ 0

Hypothesis 7:

Ho: Correlation(early motor with later motor) = 0

Ha: Correlation(early motor with later motor) ≠ 0

Operational Definitions

The variables in the present study were operationalized as follows. Cocaine exposure was determined from the medical record of the child. Children were considered for enrollment if there was evidence in their medical chart of any of the following: maternal report of cocaine abuse during pregnancy, positive maternal urine screen for cocaine use, positive child urine screen for cocaine at the time of birth.

The residential status of the child with a nonbiological mother, either foster or adoptive, was documented as follows. The foster child status was documented in the child's medical chart at Emanuel Hospital and Health Center, Pediatric Development Program in Portland, Oregon. The legal status of the child as a foster child and the legal status of the mother as the foster mother was documented by the Oregon State Offices of Services to Children and Families. The legal status of the child as an adopted child and the legal status of the mother as the adoptive mother was confirmed by the Oregon State Offices of Services to Children and Families.

The nonbiological mothers represented in this study were foster and adoptive mothers. They were assessed regarding their attitude toward parenting their child using the modified Parent-Attitude Scale (PAS: Hereford, 1962).

Child temperament was measured by the Children's

Behavior Questionnaire (Rothbart, Ahadi & Hershey, 1994). Of interest to the present study were the temperament dimensions of: activity level, attentional focusing, impulsivity, and inhibitory control.

A measure of early intervention services was obtained through documentation in the child's medical chart and from confirmation with the nonbiological mother. These data produced two measures of early intervention: the quality of intervention and the quantity of service.

Fundamental motor skill was measured by the Test of Gross Motor Development (Ulrich, 1985) which generated a score for locomotor skill, object control skill and an overall gross motor development quotient.

Assumptions

This study assumed a) the mental capacity of the children was sufficient to follow the directions of the test identified, b) the physical tasks were representative of the tasks encountered in physical activities for these children, c) the children were not unduly fatigued for testing, d) the mothers accurately reported their use of cocaine during pregnancy, e) the hospital records of the urine screen for cocaine use was a true positive for mothers of the cocaine exposed children, f) the nonbiological mother accurately reported her parental attitude, and the amount and quality of intervention services the child received.

Limitations

Of the children participating in the study, none had obvious physical disabilities. No child was diagnosed with conditions such as cerebral palsy which would have restricted the performance of the Test of Gross Motor Development. The study population is a subset of children prenatally exposed to cocaine/polydrugs.

Also, the present study is limited in the knowledge of the prenatal drug exposure including frequency, intensity, and duration of specific drugs used and therefore remains a confounding variable.

Delimitations

The present study is a preliminary exploration of the fundamental motor skill of children ages 3, 4, 5, and 6 prenatally exposed to cocaine/polydrugs. Research studies have yet to report measurements of fundamental motor skills

CHAPTER 2

REVIEW OF LITERATURE

The purpose of the literature review is to examine the factors mediating the performance of fundamental motor skill in young children ages 3, 4, 5 and 6 years with a history of prenatal drug exposure to cocaine polydrugs living with a nonbiological mother. The review for this study is presented under the following headings: The Drug Called Cocaine; Temperament: Neonate, Infancy, Toddler to Early Childhood; Development and Motor Performance: Perinatal, Infancy, Toddler, Early Childhood; Early Intervention: Caretaking Environment, Developmental Trajectory; Biological and Nonbiological Mother/Child Relationship: The Home Environment; and the Conceptual Model.

The Drug Called Cocaine

Cocaine is a powerfully addicting drug that was restricted in 1906 in the United States due to its toxic potential rather than its addictive nature. The misunderstanding continued with a resurgence of popularity with the drug in the 1970's into the 1980's. According to Dixon (1989) an astronomic rise in the use of cocaine occurred in 1982 as illegal imports increased into the United States. The drug is now recognized as addictive in as little as one month's time.

Cocaine produces feelings of pleasure, euphoria,

power, and sexual excitement (Dixon, Bresnahan & Zuckerman, 1990). Pharmacologically, cocaine blocks the re-uptake of the neurotransmitters norepinephrine, dopamine, and serotonin at presynaptic nerve terminals (Young, Vosper, & Phillips, 1992). These neurotransmitters are normally partially reabsorbed by the nerve cell that releases them. The resulting cocaine block produces excess neurotransmitters between the nerves and an exaggerated signal (Zuckerman, 1991). Norepinephrine and epinephrine increase heart rate and constriction of blood vessels (vasoconstriction). Dopamine is thought to produce feelings of pleasure and euphoria. The vasoconstrictive action of the drug is thought to be responsible for the biologic problems seen in the newborn, specifically the constriction of the placental flow of blood and nutrients to the fetus (Chasnoff, 1991; Young, 1992) resulting in low birth weight and size. The increase in neurotransmitter at the postsynaptic junction is thought to increase the risk for neurological abnormalities in the developing fetus (Chasnoff, 1991).

Dixon (1989) reports that the drug is detoxified by the enzyme cholinesterase in the plasma and liver. This enzyme has wide individual variation which may account for the unpredictability of the toxicity of cocaine. Pregnant women, fetuses, and newborns have relatively low levels of cholinesterase which may make them more vulnerable to the

toxic effect of the drug (Dixon, 1989).

Temperament

According to Goldsmith et al. (1987), the construct of temperament has no clear consensus among researchers although there are points of agreement: temperament is "...a group of related traits and not a trait itself" (p.506); temperamental dimensions are reflective of behavioral tendencies rather than specific behavioral acts; temperament has a biological basis and continuity; the link between behavior and temperament is most direct in infancy and becomes more complex as the person develops; and, temperament is an "...issue of individual differences rather than species-general characteristics." (p.507) The study of temperament is interdisciplinary including the fields of developmental psychology, psychophysiology, behavioral genetics, education, psychiatry, and personality theory.

Conceptualization of temperament differs according to "...the degree to which temperamental characteristics are present at birth and are therefore presumed to be genetically determined." (Cole & Cole, 1993, p. 139). Since the study described herein is most concerned with the interplay of environment and the expression of temperament, the work of Mary K. Rothbart and her colleagues has been chosen. Their work acknowledges that an individual's genetic inheritance is present and interacts with the individual's environment producing the expression of their

temperament.

Rothbart and colleagues define temperament as: "...constitutionally based individual differences in reactivity and self-regulation, with constitutional referring to the person's relatively enduring biological makeup, influenced over time by heredity, maturation, and experience." (Rothbart, Ahadi & Hershey, 1995, p.22)

In part, reactivity is the arousability of the individual's affect and motor activity. In turn, self-regulation is the individual's processes for modulating reactivity (Rothbart, Ahadi & Hershey, 1995). Individual differences in temperament are expressions of the degree to which reactivity and self-regulation are represented.

Rothbart, Ahadi and Hershey (1994) further postulate that temperament influences social learning. Specifically, research has been conducted in: thresholds for discomfort (Dienstibier, 1984); the capacity for passive control and active inhibitory control (Kochanska, 1993), and in the expression of aggression (Layton, 1990; Quay, Routh & Shapiro, 1987). Though the scope of the study described herein does not examine these interpretations, it is of interest to note the extension of the constructs of temperament into the social arena thus underscoring the prevalence of temperament's influence for child development.

Rothbart and colleagues developed the Children's Behavior Questionnaire (CBQ) as an assessment tool for young

children ages 3-8 (Rothbart, Ahadi, Hershey & Fisher, 1994). This questionnaire addresses 14 dimensions of temperament: activity level, anger/frustration, approach, attentional focusing, discomfort, falling reactivity and soothability, fear, high intensity pleasure, impulsivity, inhibitory control, low intensity pleasure, perceptual sensitivity, sadness, shyness, and smiling and laughter. Of particular interest to this study are the dimensions of activity level, attentional focusing, impulsivity and inhibitory control. These dimensions have been described in the literature regarding babies and young children with prenatal cocaine/polydrug exposure and are discussed in detail in this literature review.

A more global approach to the temperament dimensions of the CBQ is through the factor analysis which resulted in three higher-order factors: Surgency, Negative Affectivity and Effortful Control (Ahadi, Rothbart & Ye, 1993; Rothbart, Ahadi & Hershey, 1994; Rothbart, Ziaie & O'Boyle, 1992). Effortful Control is of particular interest to the current study. It is the sum score of 4 dimensions found in the CBQ: inhibitory control, attentional focusing, perceptual sensitivity and low intensity pleasure. These dimensions have been described in the literature on children exposed prenatally to cocaine/ polydrugs and will continue to be discussed in this review of the literature.

Neonate

According to Rothbart (1986), a newborn's response to sight, sound, touch, and movement are the early markers of neurologic function and, in part, reflect temperamental differences. That is, the response could indicate various dimensions of temperament. These observable behaviors are termed "neurobehavioral". The Brazelton Neonatal Assessment Scale (Brazelton, 1984) has been used by most researchers concerned with the neurobehavioral status of infants with prenatal cocaine exposure. Studies report that some neonates exhibit a deficient response to stimuli (Chasnoff, Burns, Schnoll & Burns, 1985; Chasnoff, Griffith, MacGregor, Dirkes & Burns, 1989; Oro & Dixon, 1987). Response variation in newborns prenatally exposed to cocaine ranges from very irritable and inconsolable, to poorly responsive and sleepy (Griffith, 1991). The neonates movement has been described as atypical due to unusually stiff muscles (hypertonia) and longer retention of primitive reflexes (Schneider, 1987). According to Chiriboga et al. (1995) a positive cocaine urine toxicology at birth revealed a high incidence of hypertonia (41%) at age 6 months.

Some neonates exposed in utero to cocaine/polydrugs do not show detectable neurobehavioral difficulties (Zuckerman, 1991). Richardson and Day (1994) examined 34 newborns prenatally exposed to cocaine/polydrugs. At 2 days of age, no difference was detected in neurobehavior compared to the

600 controls. Similar findings were report for infants assessed at 1-3 days and 11-30 days of age (Neuspiel, Hamel, Hochberg, Greene & Campbell, 1991). Coles and her colleagues (1992) assessed 107 infants at 2, 14 and 28 days of age and reported Brazelton Neonatal Assessment Scale (BNAS) scores were within the normal range as compared to controls.

Infancy

Differences were reported in rhythmicity, cooperation, and manageability for infants prenatally exposed to cocaine/ polydrugs using the Shart Infant Temperament Questionnaire (Edmonson & Smith, 1994). In another study, cocaine using mothers rated their infants lower in activity level, smiling, laughter, distress to limitations, and lower in positive reactivity using the Infant Behavior Questionnaire (Alessandri, Sullivan, Bendersky & Lewis, 1995). These findings were confirmed during laboratory observations by the researchers.

Van Baar, Fleury and Utee (1989) assessed the activity level of infants at bath time using the Infant Behavior Questionnaire (Rothbart, 1981) and observations by researchers. The infants drug-exposed exhibited higher levels of physical activity at 3 months of age. It is important to note that researchers debate whether the rigid muscle tone and irritability of the neonates is due to a transient drug withdrawal rather than temperamental

difference in the neonates (Vogel, 1992; van Baar, Fleury & Utee, 1989; Young, Vosper & Phillips, 1992).

Toddler to Early Childhood

During testing of children prenatally exposed to cocaine/polydrugs at 24 months old, researchers described anecdotal observations that a great portion of the children drug exposed had difficulty with self-regulation that interfered with their test performance on the Bayley Scales of Infant Development (Chasnoff, Griffith, Freier & Murray, 1992). At 36 months, the same cohort of children were assessed using the Auchenbach Child Behavior Checklist filled out by the primary care providers. A perseverance score was attained from the sum of measures on distractibility, activity level, gives up easily, prefers easy tasks. Results indicate that poor ability to persevere on a task had twice the negative effect on IQ as did prenatal drug exposure. During implementation of this research and earlier work, Chasnoff (1992) observed:

> The majority of attentional and behavioral problems seen in 3-year-old, cocaine-exposed children was quite similar in appearance to the self-regulatory problems seen in the newborn assessments. Those children displaying behavioral problems had low thresholds for overstimulation and low tolerance levels for frustration. (p. 314)

Van Baar and de Graaff (1994) found that children entering school with a history of prenatal exposure to cocaine polydrugs exhibited greater difficulty with endurance and cooperation during testing situations for

language and general intelligence. Most researchers anticipate that further studies of this cohort of children during school age will aid in the understanding of the temperamental influence and the extent to which brain damage may have been sustained in utero (Vogel, 1992; Chasnoff et al., 1993).

In summary, early response to neurobehavioral functioning in neonates exposed prenatally to cocaine/polydrugs is variable: irritable and easily overstimulated, to a poorly responsive and sleepy state. Regarding temperament in infancy, mothers report differences in activity level and low positive reactivity for infants cocaine/polydrug exposed. Researchers have found differences in activity level and irritability. Preschool age children appear to persist in difficulties with sustained attention and impulsivity as compared to their age peers. Speculation is that the depth of the temperamental influence on school performance will be understood as the current cohort of children enter school and experience greater demands on higher intellectual functioning for task performance.

Development and Motor Performance

Perinatal

The most extensive research on prenatal cocaine exposure has been conducted on the newborns. Perinatal

medicine focuses on the health of the mother and developing fetus two months prior to birth and the first month of life of the baby. This baby is referred to as "neonate", "newborn", and "infant". Studies on the perinatal outcome of the newborn prenatally exposed to cocaine reveal lower than expected birth weight and inability to reach their potential size (Burkett, Yadin & Palow, 1990; Chasnoff, Griffith, McGregor, Dirkes, Burns, 1989; Cherukuri, Minkoff, Feldman, Parekin & Glass, 1988; Chouteau, Namerow & Leppert, 1988; Coles, Platzman, Smith, James & Falek, 1992; Fulroth, Phillips, & Durand, 1989; Little, Snell, Klein & Gilstrap, 1989; Hadeed & Seigel, 1988; MacGregor et al., 1987; Madden, Payne & Miller, 1986; Oro & Dixon 1987; Richardson & Day, 1994; Ryan, Ehrlich & Finnegan, 1987; Zuckerman, Frank, & Hingson, 1989). In addition, most researchers also found small head circumference. A meta-analysis of 20 studies on the reproductive risk to the infant of prenatal cocaine exposure confirmed differences at birth: a small head circumference; lower gestational age and weight; and, small birth length (Lutiger, Graham, Einarson & Koren, 1991).

Birth defects have occurred infrequently in infants exposed prenatally to cocaine and therefore causality has not been established (Zuckerman, 1991). These defects include: heart (Little, Snell, Klein, Gilstrap, 1989; Lipshults, Frassica & Orra, 1991;) bowel (Chasnoff, 1985); kidney (Chavez, Mulinero & Codero, 1989); and skeletal

(Hoyme, Jones & Dixon, 1990).

Perinatal research supports the notion of a difference for some neonates in responsiveness, rigidity of muscle tone, and activity level. This has been described previously under Temperament in this review.

In summary, the perinatal findings on prenatal exposure to cocaine describes neonates low in birth weight, small for gestational age, small head circumference, with hypertonic muscle presentation. A small incidence of birth defects is found. It is important to note that some neonates have manifestations of obvious congenital defects and neurobehavioral difficulties while others do not. The exact proportions of these problems in newborns is not known.

Infancy

During the first year of life, children who exhibited the perinatal difficulties in responsiveness to stimuli and atypical muscle rigidity appear to go through a "catch up period" in psychomotor development. Van Baar, Fleury and Utee (1989) used the Dutch version of the Bayley Scales of Infant Development (Bayley, 1969) to obtain the Mental Development Index (MDI) and the Psychomotor Development Index (PDI) on children exposed prenatally to cocaine, heroin, and methadone. Scores were within the normal range, with no differences between the groups on MDI or PDI at 6 months and 12 months of age. Differences seen at 3 months

were not present at 9 months of age: there were no differences in activity level between the groups. Edmondson and Smith (1994) conducted electroencephalograms at the neonatal period and reported abnormal or suspect brain waves in 30% of babies drug-exposed and 6% in the control group. By 12 months of age, 4% of the drug-exposed and none of the controls remained in the abnormal category. In this study, the MDI for infants at 6 months of age were within the normal range using the Bayley Scales of Infant Development.

Doberczak et al. (1988) assessed neurodevelopment in infants prenatally cocaine/polydrug exposed. All the infants experienced seizures that were attributed to drug withdrawal after birth. Neurologic status at 2-4 months revealed 66% were abnormal in the exposed group and 14% in the control group. By 5-7 months, 25% of the exposed group were abnormal while none of the control group exhibited abnormality. By 8-16 months of age both groups had normal neurologic examinations. The Bayley scores for the MDI and PDI were normal at 5-7 months of age and 8-16 months of age.

Toddler

In 1989 Rodning, Beckwith, and Howard studied development and play in eighteen 18 month old toddlers with prenatal cocaine and polydrug exposure. They compared this group to 41 toddlers matched for maternal socioeconomic status (SES) and educational level. The researchers used the unrevised Gesell with the drug-exposed children, and the

Bayley with the preterm controls. There were no differences reported in the development between those children exposed and their controls. Scores were in the low-average range for the children exposed. (Unfortunately, these results stand as uninformative based on the unlikely assumption that the two test are correlated at the reported .8)

In this same study, the researchers assessed representational play such as seating a doll at the table and stirring in a pan. The drug-exposed toddlers had greater difficulty than the control group in these unstructured settings. Play was typified as "disorganized, and characterized by scattering, batting .... rather than sustained combining of toys, fantasy play, or curious exploration" (p.283). The researchers noted the discrepancy between the low average scores for the drug-exposed toddlers on standardized developmental tests and the more severely depressed scores in the unstructured play setting. The children exposed appeared to be better able to control their response to stimuli given structure by the test setting: "It is significant that only modest deficits were seen in standardized developmental assessments that imposed an external structure in which the examiner directed the tasks for the child." (p. 285)

Later in 1994, Beckwith and her colleagues examined the cohorts at 24 months of age. Findings continued to reveal differences in play behavior: children exposed exhibited

immature behavior including more mouthing, banging, waving, and repetition of acts. The play was qualitatively different from controls with the presence of abrupt transitions and decreased amounts of sustained attention and purposeful choice of toys. This clustering of behavior was described by the researchers as a developmental skill scatter representative of a potential social cognition deficit: less skill with learning symbol systems and shared social information.

Black et al. (1994) found no differences in psychomotor development for children prenatally exposed to cocaine and other drugs who were living with their biological mother. Followed from infancy to 18 months of age, there were no differences over time for psychomotor development using the Bayley Scales of Infant Development.

Early Childhood

In 1992, a study was undertaken to assess development of children prenatally exposed to cocaine/polydrugs (Chasnoff, Griffith, Freier, & Murray, 1992). These children were followed at 3, 6, 12, and 24 months of age. Growth in weight and length recovered by 3 months. At 24 months of age, there was no difference in the mean developmental scores on the Bayley Scales of Infant Development between the children prenatally exposed and controls. Despite this finding, a greater proportion of the children with cocaine/polydrug exposure were more than two

standard deviations below the mean on individual scores for the MDI and the PDI of the Bayley. Across all children, small head circumference correlated with developmental scores: the smaller the head circumference, the lower the Bayley MDI and PDI. The authors noted that a great portion of the children drug-exposed had difficulty with self-regulation (impulsivity and inattention) which reportedly interfered with their performance at 24 months.

This same cohort was studied at 3 years of age to determine intellectual functioning (Azuma & Chasnoff, 1993; Griffith, Azuma & Chasnoff, 1994). The children exposed were compared to a group of non-cocaine polydrug exposed and a control group matched for a primarily low socioeconomic status (SES). The Stanford-Binet Intelligence Scale revealed no global difference between children exposed and the controls. The children cocaine/polydrug exposed scored lower than the control group on abstract verbal reasoning although cocaine accounted for only 9% of the difference in variance in verbal reasoning.

Prior research findings had reported head circumference as potentially predictive of intellectual function (Chasnoff, Griffith, Freier, Murray, 1992; Hack et al., 1991). This was not supported in the research of Azuma and Chasnoff (1993) and Griffith, Azuma, and Chasnoff (1994). Head circumference at 3 years of age did not predict IQ despite a statistically significant difference in head size:

the drug-exposed groups had a smaller head than the control group.

Other longitudinal studies conducted reveal no difference in mental and psychomotor performance of children exposed to cocaine polydrugs as compared to the controls. Using the Bayley Scales of Infant Development, Hurt et al. (1995) reported no difference in performance through age 30 months between children exposed and the control group. They noted a trend at preschool toward lower Bayley scores for both groups. Lower scores on the Bayley were not associated with small head circumference as reported by others. In addition, a small incidence of hypertonic muscle tone in the early years was reported with resolution by age 36 months. When controlling for socioeconomic status (SES), the children with low SES had similar Bayley scores as compared to the lower SES controls.

Nulman et al. (1994), reported no significant difference with regard to the cognitive status of adopted children at ages 14 months to 6.5 years exposed prenatally to cocaine/polydrugs and controls matched for SES. The researchers used the Bayley Scales of Infant Development, the McCarthy Scales of Children's Ability and the Reynell developmental language scales. No difference was found in intelligence with the Bayley scales or the McCarthy although a trend toward lower IQ was noted in the older children on the McCarthy. Children cocaine-exposed had lower language

comprehension and expression scores than those of the controls.

No difference in cognitive development was noted in a study of young children prenatally exposed to cocaine/polydrugs conducted by Hawley and colleagues (Hawley, Halle, Drasin & Thomas, 1995). They reported on 25 children ages 3 to 5 years exposed to cocaine/polydrugs whose mothers were in a drug rehabilitation program. The control group was composed of 23 children in a Head Start program. On the McCarthy Scales of Children's Abilities, there were no differences between groups: both groups fell within the range of normal.

Differences in cognitive development of children prenatally exposed to cocaine polydrugs has been reported by Van Baar and de Graaff (1994) in the Netherlands. In a longitudinal study, they assessed children born to drug dependent mothers and compared them to a "reference group" consisting of children without risk factors for developmental problems or a mother abusing drugs. At early testing in infancy, no differences were found in neurological and motor development between the groups. During the second year, the children exposed had delayed mental development as measured by the Dutch version of the Bayley Scales of Infant Development. At ages 3.5, 4, 4.5, and 5.5 years, there were significant differences on measures of intelligence between the children exposed and

their reference group. Language development diverged from the reference group around 18 to 24 months for the children exposed. At preschool age, low scores were reported for cognitive tasks involving language comprehension. At 4 years of age, language scores were lower in both comprehension and expression for the children exposed. There were no differences reported in psychomotor development. The researchers commented that, in general, the children with prenatal drug exposure entered elementary school with cognitive delay. The authors noted that their findings of a cognitive delay differ from the findings of Chasnoff and others. This was attributed to the fact that the reference group was not matched for socioeconomic level, but rather for relative risk factors favorable to normal development. Other researchers found that matching for socioeconomic level creates a more meaningful comparison and differences between groups disappear (Nulman et al., 1994).

In summary, research on infants, toddlers, and early childhood reported a "catch up" in psychomotor development for children found deficient in infancy. During the toddler months, development for the children exposed is in the low-average range and play skill of the toddlers exposed to drugs are significantly lower when compared to skills of the controls. For infants diagnosed with hypertonic muscles, resolution was found by 36 months. At 24 months of age,

play skill continued to be immature and scores of mental and psychomotor development revealed no significant statistical differences between drug-exposed and controls, although a greater proportion of the children drug-exposed were two standard deviations below the mean. Researchers commented anecdotally that the children drug-exposed had greater difficulty with attention and concentration which interfered with test performance.

Although the scores were not statistically different from controls, at age 3 lower IQ scores were obtained for children with poor ability to persevere on a task. Head circumference alone was not predictive of IQ. At preschool age, studies of cognitive function of children cocaine/polydrug exposed are inconclusive although most researchers have found no difference between children exposed and their controls. Differences in development were diminished when a match for SES was made between children exposed and the controls.

Early Intervention

According to Bricker (1986), early intervention is based on the belief that "...early experience is instrumental in the child's future development...[and] essential to later development because continuity exists between early behavior and subsequent behavior." (p.17) Bricker explains that this belief in continuity, implies that early experiences set the individual's behavioral

repertoires. Early services provided to a child with apparent or suspected risk contribute to a positive developmental trajectory.

Does early intervention assist with a positive developmental trajectory? According to a study coordinated through Stanford University the answer is yes if attention is given to the amount and quality of early intervention service. Referred to as the Infant Health and Development Program (1990), significant increases in cognitive ability were reported in young children born low-birth-weight and premature. This study was executed in 8 sites (combined medical center/education centers) across the United States. Nearly 1,000 babies were randomly assigned to be followed for 3 years with pediatric care only; or in an early intervention program that included pediatric care, home visits, bimonthly parent meetings, and a 5 day-a-week center-based educational program for the children. Results indicated that at 3 years of age, the children in the early intervention program increased in as much as 15 points on the Stanford-Binet Intelligence Scales. To date, this has been the strongest empirical evidence to support early intervention for young children at risk. Other data from this initial study are continuing to be analyzed and published (Brooks-Gunn, Klebanov, Liaw, & Spiker, 1993; Guralnick, 1991; Spiker, Ferguson, & Brooks-Gunn, 1993). In sum, these data support early intervention that is

frequent, of sufficient duration, and provided in a quality setting with identified goals and objectives for the child.

Regarding children exposed prenatally to drugs, there is a debate regarding the type of early intervention services needed: specialized programs or nonspecialized. The first legislative mandate to provide early intervention services for children at risk for developmental delays was PL 99-457 (Hawley & Disney, 1992). This federal law identified early intervention services for children ages 3-5 and provided incentive grants to serve children 0-2. In some states, children with prenatal drug exposure were served under this law when they met criteria for "risk for delay". The type of program best suited to the child prenatally exposed was debated. In 1990, Dixon, Bresnahan & Zuckerman referred to risk within the caretaking environment for children prenatally exposed. They reasoned that stability and nurturance within the home are often absent with a mother drug abusing, and advocated for special programs in early intervention for babies prenatally drug exposed. On the other hand, Sutter and Brinker (1992) advocated for use of the same early intervention assistance for children prenatally drug exposed as has been utilized with other children at risk for developmental delay. They argued that little research data are available on development of children with prenatal exposure and therefore specialized early intervention is based on unknowns. Mayes

et al. (1992), also reiterated this stance: .."the children [prenatally exposed] can and need to be helped through early intervention strategies about which much is already known. "(p. 408). It is recommended that early intervention service be attuned to the unique problems in each child's caretaking environment. This is standard protocol with early intervention.

Caretaking Environment

Unique problems in the caretaking environment have been identified in the literature for children prenatally exposed to cocaine/polydrugs. These include recommendations for the care provider on dealing with irritable babies; provision of stable and predictable classrooms; and curriculum considerations with attention to transitioning children from one activity to another.

Caregiver education is essential in the neonatal period with an infant who is irritable and exhibiting excessive muscle rigidity. Common education strategies for infant self-regulation and over stimulation include: avoiding abruptness, bright lights, and noise; swaddling and holding the infant firmly against the caregiver's skin (Kronstadt, 1991). These techniques help promote the caregiver's ability to nurture and respond to the infant. In addition, predictability and stability of the child's environment have been described as critical for positive developmental

outcome (Vincent, Poulsen, Cole, Woodruff, & Griffith, 1991). Clinical reports refer to the chaotic environments within the home of mothers drug abusing (Chasnoff, 1992). A major reason for early child placement in foster care is due to a lack of basic safety needs for child: food, shelter, and appropriate clothing. Beyond basic needs, a mother abusing drugs may also be at risk for misreading their infant's needs or simply lack experience in the provision of developmentally appropriate interactions with their child (Vincent et al., 1991). According to Vincent, a predictable, stable, and secure environment provides the child with the opportunity "...to form attachments with nurturing, caring adults..." (p. 18).

For young children prenatally exposed to drugs, Vincent and colleagues (1991) advocate for curriculum in early intervention that are developmentally appropriate and experiential. Educators are encouraged to see the transition as an activity unto itself by providing warnings ahead of transitions, employing verbal descriptions of the next activity in advance of the activity, and focusing on small behavioral steps in making the transition.

Additional research on the home environments of children prenatally exposed to cocaine will be discussed in detail under the section on the biological and nonbiological mother/child relationship.

Developmental Trajectory

Researchers believe early intervention programs are appropriate for children prenatally exposed to cocaine/polydrugs. According to Mayes et al. (1992), "Whatever the damage from prenatal exposure to cocaine may prove to be, outcome will not be improved by an attitude that assumes that exposed children cannot be helped or that they are different from other children." (p. 408)

Beyond the perinatal period for those with prenatal exposure to cocaine, global measures of mental and physical development in early childhood have, for the most part, been reported as not statistically different from the controls. Yet in each case, researchers have reported children exposed with low average range and individual scores falling below the mean (Azuma & Chasnoff, 1993; Beckwith et al., 1994; Chasnoff et al., 1992; Hurt et al., 1995; Hawley et al., 1995; Rodning et al., 1989). On the other hand, Van Baar and de Graaff (1994) reported a statistically significant difference in cognitive ability at school age.

In addition, problems with attention and impulsivity at 3 years of age have impeded intellectual performance (Azuma & Chasnoff, 1993). The problems of identified delay coupled with the demands in the caretaking and educational environment appear to warrant early intervention service. Even in the face of a lack of specific motor or cognitive delay, researchers believe that there exists a fragility of

developmental risk given prenatal drug exposure, particularly when considering those in poverty (Coles, et al., 1992; Zuckerman & Frank, 1993). These researchers ask: Will the prenatal drug exposure outweigh the environment that encompasses the developing child? Some clinicians believe that the postnatal environment may be far more critical to the child's well-being than the prenatal drug exposure (Chasnoff 1991; Kronstadt 1991; Zuckerman, 1990, 1991), although some researchers have found little evidence to support this (Hurt et al., 1994; Nulman et al., 1994). In general, these children are considered at risk and in need of early intervention programs (Chasnoff, 1989; Weston, 1991; Zuckerman, 1993; van Baar & de Graaff, 1994; Coles et al., 1992).

In summary, early intervention programs have been found to be effective in reaching at risk children if the intervention is of sufficient intensity and of a high quality. Early intervention has been recommended for children with prenatal exposure to cocaine and other drugs based on the at-risk model for developmental delay: though global scores reveal development within the normal range, scores are often in the low average range with some children in the delayed category. Caregiver education and direct child intervention are recommended for infants who are hypertonic, irritable and easily overstimulated or unresponsive to stimuli. Early intervention service is also

advocated in early childhood to: create predictable and stable environments in the home and at school programs; assist with delays in psychomotor function and play skills; and regulate stimulation in play environments. Children with prenatal exposure to cocaine are considered "at risk" and in need of early intervention services. Due to the variability in the children and the caretaking environments, an individualized approach to service delivery is recommended.

Biological and Nonbiological Mother/Child Relationship: The Home Environment

Foster care of children becomes a necessity for many children who are born to drug abusing mothers. One of the major reasons for foster care placement is child safety (personal communication, S. Budden, MD, March, 1993). In one study by Black & Mayer, neglect of children in substance abusing homes was found in 41% of the families (Bayes, 1992). The substance abusing mother is often: poor, unemployed, lacking job skills, single, separated from social support, and a mother of children who need her for care and support (Kumpfer, 1991). A personal history of drug abuse correlates with: a history of multigenerational substance abuse, dysfunction within the family of origin, on-going physical abuse by a partner, low self esteem, depression, and sexual abuse (Tracy & Williams, 1991; Finnegan, 1991). Placement in foster care can remove the

child from the chaos in the mother's life.

Limited research has been conducted to explore the influences of the home environment on the psychological state of the child. Researchers at University of California Los Angeles studied toddlers exposed to cocaine and phencyclidine regarding their attachment to their caretakers (Rodning, Beckwith, & Howard, 1991). Primary care providers consisted of biological mothers, extended family members, and foster care mothers. Rodning et al. reported less secure attachment in 15 month old toddlers prenatally exposed. Using the Ainsworth rating system (1976), 61% of the children drug exposed were insecurely attached. Most of the children insecurely attached were living with their biological mother (88%). Secure attachments were found in the toddlers living with extended family (75%), and those living with a foster parent (50%). Of the control group of preterm children, most were classified as securely attached to their primary care provider (77%).

Azuma and Chasnoff (1993) studied the quality of the home environment regarding the impact on the developing child. Cognitive ability of 3-year-olds with prenatal cocaine/polydrug exposure and the mediating effect of the home environment was studied using the Home Screening Questionnaire (HSQ). This questionnaire screens for environmental factors that put the child at risk for developmental delay. Caretakers filled out the HSQ

questionnaire. Most of the caretakers were extended family members, and an insignificant number of the caretakers were foster mothers (personal communication, Dr. Scott Azuma, April, 1994). Findings indicated that a higher quality home environment predicted higher IQ score. Bradley et al. reported similar results when studying the home environment and cognitive development in a general study of children in North America (1989). Griffith et al. (1994) reported a difference on verbal reasoning using the Stanford-Binet Intelligence Scales for children living with a mother drug abusing.

Other studies have reported no difference in developmental outcome given the caregiving environment. In 1995, Hurt et al. reported that differences in the caretaking environment of young children prenatally exposed to cocaine polydrugs were not correlated with the MDI and the PDI of the Bayley Scales of Infant Development. The mothers were biological and foster. Nulman et al. (1994) reported on the development of children ages 14 months to 6.5 years, prenatally exposed to cocaine/polydrugs and adopted into middle and upperclass families. Compared to the control group matched for mother's IQ and SES, no differences were reported in IQ which was in the normal range. Differences in developmental scores were found to be independent of the home environment and more suggestive of intrauterine drug exposure as represented by a small head

circumference, small for gestational age and low birthweight.

Whether living with their biological mother or with others, Beckwith et al. (1994) reported no difference in play skill for children prenatally exposed to cocaine and phencyclidine. All the children exposed exhibited immature play skill.

Black et al. (1994) reported on a home intervention for infants prenatally exposed to cocaine polydrugs who lived with a mother abusing drugs. Followed from birth to 18 months of age, there were marginal statistical differences in the child-centered nature of the intervention homes. Minimal gains were made in cognition given biweekly visits for the intervention group as compared to the control group of infant-mother dyads who did not receive intervention. In the intervention homes, the mothers were emotionally and verbally more responsive and provided more opportunity for a variety of daily stimulation for their child. Researchers recommended a more intense full day center-based program in order to sustain and further enhance the gains made in the intervention group.

The results of research conducted on the caregiving environment remain inconclusive. When comparisons are made within a lower SES, environment does not predict outcome although skills such as play are lower and IQ is in the lower end of normal for children exposed to

cocaine/polydrugs. Overall, it must be pointed out that the children are developing much better than originally anticipated by the research of the middle 1980's. But, Coles et al., (1992) wonder if the results are good or just the result of picking babies without serious medical problems, thereby eliminating those more vulnerable to cocaine. As Hurt and colleagues (1995) suggest, initial damage to the fetus may outweigh the benefits of environment when the damage is severe.

In summary, foster care of children born to women drug addicted occurs due to the inability of the biological mother to provide a safe and healthy environment for the child. Insecure attachment to the primary care provider is seen in children being raised with the biological mother abusing drugs; more secure attachment is seen in those children being raised in foster care or by extended family. Research on the quality of the home environment of the child prenatally exposed to cocaine and other drugs, reports that higher intellectual development correlates with higher quality of home environment in 3-year-old children. Some studies report no difference in child outcome given the home environment. Some trends appear: no differences in cognitive development and play skill appear when comparing the home environment of low SES children prenatally drug exposed to low SES children noncocaine exposed--both are low. Minimal gains in the quality of the interaction

between drug abusing mothers and their children given intervention in that home environment as compared to low SES children in a drug abusing home: both mothers were lacking in appropriate responsiveness and interaction with the child. In general, the research on the mediating effect of the home environment is inconclusive.

Conceptual Model

Bronfenbrenner and Crouter (1983) advocate for a study of the developing child from the perspective of the ecology of human development. They reason that in order to fully comprehend child development the research design must account for: the person, the people with whom that person has significant interactions, and the social settings in which this takes place. Referred to as the person-process-context model, it is designed to elucidate the characteristics of person-process-context and their interactions. This model is also referred to as development-in-context. The assumption is that differences in child development are influenced by: the reciprocal nature of the child's effect on environment and the environment's effect on the child; the interaction of the child's biology and the environment; and the effect that childrearing practices have on developmental outcome. In short, prediction of child outcome is in an "it depends" context: "...biological and interpersonal influences can have different effects depending on the context in which

they operate." (p. 375)

The person-process-context model was chosen for this study because of it's match with the questions of interest regarding developmental outcomes for children prenatally exposed to cocaine/polydrugs. The early research on prenatal cocaine exposure was criticized for a limited research design focused primarily on the main effect of cocaine exposure. In 1991, Claire Coles and others recommended that future research utilize a broader child development perspective. The ecological model of Bronfenbrenner and Crouter (1983) meets this criteria. Using this model, multiple variables can be used to describe development. This is particularly appropriate given the complex nature of variable identification in research conducted with participants who abuse drugs. Methodological problems (Chasnoff, 1989) have plagued the research (ie, lack of controls, lack of match of control groups for nutritional status and drug abuse pattern) as well as a lack of intervening variables, such as poverty, that could account for the variability in developmental outcome (Zuckerman, 1991).

In designing an ecological model of development-in-context, the following variables were chosen for this study: temperament of the child (person); the nonbiological mother's parental attitude, and the early intervention service (process); and the child prenatally exposed to

cocaine/polydrugs who resides with a nonbiological mother that is either foster or adoptive (context) (see Figure 1).

These variables have been selected because they appear to be important ones that could elucidate the development of these very young children who were exposed to cocaine and other drugs in utero. Although the research on the development of the young child prenatally exposed to cocaine/polydrugs is only a decade old, results are inconclusive. It is important to bring in as many of the significant variables using the development in context model in order to study these children.

Each variable in this study is expected to interact with the others. No one variable is expected to explain motor skill performance. Temperament was chosen for it's fundamental relationship to the developing child: biologically based expression influenced by the child's maturation and environment. Specific interests in temperament are the dimensions of reactivity and self-regulation as expressed in motor performance and the interactions with the caregiver's parenting attitude and access to early intervention. It is suspected that early neurobehavioral findings of irritability and difficulty in modulating expression are retained in early childhood (Chasnoff, 1992) and negatively influence performance on developmental testing (Azuma & Chasnoff, 1993). To date

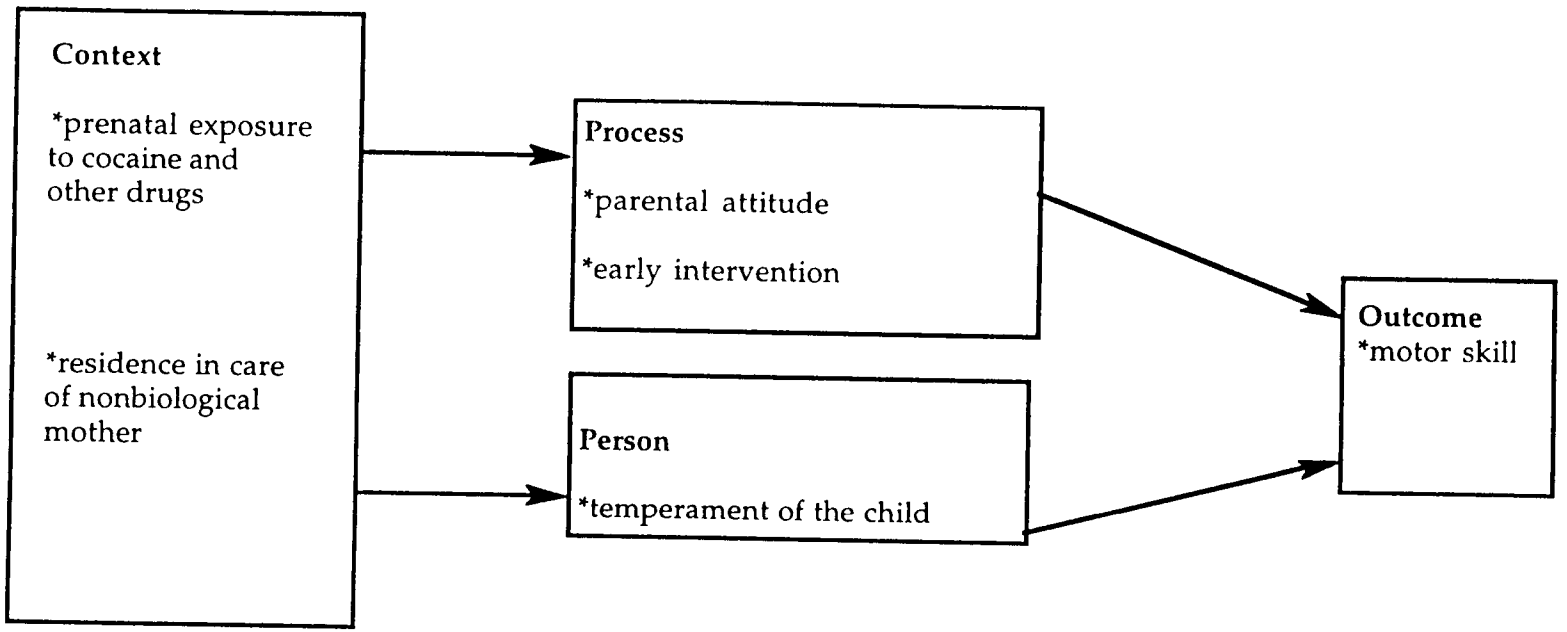

Figure 1. Person-Process-Context Model for examining the fundamental motor skills of young children prenatally exposed to cocaine/polydrugs

there has been no evidence of fundamental motor skills for children with prenatal drug exposure to cocaine/polydrugs. It would be important to explore motor performance in early childhood and the influence of reactivity and self-regulation. Using the terminology of temperament, physical movement may signal an arousal (reactivity) and a concomitant need for modulating that arousal (self-regulation). The interactional makeup of the child's temperament with the other variables in this study is expected to predict motor performance.

Two other variables chosen for exploration in this study are the characteristics of the nonbiological mother's parental attitude and early intervention service. Research is inconclusive regarding the effect of the home environment on the child prenatally exposed to cocaine/polydrugs. Many children are removed from the care of their mother who is drug abusing. Foster care and adoption are the result of placements outside of the biological mother's home. Since many of these children experience out of home placement at a very early age (primarily infancy) their primary care provider should be a significant person in their life. This is the one person that the child depends on for safety and nurtruance. This study is expected to explore the relationship between the attitude the nonbiological mother (adoptive or foster mother) has toward parenting the child and the interaction this attitude has with temperament and

early intervention service in predicting gross motor performance.

Little research has been conducted on the outcome of early intervention services for children with prenatal drug exposure to cocaine/polydrugs. While acknowledging that many of the children do not have detectable developmental difficulties, many of the children appear to fit a model of a child at risk: born to a mother who may lack the skill and ability to care for them; living in poverty; scoring under the norm for motor development as well as cognitive development; and developmental test performance impeded by impulsivity and high activity levels. It has been demonstrated through the Infant Health and Development Program that a high quality and sufficient amount of early intervention service significantly improves child outcome. Therefore, one could argue that the motor performance of a child prenatally exposed would benefit from a sufficient amount of high quality early intervention. Therefore, this study includes early intervention service as one of the variables to predict gross motor performance.

In conclusion, the person-process-context model appears to represent an appropriate developmental model for studying the outcome in fundamental motor skill for the young child prenatally exposed to cocaine/polydrugs who resides with a nonbiological mother (context). Using this model, an exploration was made of the contribution of the child's

temperament (person), the parental attitude of the nonbiological mother, and the child's early intervention service (process) in predicting fundamental motor skill performance.

CHAPTER 3

METHODS AND PROCEDURES

The purpose of this investigation was to examine the factors contributing to the fundamental motor skills of young children with prenatal exposure to cocaine and other drugs. The study explored the practicality of the conceptual model proposed in Chapter 2 to predict the effects of child temperament, the nonbiological mother's (foster, adoptive) parental attitude, and early intervention on the performance of fundamental motor skills. Chapter 3 describes the Participants, Instruments and Apparatus, Procedures, Research Design, and Statistical Analysis.

Participants

Participants included 28 children ages 3, 4, 5 and 6 years (n= 15 males; n= 13 females) who were prenatally exposed to cocaine/polydrugs. Of these children, 17 were African American, 7 were Caucasian, and 4 were Hispanic. They resided with a nonbiological mother (n= 6 foster; n= 22 adoptive) and had been followed for pediatric care by Dr. Sarojini Budden, Director of the Pediatric Development Program at Emanuel Hospital and Health Center, Portland, Oregon. During the course of this study, background information on these children included data on the foster family in which the child resided, identification of foster family head(s) of household, and the frequency and duration

of the child's past foster home placements. For purposes of the study, the child was required to reside in the foster or adoptive home a minimum of 1 year. In addition, background information was obtained on the child including age, ethnicity, and gender (Table 1).

Cocaine exposure was determined by hospital record of maternal and/or infant positive urine screen for cocaine, and/or reports from the biological mother of use of cocaine during pregnancy. Although cocaine may be reported as the maternal "drug of choice", these mothers typically also use alcohol and tobacco (Chasnoff, 1991). Hence, the addition of the term "polydrug" when describing the cocaine abuse.

Participants were selected by Dr. Sarojini Budden from her patient population meeting the criteria for drug exposure. From this list, letters were sent soliciting volunteers for the research. Phone follow-up confirmed an interest in participation. Appointment for the evaluation at Emanuel Hospital's Pediatric Development Program were scheduled and an information packet was sent. Since many of the children on Dr. Budden's list had been adopted (about 85%), extensive tracking of foster to adoptive homes was conducted in cooperation with the State Office of Services to Children and Families. In this case, the caseworker in charge of handling the adoption contacted the adoptive parent to solicit interest in the research. If the parent was interested, another contact was made by the principal

Table 1

Demographic Information

Age	Gender	Care	Ethnicity
72	1	1	2
43	1	1	1
55	2	2	2
36	1	2	1
51	1	2	2
68	1	2	2
62	1	1	1
50	2	1	3
65	2	1	1
71	2	1	1
69	2	2	2
75	2	1	2
63	2	1	2
66	2	1	2
67	1	1	2
72	2	1	2
83	2	1	2
73	1	1	2
42	1	1	3
60	2	1	2
47	1	1	2
59	2	1	2
70	1	1	2
74	2	1	3
72	2	1	1
58	1	1	2
82	1	2	1
41	2	1	3

Key:
Age: given in months
Gender: 1 = female; 2 = male
Care: 1 = adopted; 2 = foster
Ethnicity: 1 = Caucasian
2 = African American
3 = Hispanic

investigator for this study and the usual recruitment protocol was followed. The amount of time from initial inquiry to actual clinical appointment for the participants was 6 to 8 weeks.

This study was approved by the Oregon State University Institutional Review Board for the Protection of Human Subjects (Appendix A). For children in foster care, informed consent was obtained from State Office of Services to Children and Families and, as a courtesy, from the foster mother. For children who had been adopted, the adoptive mother read and signed the informed consent form.

Instruments and Apparatus

The Test of Gross Motor Development (Ulrich, 1985) was used to measure performance of fundamental motor skills of young children prenatally exposed to cocaine and other drugs. A copy of this test is found in Appendix B. The Test of Gross Motor Development (TGMD) evaluates locomotor skills and object control skills. The locomotor skills are: run, gallop, hop, leap, horizontal jump, skip and slide. The object control skills are: two-hand strike, stationary bounce, catch, kick and overhand throw. Each of these skills contain 3-4 critical components "performance criteria" for evaluation. Locomotor and object control skills are recorded in raw scores (total "performance criteria" points), percentiles, and standard scores. A determination is make of a global score of gross motor skill

called the Gross Motor Development Quotient (GMDQ) ($\underline{M}$ = 100; $\underline{SD}$ = 15). The apparatus used during testing with the TGMD include the following: 4-6 inch light weight ball, plastic bat, 8-10 inch playground ball, 6-8 inch sponge ball, tape or other marking device, 8-10 inch plastic or slightly deflated playground ball, 3 tennis balls (Ulrich, 1985). TGMD scores for the study population are listed in Table 2 with the GMDQ standardized score and range listed in Table 3. An indepth discussion of the TGMD test results follows in Chapter 4.

The Test of Gross Motor Development (TGMD) has been used for research with children with disabilities including studies of: movement control with children with mental retardation (Ulrich, Riggen, Ozmun, Screws & Cleland, 1989), and testing item response theory in adapted physical education (Cole, Wood & Dunn, 1991). In addition, studies have been conducted using the TGMD with children without disabilities including studies of dribbling performance in first-grade children (Burton & Welch, 1990), and developmental gross motor skill ratings (Ulrich, Ulrich, & Branta, 1988).

Validity and reliability for the TGMD have been established including content and construct related evidence for validity, and test-retest generalizability coefficients (locomotor = .96, object control = .97) as evidence of reliability (Ulrich, 1985). The participant's performance

Table 2

Test of Gross Motor Development (TGMD), Age and Standard Scores

Age	Locomotor	Obj. Contol	GMDQ
72	21	11	109
43	18	13	151
55	21	12	142
36	5	3	94
51	21	11	148
68	21	18	127
62	18	13	115
50	18	8	121
65	15	11	112
71	17	13	112
69	22	15	124
75	20	14	112
63	17	15	115
66	23	16	127
67	23	14	124
72	21	18	124
83	24	15	127
73	17	8	91
42	11	6	124
60	24	10	121
47	19	9	145
59	20	15	145
70	24	11	121
74	21	13	112
72	17	10	97
58	16	9	127
82	22	18	127
41	6	6	109

Key:
Age = given in months
Locomotor = locomotor skill
Obj. Control = object control skill
GMDQ = gross motor development quotient

Table 3

GMDQ Standardized Score and Range

Score	Range
131-165	Very Superior
121-130	Superior
111-120	Above Average
90-110	Average
80-89	Below Average
70-79	Poor
35-69	Very Poor

on the TGMD could not be videotaped due to restrictions from the responsible state agency. Therefore, a percent agreement was determined by videotaping the principal investigator assessing 3 children without prenatal drug exposure. This tape was viewed by the principal investigator and another rater who had extensive experience with both the TGMD and in observing young children move. The agreement was 90% for locomotor and 87% for object control.

As a control variable, an early motor score was obtained from the child's medical chart. This score was used to document the status of gross motor delay for the child. In general the study participants were tested for gross motor skill during the first year of life. Of the 28 children in the study, 11 were diagnosed with a motor delay (39%). Only one child lacked early developmental records. She entered at age 3 years into the jurisdiction of the State Offices of Services to Families and Children. Her biological mother was not able to provide any records of her early development. For early gross motor skill, Table 4 lists the assessment tool and the scores obtained by the child. Only one child did not have the name of the assessment tool listed in her chart. The clinician described her as having an "overall global delay". Over the course of 5 years, her chart documented early intervention services directed at remediating the global delay.

Table 4

Early Motor Scores, Assessment Tool, Identification of Delay

ID	EarlyMotor	Assessment	Delay
1	90	CDRC	
2	69	Peabody	x
3	91	Bayley	
4	<50	Bayley	x
5	100	Bayley	
6	–	–	x
7	70	Bayley	x
8	114	Bayley	
9	100	CDRC	
10	87	CDRC	x
11	<50	Bayley	x
12	115	Bayley	
13	91	Bayley	
14	76	Bayley	x
15	103	Peabody	
16	105	Bayley	
17	74	Bayley	x
18	<50	Bayley	x
19	97	Bayley	
20	69	Peabody	x
21	97	Bayley	
22	94	Bayley	
23	97	Bayley	
24	108	Bayley	
25	74	Bayley	x
26	93	CDRC	
27	–	–	–
28	91	CDRC	

Key:
Bayley = Bayley Scales of Infant Development
Peabody = Peabody Developmental Motor Scales
CDRC = Child Development and Rehabilitation Center, Test of Gross Motor Development
- = not able to obtain data

To measure child temperament the Children's Behavior Questionnaire (CBQ) was utilized. According to Rothbart (correspondence, April 1994), this scale is used with preschoolers and has been adapted from dimensions studied in infants (Rothbart, 1981, 1986) and in adults (Derryberry & Rothbart, 1984). This scale has shown to be quite reliable, with the Cronbach's alpha for the subscales ranging from .67 to .94 using normally developing children. The Cronbach's alpha as used in this sample were: activity level, .87; attentional focusing, .65; impulsivity, .26; inhibitory control, .84; perceptual sensitivity, .79; low intensity pleasure, .73. This scale was chosen because the dimensions address characteristics described in the literature on temperament for children prenatally exposed to cocaine and other drugs. In particular, these dimensions are: activity level, attentional focus, impulsivity, inhibitory control, perceptual sensitivity, and low intensity pleasure. The total battery also includes: anger/frustration, approach, discomfort, fear, high intensity pleasure, sadness, shyness and laughter. The questionnaire contains 195 statements about the behavior of a child. The nonbiological mothers were asked if the statement was "true" or "untrue" of their foster or adopted child. The seven point scale ranged from extremely untrue to extremely true. For each dimension, a scale score between 1 and 7 was obtained. The nonbiological mother completed the Children's Behavior Questionnaire. A

copy of the questionnaire is attached in Appendix B.

To measure the nonbiological mother's parental attitude, the modified Parent-Attitude Survey (PAS: Hereford, 1963) was used. The survey consists of 40 questions, separated into four scales composed of 10 items:

I. Confidence - certainty toward role as parent

II. Acceptance - of child's behaviors and feelings

III. Understanding - communication between dyad

IV. Trust - parental ideal about child's rights

The survey uses a five point Likert scale ranging from strongly disagree to strongly agree. Internal consistency reliability coefficients for the total scale, r = .80; and for subscales: Confidence, r = .78, Acceptance, r = .68, Understanding, r = .86, and Trust, r = .84 (Hereford, 1963). These construct measures for parental attitude favor nurturance and support. This seemed an appropriate scale when taking into account the history of the child's early removal to foster care for issues of health and safety. This child would benefit from a nurturing and supportive relationship with a primary care provider. A copy of the survey is attached in Appendix B.

Early intervention was measured by a review of the child's medical chart to obtain the following data: <u>amount</u> of early intervention service, <u>quality</u> of that service. This measurement orientation is supported by research conducted at Stanford University under the title of the

Infant Health and Development Program (1990). This study was executed in 8 sites (combined medical center/education centers) across the United States. Nearly 1,000 babies (low-birth-weight and premature) were randomly assigned to be followed for 3 years with pediatric care only; or in an early intervention program that included pediatric care, home visits, bimonthly parent meetings, and a 5 day-a-week educational program for the children. The results indicated that at 3 years of age, the children in the early intervention program, increased in cognition by as much as 15 points as measured by the Stanford-Binet test of intelligence. To date, this has been the strongest evidence to support early intervention for young children at risk. Other data from this initial study continue to be analyzed and published (Blaire, Ramey, Hardin, 1991; Brooks-Gunn, Klebanov, Liaw, & Spiker, 1993; Guralnick, 1991; Spiker, Ferguson, & Brooks-Gunn, 1993). These data support early intervention that is frequent, of sufficient duration, and provided in a quality setting with identified goals and objectives for the child.

In the proposed study, amount of early intervention was measured by the number of hours of intervention received. The quality of early intervention service was assigned as follows:

-The Highest Quality: A state sponsored program in early intervention where each child has specific goals and

objectives. This type of program was given a value of "3".

-An Intermediate Quality: A funded enrichment program that may not necessarily have goals and objectives for the child but which serves to enhance the child's development through curriculum activities offered in group settings on a regular basis. This program was given a value of "2".

-Other Specialized Day Care: A program identified for the child by one of the child advocates (foster mother, pediatrician) which does not have a specific curriculum for children, but provides care at a basic level: safe, supportive, and social. This program was given a value of "1".

The means and standard deviations for all the variables selected in the study are found in Table 5.

Procedures

Subjects were tested at Emanuel Hospital and Health Center, Pediatric Development Program. It was the sole responsibility of the principal investigator to collect necessary data. The principal investigator was trained, tested for proficiency, and considered an expert in use of the TGMD. All children's data and associated names were coded by number to maintain anonymity. Only the principal investigator had access to the key which was entered into a computer and accessed with a code word.

Data collection was conducted at Emanuel Hospital and Health Center. Subjects entered the designated area at the

Table 5

Means and Standard Deviations for All Variables Considered for Predicting Fundamental Motor Skill

Activity	Impulsivity	Attention	Inhibit	Lw. Intense	Percep Sens.	Effort	Confidence	Understand'g	Acceptance	Trust	GMDQ	EI amt.	Log EI amt.	EI quality	EarlyMotor
3.85	4.31	4.44	3.69	5.46	4.75	18.35	29	42	41	36	109	784	6.67	3	90
6.54	6.62	3.11	2.46	5.62	5.42	16.60	39	33	43	28	151	720	6.58	2	69
5.62	4.00	3.11	3.00	3.69	3.00	12.80	31	33	38	32	142	806	6.69	3	74
6.92	5.00	2.67	2.85	4.54	2.92	12.97	30	38	43	32	94	676	6.52	3	77
3.75	3.58	5.44	5.85	5.77	5.92	22.98	28	32	26	22	148	2160	7.68	2	100
6.38	5.15	2.89	2.46	4.69	5.67	15.71	28	32	26	22	127	2160	7.68	3	
4.77	4.62	3.78	4.00	6.08	5.92	19.77	31	37	39	34	115	328	5.80	2	70
6.77	5.38	4.11	2.08	6.00	5.42	17.60	19	42	40	33	121	240	5.49	3	114
6.38	5.46	2.89	3.08	5.00	3.75	14.72	40	39	48	27	112	780	6.66	3	100
3.15	3.46	4.22	4.38	6.08	5.08	19.77	40	39	48	28	112	2141	7.67	3	87
5.38	6.00	2.33	3.85	4.46	4.58	15.22	44	42	44	33	124	564	6.34	3	50
5.00	4.62	4.67	5.23	6.31	5.17	21.37	39	43	39	36	112	48	3.91	3	115
6.08	5.17	3.00	4.00	5.15	4.45	16.61	37	36	34	22	115	2317	7.75	3	91
5.92	5.92	3.33	3.92	5.15	5.75	18.15	29	43	39	25	127	1152	7.06	3	76
5.23	5.77	4.22	4.15	5.77	4.83	18.98	30	39	34	32	124	0	0.69	0	103
6.62	6.08	2.89	2.54	3.92	4.00	13.35	41	50	46	40	124	92	4.54	3	105
5.00	5.08	3.78	3.38	5.92	6.58	19.66	36	42	42	32	127	417	6.04	3	90
5.85	4.42	2.33	4.45	5.23	3.50	15.52	38	42	42	32	91	384	5.96	3	50
4.00	3.46	4.22	4.83	5.77	4.50	19.32	27	42	43	37	124	0	0.69	0	97
3.67	3.08	5.11	5.09	6.23	3.50	19.93	45	44	37	35	121	579	6.36	3	69
4.38	3.54	5.78	6.55	6.46	5.55	24.33	46	44	38	35	145	0	0.69	0	89
4.31	3.92	4.67	5.92	6.46	5.73	22.77	46	45	37	37	145	6	2.08	3	94
4.69	4.83	3.67	4.00	5.38	5.82	18.87	39	33	46	34	121	1044	6.95	3	97
6.31	6.00	4.22	3.00	5.15	4.42	16.79	34	36	35	28	112	1080	6.99	3	108
3.92	3.83	3.44	3.85	6.15	4.08	17.53	34	36	35	28	97	1269	7.15	3	74
6.69	6.31	2.67	2.54	5.15	4.92	15.28	34	36	35	28	127	0	0.69	0	93
6.54	6.75	3.67	2.00	6.70	6.50	18.87	38	43	46	42	127	432	6.07	2	
6.62	5.62	3.67	1.23	4.92	4.17	13.99	16	36	39	43	109	0	0.69	0	91
M 5.37	4.93	3.73	3.73	5.47	4.85	17.78	34.57	39.25	39.39	31.89	121.54	720.68	5.29	2.32	86.65
SD 1.15	1.05	0.91	1.28	0.76	1.00	3.03	7.48	4.57	5.60	5.61	15.30	723.17	2.49	1.16	17.62

Key:

activity = activity level
attend = attentional focusing
impulse = impulsivity
inhibit = inhibitory control
lw. intense = low intensity pleasure
percep sens. = perceptual sensitivity
confidence = confidence
accept = acceptance
understand = understanding
trust = trust
ei amt = early intervention amount
ei quality = early intervention quality
effort = effortful control
GMDQ = gross motor development quotient
early motor = early gross motor score

hospital site accompanied by their nonbiological mother and sometimes the nonbiological father. When the child arrived at the clinic, the principal investigator explained the activities of the Test of Gross Motor Development and asked if they wanted to participate. Although the children were sometimes shy, all children participated fully in the study with the exception of one child. This child had just turned 3 years of age and had been diagnosed with a motor delay. Since the TGMD is valid beginning at age 3, it was believed that the test was too difficult for him at this time. Prior to participation, all children received information that a toy would be given to them for coming to the clinic. The implication was that whether or not they participated, the toy was theirs. Standardized procedures outlined in the TGMD manual (Ulrich, 1985) were used. The child's right to refuse to participate was honored.

The nonbiological mother filled out the Children's Behavior Questionnaire, and the Parent-Attitude Scale in their home prior to attending the gross motor assessment session at the hospital. A letter regarding the summary of early intervention services the child had received was sent to the nonbiological mother in order to confirm the data and seek additional information that was needed.

Research Design

This investigation was an exploratory analysis of the factors contributing to the performance of fundamental motor

skills in young children ages 3, 4, 5 and 6 years prenatally exposed to cocaine/polydrugs. The person-process-context model of Bronfenbrenner and Crouter (1983) was employed (Figure 1). Variables identified for this model were presented in Chapter 2.

Statistical Analysis

To examine the predicted fundamental motor skill of children prenatally exposed to cocaine and other drugs, multiple regression procedures were conducted (Pedhauzer, 1982). The statistical procedures were carried out with the program SAS (SAS Institute, 1995).

CHAPTER 4

RESULTS AND DISCUSSION

This exploratory study examined the selected variables contributing to the relationship between prenatal drug exposure and fundamental motor skill in male and female children ages 3, 4, 5 and 6 years. Utilizing an ecological theory of child development (Bronfenbrenner & Crouter, 1983), the focus was on the child within a natural life setting: person, process, context. The fundamental motor skill was examined in the context of 1) prenatal exposure to cocaine/polydrugs, and 2) the child's primary care provision in either foster care or an adoptive home. The processes examined were the parental attitude of the nonbiological mother, and the early intervention service received by the child. The person component of the model was the temperament of the child. The questions of interest were answered by analyzing the association among selected variables and their contribution to the variability in fundamental motor skill performance.

This chapter is divided into the following sections: an explanation of the multiple regression procedures used to identify the model fit for fundamental motor skill; a review of each hypotheses in light of the statistical analysis of the data; an interpretation of the 3-way interactions; explanation of trends to illustrate the 3-way interactions, and speculation regarding the trends. A discussion section

follows which includes: the contribution this study makes in reference to the work of others; and an exploration of the theoretical and practical implications that can be drawn from this study.

Multiple Regression Procedures

Multiple regression procedures were performed to determine the extent to which the independent variables made a contribution to the explanation of the variation of fundamental motor skill in young children prenatally exposed to cocaine/polydrugs. The variables which model fundamental motor skill are described by three groups: temperament, parenting, and early intervention. Temperament was measured by the Children's Behavior Questionnaire (Derryberry & Rothbart, 1984; Rothbart, 1981, 1986). This scale has 13 dimensions of which 4 were initially chosen to analyze in relationship to fundamental motor skill: activity level, inhibitory control, attentional focusing, and impulsivity. Later temperament data were collapsed under the one term effortful control which is the sum of: inhibitory control, attentional focusing, low intensity pleasure, and perceptual sensitivity. The Cronbach's alpha as used in this sample were: activity level, .87; attentional focusing, .65; impulsivity, .26; inhibitory control, .84; perceptual sensitivity, .79; and low intensity pleasure, .73. Parenting was measured by: understanding, acceptance, trust, and confidence (Hereford, 1963). Early intervention was

measured by the amount and quality of early intervention service. The log of early intervention amount was eventually used to account for the wide variation from 0 to >2,000 hours. Table 6 lists the independent variables.

Analysis of the data began with a visual examination of the variables within each group. First, scatterplot matrices were created to plot and visualize the relationship between each pair of independent variables. Strength of associations between variables was quantified by computing the correlation statistics for each pair of variables. These descriptive measures helped to avoid multicollinarity between independent variables in the variable selection process, and to identify variables which may be important predictors of fundamental motor skill. Individual scatterplots of some pairs of independent variables were examined to assist with the visualization and assessment of the strength of the correlations. These plots provided visual evidence that strong associations existed within each group of variables. Correlations were calculated (Table 7).

The preceding protocol provided a subset of the original set of independent variables to be considered for entry into the regression model. Each of the three groups of variables (temperament, parenting and early intervention) was represented after this initial attempt to reduce the set of variables. After viewing the correlations and scatterplots the following variables were chosen to enter

Table 6

Summary of Independent Variables Predicting Fundamental Motor Skill Performance

1) Child Temperament:	
activity level	
inhibitory control	
attentional focusing	
impulsivity	
effortful control:	inhibitory control
	attentional focusing
	low intensity pleasure
	perceptual sensitivity
2) Parenting Attitude	
confidence	
understanding	
acceptance	
trust	
3) Early Intervention	
early intervention amount	
early intervention quality	
log early intervention amount	

Table 7

Correlations Among Variables Selected for Regression

Temperament

	attend	impulse	active	inhibit
attend	1.0	-0.05	-0.63	0.62
impulse	-0.54	1.0	0.80	-0.71
active	-0.63	0.80	1.0	-0.76
inhibit	-0.62	-0.71	-0.76	1.0

Parental Attitude

	confdse	accept	underst	trust
confdse	1.0	0.30	0.37	0.04
accept	0.30	1.0	0.43	0.49
underst	0.37	0.43	1.0	0.57
trust	0.04	0.49	0.57	1.0

Early Intervention

	lgeiamt	eiqual
lgeiamt	1.0	-0.09
eiqual	-0.09	1.0

key:
attend = attentional focusing
impulse = impulsivity
active = activity level
inhibit = inhibitory control
confdse = confidence
accept = acceptance
underst = understanding
trust = trust

lgeiamt = log early intervention amount

into the regression model. Temperament was represented by inhibitory control and attentional focusing. Parenting was represented by either understanding and trust, or confidence and acceptance. Early intervention was represented by the log of early intervention amount.

The inclusion of the previously mentioned four temperament variables of activity, impulsivity, inhibitory control and attentional focusing produced a model fit that was difficult to interpret. This was due to the presence of fourth order interaction terms and the small sample size of 28. Thus, a decision was made to collapse the temperament data into the theory driven concept of effortful control as reported by Rothbart and her colleagues (Rothbart, Ahadi & Hershey, 1994; Rothbart, Ziaie & O'Boyle, 1992). Effortful control is the sum score of 4 dimensions found in the Children's Behavior Questionnaire: inhibitory control, attentional focusing, perceptual sensitivity, and low intensity pleasure. These four dimensions grouped together as a factor (1 of 3) that capture the vagrance in the Children's Behavioral Questionnaire. Rothbart and colleagues (Ahadi, Rothbart & Ye, 1993) reported "effortful control" which adequately described a dimension of temperament in a cross-cultural study with over 1,000 children. Two of the dimensions of temperament found in effortful control, inhibitory control and attentional focusing, have been described in the review of literature

for this study. The research evidence associated with inhibitory control and attentional focusing can also be utilized to support the other two dimensions of effortful control, namely perceptual sensitivity and low intensity pleasure. Perceptual sensitivity is described in the definitions of the Children's Behavior Questionnaire as the ability to detect slight, low intensity stimuli from the environment. Low intensity pleasure is defined as the amount of pleasure from low stimulus including the rate, intensity, complexity, novelty and incongruity. There appears to be a relationship between low intensity pleasure and perceptual sensitivity regarding the reports of easily overstimulated babies (Griffith, 1991), and the later findings of low thresholds for overstimulation in 3 year olds (Chasnoff, 1992).

The parenting group was represented by the variables understanding and acceptance based on an earlier investigation of the correlation between understanding and trust to be $r = .57$ and the correlation between acceptance and confidence to be $r = .49$. A full regression model with fourth order interactions using understanding and acceptance was considered. A similar model was generated using confidence and trust as the parenting variables in place of the variables understanding and acceptance. There was little change in the estimated coefficients for the parenting variable, and in the error of the model. A

decision was made, therefore, to apply understanding and acceptance in the model instead of confidence and trust. The primary rationale for this decision was related to the fact that all the children in this study were removed from the care of their drug abusing mother. One can argue that the child's new foster mother would need to be understanding of the child's past and willing to accept the child into her home for care. Through additional regression analysis, it became clear that models which included understanding and confidence provided the best fit. This seemed defensible given Bandura's self-efficacy theory and the notion of self-fulfilling prophecy (1962): a parent who believes herself to be understanding and confident will act accordingly. Thus, a child will derive positive benefit from being understood by a confident parent.

Early intervention amount was chosen over quality of early intervention for multiple reasons but primarily because of the more exact measure given by the tally of hours in intervention (amount) instead of the subjective assigned value of 1-2-3 for quality of intervention. Quality did not discriminate well since more than 98% of the children received a high quality of intervention (3). A log transformation was performed on early intervention amount to adjust for the extreme range of scores (0 to > 2,000 hours). Also, the use of one variable representing early intervention increased the degree of freedom for the error

by 1. Overall, with so few subjects, limiting the number of variables was necessary. The correlations for all variables considered for the regression model are seen in Table 8.

Inclusion of these variables into a regression model resulted in a large number of terms, including main effects up to fourth order interactions, which could explain the variation of fundamental motor skill. The extra sums of square technique was used to compare a full model to a reduced model, which corresponded to the hypotheses for this study. Those variables not found to be making a statistically significant contribution with respect to the prediction of motor skill were discarded.

The subset of independent variables considered for a regression model were: the main effects of effortful control, understanding, confidence, and the log of early intervention amount; and, all of the possible interaction terms. The extra sums of squares technique was again used to compare a full model to a reduced model corresponding to the hypotheses for this study.

There was suggestive but inconclusive evidence that fundamental motor skill represented by the gross motor development quotient score (Ulrich, 1985) for this set of children can be associated with effortful control, understanding, confidence, log of early intervention amount, and some of their interaction terms [F (7, 20) = 2.24, p = 0.0740]. This model is given by the regression fit

Table 8

Correlations for All Variables Considered for the Regression Model Predicting Fundamental Motor Skill

	attend	impulse	inhibit	confidence	accept	understand	trust	log ei amt	ei quality	effort	active
attend	1.00										
impulse	-0.54	1.00									
inhibit	0.62	-0.71	1.00								
confidence	0.07	-0.1	0.50	1.00							
accept	-0.26	0.19	-0.20	0.29	1.00						
understand	0.18	-0.02	0.23	0.37	0.43	1.00					
trust	0.19	0.05	-0.11	0.04	0.49	0.57	1.00				
log ei amt	-0.21	0.01	-0.26	-0.36	-0.19	-0.64	-0.67	1.00			
ei quality	-0.25	-0.07	-0.03	0.26	0.16	0.07	-0.26	-0.09	1.00		
effort	0.84	-0.47	0.77	0.28	-0.21	0.21	0.04	-0.27	-0.17	1.00	
active	-0.63	0.80	-0.76	-0.27	0.07	-0.10	-0.023	-0.015	-0.0087	-0.69	1.00

Key:

attend = attentional focusing
impulse = impulsivity
inhibit = inhibitory control
confidence = confidence
accept = acceptance
understand = understanding
trust = trust
log ei amt = log early intervention amount
ei quality = early intervention quality
effort = effortful control
active = activity level

predicting GMDQ as seen in Table 9.

The percentage of total variation explained by the variables in the model was 43% (power = .8; alpha = .05; mean square error = 13.4). A scatterplot of the residuals against the predicted values of GMDQ was created and showed no evidence of departure from the normal model assumptions. The means and standard deviations for all variables in the final regression model are found in Table 10.

Hypotheses

Introduction

Within the model fit for these data, the presence of higher order interaction terms precluded all discussion of the direct main effects of a variable without considering the interrelationships among the independent variables that explain GMDQ. Since the 3-way interactions were significant, the main effects were kept in the model regardless of the strength of significance (p-value). If an examination of the main effects was made, it could have lead to an inappropriate and misleading conclusion. For in doing so, the investigation would have focused on the individual variables of the regression fit and would have ignored the important structure that shapes the proper interpretation of specific interactions in the higher order. For example, to describe the statistical insignificance of the main effect of effortful control is to ignore the important contribution it makes to the significant 3-way

Table 9

Model for Regression Fit Predicting Fundamental Motor Skill

	Estimated Coefficients	p-value	SE
Effortful Control	-5.79	0.155	4.05
Understanding	4.31	0.167	3.00
Confidence	2.09	0.049	1.00
Log EI Amount	43.12	0.039	19.58
Log EI Amount x Understanding	-1.71	0.038	.77
Effortful Control x Log EI Amount x Understanding	0.047	0.055	.02
Effortful Control x Log EI Amount x Confidence	-0.018	0.071	.01

Table 10

Means and Standard Deviations of Variables for Final Regression Model

Effort	Log EI amt.	Confidence	Understand	GMDQ
18.35	6.67	29	42	109
16.60	6.58	39	33	151
12.80	6.69	31	33	142
12.97	6.52	30	38	94
22.98	7.68	28	32	148
15.71	7.68	28	32	127
19.77	5.80	31	37	115
17.60	5.49	19	42	121
14.72	6.66	40	39	112
19.77	7.67	40	39	112
15.22	6.34	44	42	124
21.37	3.91	39	43	112
16.61	7.75	37	36	115
18.15	7.06	29	43	127
18.98	0.69	30	39	124
13.35	4.54	41	50	124
19.66	6.04	36	42	127
15.52	5.96	38	42	91
19.32	0.69	27	42	124
19.93	6.36	45	44	121
24.33	0.69	46	44	145
22.77	2.08	46	45	145
18.87	6.95	39	33	121
16.79	6.99	34	36	112
17.53	7.15	34	36	97
15.28	0.69	34	36	127
18.87	6.07	38	43	127
13.99	0.69	16	36	109
M 17.78	**5.29**	**34.57**	**39.25**	**121.54**
SD 3.03	**2.49**	**7.48**	**4.57**	**15.30**

Key:
Effort = Effortful Control
Log EI amt = Log Early Intervention Amount
Confidence = Parental Confidence
Understand = Parental Understanding
GMDQ = Gross Motor Development Quotient

interactions. Therefore, in each explanation of an hypothesis addressing a main effect, the following will be reported: the strength of the relationship (p-value), and the variables excluded when only the main effect is considered. The discussion of the main effects will be brief and the focus will be on the interpretation of the 3-way interactions.

Hypothesis 1: Temperament will be associated with children's motor skill.

The effortful control coefficient (-5.79) is not statistically significant ($p = 0.155$). There is no interpretable direct effect of effortful control on motor skill. Rather, it is in the interaction terms that the interpretation and effect of effortful control on motor skill is exhibited. Effortful control appears to be a prime component of the 3-way interactions since it appears in each of the 3-way interactions, and therefore makes an indirect effect on GMDQ. Any direct explanation of the relationship between temperament and motor skill would ignore the interdependence of early intervention, confidence and understanding.

Hypothesis 2: Parenting will be associated with children's motor skill.

There are two variables in the model fit that represent parenting: confidence and understanding. The confidence coefficient (2.09) has a strong to moderate statistical

significance (p = 0.049). On the other hand, the direct effect of the understanding coefficient (4.31) is not statistically significant (p = 0.167). It is in the 2-way interaction that understanding has a significant indirect effect on GMDQ. And, both confidence and understanding have a strong indirect effect on GMDQ through the 3-way interactions. Any linear explanation of confidence and understanding on motor skill would ignore the interdependence of early intervention and temperament.

Hypothesis 3: Early intervention will be associated with children's motor skill.

The early intervention coefficient (43.12) has a strong statistical significance (p = 0.039). An explanation of the main effect of early intervention's relationship to GMDQ would ignore understanding, confidence and the temperament variable.

Hypothesis 4: The interaction of parenting and early intervention will be associated with children's motor skill.

The coefficient for the interaction of the parenting variable understanding and the log of early intervention amount (-1.71) has a strong to moderate statistical significance (p = 0.0368). The extra sum of squares technique was calculated for the influence of this 2-way interaction in the full model. The extra sum of squares test without the influence of the 2-way interaction of early

intervention x understanding was significant [F (20,1) = 5.0516, <.05 p <.02). Thus, the 2-way interaction was retained in the model. The interaction of understanding and log early intervention amount makes a unique and significant contribution to the prediction of motor skill that is explained in the third order interactions.

Hypothesis 5: The interaction of parenting and temperament will be associated with children's motor skill.

The model fit does not include a 2-way interaction of the effect of parenting and effortful control on motor skill. There is suggestive evidence in the 3-way interactions that the relationship between parenting and effortful control depends on the level of early intervention.

Hypothesis 6: The interaction among temperament, parenting and early intervention will be associated with children's motor skill.

The interaction of temperament, parenting and early intervention is expressed in the 3-way interaction: effortful control x log of early intervention amount x understanding (ELU) with the estimated coefficient of 0.047 having a strong to moderate statistical significance (p = 0.055); and effortful control x log early intervention amount x confidence (ELC) with a coefficient of -0.018 having a moderate statistical significance (p = 0.078).

The extra sum of squares technique was applied to

full model. The extra sum of squares test obtained when the term effortful control x log early intervention amount x confidence (ELC) was excluded from the full model resulted in suggestive evidence of an interdependence among these variables that explains the variation in GMDQ scores [F (20,1) = 3.64], .05 < p <.10]. Similarly, exclusion of the third order term temperament x early intervention x understanding (ELU) resulted in a comparison between models that provided evidence to support the inclusion of this term in the final model [F (20,1) = 4.09, .05 < p <.10]. Therefore, these two third order interaction terms made a statistically significant contribution to the explanation of GMDQ and were retained in the model.

Before moving on to further details of the results of the 3-way interactions, Hypothesis 7 is stated and then the discussion of the 3-way interactions will continue:

Hypothesis 7: There is a relationship between the early motor score and the motor score at ages 3, 4, 5, and 6 years.

Early motor scores acted as a control variable by providing evidence of delay or non-delay of motor skill. Therefore, a measure of later development can be correlated with early motor score. Any change in the status of delay or non-delay could then be explored in association with the variables in the model (temperament, parenting, early intervention). Early motor score did not predict later

variables in the model (temperament, parenting, early intervention). Early motor score did not predict later motor score, r = .10. More importantly, with this set of children, early delay in gross motor skill did not result in gross motor delay in ages 3 to 6 years as measured by the Test of Gross Motor Development (Ulrich, 1985).

Interpretation of the 3-Way Interactions

The third order interactions have depth which sets their visualization apart from a more easily understood visualization of a linear regression model of either the main effects or the second order interaction. The presence of higher order interaction terms (3-way interactions) precludes a direct discussion of the main effects and the 2-way interaction without considering the interdependence among the other variables that explain GMDQ. In the 3-way interactions, the depth of all simultaneous data points are not easily visualized. In essence, the 2 dimensional space of a graph creates a limiting framework for 3 dimensional space. Nevertheless, a graphical display can be used to understand 3-way interactions, so such a display was created for the present data set.

The display constructed is a scatterplot matrix. There are nine cells in each scatterplot matrix. Each cell is comprised of a plot of GMDQ by log of early intervention. Log of early intervention was chosen since it is common to both of the third order interactions. The data points

displayed in each plot were the result of a systematic division of each of the other two variables involved in the third order interaction into three groups, so that each of the nine cells would contain two or three data points. The collection of nine scatterplots allows for a visualization in the change in GMDQ scores for different levels of the 3-way interaction: effortful control, log of early intervention amount, and understanding (ELU); and effortful control, log of early intervention amount, and confidence (ELC). In this way, there is organization given to the variables predicting GMDQ and the trends in the data set can be observed.

Trends to Illustrate the 3-Way Interactions

The 3-way interactions are represented by: effortful control x log early intervention amount x understanding (ELU); and, effortful control x log early intervention amount x confidence (ELC). The discussion of trends in the 3-way interactions are organized by trend (1 and 2) and followed by a discussion of the predicted GMDQ scores given low levels of early intervention and high levels of early intervention. Within each trend, three relationships are identified and discussed regarding the levels of temperament and parenting attitude. Concluding this section is a speculative discussion regarding the trends and individual cells of interest.

Effortful Control x Log Early Intervention Amount x Understanding (ELU)

Trend 1 for ELU

The model has different trends across the level of effortful control and parental understanding. That is, the relationship between predicted GMDQ and the log of early intervention changes for different combinations of effortful control and parental understanding (Figure 2). Hence the 3-way interaction.

Relationship in (A):

1. The trend is <u>positive</u> when (A):

   effort < 16.5 and understanding < 36.5.

Low Levels of Early Intervention:

The model would predict GMDQ scores in average to above average range for children receiving low levels of early intervention and having low temperamental control and parental understanding.

High Levels of Early Intervention:

As we move across the levels of early intervention in (A), the relationship of predicted GMDQ to early intervention is positive: the GMDQ scores rise as early intervention increases. The predicted GMDQ scores are in the above average range for the child despite low temperamental control and low parental understanding. While holding temperamental control and parent understanding constant at low levels, it appears that early intervention

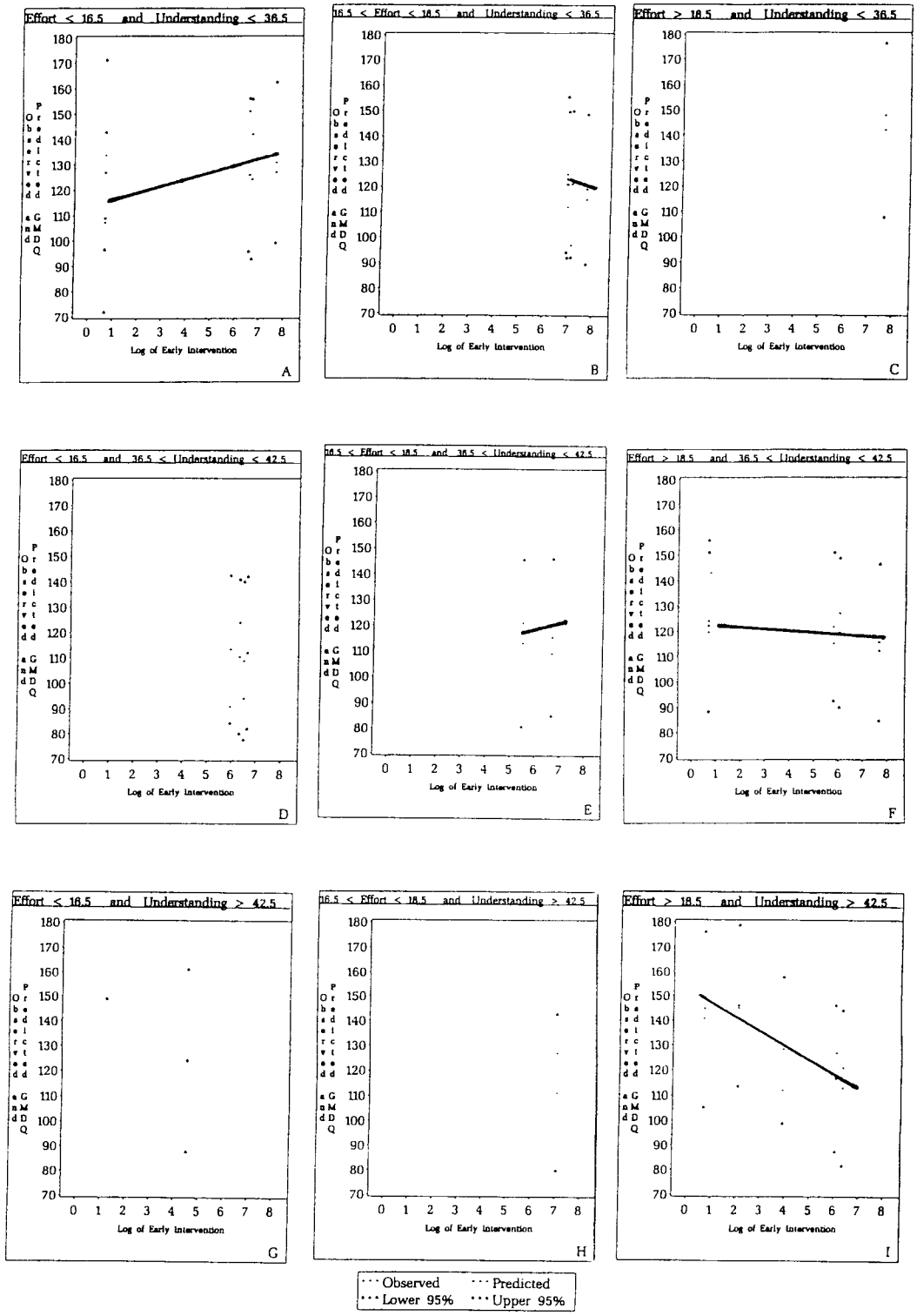

Figure 2. Graph of the 3-way interaction of effortful control, log of early intervention amount, and understanding (ELU).

has a mediating effect for children needing higher levels of early intervention.

Relationship of (A) to (B):

2. The trend becomes slightly negative as effort increases from (A) to (B) and understanding is fixed:

   < 16.5 effort < 18.5 and understanding <36.5.

As the relationship moves across the level of temperament (effort) and understanding remains fixed (A) to (B), the relationship between the predicted GMDQ and early intervention is slightly negative.

High Levels of Early Intervention:

There are no children at low levels of early intervention in this cell (B); instead, children with greater delays are represented. The predicted GMDQ scores begin to descend slightly from the above-average range for a child with moderate temperamental control and low parental understanding. Despite a moderate amount of temperamental control it appears that a child who needs greater intervention performs well in motor skill but runs a risk of lower scores with a less understanding mother.

Relationship of (E):

3. The trend remains positive with a simultaneous increase in understanding (E).

   <16.5 effort <18.5 and <36.5 understanding <42.5.

Here temperament remains fixed in the moderate range and the level of parent understanding increases to the moderate range from (B) to (C).

High Levels of Early Intervention:

There are no children in the low levels of early intervention represented in this cell (B). Instead, this cell contains children who need greater amounts of early intervention. The predicted GMDQ scores are in the average range and rising for children with greater needs for early intervention with moderate temperamental control and parental understanding. Thus, holding temperamental control in the moderate range but increasing parental understanding to the moderate range, a trend upward in GMDQ performance is predicted. It appears that a moderate amount of parental understanding has a positive mediating effect on GMDQ when greater amounts of early intervention service are needed for a child with moderate temperamental control. The difference between cell (B) and (E) is the increased level of parental understanding.

Trend 2 for ELU:

The second trend in this 3-way interaction moves from moderate to high levels of temperamental control and parental understanding.

Relationship (E) to (F):

1. The trend is <u>positive</u> when (E):

   <16.5 effort <18.5 and 36.5 < understanding <42.5.

2. The relationship becomes slightly negative as effort increases (E) to (F) and understanding is fixed:

effort > 18.5 and 36.5 < understanding < 42.5.

Low Levels of Early Intervention:

The predicted GMDQ scores have risen from cell (E) where they were in the solid average range, to cell (F) where they are primarily in the above average range. The predicted GMDQ is above-average for children at low levels of intervention who have the greatest amount of temperamental control and moderate amounts of parental understanding (F).

High Levels of Early Intervention

The child with high temperamental control and moderate parental understanding runs the risk of a trend toward lower GMDQ scores (above-average to average or lower) when needing higher levels of early intervention. Thus temperamental control seems to mediate GMDQ scores overall, but the trend is slightly negative. As we move into the highest level of temperamental control and parental understanding (I), a dramatic negative trend occurs.

Relationship (I):

A dramatic relationship between GMDQ and log early intervention is seen as parental understanding is increased to the highest level while holding temperamental control at the highest level (I).

3. The trend is dramatically negative with a simultaneous increase in understanding (I): effort > 18.5 and understanding > 42.5.

Low Level of Early Intervention:

The predicted GMDQ is above average to superior for children receiving less intervention while having the greatest amount of temperamental control and greatest amount of parental understanding (I). A very understanding mother appears to mediate higher GMDQ scores when the child has good control. This trend dramatically reverses itself as log of early intervention increases.

Higher Level of Early Intervention:

As these children receive greater early intervention services, the predicted GMDQ falls from above average to average. The dramatic negative trend in this cell is influenced by the high scores for predicted GMDQ at low levels of early intervention. But the trend, though negative, remains in the above-average range in predicted GMDQ suggesting that greater control and a very understanding mother interact to maintain the child's motor performance within that range.

Effortful Control x Log Early Intervention Amount x Confidence (ELC)

Trend 1 for ELC

Again, the model has different trends as we move across the level of effortful control and parental attitude

represented by confidence in this 3-way interaction. That is, the relationship between predicted GMDQ and the log of early intervention changes for different combinations of temperament (effort) and parental confidence and is evidence of a 3-way interaction (Figure 3).

Relationship (A):

1. The trend is positive when (A):

   effort < 16.5 and confidence < 31.5.

Low Levels of Early Intervention

The model would predict GMDQ scores in the average range for children receiving less intervention who have a low amount of temperamental control and parental confidence. As early intervention increases, the relationship of predicted GMDQ to early intervention is positive: the GMDQ scores rises from average to superior range.

High Levels of Early Intervention

Predicted GMDQ is in a range of average to superior for children receiving high amounts of early intervention who have low levels of temperamental control and parental confidence. It appears that early intervention is a strong mediator for positive outcome for predicted GMDQ in this situation.

Relationship (A) to (B):

2. The trend becomes slightly negative as effort increases from (A) to (B) and confidence is fixed:

   16.5 < effort < 18.5 and confidence < 31.5

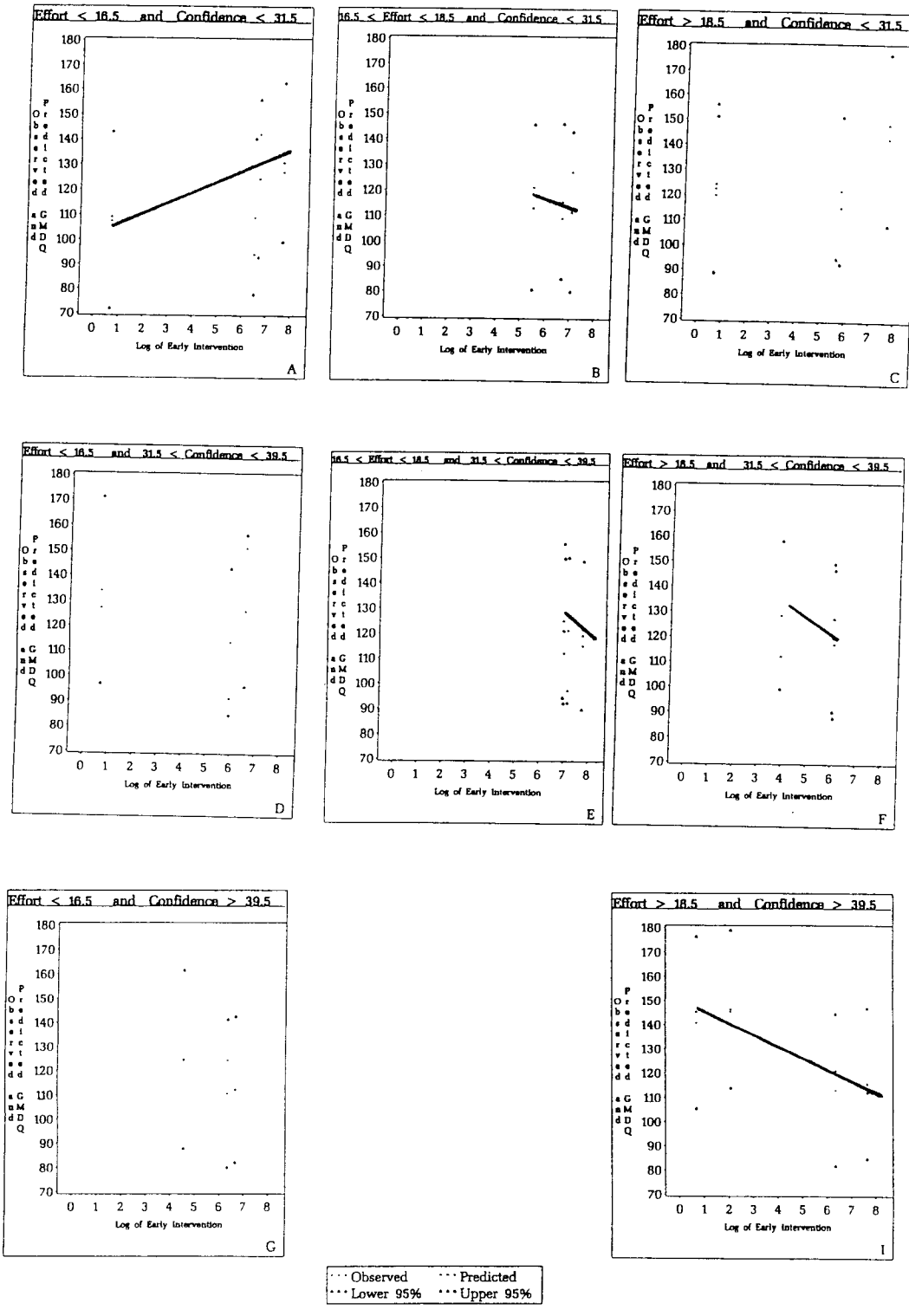

Figure 3. Graph of the 3-way interaction of effortful control, log of early intervention amount, and confidence (ELC).

In this relationship (A) to (B), the level of temperamental control (effort) increases to the moderate range as confidence remains fixed at a low level. The relationship between predicted GMDQ and log early intervention is slightly negative.

High Levels of Early Intervention:

The trend in (B) focuses on those children who required higher amounts of early intervention service since there are not children represented under low early intervention in this cell. The predicted GMDQ scores begin to decline slightly, although remaining in the average range, for children receiving high levels of early intervention who have a moderate amount of temperamental control with low parental confidence. It appears with the presence of low parental confidence, an increase of temperamental control to a moderate level does not predict better scores in GMDQ for these children: the scores remain in the average range with the risk of a decline. What would occur with a moderate level of parental confidence for these children?

Relationship (E):

3. The trend <u>is more strongly negative</u> with a simultaneous increase in confidence (E):

   $16.5 < \text{effort} < 18.5$ and $31.5 < \text{confidence} < 39.5$

The slight negative relationship is retained between predicted GMDQ and early intervention when temperamental

control (effort) remains in the moderate range and parental confidence increases to a moderate level (E).

High Levels of Early Intervention:

There are no children represented in the low levels of early intervention in this cell (E). Instead, this cell contains children who need greater amounts of early intervention. The predicted scores for GMDQ are in the above-average range and declining for children receiving high amounts of early intervention given moderate amounts of temperamental control and parental confidence. In general, increasing the amount of parental confidence to a moderate level boosts scores from (B) to an above-average range (E) but the trend is still toward a declining GMDQ score.

Trend 2 for ELC

The second trend described in this 3-way interaction represents the movement from moderate to highest level of temperamental control and parental confidence.

Relationships (E) and (F):

1. The trend is <u>slightly negative</u> when (E):

   16.5 < effort < 18.5 and < 31.5 confidence < 39.5

2. The trend <u>continues in a strong negative direction</u> as effort increases from (E) to (F) and confidence is fixed:

   effort >18.5 and <31.5 confidence <39.5

The negative relationship between predicted GMDQ and early intervention is retained despite increasing

temperamental control to a moderate level and retaining parental confidence at a moderate level ((E) to (F)).

High Levels of Early Intervention:

There are no children requiring low levels of early intervention in this cell (F): all received higher levels of intervention. The predicted GMDQ scores are in the above average range and falling into the average range as early intervention increases for children with the highest levels of temperamental control and moderate levels of parental confidence. Relationship (I):

3. The trend <u>is dramatically negative</u> with a simultaneous increase in confidence (I): effort > 18.5 and confidence > 39.5.

Low Levels of Early Intervention:

The dramatic negative trend in (I) is created by the presence of children in the lower levels of early intervention. Here predicted GMDQ scores are in the very-superior range for the child with the highest amount of temperament control and parental confidence.

High levels of Early Intervention:

The children who have received higher levels of early intervention are predicted to perform in the above average range of GMDQ score. This is representative of those children who have identified delays needing greater early intervention service.

Focusing on trends for the interaction of temperamental

control, early intervention and confidence, it is apparent that this interaction remains moderately influential in predicting GMDQ. With the exception of (A), the predicted scores for GMDQ are in a slight decline throughout the trends yet remain near average or above. Support for this moderate influence is also seen in the estimated coefficient -0.018 with a p-value of .071 for the interaction term of ELC.

Speculation Regarding Trends

Thus far, the interpretation of the 3-way interactions via trends has communicated the essence of the 3-way interactions as hypothesized. Before completing the discussion of the 3-way interactions, an additional description is made of individual cells. This was conducted first by looking at the extreme values of temperament and parental attitude followed by the middle range values. Speculation was made regarding the implications for the motor skill development. Both 3-way interactions are considered simultaneously for the extreme and middle range of the variables predicting GMDQ. In this section, a purposeful terminology shift occurs from scientific language to less sophisticated language. Children receiving low levels of intervention are referred to as "less delayed" while those receiving higher levels of intervention are described as children "more or greater delayed". The other language shift will be evident.

Viewing the Extremes:

Low: temperamental control, parental understanding & confidence

In the 3-way interactions, children with the least amount of temperamental control and the least amount of parental understanding or confidence have a predicted GMDQ in the following range:

-less delayed are in the average to above-average range (understanding) and average (confidence);

-and the greater delayed are in the above-average range (understanding) and average to superior (confidence).

One could speculate at this juncture that a child does not have as much going for them (low control & parental understanding/confidence) and needs a little help (intervention) and gets a little help, then they do okay: hence, motor skill in the average-above average. If on the other hand, they need a lot of help and they receive it; they do very well (average-superior). It appears that early intervention makes a significant impact for a child with low temperamental control in the absence of an understanding or confident mother. Could we say that the strongest deterrent to a better performance in GMDQ is the child's low level of control over arousal and modulation? If so, the high GMDQ scores could be attributed to the high quality of early intervention. That is, early intervention focuses the child for successful motor skill development by creating both a

curriculum and an environment for the low level of temperamental control and lack of parental understanding and confidence.

One could also speculate that the mother gains from early intervention. Based on the principle that reciprocity between the parent-child dyad influences development, early intervention services have always included the primary care provider. If the child who has a mild delay receives minimal amounts of early intervention, then the mother also receives less support. Hence, children with mothers low in understanding and confidence have a predicted GMDQ score in the average range. Conversely, children needing more intervention have a parent that receives more support. At low levels of parental understanding and confidence this support may have a minimal impact and be overruled by the mediating impact of direct early intervention service for the child. Nevertheless, the children in this cell show evidence of high GMDQ scores. From a practical standpoint, without parental support to coordinate and physically transport the child to the appropriate professional, the scores may be lower.

High: temperamental control, parental understanding & confidence

In the 3-way interactions, children with the greatest amount of temperamental control and the greatest amount of

parental understanding or confidence have a predicted GMDQ in the following range:

-less delayed are in the average to superior range (understanding) and average (confidence);

-and more delayed, for understanding predicted GMDQ scores are in the above-average to average range with a negative trend; and for confidence predicted GMDQ scores are above average with a positive trend.

Children in this situation could be described as potentially having the best of the best (high control & parental understanding/confidence). If they need a little help (intervention) and get a little help, then they do very well: hence, motor skill in the above average to superior. If on the other hand, they need a lot of help and they receive it, they do okay. Why just okay? In the presence of a very understanding or confident mother, given a child with high temperamental control, why are the motor scores hovering around average. Why are they not higher? Could it be that this child is less hampered by an inability to focus on the tasks and more hampered by another factor influencing the actual developmental delay? In the 3-way interaction with understanding, the child with the greatest delay appears to be hovering in an "at risk" range: the trend is in the above-average to average range and declining (negative). What is the cause(s)? Looking at the data, moving up one cell to (F) the same high level of

temperamental control, at high levels of intervention with moderate parental understanding, the predicted GMDQ score is a little higher. Possible factors influencing this may be illuminated by the degree of early delay and the length of residence in this home. These have not been accounted for in the present study. It certainly seems counter-intuitive to think that high levels of parental understanding and confidence would produce lower motor skills in children with greater delays. Children in this study are functioning at a solid average range. It may well be that developmental success for children who have greater temperamental control and greater developmental delay is determined by the support of a foster or adoptive mother with higher levels of confidence and understanding.

Viewing the Middle:

Middle: moderate control to high control,
moderate parent confidence & understanding

In the 3-way interactions, children moving from moderate to high temperamental control with a moderate amount of parental understanding or confidence have a predicted GMDQ in the following range:

-for understanding, less delayed children range from average to superior; the confidence interaction has no children in the cell for less delayed;

-and for understanding, the greater delayed child moved from above-average and ascending (moderate parent) to above

average and descending (high parent variable); and for confidence, the movement is similar from above-average and descending (moderate parent variable) to above-average and descending (high parent variable).

In both 3-way interactions, if the child has the highest level of temperamental control with either moderate or high levels of the parent variable, the trend is for above-average scores with a risk for descending motor performance. If a child has a lot of control and needs a lot of help (intervention) and gets it, the scores are predicted to be in the above-average to average range with a descending trends. This descent could be an "at risk" phenomena. The middle range child with moderate temperamental control could be an "at risk" sector of these children. Their continued maintenance in an acceptable range of motor development may be more fragile.

Relationship to the Work of Others

There is suggestive but inconclusive evidence for the hypothesis that fundamental motor performance in young children prenatally exposed to cocaine/polydrugs is predicted by the interaction of child temperament, parental attitude and the amount of early intervention service. The other hypotheses dealing with the main effects and a 2-way interaction in this study are considered in relationship to the higher order interactions: variability in the predicted outcome is explained in the presence of the 3-way

interactions rather than any one effect or lower order interaction.

The data collected for the present study confirm the conclusions of others. Doberczak et al. (1988), and Edmondson & Smith (1994;) described the first year of life as a catch-up period in development for infants prenatally exposed to cocaine/ polydrugs. This was evident in the present study when tracking early intervention service. Through this tracking it was noted that some of the children (38%) had a motor delay at an early age. During the later part of infancy and into the early childhood years, the motor skills were within the range of normal. Similar to the work of others, the current study also found overwhelming evidence for normal development in early childhood for young children prenatally exposed to cocaine/polydrugs. At 24 months, Chasnoff and colleagues (1992) found no difference for children exposed to cocaine/polydrugs compared to controls for both the Mental Developmental Index (MDI) and the Psychomotor Developmental Index (PDI) of the Bayley Scales of Infant Development. When this cohort reached 36 months of age, intelligence was within normal range (Azuma, Griffith & Chasnoff, 1993). Hawley et al. (1995) found no difference in cognitive development between young children prenatally exposed to cocaine/polydrugs and a control group.

In the current study, the test results for gross motor function were not only within normal range, but were unusually high for a group of children. The average score for the Test of Gross Motor Development (Ulrich, 1985) is from 90 to 100 (Table 3). The mean average score for the participants in this study was 121.54 which is in the superior range (Table 2). This is acknowledged to be high. Two explanations for this unusually high average are that: 1) all the children in this data set who were recommended to receive early intervention service received it; and 2) the testing for gross motor skill was conducted in a one-on-one clinical setting. It may be that the children's performance would not be as high: 1) if a child needed early intervention for developmental delay and did not receive it; or 2) performance was measured in a distracting physical environment such as a large gymnasium or in the presence of other children. The high motor scores herein may be a result of optimal conditions for gross motor performance: access to appropriate early intervention service.

Few studies of children prenatally exposed to cocaine/ polydrugs have used multivariate data. The present study included multivariate data. The work of Azuma and Chasnoff (1993) made a major contribution using a path analysis. They identified the quality of home environment as a predictor of intelligence: high quality home environment correlated with high intelligence quotient. The present

study provides evidence for predicting fundamental motor skill given levels of parental understanding, confidence, amount of early intervention service, and child temperamental control. Interestingly in this study, 75% of the families are minority status (African-American 61%; Hispanic 14%). These families as a group are functioning at a high level of child care as exemplified by facilitating appropriate access to early intervention services, and on the parent measure of understanding and confidence. This finding is important to communicate in order to balance negative bias toward minority families and care of children prenatally exposed to cocaine/polydrugs.

The present study takes a closer look at the impact of the parental attitude on raising a child prenatally exposed to cocaine/polydrugs by directly assessing the parent. Other studies pointed to complications in the child-mother dyad via an assessment of the child. Rodning et al. (1991) reported development within the low normal range with a greater percentage of insecure attachment to the biological mother. In 1994, Beckwith et al., reported less positive social interactions in play behavior between the primary care provider and the toddler exposed to polydrug substance abuse. The present study added another dimension to the knowledge of the child-mother dyad. Results were far less negative within the context of the 3-way interactions: children performed in the average and above range in gross

motor function despite wide variability in parental understanding and confidence.

Few studies have been designed to assess the status and outcome of early intervention for children prenatally cocaine/polydrug exposed. The current study focused on the amount of early intervention the child received. Black et al. (1994) studied the impact of a home intervention program for biological mothers raising their child while using drugs. While differences were found in the reciprocity of the mother-child dyad, no statistical differences were found between treatment group and control group. The children were developing within the normal range. The lack of change prompted the researchers to conclude that a more intense center-based program would have more impact. The current study provides some evidence to support this conclusion. Participants predominately received their early intervention away from the home setting while in the care of a non-drug abusing mother. One could argue that assessing parental understanding and confidence is to assess qualities that would impact on the reciprocity of the mother-child dyad. Given this assumption, the developmental outcome in motor skill in the present study was very positive given early intervention with mothers at various levels of understanding and confidence.

Before leaving a discussion of early intervention, it is important to note that the early large scale studies

conducted on the developmental outcome of children prenatally exposed to cocaine/polydrugs were implemented while both mother and child received intervention from a multidisciplinary clinical team (Azuma & Chasnoff, 1993; Chasnoff et al., 1991). The researchers readily admitted to the bias in research findings toward children and mothers who had received substantial intervention. The outcome was in the low average range and their fear was that the situation for these children was much worse outside this intense arena of care and support. The current study adds another dimension to their findings and concerns. That is, the study's population did not receive obstetrical care. Intervention began initially in foster care and continued into adoptive care settings. Given this, outcome in motor skill was average and above. Thus the postnatal environment was optimized for positive developmental outcome.

Anecdotal reports of difficulty with self-regulation (Chasnoff et al., 1991) as well as quantitative data on difficulty in sustained attention (Azuma & Chasnoff, 1993) have been cited as impeding performance on tests of intelligence and motor skill. The current study noted difficulties with attention across the age span of 3 to 6 years. This was particularly evident at the younger ages. The Test of Gross Motor Development used in this study was chosen for its short administrative time: 15 minutes for a cooperative child. For many of the children, a longer test

would have taxed their ability to attend. The principal investigator for this study had in excess of 10 clinical years working with children with low thresholds for attention. This experience facilitated a positive child participation given potential problems with attending to the gross motor test.

Finally, there is a debate as to whether these children are truly impacted by their fetal exposure to cocaine/polydrugs or more by their postnatal environment. A few examples are cited here that underscore the debate.

One of the adoptive mothers in our study commented, "I just want him to be a good citizen". As with many of the mothers in the study, this mother began foster care with a baby. As it became more apparent that the child would not return to the biological mother, she and her husband adopted the child. Subsequently they adopted another foster child also prenatally exposed. Now at age 5, both were extremely impulsive, had received extensive early intervention, and were performing in the average range in motor skills. At testing, they were clean, well-nourished, happy and the parent-child interaction was very positive.

A contrasting picture is represented by Mr. Carl Upchurch (1995) during a lecture delivered for the Chautauqua Institute that described his early life in the ghettos of Philadelphia. Born to a mother abusing drugs, Mr. Upchurch recounted that at age 3 he slept under a rat-

infested sink on a mattress with maggots while he tried to hide from the roaches crawling over him. He regularly witnessed sexual activity, needles in arms, and the stabbing of family members by other family members. In response to current conservative political thinking, he ironically asked his audience, "...[in] what portion of that development should I have known that I shouldn't have been participating?" He left school at age 9, became intimately involved with the criminal life and was incarcerated for years on charges of armed robbery. Born in 1950, help was not available in this deplorable situation for Mr. Upchurch and his mother. Fortunately, Mr. Upchurch began to find a way out of the criminal life while in prison. That route led him to a college education and the eventual founding of the Council for Urban Peace and Justice whose aim it is to work with inner city gangs.

Mr. Upchurch's description of early life is much like what could be imagined with the study participants. One chart described the delivery of a baby girl on the floor of a crack house to a woman who did not know she was pregnant. The woman and her boyfriend wrapped the premature infant in a blanket and brought the cold bundle to the hospital emergency room. After failed attempts by her drug abusing mother to care for her, this little girl was placed in foster care. After three foster placements, she was adopted at age 3. Now, at age 5 she presents as an easily

distracted child but not impulsive. She has received early intervention since her placement in foster care and performed in the average range in motor skill for the present study. Another example of the debate regarding source of the impact of drug exposure is a boy placed in foster care from the newborn nursery. His biological mother never claimed him and the Caucasian foster mother eventually adopted the handsome African American baby. Now at age 4, he is developing well having had minimal early intervention services under the watchful eye of his adoring mother. And finally, an example from an older African American couple who adopted 3 children originally placed as infants in their foster home. The children are still very young, but attend preschool and kindergarten having received minimal early intervention services. During testing procedures for this study, they arrived well groomed, laughing and played well as they took turns performing the gross motor tasks.

All this is to say, that the study participants appear to represent a valid subset of drug exposed children who are doing well despite rough starts in development. The strength of their positive development could be mediated by their supportive postnatal environment despite fetal exposure to cocaine/polydrugs. The dollars spent in early intervention and foster care appear to be well spent. What could have been the reality for these children is probably not off the mark echoed in Mr. Upchurch's early life

experiences: misery, failure, incredible anger and an eventual criminal life. And as Mr. Upchurch intimates, no child has the ability to know in what portion of their wretched life they should not be participating.

Theoretical and Practical Implications

Theoretical

The present study contributes to the theoretical work of Bronfenbrenner and Crouter (1983) regarding the ecological theory of child development, specifically the person-process-context model. By identifying independent variables representing the person-process-context of the child in development, more than 43% of the variance was predicted for gross motor development in the present study. This is an indicator of the strength of the model since currently child development research considers 21% representative of a high accounting for the variance. No doubt, future studies can employ this person-process-context model precisely because it fits the questions of interest regarding the development of children prenatally exposed to cocaine/polydrugs.

A closer examination of the context variables are important for future work with children prenatally exposed to cocaine/polydrugs. The context of the current study was the residence of the child with a nonbiological mother (foster or adoptive). It is important to note that the

motor skill performance was not assessed in the natural context. The measure was obtained within a clinical setting, in a one-on-one setting between principal investigator and the child. The study did not measure whether this performance could also been elicited in gymnasiums with groups of children in physical activity. For example, would the child be able to kick the ball if there was a large group of children also kicking balls? Could the child perform in a game and it's requisite motor skills if the movement was fast paced?

The person-process-context model (Bronfenbrenner and Crouter, 1983) was generated from ecological theory of child development (Bronfenbrenner, 1977) which stressed the systematic study of the child as relationships change between the child and their environment. Just a few years prior to Bronfenbrenner's ecological theory, the seminal work of Sameroff and Chandler (1975) identified the transactional model: that development is affected by a transaction between the child and the environment. The child influences the environment and the environment influences the child. Thus, development is constant. The transactional model assumes a dynamism that influences change in the child's development because it is believed that the child actively attempts to organize his/her world. According to Sameroff and Chandler, if a breakdown in function occurs, it is due to a continuous malfunction of

the organism to reorganize. To study development is to study the dynamics of this breakdown. Hence, the person-process-context model and the transactional model can be applied to research questions regarding the child prenatally exposed to cocaine/polydrugs. Variable selection can be influenced by speculating on where the impediment is occurring in development? Understanding long-term outcome could be based on: 1) an assessment of the prenatal complications, and 2) the nature of the caretaking environment, and 3) an understanding of child variables. The transactional model appears to be integral to ecological theory of child development.

Recently, Lester and Tronick (1994) established the groundwork for future research using the transactional model with infants cocaine/polydrug exposed. After reviewing the decade of research with children cocaine/polydrug exposed, they pointed out that: 1) the problem is more complicated than was originally thought, and 2) any one of the life-style complications of drug abuse are known to contribute to poor developmental outcome. Lester and Tronick argue that prenatal cocaine/polydrug exposure predisposes the infant to short-term neurobehavioral vulnerability which directly affects attention, arousal, affect and the physical action of infants. Over time, "The long term drug effect is indirect, mediated by the environmental factors". (p.112) In the current study, these observations are apparent in the

3-way interactions describing the child's postnatal environment, and the child variable of effortful control.

These are important concepts for interpreting the current study and for future research directions. First, the current study found suggestive but inconclusive evidence that the child with prenatal cocaine/polydrug exposure experienced initial neurodevelopmental difficulties that led to early intervention services. In the present study the transactional relationship between a range of parent understanding and confidence and a range of child temperamental control predicted average range and above GMDQ scores in the presence of a range of early intervention. In other words, predicted GMDQ remained in the average range across levels of parenting attitude, temperamental control and early intervention amount. The model fit in the present study identified factors in the postnatal environment as well as a child factor that described the outcome in fundamental motor skill given prenatal cocaine/polydrug exposure.

Future research directions will be influenced by the attention to the context of the transactional relationships. According to Lester and Tronick (1994) future research on drug exposed children can be modeled after the study of preterm infants. They found the research history for children prenatally drug exposed followed a similar path as the research with premature infants. For the premature

infant the research history was as follows: first, negative outcome was predicted based on prematurity; second, reports of normal development contradicting the earlier gloom research; third, the study of the caretaking environment was initiated by the discovery that the premature infant was not homogenous in behavior or development. Certainly the review of literature for the present study validates the commentary of Lester and Tronick. For these researchers, future study should address the number of risk factors rather than the nature of them; the resilience of children doing well despite multiple risk factors; and, the concomitant protective factors. Using the thoughtful work of these researchers, exploration of the acute and long-term effects of prenatal drug exposure on the developing child can be explored. Early work in this area was limited to the main effects of drug exposure. A current research trend is to account for more of the variables thought to influence developmental outcome. A return to basic child development processes for risk factors has the potential to open up the research arena by giving greater consideration to the world in which the child prenatally drug exposed resides.

Practical

Based on the suggestive evidence in this study of the interaction of child temperamental control, parental attitude and early intervention service, it is anticipated that recommendations can be made for early intervention

service provision, preschool and school program development, and parent education programs. The study appeared to offer a reasonable description for early intervention's positive effect on gross motor performance in some situations described in the trends, but other situations remain unexplained. For example, the participants in this study appeared to benefit from early intervention service when the child has low temperamental control with mothers with low understanding and confidence. This fit may not be the best for children with high temperamental control with mothers with high levels of understanding and confidence. Since a great amount of research on children with prenatal exposure to cocaine/polydrugs is inconclusive, Lester and Tronick (1994) caution: "Do we have any reason to suspect that a drug-exposed child with an attentional problem needs to be treated differently than a non-drug-exposed child with attentional problems?" (Lester & Tronick, 1994, p.108).

The study suggests that parents make a contribution to the motor development of their child. Exactly how they make this contribution is unclear at the present time. Early intervention services as well as educational and social services may want to better assess the range of parental understanding and confidence. It is an observation from this study, that a hands-on experience for parents is beneficial. Most of the mothers in this study watched intently as their child performed the tasks of the test.

For example, with the 3 and 4 year olds, most of the parents were impressed with their child's skill in ball and bat activities. Many reported that they were unaware that their child could perform this activity and showed interest in it. More than one parent left the clinic to purchase a plastic bat and ball!

Regarding motor delay, children in this study who were gross motor delayed at an early age experienced a "catch up" in motor skill during early childhood. The practical implication for educational settings is that access to gross motor activity and appropriate intervention at an early age may remediate motor delay. Given the heterogeneity of the study group, generalization to other groups of children prenatally exposed to cocaine/polydrugs is guarded. Within the context of a child-centered curriculum, it is recommended that careful assessment and observation be given regarding the gross motor abilities of the child prenatally exposed to cocaine/polydrugs. The upper limit of motor skill performance has not been established for these children. Certainly, the lower limited has been the focus of speculation but results are inconclusive to date.

Findings in this study suggest that child temperamental control for many of the research participants can be characterized in the low end. A highly impulsive child who is easily stimulated by activity may miss instruction time and ignore learning from their peers. Early childhood

educators, physical educators, teachers, parents and other primary care providers could benefit from education regarding techniques in effectively working with impulsive and highly active children. Specifically, once the developmental level is identified, adherence to a predictable format for instruction that reduces the amount of instruction time and increases gross motor participation is recommended. Also, considering transitions as activities in and of themselves is recommended for these children both at home and in the school settings.

The current study has contributed to the limited knowledge regarding gross motor development for young children prenatally exposed to cocaine/polydrugs. This group of children are doing well motorically. To date, no other study has confirmed this. This study is also unique in the use of the person-process-context model (Bronfenbrenner & Crouter, 1983) to explore motor development in early childhood given prenatal exposure to cocaine/polydrugs. Given the overall positive nature of the findings and the high accountability for variability in motor performance, replication of the current work is recommended. The addition of participants would serve to further elucidate the validity of the trends seen in the 3-way interactions.

It is recognized that the present study may over represent the best of the best: concerned parenting, the

provision of a stable home environment, acceptance, and a life commitment to caring for the child. If this is true, then the current research findings contribute to a more broad understanding of the child prenatally exposed to cocaine/polydrugs and stand in stark contrast to the negative developmental trajectory originally projected.

CHAPTER 5

SUMMARY and RECOMMENDATIONS

Little research data are available regarding the developmental prognosis for children exposed in utero to cocaine and other drugs. To date, the data suggests that these babies are often born small for gestational age and low in birthweight (Burkette, Yandin & Palow, 1990; Chasnoff, Griffith, MacGregor, Dirkes & Burnes, 1989). Few babies have birth defects (Zuckerman, 1991). Abnormal neurobehavioral function has been detected in some, but not all infants (Chasnoff, Burns, Schnoll & Burns, 1985; Chasnoff et al., 1989, Oro & Dixon, 1987). Some babies who have low developmental scores at birth score within the normal range during infancy (van Baar, Fleury & Utee, 1988). At 3 years of age, intellectual functioning is in the average to the low-average range with some children showing delay (Azuma & Chasnoff, 1993). In general, developmental scores in early childhood are within the normal range in cognitive and psychomotor domains (Hawley et al., 1995; Lester & Tronick, 1994; Hurt et al., 1995). At 3 years of age the quality of the home environment is predictive of IQ: the higher the quality of the home environment, the higher the IQ (Azuma & Chasnoff, 1993). During testing at ages 2 and 3, performance on developmental tests was impeded by the child's difficulty with self-regulation (Azuma & Chasnoff, 1993; Chasnoff, 1992). In general, children with prenatal

exposure to cocaine and other drugs are considered to be "at risk" for developmental difficulties, and therefore in need of early intervention services (Zuckerman, 1991).

The children studied thus far are still very young and developmental outcome is considered speculative (Church, 1993). In an effort to expand the knowledge of drug effect on development, researchers have called for greater attention to the postnatal environment of children prenatally exposed to cocaine/polydrugs. The purpose of this study was to assess selected factors felt to contribute to the outcome of fundamental motor skill development (run, jump, skip, hop, slide, gallop, strike, bounce, kick, throw and catch) in young children ages 3 to 6 years who reside in foster or adoptive care and have a documented history of prenatal exposure to cocaine and other drugs. Using an ecological theory of child development and the person-process-context model (Bronfenbrenner & Crouter, 1983), the study addressed the child in development. Fundamental motor skills were assessed using the Test of Gross Motor Development (Ulrich, 1985). Through multiple regression analysis, the study considered the contributions of the following on motor skill performance: child temperamental control as measured by the Children's Behavior Questionnaire (Rothbart, 1981; 1986), the postnatal environment of the nonbiological mother's parental attitude as measured by the adapted Parent Attitude Survey (Hereford, 1963), and the

amount of early intervention services as recorded in the child's medical chart. There is suggestive but inconclusive evidence for the hypothesis that fundamental motor performance is predicted by the interaction of child temperamental control, parental attitude and the amount of early intervention service [F (7, 20) = 2.24, $p < 0.07$].

Based on the findings of this study, children with prenatal exposure to cocaine/polydrugs are viewed as variable regarding temperamental control and gross motor performance, but perform in the average to above average in gross motor skill. Further research is needed to validate trends observed in this study, specifically regarding the interactive effects of child effortful control, parental attitude, and the amount of early intervention service received.

Recommendations

The overall model for the data in this study is interpreted to be suggestive but inconclusive [F (7, 20) = 2.24, $p < 0.07$]. Therefore, the practical recommendations for this study are divided into suggestive and inconclusive. Also included herein are personal reflections gleaned from conducting the study.

Suggestive

1. There is variability in the characteristics of children

prenatally exposed to cocaine/polydrugs and their nonbiological mother.

The data in this study show a range of characteristics in child temperament dimension of effortful control, child performance of fundamental motor skills, and parental attitudes of understanding and confidence. The evidence refutes the notion that prenatal drug exposure predicts a certain type of child, but rather suggests that there is a spectrum of child characteristics in this population. Therefore, clinicians and educators working with children prenatally exposed to cocaine/polydrugs can expect a range of performance. The child's performance is also impacted by the amount of early intervention service received, and the degree of parental understanding and confidence. It is therefore important to account for any unique combination of these aspects when making clinical, educational and intervention plans. The variability in child and mother attributes will impact various aspects of effective service delivery.

To account for variability, standardized testing and observational data can be utilized. The results of the gross motor performance in this study were conducted in a clinical one-on-one setting. Performance on the playground or other physical activity environments may differ. It is recommended that both observational methods and standardized tests be utilized for ascertaining accurate representation

of the child's gross motor performance.

2. Professionals expect that some children prenatally exposed to cocaine/polydrugs will perform gross motor skills within normal limits.

Too often the expectation has been to consider these children irreparably damaged in utero. This study's data set is an example of a subgroup of these children who are performing their motor skills at the average and above average level for children their age.

3. The activities that foster gross motor development can be seen as positive for the child's life.

The subjects in this study are successful performers of gross motor skills. It is evident that this success can be utilized to engage the child in enjoyable activity. This enjoyment can impact on other areas of the child's life that could be stressful. As yet, the scientific community does not know how these children will develop as they advance in age. Successful play activities at home, in the community, and at school can potentially enhance the child's ability to cope if difficulties occur. Successful physical activity can provide for an appropriate release of energy for the child, add to a positive self-concept, and engage the child in pleasurable age-appropriate activity. Physical activity has the potential to be a very powerful and positive experience in children prenatally exposed to cocaine/polydrugs.

Inconclusive

1. This investigation will need to be replicated to validate the trends for predicting fundamental motor performance in young children prenatally exposed to cocaine/polydrugs.

The data analysis in this study, given the sample size, make definitive trend analysis difficult. Despite this, some of the trends seem to fit with current research regarding the benefit of early intervention in the development of motor skills. This occurs in the cells with lower parental understanding and confidence, and lower child effortful control. What is not explained well are the children who fall into cells represented by either moderate amounts of the variables or by the higher levels. Given high effortful control and high parental understanding and confidence, gross motor development scores appear to decline over early intervention.

Speculation arises as to whether this is due to stability in the scores. For example, was the child able to achieve in the average range of gross motor skill performance due to the early intervention services received? In order to answer this question, it is recommended that further study track the amount of delay and the amount of early intervention to better determine the impact of predicting the gross motor development quotient (GMDQ) for children prenatally exposed to cocaine/polydrugs. This was

not done in this study.

It is recommended that additional observations be made of children in physical activity settings outside the clinical one-on-one setting. Other speculation about children prenatally exposed is that they may look attentive, hence higher scores on effortful control. In reality, however, they may not be attentive, but rather, lost. To help delineate the difficulties these children might be having, it is recommended that observational data from a physical activity class be collected. The testing for gross motor performance for this study was done solely in a clinical one-on-one setting.

2. Early intervention service to children should be studied to determine the effect of intervention in various combinations on service delivery. Specifically, would a greater increase in the GMDQ be observed given higher parental understanding and confidence, if more intervention were directed to the mother? The child spends the greater bulk of his/her time outside of therapy. If non-therapy time offered greater opportunity to perform motor tasks geared to the child's developmental level, would greater gain in skill development occur? Mothers who possess greater understanding and confidence may be under utilized as a resource by clinicians and educators serving the motor needs of the child. In general, it appears that there are positive outcomes with early intervention and that there are

some things that we do not understand about intervention. Continued investigation of early intervention is needed. One type of intervention does not fit all children or all families.

Personal Reflections

The personal reflections from this study come from a combination of the scientific method and the unknown. During the presentation of this study, the process of the scientific method has been used, specifically the quantitative approach. At this point, it appears that the study allows for movement where the researcher can mix the quantitative data of this study and the work of others, with the realm outside of the scientific method. Underscored in this mix is an acknowledgement of a language of love that acknowledges the unknown and the soul of the quest.

From either a spiritual or secular perspective, love simply is about a profound care of someone or something. Henry Nouwen (1989), formerly of the Harvard Divinity School, explains how ridiculous it is to try and answer the "why question" about love: Why do you love him; why did you become a priest? He describes the response as coming from "... an inner must, an inner urge, or inner call that answers all those questions which are beyond explanation." (p.110) In other words, the mystery in love and in life's quests. How do we try to answer the "why question" about love? According to Nouwen: I saw him and I loved him. So,

the attempt at explanation is just that--an attempt at naming the mysterious. We know it. We feel it. It becomes our life reality. But "why", we know not.

Soul also has mystery. According to Thomas Moore (1992) care of one's soul is to apply poetics to everyday life. The aim of working with the soul is to create a "...richly elaborated life, connected to society and nature, woven into the culture of family, nation, and globe...to be profoundly connected in the heart to ancestors and to living brothers and sisters in all the many communities that claim our hearts." (p.xviii) So, as love is in the heart, so also is soul. Love and soul have mystery.

In addition to this mystery, this study is about writing. It is about reading what others have written and, in turn producing commentary to further illuminate the questions of interest. Isabel Allende, an author, joined other well-known authors of our time to lecture in New York City about the creation of political novels. Her description is an illumination, in poetic terms, of the direction for recommendations from this study. She explains:

> I feel that writing is an act of hope, a sort of communion with our fellow men [people]. The writer of good will carries a lamp to illuminate the dark corners. Only that, nothing more--a tiny beam of light to show some hidden aspect of reality, to help decipher and understand it and thus to initiate, if possible a change in the conscience of some readers. This kind of writer is not seduced by the mermaids voice of celebrity or tempted by exclusive literary circles. He [She] has both feet

> planted firmly on the ground and walks hand in hand with the people on the streets. He [She] knows that the lamp is very small and the shadows immense. This makes him [her] humble. (Allende, 1989, p.48)

An Act of Hope

1. It is recommended that we remain hopeful when working with the child cocaine/polydrug exposed.

This research was undertaken to examine the development of children who have been considered the most unlucky of children in our current society: cocaine/polydrug exposed prenatally. The review of literature has addressed the negative sentiment that segments of our society have toward these children. Early researchers focused on "differences" in development attributed to the mother who disregarded the new life in her body and engaged in excessive drug use. After this initial start, broader research protocols are reporting mixed results in development. Striking is the continual report of early childhood development that is "within the range of normal" despite the residence of the child. Is not this hopeful? As these studies continue to follow the children, is there not hope? With our application of the knowledge of child development and early intervention, is not something happening that is hopeful?

Communion with our Fellow People

2. Commune with a broad array of research tools in order to assist those who are responsible for the care and

education of these children with suspected "risk to development".

The continued quest for understanding the developmental issues for these children has been addressed through qualitative studies of development. The communion requires a broader range of information gathering and dissemination. Interestingly enough, when researchers in Chicago first assessed these children, the clinicians were suspicious of the results. What they "saw" in the child did not equal what the numbers told them. They suspected there were additional problems facing the child. The mystery was not being solved by conventional developmental measures. It was as if the parameters for normal development had not been established. In time, the researchers looked for more sensitive evaluation tools and, in some cases, found them, in other cases, they are still looking.

Qualitative study is needed of the child and the natural context of his/her lives. While the data for this current study were quantitative, there was ample qualitative opportunity. These mothers were deeply committed to these children. Some were terribly frustrated. Others were very happy and proud of their adopted child. What do the nonbiological mothers have to say about their lives with these children? What has contributed to the psychological strength of the nonbiological mother to empower and care for this child? From whom do these mothers take the lead? What

is the role of the foster father for these young boys? What are the expectations of the adoptive mothers and fathers for their new family member? In addition, the children have a story to tell us about their lives. What can these children tell us about their lives? How can they dance, draw, sing or "move it" out? Must we wait for the stories to come out in newspaper interviews? Why could we, the child development experts, not ask now?

3. Recognize that recruitment is difficult.

All of the children in this study were made wards of the courts in early infancy and placed in foster care. Most were adopted. The result is that government agencies have been involved since the child's birth. Often the child's name was changed while in the care of the biological mother and, most assuredly, in adoption. Some the children in this study had as many as 3 different names. Finding the child is difficult. A good medical chart can be a valuable resource. In addition, cooperation from state and local agencies is imperative. Good communication regarding the aims of the research assists in soliciting recruitment of the study participants. For the researcher, an important alliance is needed with professionals whom the parents feel are genuinely concerned, respectful and helpful.

A Lamp to Illuminate the Dark

4. Resist pre-judging the child and remain open to discovering and facilitating the potential in that child to

enjoy physical activity.

The cocaine/polydrug exposed child may be coming into the classroom with a great need to find pleasure and an outlet for their life's stress. In a sense, successful physical activity can be the lamp that keeps this child's world from darkness. Cole (1995) explained that many of these children face poverty, early abuse, neglect, multiple residential placements, and possibly neurologic damage. Successful physical activity experiences have the potential to enhance physical health as well as the child's mental health. Due to environmental and maternal deprivation, these children most likely lack experience in age appropriate play and the accompanying social skills. Neurological damage may disturb the information processing needed to follow directions and participate in activities. Rather than judging these as oppositional behavior, specific intervention strategies can be developed to address the difficulties and engage the child in activity.

5. Be positive with the child.

In cases of deprivation or abuse, the child's self-esteem and self-confidence are negatively impacted. Research on resilience indicates that overcoming difficulties can be attained if the child feels at least one person believes in them. Facilitating enjoyable physical activity may be invaluable. Many children in this study happily skipped and ran down the hallway of the medical

center. Physical activity's claim on positive mental health can only be enhanced with professionals that are positive toward the child.

A Tiny Beam of Light..Help to Understand and Initiate Change

6. Direct attention to a keen observation of the child's performance.

In some sense, we are asked to be an advocate without fully understanding the child abilities or disabilities, recognizing the mystery that still is part of that child's life and inner processing. Is that really so different than what we may already do with our own children or those we know have not been prenatally exposed to drugs? Share the successes that the child experiences with the child, their care giver and the other professionals working with child.

Tiny flashes of light, or the "ah ha" experience can greatly diminish negative outcome for these children. The temperamental expressions of high activity, difficulties with inhibitory control, low intensity pleasure can be intertwined with the daily lives of the child. Therefore, know what is going on in their lives. Understand that some days will be better than others and not all inappropriate behavior can be attributed to drug exposure.

7. Be careful in calling a child drug exposed.

The history of drug exposure to cocaine/polydrugs does not carry with it known developmental outcomes. This is unlike Fetal Alcohol Syndrome (FAS) or possible (FAE) where

20 years of research has been conducted and a known syndrome can be identified. In many school systems, professionals will not know what drugs the mother used, only that there was some exposure. Use person-first terminology when referring to the child. Avoid references to the "crack baby", the drug exposed child. Rely on the child's name as a reference and get to know the child.

8. Do not let the review of the case history prejudice you toward the child.

Take the case history to heart, but remember that the child is just a child and there is tremendous variation among them. Success with the child is based on the tools of the trade for a child in physical activity: conduct a good assessment, plan well and make changes based on the data and input from the family and other professionals.

Both Feet Firmly on the Ground

9. Do not feel you can do this alone.

Join in a team with others. Enjoin the family including the foster parents, extended family members, adoptive parents and the biological mother. Chaos is often prevalent in homes where substance abuse is or has been present. Remember to stay focused on the part you can play for the child and coordinate with others involved in the child's care.

10. The verdict is out.

As this study has shown, there is still a lot to learn.

There is great variability in the child temperament and in other aspects of development, consequently, there will be differences. The parents are only human with various levels of confidence and understanding of their parenting role.

Walk Hand in Hand with the People on the Street

11. Find ways to enter the community to enhance daily life that is physically active within the range of family resources and the age appropriate needs of the child.

The biological mothers and the nonbiological parents (foster and adoptive) of these children are often poor. Recommendations for physical activity for the children needs to involve the family in the decision making processes. For these families, it would be helpful to simply know what is available in the community for recreation and the skill level of the child. These discussions came up repeatedly while testing children in this study.

The Lamp is Small and the Shadows Immense

12. Recognize the limited research base regarding children prenatally exposed to cocaine/polydrugs. In the light of the lack of evidence, trust action that is in the best interest of any developing child: attention that is loving, delivered with respect for soul and mystery.

This research study was conducted with 28 children and their foster or adoptive mothers. The only test that was conducted on the child was the gross motor test. The other

two measures were reported by the nonbiological mothers. It is a little beam of light that is surrounded in mystery and soul. Statistically, we relied on trend descriptions of 3-way interactions of variables. We could not dig any deeper into the "Statistical Source" because it is unknown: the relationship of the depth of the data points in the 3-way interactions cannot be known at this time. Of course, continued replication will illuminate the trends, but not necessarily the statistical source of the inter-relationships. From a child development standpoint, mystery is everywhere. Some researchers communicate that the best we can know about these children will be what they show us as they develop. The methods for obtaining measures on the extent of the prenatal exposure, specifically the frequency, intensity and duration of the drug exposure, may be difficult to determine for some time to come. And therefore, we may need to continue to study these children recognizing the unknown, the mystery.

So what did we see with our little beam of light? Yes, immense shadows are the physical reality given a little light at the right time of the day. But, let us take the perspective of the young child first. From a physical standpoint, young children love playing with shadows: trying to catch their own or others, making animals out of their hands against an old sheet backdrop, seeing that their shadow is just as big as yours. Metaphorically, in the

hands of an imaginative adult it doesn't take much light shown in the right direction to create fun for a child. Yet, from the perspective of an adult, the shadows created by a little light can be overwhelming. Without playing with the shadow, the adult worries about uncovering what cannot be seen by the distortion. As Allende (1989) concludes, this makes the adult humble. So, it may be that in our humility we can best serve these children.

This research rests in the hope of attempting to communicate something positive in the political arena of prenatal drug abuse and society's response. Returning to the opening statements about the ridiculous nature of the question "Why do you love?", we could probably add "Why do we do research?" Really, in both questions the answer resonates with, I saw and I loved. Personally, I saw them and I loved them. From a research perspective, the mysterious provocation to act in this arena was surrounded in the illumination of more mystery. In conclusion, in the spirit of mystery, it is the hope that these children's lives do receive the rich elaboration described earlier: souls woven into the culture of family and a nation; and, profoundly connected to all the many communities that claim their hearts and ours.

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APPENDICES

Appendix A

OREGON STATE UNIVERSITY

Committee for the Protection of Human Subjects

Chair's Summary of Review

Title: Gross motor skill development in young children with prenatal exposure to cocaine and other drugs

Program Director: John Dunn

Recommendation:

__X__ Approval* ____ Provisional Approval ____ Disapproval ____ No Action

*The informed consent forms obtained from each subject need to be retained for the long term. Please have the forms retained in your files for three years beyond the end date of the project.

Remarks:

The significance of the proposed study is now clear. All other concerns of the IRB have been suitably addressed and necessary changes made.

Date: 7 June 1994 Signature: Christie W. Sturm

If the recommendation of the committee is for provisional approval or disapproval, the program director should resubmit the application with the necessary corrections within one month.

APPLICATION FOR APPROVAL OF THE OSU INSTITUTIONAL REVIEW BOARD
(IRB)
FOR THE PROTECTION OF HUMAN SUBJECTS

Principal Investigator: John M. Dunn, EdD

Department: Exercise and Sport Science **Phone:** 737-0732

Project Title: Gross Motor Skill Development in Young Children with Prenatal Exposure to Cocaine and Other Drugs

Present or Proposed Source of Funding:

Type of Project: _Student Thesis
Student's Name: Carol A. Leitschuh **Phone:** 929-3779
Student Mailing Address: PO Box 960, Philomath, OR, 97370
Student Campus Address: Women's Building, Rm. 206

Type of Review Requested: Full Board

1. SIGNIFICANCE OF THE PROJECT:

The popular press had depicted a negative prognosis for children exposed in utero to cocaine and other drugs. These babies are often born small for gestational age and low in birthweight (Burkette, Yadin & Palow, 1990; Chasnoff, Griffith, MacGregor, Dirkes & Burnes, 1989; Cherukuri, Minkoff, Feldman, Parekh & Glass, 1988; Chouteau, Namerow & Leppert, 1988; Fulroth, Phillips & Druand, 1989; Little, Snell, Klein & Gilstrap, 1989; Hadeed & Seigel, 1988; MacGreagor et al., 1987; Madden, Payne & Miller, 1986; Oro & Dixon, 1978; Ryan, Ehrlich & Finnegan, 1987; Zuckerman, Frank & Hingson, 1989). Public awareness of the developmental outcomes for these children is limited by the popular press interpretation rather than an understanding of current research. Research is woefully lacking, limited and presenting conflicting results (Coles, 1993).

Most babies have no birth defects (Zuckerman, 1991). Abnormal neurobehavioral function has been detected in some, but not all infants (Chasnoff, Burns, Schnoll & Burns, 1985; Chasnoff et al., 1989; Oro & Dixon, 1987). Babies with low developmental scores at birth, begin catching up during infancy (Van Baar, Fleury & Utee, 1988). At 3 years of age, intellectual functioning is in the average, to low-average range, with some children showing delay (Azuma & Chasnoff, 1993). The quality of the home environment is predictive of the IQ: the higher the quality of the home environment, the higher the IQ. During testing at ages 2 and 3, children's attention and impulsive behaviors impeded performance (Chasnoff, 1992). Children with prenatal exposure are considered to be "at risk" for developmenatal difficulties, and therefore, in need of early intervention services (Zuckerman, 1991).

The children studied so far are still very young (Church, 1993) and developmental outcome is considered speculative. To date, there is no published data regarding the develoment of gross motor skill in preschool children with prenatal exposure to cocaine and other drugs. **The purpose** of this study is to assess the fundamental motor skill development (run, jump, skip, hop, slide, gallop, strike, bounce, kick, throw and catch) of preschool children ages 3-4-5 who are in foster care, and have a documented history of prenatal drug exposure. Fundamental motor skills will be assessed using the Test of Gross Motor Development (Ulrich, 1985). The study will consider the contributions of the following on performance of fundamental skill performance: child temperament as measured by the Children's Behavior Questionnaire (Rothbart, 1981; 1986), foster mother-child relationship as measured by the adapted Parent Attitude Survey (Herford, 1963), and early intervention services as obtained by a review of the child's medical record (Appendix B). Based on the findings in this study, it is anticipated that recommendations can be made for preschool program development, in-service and pre-service professional preparation for service providers, parent education programs and early intervention service provision.

2. METHODS AND PROCEDURES

The child and their foster mother will meet with Carol Leitschuh and a representative of Emanuel Hospital and Health Center (Emanuel Hospital) at the Pediatric Development Program. The child will participate in an assessment of gross motor skill using the Test of Gross Motor Development (TGMD). The TGMD measures the following skills: run, jump, skip, hop, slide, gallop, strike, bounce, kick, throw and catch. The test items represent activities commonly experienced by young children. The child's right to refuse, to participate in the activities, will be honored. Children will be video taped during performance of the TGMD. The foster mother will fill out a questionnaire on: a) the child's temperament using the Children's Behavior Questionnaire, and b) the quality of the foster parent/child relationship, using the adapted Parent Attitude Survey. The extent of early intervention services received by the child will be obtained from the child's medical record.

3. BENEFITS

By participating in this research, the foster parent has the opportunity to gain useful information about their foster child. In addition, the foster parent and child will be contributing new information which may benefit others in the future. As result of participating in the activities of the TGMD, children usually have fun and enjoy having the attention of the adult tester. The child will be given a toy to take home whether they participate in the activities or not. Results from the gross motor testing will be shared with the foster parent once the results are tabulated. Carol Leitschuh will refer the foster parent to appropriate services if testing indicates a motor delay.

Researchers interested in children exposed to drugs will benefit from the first study of this kind on fundamental motor skills of preschool children with prenatal exposure to cocaine. The information from this research will help in understanding how the children are developing and identify the need for early intervention services.

RISKS

There is no unusual risk of injury from performing the motor skills of the TGMD. The risks are minimized by a) Carol Leitschuh is experienced in administering the test and has over 17 years of clinical experience with young children, b) the test is a non-invasive procedure, c) the children will be in a familiar environment at Emanuel Hospital, d) the apparatus used in the TGMD (playground balls, nerf balls, tennis balls and a plastic bat) are used under controlled situations, e) the test items represent activities commonly experienced by young children. The equipment is light and easy to handle for young children. If injury

should arise, personnel from the study (Carol Leitschuh and/or Dr. Budden) will remain with the child until the situation has stabilized and hospital staff have attended to the injury. The children are all patients of Dr. Budden's and the activities will be carried out at the hospital where the children typically receive their medical care.

There is no known risk to filling out the self-administered questionnaires. Carol Leitschuh will be available to answer questions and to observe the foster mother's behavior while filling out the questionnaire. Dr. Budden, Medical Director, Pediatric Development Program, Emanuel Hospital and Health Center, has known most of the foster parents for some time, and would be available to talk with the foster mother if emotional distress is brought up by any of the questions.

4. SUBJECT POPULATION

This research project is being conducted with the cooperation of Sarojini Budden, MD, FRCP (C), FAAP, Medical Director, Pediatric Development Program, Emanuel Hospital and Health Center, Portland, Oregon. In addition to her work at Emanuel Hospital and Health Center, Dr. Budden is Associate Professor of Pediatrics at the Oregon Health Sciences University (OHSU) where she conducts research, teaches and serves children with disabilities as Director of Neurodevelopment at the Child Development and Rehabilitation Center (CDRC). Her lectures are delivered internationally, nationally and throughout Oregon.

For the purposes of the proposed study on developmental outcome of preschool children prenatally exposed to cocaine and other drugs, Dr. Budden has made available her client population at Emanuel Hospital and Health Center. It is important to note that research addressing the developmental outcome of children with exposure to drugs is typically conducted at major medical centers. The research proposed herein is fortunate to have drawn the attention, interest and cooperation of an academician, developmental pediatrician and researcher from a major medical center.

The subject population in this study are male and female preschool children, ages 3-4-5, who were prenatally exposed to cocaine. To initiate the proposed research, a letter will be sent by Dr. Budden to the foster mother of her patients who meet criteria for the study: a) prenatal drug exposure to cocaine as the primary drug of choice, b) residing with the foster mother for at least one year, and c) a preschool child male or female, ages 3-4-5. The letter will inform the foster mothers of the research taking place at Emanuel Hospital, and that Carol Leitschuh will call them to answer questions and inquire about their interest in participation. They will be informed that their participation is voluntary, and that refusal to participate will not affect their health care at Emanuel Hospital, or status as a patient with Dr. Budden. Together with the foster mother, Carol Leitschuh will schedule an appointment for testing. A packet of information, including the informed consent, will be mailed to the foster mother. When the foster mother arrives at thePediatric Development Program for testing, additional questions or concerns will be addressed.

Permission for video taping of the TGMD will be needed from Children's Services Division (CSD) which is the legal guardian of the children in foster care. Once the foster mother has indicated an interest in participating in the research, Dr. Budden will contact Mr. John Richmond LCSW, Supervisor, St. John's Branch, Children's Protective Services. Mr. Richmond is responsible for giving permission for video taping for the children in foster care who under the legal custody of the Children's Services Division (CSD). Mr. Richmond has worked with Dr. Budden for numerous years and has indicated an interest in facilitating permission for the video taping.

Approximately 150 children in Dr. Budden's care currently meet the research criteria for this study. It is hope for the entire 150, and every effort will be directed toward that goal.

5. INFORMED CONSENT (copy enclosed)

A copy of the informed consent used for this study is included in this application under Appendix A.

6. OBTAINING INFORMED CONSENT

After the foster mother has indicated an interest in participating with her foster child in the research, a packet of information, including the informed consent, will be sent to the foster parent. Testing will take place at Emanuel Hospital. Upon arrival at the Pediatric Development Program, Carol Leitschuh will greet the foster mother and the child, and address additional questions and concerns. To ascertain whether the child would like to participate, the child will have the test items for the TGMD explained. The foster mother and the child's refusal to participate in the research will be honored. The foster mother will be informed that lack of participation will not negatively influence the health care of her child at Emanuel Hospital or with Dr. Budden. The child will receive a toy whether he/she participates in the testing. If the foster mother agrees to participate in the research with her foster child, and the child agrees, then the informed consent can be signed and testing can commence.

During testing, either the child or the foster mother can withdraw at any time from the study and their request will be honored. Additionally, their care at Emanuel Hospital and with Dr. Budden will not be adversely affected by their withdrawal.

7. CONFIDENTIALITY

Information about the foster mother and the child will be kept strictly confidential. Dr. Dunn, Dr. Budden and Carol Leitschuh will have access to confidential information from this study. All information using names of the foster mother and the child will be coded by Carol Leitschuh and entered into a computer with access by a password. This list will be destroyed after the data have been analyzed and the study has been concluded. Neither the foster mother's name or identity, or the child's name or identity will be used for publication or publicity purposes. All video filming will be destroyed after data have been coded.

8. COPIES OF TEST FORMS, AND QUESTIONNAIRES (appended herein)

Copies of the following have been included in Appendix B:

1. Test of Gross Motor Skill Development
2. Child Behavior Questionnaire
3. Parent Attitude Survey

9. OTHER APPROVALS

Approval for video taping the children will be obtained by Dr. Budden through Mr. John Richmond, LCSW, Supervisor, St. John's Branch, Children's Protective Services, for the state of Oregon. In addition, approval for conducting this research at Emanuel Hospital will be secured by Dr. Budden through Emanuel Hospital and Health Center, Office of Research. She has requested that a copy of the approved application from Oregon State University's IRB committee be submitted to the hospital research office. Copies of these approvals will be kept on file by Carol Leitschuh.

Legacy Health System
Informed Consent for the Adoptive Mother

Research Title: Gross Motor Skill Development in Young Children Prenatally Exposed to Cocaine and Other Drugs

1. PURPOSE

This study is a cooperative research project of Emanuel Hospital and Health Center, and Oregon State University, Department of Exercise and Sport Science. The researchers are Dr. Sarojini Budden, Medical Director of the Pediatric Development Program at Emanuel Hospital, Ms. Carol Leitschuh, a doctoral candidate at Oregon State University, and her advisor, Dr. John M. Dunn at Oregon State University. The research is in partial fulfillment for a Doctor of Philosophy degree in Human Performance by Carol Leitschuh. The purpose of this joint research project is to gain a better understanding of children's development given prenatal exposure to drugs such as cocaine, alcohol and tobacco. This study will measure the gross motor development (run, jump, skip, hop, slide, gallop, strike, bounce, kick, throw and catch) of children ages 3-4-5 with a documented history of prenatal drug exposure. The study will consider the contributions of the following on the performance of the gross motor skills: the child's temperament, the relationship between the child and their mother, and the involvement the child has had in early intervention services. Approximately 60 children will be involved in the study.

TIME INVOLVEMENT

For most children, the Test of Gross Motor Development (TGMD) test takes about 15 minutes. There will be two questionnaires that I will fill out at the time of the appointment: 1) on my child's temperament, and 2) on the relationship between my child and me as mother. Carol Leitschuh will remain with my child (children) until I have been able to complete the questionnaires. The questionnaires should not take me more than 30 minutes to fill out.

PROCEDURES

The testing will take place at Emanuel Hospital, Pediatric Development Program. I will check in at the desk for the Pediatric Development Program and Carol Leitschuh will escort me and my foster child to the testing area. She has reviewed the Informed Consent form with me and answered any questions I may have. To insure that my child is giving an informed consent, Carol has explained the activities of the gross motor test to my child. If my child does not want to participate in the activities, my child's refusal will be honored. My child will receive a toy regardless of their participation in the study. At any time I can withdraw from the study. My child can also withdraw from the testing at any time. This will not adversely affect the care that my child receives from Emanuel Hospital or from Dr. Budden.

My child will be tested using the Test of Gross Motor Development (TGMD). The TGMD measures the following skills: run, jump, skip, hop, slide, gallop, strike, bounce, kick, throw and catch. The test session will be video taped unless otherwise

sitpulated by me as the mother. Not all children need to be video taped, and if I do not want my child to be video taped, I can inform Dr. Budden or Carol Leitschuh.

2. RISKS AND DISCOMFORTS

Children typically enjoy going through the activities of the TGMD. Carol Leitschuh has administered this test for numerous years. The test items represent activities commonly experienced by young children. There is no unusual risk of injury from the test items. Children's playground balls, nerf balls, tennis balls and a plastic bat are used under controlled situations. There is no known physical discomfort to participating in the activities. The equipment is light and easy to handle for young children. If a problem should arise, Carol Leitschuh will remain with me and my child until the situation has stabilized.

There is no known risk to filling out the questionnaires. Carol Leitschuh will be on hand to answer questions and I can stop filling out the forms and end my participation in the study at any time. As the pediatrician for my foster child, Dr. Budden will be available to answer questions or concerns that may arise as a result of my participation in this study.

3. BENEFITS

As result of participating in the activities of the TGMD, children usually have fun and enjoy having the attention of the adult tester. My child will be given a toy to take home whether or not he/she participates in the study. Results of the TGMD will be shared with me once the results are tabulated. This report can be made available to me for on-going support of my child's gross motor development.

Medical science will benefit from the first study of this kind on gross motor skills of preschool children with prenatal exposure to drugs. The information from this research will help in understanding how children develop and identify the needs in early intervention service delivery.

Therefore, by participating in this research, I have the opportunity to gain useful information about my foster child. In addition, I will be contributing new information which will most likely benefit other mothers and children in the future.

5. CONFIDENTIALITY

Information collected for this study will be kept strictly confidential. Dr. Budden, Dr. Dunn and Carol Leitschuh will have access to confidential information from this study. Neither my name, my child's name, the name of the biological mother, my identity, my child's identity, or the identity of the biological mother will be used for publication or publicity purposes. A code number will be given for all names and entered into a computer with access by a password. All data will be

analyzed using the code number rather than names. This code sheet will be destroyed after the study has been concluded. All video tapes will be destroyed after data have been entered and the study concluded.

7. Other

a) I understand that I am free to refuse to participate or to withdraw from participation in this study at any time and it will in no way effect my relationship with, or treatment at Legacy Health Systems.

b) I understand that Oregon State University does not provide a research subject with compensation or medical treatment in the event the subject is injured as a result of participation in the research project. Legacy Health System is composed of non-profit hospitals that are dedicated to provide medical treatment for injury or illness. Should I suffer any injury as a result of this project, emergency medical treatment will be available. However, compensation for emergency medical treatment will be available from the hospital only if I established that the injury occurred through the fault of the hospital, its physicians, officers or employees. Further information regarding this policy, or questions concerning my rights as a research participant may be obtained from the Office of Research Administration at 413-2474.

c) Carol Leitschuh can be contacted at Oregon State University at 503-737-3402 if I have any questions. Her advisor, Dr. John M. Dunn can be contacted at Oregon State University at 503-737-0732, and Dr. Budden can be contacted at Emanuel Hospital at 413-4505 about the research, my rights and the rights of my foster child.

d) As the parent of the child being tested, I will be the person signing this consent form and will receive a copy of it. My signature below indicates that I have read the foregoing and agree to participation in this study. I also give permission for my child:_____to participate in this study.
print name

I have read and understand the foregoing.

_____ _____
Signature of Parent Parent Date

_____
Print Name of Parent Parent

_____ _____
Signature of Witness Date

Legacy Health System
Informed Consent for the Foster Mother
Research Title: Gross Motor Skill Development in Young Children Prenatally Exposed to Cocaine and Other Drugs

1. PURPOSE

This study is a cooperative research project of Emanuel Hospital and Health Center, and Oregon State University, Department of Exercise and Sport Science. The researchers are Dr. Sarojini Budden, Medical Director of the Pediatric Development Program at Emanuel Hospital, Ms. Carol Leitschuh, a doctoral candidate at Oregon State University, and her advisor, Dr. John M. Dunn at Oregon State University. The research is in partial fulfillment for a Doctor of Philosophy degree in Human Performance by Carol Leitschuh. The purpose of this joint research project is to gain a better understanding of children's development given prenatal exposure to drugs such as cocaine, alcohol and tobacco. This study will measure the gross motor development (run, jump, skip, hop, slide, gallop, strike, bounce, kick, throw and catch) of children ages 3-4-5 with a documented history of prenatal drug exposure. The study will consider the contributions of the following on the performance of the gross motor skills: the child's temperament, the relationship between the child and their foster mother, and the involvement the child has had in early intervention services. Approximately 60 children will be involved in the study.

TIME INVOLVEMENT

For most children, the Test of Gross Motor Development (TGMD) test takes about 15 minutes. There are two questionaires that I will fill out. Carol Leitschuh will remain with my child (children) until I have been able to complete the questionnaires. The two questionnaires completed by me should not take me more than 30 minutes to fill out.

PROCEDURES

The testing will take place at Emanuel Hospital, Pediatric Development Program. Children's Services Divison (CSD) has given permission for the gross motor assessment to be conducted by Carol Leitschuh at Emanuel Hospital with Dr. Budden's patients. I will check in at the desk for the Pediatric Development Program and Carol Leitschuh will escort me and my foster child to the testing area. She has reviewed the Informed Consent form with me and answered any questions I may have. To insure that my foster child is giving an informed consent, Carol has explained the activities of the gross motor test to my child. If my child does not want to participate in the activities, my child's refusal will be honored. My foster child will receive a toy regardless of their participation in the study. There will be two questionnaires that I will fill out at the time of the appointment: 1) on my foster child's temperament, and 2) on the relationship between my foster child and me as foster mother. At any time I can withdraw from the study. My foster child can also withdraw from the testing at any time. This will not adversely affect the care that my foster child receives from Emanuel Hospital or from Dr. Budden.

My foster child will be tested using the Test of Gross Motor Development (TGMD). The TGMD measures the following skills: run, jump, skip, hop, slide, gallop, strike, bounce, kick, throw and catch.

2. RISKS AND DISCOMFORTS

Children typically enjoy going through the activities of the TGMD. Carol Leitschuh has administered this test for numerous years. The test items represent activities commonly experienced by young children. There is no unusual risk of injury from the test items. Children's playground balls, nerf balls, tennis balls and a plastic bat are used under controlled situations. There is no known physical discomfort to participating in the activities. The equipment is light and easy to handle for young children. If a problem should arise, Carol Leitschuh will remain with me and my foster child until the situation has stabilized.

There is no known risk to filling out the questionnaires. Carol Leitschuh will be on hand to answer questions and I can stop filling out the forms and end my participation in the study at any time. As the developmental pediatrician for my foster child, Dr. Budden will be available to answer questions or concerns that may arise as a result of my participation in this study.

3. BENEFITS

As result of participating in the activities of the TGMD, children usually have fun and enjoy having the attention of the adult tester. My foster child will be given a toy to take home whether or not he/she participates in the study. Results of the TGMD will be shared with me once the results are tabulated and will become part of my foster child's medical record at Emanuel Hospital. This report can be made available to me for on-going support of my foster child's gross motor development.

Medical science will benefit from the first study of this kind on gross motor skills of preschool children with prenatal exposure to drugs. The information from this research will help in understanding how children develop and identify the needs in early intervention service delivery.

Therefore, by participating in this research, I have the opportunity to gain useful information about my foster child. In addition, I will be contributing new information which will most likely benefit other mothers and children in the future.

5. CONFIDENTIALITY

Information collected for this study will be kept strictly confidential. Dr. Budden, Dr. Dunn and Carol Leitschuh will have access to confidential information from this study. Neither my name, my foster child's name, the name of the

biological mother, my identity, my foster child's identity, or the identity of the biological mother will be used for publication or publicity purposes. A code number will be given for all names and entered into a computer with access by a password. All data will be analyzed using the code number rather than names. This code sheet will be destroyed after the study has been concluded.

7. Other

a) I understand that I am free to refuse to participate or to withdraw from participation in this study at any time and it will in no way effect my relationship with, or treatment at Legacy Health Systems.

b) I understand that Oregon State University does not provide a research subject with compensation or medical treatment in the event the subject is injured as a result of participation in the research project. Legacy Health System is composed of non-profit hospitals that are dedicated to provide medical treatment for injury or illness. Should I suffer any injury as a result of this project, emergency medical treatment will be available. However, compensation for emergency medical treatment will be available from the hospital only if I established that the injury occurred through the fault of the hospital, its physicians, officers or employees. Further information regarding this policy, or questions concerning my rights as a research participant may be obtained from the Office of Research Administration at 413-2474.

c) Carol Leitschuh can be contacted at Oregon State University at 503-737-3402 if I have any questions. Her advisor, Dr. John M. Dunn can be contacted at Oregon State University at 503-737-0732, and Dr. Budden can be contacted at Emanuel Hospital at 413-4505 about the research, my rights and the rights of my foster child.

d) As the foster parent of the child being tested, I will be the person signing this consent form and will receive a copy of it. My signature below indicates that I have read the foregoing and I agree to participation in this study.

I have read and understand the foregoing.

_____ _____

Signature of Foster Parent Date

_____

Print Name of Foster Parent

_____ _____

Signature of Witness Date

Appendix B

PARENTAL-ATTITUDE SURVEY (PAS)

Listed below are statements about parenting and about child rearing. Please read each statement carefully and circle the degree to which you agree or disagree with each statement.

	Strongly Disagree	Disagree	It Depends	Agree	Strongly Agree
1. I feel I am faced with more problems than most parents.	SD	D	ID	A	SA
2. Few parents have to face the problems I find with my children.	SD	D	ID	A	SA
3. It's hard to know what to do when a child is afraid of something that won't hurt him/her.	SD	D	ID	A	SA
4. Most parents aren't sure what is the best way to bring up children.	SD	D	ID	A	SA
5. Children don't realize that it mainly takes suffering to be a good parent.	SD	D	ID	A	SA
6. Parents sacrifice most of their fun for their children.	SD	D	ID	A	SA
7. Raising children isn't as hard as most parents let on.	SD	D	ID	A	SA
8. It's hard to know when to make a rule and stick by it.	SD	D	ID	A	SA
9. Raising children is a nerve-wracking job.	SD	D	ID	A	SA
10. It's hard to know what healthy sex ideas are.	SD	D	ID	A	SA
11. The earlier a child is weaned from his/her emotional ties to his/her parents the better he/she will handle his/her own problems.	SD	D	ID	A	SA
12. A child who misbehaves should be made to feel guilty and ashamed of him/herself.	SD	D	ID	A	SA
13. There is no reason why a child should not learn to keep his/her clothes clean very early in life.	SD	D	ID	A	SA
14. Children should be toilet-trained at the earliest possible time.	SD	D	ID	A	SA

(PAS, continued)

	Strongly Disagree	Disagree	It Depends	Agree	Strongly Agree
15. A child who wants too much affection may become a "softie" if it is given to him/her.	SD	D	ID	A	SA
16. One thing I cannot stand is a child's constantly wanting to be held.	SD	D	ID	A	SA
17. A child should be weaned away from the bottle or breast as soon as possible.	SD	D	ID	A	SA
18. It's a parent's right to refuse to put up with a child's annoyance.	SD	D	ID	A	SA
19. If you put too many restrictions on a child, you will stunt his/her personality.	SD	D	ID	A	SA
20. When a boy is cowardly, he should be forced to try things he is afraid of.	SD	D	ID	A	SA
21. Family life would be happier if parents made children feel they were free to say what they think about anything.	SD	D	ID	A	SA
22. Talking with a child about his/her fears most often makes the fear look more important than it is.	SD	D	ID	A	SA
23. A child's ideas should be seriously considered in making family decisions.	SD	D	ID	A	SA
24. Children should have a share in making family decisions just as the grown-ups do.	SD	D	ID	A	SA
25. If you let children talk about their troubles they end up complaining even more.	SD	D	ID	A	SA
26. Children shouldn't be asked to do all the compromising without a chance to express their side of things.	SD	D	ID	A	SA
27. There's a lot of truth in the saying, "children should be seen and not heard."	SD	D	ID	A	SA
28. Most children's fears are so unreasonable it only makes things worse to let them talk about them.	SD	D	ID	A	SA

(PAS, continued)

	Strongly Disagree	Disagree	It Depends	Agree	Strongly Agree
29. Family conferences which include the children don't usually accomplish much.	SD	D	ID	A	SA
30. The trouble with trying to understand children's problems is they usually just make up a lot of stories to keep you interested.	SD	D	ID	A	SA
31. Children who are not watched will get in trouble.	SD	D	ID	A	SA
32. Children must be told exactly what to do and how to do it or they will make mistakes.	SD	D	ID	A	SA
33. Children have no right to keep anything from their parents.	SD	D	ID	A	SA
34. Children have a right to activities which do not include their parents.	SD	D	ID	A	SA
35. A child should be allowed to try out what he/she can do at times without the parents watching.	SD	D	ID	A	SA
36. More parents should make it their job to know everything their child is doing.	SD	D	ID	A	SA
37. If rules are not closely enforced children will misbehave and get into trouble.	SD	D	ID	A	SA
38. It is hard to let children go and visit people because they might misbehave when parents aren't around.	SD	D	ID	A	SA
39. It is hard to know when to let boys and girls play together when they can't be seen.	SD	D	ID	A	SA
40. A child should never keep a secret from his/her parents.	SD	D	ID	A	SA

Children's Behavior Questionnaire
Version 1

Subject No. _____ Date of Child's Birth:

Today's Date _____ _____ _____ _____
Month Day Year

Sex of Child _____

Age of Child _____ _____
Years months

Instructions: Please read carefully before starting:

On the next pages you will see a set of statements that describe children's reactions to a number of situations. We would like you to tell us what your child's reaction is likely to be in those situations. There are of course no "correct" ways of reacting; children differ widely in their reactions, and it is these differences we are trying to learn about. Please read each statement and decide whether it is a "true" or "untrue" description of your child's reaction within the past six months. Use the following scale to indicate how well a statement describes your child:

Circle #	If the statement is:
1	extremely untrue of your child
2	quite untrue of your child
3	slightly untrue of your child
4	neither true nor false of your child
5	slightly true of your child
6	quite true of your child
7	extremely true of your child

If you cannot answer one of the items because you have never seen the child in that situation, for example, if the statement is about the child's reaction to your singing and you have never sung to your child, then circle NA (not applicable).

Please be sure to circle a number or NA for every item.

Please be sure to answer the questions on the back of this sheet.

1	2	3	4	5	6	7	NA
extremely untrue	quite untrue	slightly untrue	neither true nor untrue	slightly true	quite true	extremely true	not applicable

My child:

1. Seems always in a big hurry to get from one place to another.

1 2 3 4 5 6 7 NA

2. Gets angry when told s/he has to go to bed.

1 2 3 4 5 6 7 NA

3. Her/his feelings are not easily hurt by what parents say.

1 2 3 4 5 6 7 NA

4. Can lower his/her voice when asked to do so.

1 2 3 4 5 6 7 NA

5. Is not very bothered by pain.

1 2 3 4 5 6 7 NA

6. Is hard to get her/his attention when s/he is concentrating on something.

1 2 3 4 5 6 7 NA

7. Sometimes prefers to watch rather than join other children playing.

1 2 3 4 5 6 7 NA

8. Likes going down high slides or other adventurous activities.

1 2 3 4 5 6 7 NA

9. Notices the smoothness or roughness of objects s/he touches.

1 2 3 4 5 6 7 NA

10. Gets so worked up before an exciting event that s/he has trouble sitting still.

1 2 3 4 5 6 7 NA

11. Laughs a lot at jokes and silly happenings.

1 2 3 4 5 6 7 NA

12. Rarely enjoys just being talked to.

1 2 3 4 5 6 7 NA

13. Usually rushes into an activity without thinking about it.

1 2 3 4 5 6 7 NA

14. Has a hard time settling down for a nap.

1 2 3 4 5 6 7 NA

15. Is not afraid of large dogs and/or other animals.

1 2 3 4 5 6 7 NA

16. When picking up toys or other jobs, usually keeps at the task until it's done.

1 2 3 4 5 6 7 NA

17. Is comfortable in situations where s/he will be meeting others.

1 2 3 4 5 6 7 NA

18. Cries sadly when a favorite toy gets lost or broken.

1 2 3 4 5 6 7 NA

19. Rarely gets irritated when s/he makes a mistake.

1 2 3 4 5 6 7 NA

20. Is good at games like "Simon Says," "Mother, May I?" and "Red Light, Green Light."

1 2 3 4 5 6 7 NA

21. Becomes quite uncomfortable when cold and/or wet.

1 2 3 4 5 6 7 NA

22. Likes to play so wild and recklessly that s/he might get hurt.

1 2 3 4 5 6 7 NA

23. Seems to be at ease with almost any person.

1 2 3 4 5 6 7 NA

Please be sure to answer the questions on the <u>back</u> of this sheet.

1	2	3	4	5	6	7	NA
extremely untrue	quite untrue	slightly untrue	neither true nor untrue	slightly true	quite true	extremely true	not applicable

My child:

24. When s/he sees a toy s/he wants, gets very excited about getting it.

1 2 3 4 5 6 7 NA

25. Tends to run rather than walk from room to room.

1 2 3 4 5 6 7 NA

26. Sometimes interrupts others when they are speaking.

1 2 3 4 5 6 7 NA

27. Calms down quickly following an exciting event.

1 2 3 4 5 6 7 NA

28. Usually doesn't comment on changes in parents' appearance.

1 2 3 4 5 6 7 NA

29. Can easily shift from one activity to another.

1 2 3 4 5 6 7 NA

30. Doesn't care for rough and rowdy games.

1 2 3 4 5 6 7 NA

31. Notices it when parents are wearing new clothing.

1 2 3 4 5 6 7 NA

32. Has a hard time following instructions.

1 2 3 4 5 6 7 NA

33. Is afraid of elevators.

1 2 3 4 5 6 7 NA

34. Has temper tantrums when s/he doesn't get what s/he wants.

1 2 3 4 5 6 7 NA

35. When s/he wants to do something, s/he talks about little else.

1 2 3 4 5 6 7 NA

36. Enjoys just sitting quietly in the sunshine.

1 2 3 4 5 6 7 NA

37. Gets embarrassed when strangers pay a lot of attention to her/him.

1 2 3 4 5 6 7 NA

38. When practicing an activity, has a hard time keeping her/his mind on it.

1 2 3 4 5 6 7 NA

39. Tends to feel "down" at the end of an exciting day.

1 2 3 4 5 6 7 NA

40. Is afraid of burglars or the "bogie man."

1 2 3 4 5 6 7 NA

41. When outside, often sits quietly.

1 2 3 4 5 6 7 NA

42. Can be "cheered up" by talking about something s/he is interested in.

1 2 3 4 5 6 7 NA

43. Enjoys funny stories but usually doesn't laugh at them.

1 2 3 4 5 6 7 NA

44. Tends to become sad if the family's plans don't work out.

1 2 3 4 5 6 7 NA

45. Acts very friendly and outgoing with new children.

1 2 3 4 5 6 7 NA

46. Decides what s/he wants very quickly and goes after it.

1 2 3 4 5 6 7 NA

Please be sure to answer the questions on the <u>back</u> of this sheet.

1	2	3	4	5	6	7	NA
extremely untrue	quite untrue	slightly untrue	neither true nor untrue	slightly true	quite true	extremely true	not applicable

My child:

47. Will move from one task to another without completing any of them.

1 2 3 4 5 6 7 NA

48. Moves about actively (runs, climbs, jumps) when playing in the house.

1 2 3 4 5 6 7 NA

49. Dislikes having nails cut.

1 2 3 4 5 6 7 NA

50. Is afraid of loud noises.

1 2 3 4 5 6 7 NA

51. Does not like to take chances for the fun and excitement of it.

1 2 3 4 5 6 7 NA

52. Seems to listen to even quiet sounds.

1 2 3 4 5 6 7 NA

53. Has a hard time settling down after an exciting activity.

1 2 3 4 5 6 7 NA

54. Enjoys taking warm baths.

1 2 3 4 5 6 7 NA

55. Seems to feel depressed when unable to accomplish some task.

1 2 3 4 5 6 7 NA

56. Smiles and laughs during play with parents.

1 2 3 4 5 6 7 NA

57. Joins others quickly and comfortably, even when they are strangers.

1 2 3 4 5 6 7 NA

58. Doesn't worry about injections by the doctor.

1 2 3 4 5 6 7 NA

59. Often rushes into new situations.

1 2 3 4 5 6 7 NA

60. Doesn't like to go down high slides at the amusement park or playground.

1 2 3 4 5 6 7 NA

61. Is quite upset by a little cut or bruise.

1 2 3 4 5 6 7 NA

62. Gets quite frustrated when prevented from doing something s/he wants to do.

1 2 3 4 5 6 7 NA

63. Prepares for trips and outings by planning things s/he will need.

1 2 3 4 5 6 7 NA

64. Becomes upset when loved relatives or friends are getting ready to leave following a visit.

1 2 3 4 5 6 7 NA

65. Comments when a parent has changed his/her appearance.

1 2 3 4 5 6 7 NA

66. Doesn't enjoy being read to very much.

1 2 3 4 5 6 7 NA

67. Enjoys activities such as being chased, spun around by the arms, etc.

1 2 3 4 5 6 7 NA

68. When angry about something, s/he tends to stay upset for ten minutes or longer.

1 2 3 4 5 6 7 NA

69. Has strong desires for certain kinds of foods.

1 2 3 4 5 6 7 NA

Please be sure to answer the questions on the back of this sheet.

1	2	3	4	5	6	7	NA
extremely untrue	quite untrue	slightly untrue	neither true nor untrue	slightly true	quite true	extremely true	not applicable

My child:

70. Is not afraid of the dark.

1 2 3 4 5 6 7 NA

71. Takes a long time in approaching new situations.

1 2 3 4 5 6 7 NA

72. Does not usually become tearful when tired.

1 2 3 4 5 6 7 NA

73. Gets mad when even mildly criticized.

1 2 3 4 5 6 7 NA

74. Is sometimes shy even around people s/he has known a long time.

1 2 3 4 5 6 7 NA

75. Can wait before entering into new activities if s/he is asked to.

1 2 3 4 5 6 7 NA

76. Enjoys "snuggling up" next to a parent or babysitter.

1 2 3 4 5 6 7 NA

77. Enjoys being in crowds of people.

1 2 3 4 5 6 7 NA

78. Gets angry when s/he can't find something s/he wants to play with.

1 2 3 4 5 6 7 NA

79. Usually stops and thinks things over before deciding to do something.

1 2 3 4 5 6 7 NA

80. Is afraid of fire.

1 2 3 4 5 6 7 NA

81. Her/his feelings are easily hurt by what parents say.

1 2 3 4 5 6 7 NA

82. Looks forward strongly to the visit of loved relatives.

1 2 3 4 5 6 7 NA

83. Usually has a serious expression, even during play.

1 2 3 4 5 6 7 NA

84. Doesn't usually comment on people's facial features, such as size of nose or mouth.

1 2 3 4 5 6 7 NA

85. Seems to forget a bump or scrape after a couple of minutes.

1 2 3 4 5 6 7 NA

86. Doesn't care much for quiet games.

1 2 3 4 5 6 7 NA

87. Is bothered by light or color that is too bright.

1 2 3 4 5 6 7 NA

88. Sometimes sits quietly for long periods in the house.

1 2 3 4 5 6 7 NA

89. Sometimes seems nervous when talking to adults s/he has just met.

1 2 3 4 5 6 7 NA

90. Is slow and unhurried in deciding what to do next.

1 2 3 4 5 6 7 NA

91. Is very frightened by nightmares.

1 2 3 4 5 6 7 NA

92. Changes from being upset to feeling much better within a few minutes.

1 2 3 4 5 6 7 NA

Please be sure to answer the questions on the <u>back</u> of this sheet.

1	2	3	4	5	6	7	NA
extremely untrue	quite untrue	slightly untrue	neither true nor untrue	slightly true	quite true	extremely true	not applicable

My child:

93. Has difficulty waiting in line for something.

1 2 3 4 5 6 7 NA

94. Becomes tearful when told to do something s/he does not want to do.

1 2 3 4 5 6 7 NA

95. Has a lot of trouble stopping an activity when called to do something else.

1 2 3 4 5 6 7 NA

96. Becomes very excited while planning for trips.

1 2 3 4 5 6 7 NA

97. Finds rough materials uncomfortable, such as wool against his/her skin.

1 2 3 4 5 6 7 NA

98. Is quickly aware of some new item in the living room.

1 2 3 4 5 6 7 NA

99. Hardly ever laughs out loud during play with other children.

1 2 3 4 5 6 7 NA

100. Enjoys exciting and suspenseful TV shows.

1 2 3 4 5 6 7 NA

101. Is not very upset at minor cuts or bruises.

1 2 3 4 5 6 7 NA

102. Prefers quiet activities to active games.

1 2 3 4 5 6 7 NA

103. Falls asleep within ten minutes of going to bed at night.

1 2 3 4 5 6 7 NA

104. Tends to say the first thing that comes to mind, without stopping to think about it.

1 2 3 4 5 6 7 NA

105. Usually comments if someone has an unusual voice.

1 2 3 4 5 6 7 NA

106. Acts shy around new people.

1 2 3 4 5 6 7 NA

107. Enjoys meeting Santa Claus or other strangers in costumes.

1 2 3 4 5 6 7 NA

108. Has trouble sitting still when s/he is told to (at movies, church, etc.).

1 2 3 4 5 6 7 NA

109. Rarely cries when s/he hears a sad story.

1 2 3 4 5 6 7 NA

110. Sometimes smiles or giggles when playing by her/himself.

1 2 3 4 5 6 7 NA

111. Isn't interested in watching quiet TV shows such as "Mister Rogers."

1 2 3 4 5 6 7 NA

112. Rarely becomes upset when watching a sad event in a TV show.

1 2 3 4 5 6 7 NA

113. Enjoys just being talked to.

1 2 3 4 5 6 7 NA

114. When eager to go outside, sometimes rushes out without putting on the right clothes.

1 2 3 4 5 6 7 NA

115. Is bothered by bathwater that is too hot or too cold.

1 2 3 4 5 6 7 NA

Please be sure to answer the questions on the <u>back</u> of this sheet.

1	2	3	4	5	6	7	NA
extremely untrue	quite untrue	slightly untrue	neither true nor untrue	slightly true	quite true	extremely true	not applicable

My child:

116. Is able to resist laughing or smiling when it isn't appropriate.

1 2 3 4 5 6 7 NA

117. Becomes very excited before an outing (e.g., picnic, party).

1 2 3 4 5 6 7 NA

118. If upset, cheers up quickly when s/he thinks about something else.

1 2 3 4 5 6 7 NA

119. Is comfortable asking other children to play.

1 2 3 4 5 6 7 NA

120. Rarely gets upset when told s/he has to go to bed.

1 2 3 4 5 6 7 NA

121. Rarely smiles and laughs when playing with pets.

1 2 3 4 5 6 7 NA

122. Does not seem to notice parents' facial expressions.

1 2 3 4 5 6 7 NA

123. Rarely runs or moves quickly in the house.

1 2 3 4 5 6 7 NA

124. Enjoys exploring new places.

1 2 3 4 5 6 7 NA

125. When drawing or coloring in a book, shows strong concentration.

1 2 3 4 5 6 7 NA

126. Plays games slowly and deliberately.

1 2 3 4 5 6 7 NA

127. Sometimes appears downcast for no reason.

1 2 3 4 5 6 7 NA

128. Becomes easily frustrated when tired.

1 2 3 4 5 6 7 NA

129. Talks easily to new people.

1 2 3 4 5 6 7 NA

130. Is afraid of the dark.

1 2 3 4 5 6 7 NA

131. Is usually pretty calm before leaving on an outing (e.g., picnic, party).

1 2 3 4 5 6 7 NA

132. Is likely to cry when even a little bit hurt.

1 2 3 4 5 6 7 NA

133. Enjoys looking at picture books.

1 2 3 4 5 6 7 NA

134. Is easy to soothe when s/he is upset.

1 2 3 4 5 6 7 NA

135. Doesn't often giggle or act "silly."

1 2 3 4 5 6 7 NA

136. Is good at following instructions.

1 2 3 4 5 6 7 NA

137. Approaches slowly places where s/he might hurt her/himself.

1 2 3 4 5 6 7 NA

138. Is rarely frightened by "monsters" seen on TV or at movies.

1 2 3 4 5 6 7 NA

Please be sure to answer the questions on the <u>back</u> of this sheet.

1	2	3	4	5	6	7	NA
extremely untrue	quite untrue	slightly untrue	neither true nor untrue	slightly true	quite true	extremely true	not applicable

My child:

139. Likes to go high and fast when pushed on a swing.

1 2 3 4 5 6 7 NA

140. Gets irritable about having to eat food s/he doesn't like.

1 2 3 4 5 6 7 NA

141. Becomes distressed when hair is combed.

1 2 3 4 5 6 7 NA

142. Doesn't usually react to different textures of food.

1 2 3 4 5 6 7 NA

143. Sometimes turns away shyly from new acquaintances.

1 2 3 4 5 6 7 NA

144. When building or putting something together, becomes very involved in what s/he is doing, and works for long periods.

1 2 3 4 5 6 7 NA

145. Sits quietly in the bath.

1 2 3 4 5 6 7 NA

146. Likes being sung to.

1 2 3 4 5 6 7 NA

147. Approaches places s/he has been told are dangerous slowly and cautiously.

1 2 3 4 5 6 7 NA

148. Gets very enthusiastic about teh things s/he does.

1 2 3 4 5 6 7 NA

149. Rarely becomes discouraged when s/he has trouble making something work.

1 2 3 4 5 6 7 NA

150. Is very difficult to soothe when s/he has become upset.

1 2 3 4 5 6 7 NA

151. Likes the sound of words, as in nursery rhymes.

1 2 3 4 5 6 7 NA

152. Smiles a lot at people s/he likes.

1 2 3 4 5 6 7 NA

153. Plays actively outdoors with other children.

1 2 3 4 5 6 7 NA

154. Notices even little specks of dirt on objects.

1 2 3 4 5 6 7 NA

155. When s/he sees a toy or game s/he wants, is eager to have it right then.

1 2 3 4 5 6 7 NA

156. Rarely protests when another child takes his/her toy away.

1 2 3 4 5 6 7 NA

157. Cries when given an injection.

1 2 3 4 5 6 7 NA

158. Seems completely at ease with almost any group.

1 2 3 4 5 6 7 NA

159. Likes rough and rowdy games.

1 2 3 4 5 6 7 NA

160. Has difficulty leaving a project s/he has begun.

1 2 3 4 5 6 7 NA

161. Is not afraid of heights.

1 2 3 4 5 6 7 NA

Please be sure to answer the questions on the back of this sheet.

1	2	3	4	5	6	7	NA
extremely untrue	quite untrue	slightly untrue	neither true nor untrue	slightly true	quite true	extremely true	not applicable

My child:

162. Is not very careful and cautious in crossing streets.

1 2 3 4 5 6 7 NA

163. Often laughs out loud in play with other children.

1 2 3 4 5 6 7 NA

164. Enjoys gentle rhythmic activities such as rocking or swaying.

1 2 3 4 5 6 7 NA

165. Rarely laughs aloud while watching TV or movie comedies.

1 2 3 4 5 6 7 NA

166. Shows great excitement when opening a present.

1 2 3 4 5 6 7 NA

167. Has a hard time going back to sleep after waking in the night.

1 2 3 4 5 6 7 NA

168. Can easily stop an activity when s/he is told "no."

1 2 3 4 5 6 7 NA

169. Is among the last children to try out a new activity.

1 2 3 4 5 6 7 NA

170. Doesn't usually notice odors such as perfume, smoke, cooking, etc.

1 2 3 4 5 6 7 NA

171. Is easily distracted when listening to a story.

1 2 3 4 5 6 7 NA

172. Is full of energy, even in the evening.

1 2 3 4 5 6 7 NA

173. Easily gets irritated when s/he has trouble with some task (e.g., building, drawing, dressing).

1 2 3 4 5 6 7 NA

174. Enjoys sitting on parent's lap.

1 2 3 4 5 6 7 NA

175. Doesn't become very excited about upcoming television programs.

1 2 3 4 5 6 7 NA

176. Is rarely afraid of sleeping alone in a room.

1 2 3 4 5 6 7 NA

177. Rarely cries for more than a couple of minutes at a time.

1 2 3 4 5 6 7 NA

178. Is bothered by like loud or scratchy sounds.

1 2 3 4 5 6 7 NA

179. Smiles at friendly strangers.

1 2 3 4 5 6 7 NA

180. Has an easy time leaving play to come to dinner.

1 2 3 4 5 6 7 NA

181. Gets angry when called in from play before s/he is ready to quit.

1 2 3 4 5 6 7 NA

182. Enjoys riding a tricycle or bicycle fast and recklessly.

1 2 3 4 5 6 7 NA

183. Is "slow to warm up" to others.

1 2 3 4 5 6 7 NA

184. Sometimes doesn't seem to hear me when I talk to her/him.

1 2 3 4 5 6 7 NA

Please be sure to answer the questions on the <u>back</u> of this sheet.

1	2	3	4	5	6	7	NA
extremely untrue	quite untrue	slightly untrue	neither true nor untrue	slightly true	quite true	extremely true	not applicable

My child:

185. Is usually able to resist temptation when told s/he is not supposed to do something.

1 2 3 4 5 6 7 NA

186. Sometimes becomes absorbed in a picture book and looks at it for a long time.

1 2 3 4 5 6 7 NA

187. Has difficulty sitting still at dinner.

1 2 3 4 5 6 7 NA

188. Remains pretty calm about upcoming desserts like ice cream.

1 2 3 4 5 6 7 NA

189. Gets nervous about going to the dentist.

1 2 3 4 5 6 7 NA

190. Hardly even complains when ill with a cold.

1 2 3 4 5 6 7 NA

191. Looks forward to family outings, but does not get too excited about them.

1 2 3 4 5 6 7 NA

192. Likes to sit quietly and watch people do things.

1 2 3 4 5 6 7 NA

193. Gets mad when provoked by other children.

1 2 3 4 5 6 7 NA

194. Smiles when looking at a picture book.

1 2 3 4 5 6 7 NA

195. Has a hard time concentrating on an activity when there are distracting noises.

1 2 3 4 5 6 7 NA

Please check back to make sure you have completed all the pages of the questionnaire. Thank you very much for your help!

Name _____

School/Agency _____

Sex: Male _____ Female _____ Grade _____

TGMD

TEST OF GROSS MOTOR DEVELOPMENT

Dale A. Ulrich

TESTING INFORMATION

1ST TESTING

	Year	Month	Day
Date Tested			
Date of Birth			
Chronological Age			

Examiner's Name

Examiner's Title

Purpose of Testing

2ND TESTING

	Year	Month	Day
Date Tested			
Date of Birth			
Chronological Age			

Examiner's Name

Examiner's Title

Purpose of Testing

RECORD OF SCORES

1ST TESTING

Subtests	Raw Scores	%iles	Std. Scores
Locomotor Skills			
Object Control Skills			
Sum of Standard Scores =			
Gross Motor Development Quotient (GMDQ) =			

2ND TESTING

Subtests	Raw Scores	%iles	Std. Scores
Locomotor Skills			
Object Control Skills			
Sum of Standard Scores =			
Gross Motor Development Quotient (GMDQ) =			

COMMENTS/RECOMMENDATIONS

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LOCOMOTOR SKILLS

Skill	Equipment	Directions	Performance Criteria	1st	2nd
RUN	50 feet of clear space, colored tape, chalk or other marking device	Mark off two lines 50 feet apart Instruct student to "run fast" from one line to the other	1. Brief period where both feet are off the ground 2. Arms in opposition to legs, elbows bent 3. Foot placement near or on a line (not flat footed) 4. Nonsupport leg bent approximately 90 degrees (close to buttocks)		
GALLOP	A minimum of 30 feet of clear space	Mark off two lines 30 feet apart Tell student to gallop from one line to the other three times Tell student to gallop leading with one foot and then the other	1. A step forward with the lead foot followed by a step with the trailing foot to a position adjacent to or behind the lead foot 2. Brief period where both feet are off the ground 3. Arms bent and lifted to waist level 4. Able to lead with the right and left foot		
HOP	A minimum of 15 feet of clear space	Ask student to hop 3 times, first on one foot and then on the other	1. Foot of nonsupport leg is bent and carried in back of the body 2. Nonsupport leg swings in pendular fashion to produce force 3. Arms bent at elbows and swing forward on take off 4. Able to hop on the right and left foot		
LEAP	A minimum of 30 feet of clear space	Ask student to leap Tell him/her to take large steps leaping from one foot to the other	1. Take off on one foot and land on the opposite foot 2. A period where both feet are off the ground (longer than running) 3. Forward reach with arm opposite the lead foot		
HORIZONTAL JUMP	10 feet of clear space, tape or other marking devices	Mark off a starting line on the floor, mat, or carpet Have the student start behind the line Tell the student to "jump far"	1. Preparatory movement includes flexion of both knees with arms extended behind the body 2. Arms extend forcefully forward and upward, reaching full extension above head 3. Take off and land on both feet simultaneously 4. Arms are brought downward during landing		

LOCOMOTOR SKILLS

Skill	Equipment	Directions	Performance Criteria	1st	2nd
SKIP	A minimum of 30 feet of clear space, marking device	Mark off two lines 30 feet apart Tell the student to skip from one line to the other three times	1. A rhythmical repetition of the step-hop on alternate feet 2. Foot of nonsupport leg carried near surface during hop 3. Arms alternately moving in opposition to legs at about waist level		
SLIDE	A minimum of 30 feet of clear space, colored tape or other marking device	Mark off two lines 30 feet apart Tell the student to slide from one line to the other three times facing the same direction	1. Body turned sideways to desired direction of travel 2. A step sideways followed by a slide of the trailing foot to a point next to the lead foot 3. A short period where both feet are off the floor 4. Able to slide to the right and to the left side		
			LOCOMOTOR SKILLS SUBTEST SCORE		

OBJECT CONTROL SKILLS

Skill	Equipment	Directions	Performance Criteria	1st	2nd
TWO-HAND STRIKE	4-6 inch light-weight ball, plastic bat	Toss the ball softly to the student at about waist level Tell the student to hit the ball hard Only count those tosses that are between the student's waist and shoulders	1. Dominate hand grips bat above nondominant hand 2. Nondominant side of body faces the tosser (feet parallel) 3. Hip and spine rotation 4. Weight is transferred by stepping with front foot		
STATIONARY BOUNCE	8-10 inch playground ball, hard, flat surface (floor, pavement)	Tell the student to bounce the ball three times using one hand Make sure the ball is not underinflated Repeat 3 separate trials	1. Contact ball with one hand at about hip height 2. Pushes ball with fingers (not a slap) 3. Ball contacts floor in front of (or to the outside of) foot on the side of the hand being used		

OBJECT CONTROL SKILLS

Skill	Equipment	Directions	Performance Criteria	1st	2nd
CATCH	6-8 inch sponge ball, 15 feet of clear space, tape or other marking device	Mark off 2 lines 15 feet apart. Student stands on one line and the tosser on the other. Toss the ball underhand directly to student with a slight arc and tell him/her to "catch it with your hands." Only count those tosses that are between student's shoulders and waist.	1. Preparation phase where elbows are flexed and hands are in front of body 2. Arms extend in preparation for ball contact 3. Ball is caught and controlled by hands only 4. Elbows bend to absorb force		
KICK	8-10 inch plastic or slightly deflated playground ball, 30 feet of clear space, tape or other marking device	Mark off one line 30 feet away from a wall and one that is 20 feet from the wall. Place the ball on the line nearest the wall and tell the student to stand on the other line. Tell the student to kick the ball "hard" toward the wall.	1. Rapid continuous approach to the ball 2. The truck is inclined backward during ball contact 3. Forward swing of the arm opposite kicking leg 4. Following-through by hopping on nonkicking foot		
OVERHAND THROW	3 tennis balls, a wall, 25 feet of clear space	Tell student to throw the ball "hard" at the wall	1. A downward arc of the throwing arm initiates the windup 2. Rotation of hip and shoulder to a point where the nondominant side faces an imaginary target 3. Weight is transferred by stepping with the foot opposite the throwing hand 4. Following-through beyond ball release diagonally across body toward side opposite throwing arm		
			OBJECT CONTROL SKILLS SUBTEST SCORE		