THE DEVELOPMENTAL CHARACTERISTICS OF YOUNG CHILDREN
PRENATALLY SUBSTANCE-EXPOSED

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Diane L. Taylor, B.S., M.Ed.
Denton, Texas
December, 1992
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Drug use among women of child-bearing age continues to be a pervasive problem in today’s society. As a consequence, health-care providers, social service workers, and educators are seeing a continued increase in the number of children born prenatally substance-exposed. As these children continue to grow in number, it becomes increasingly important that the effects of prenatal substance-exposure be documented.

The purpose of this study was to explore the developmental characteristics of young children (ages 11-60 months) with prenatal substance-exposure. A developmental rating scale, the Developmental Checklist (DC) of the Developmental Observation Checklists (DOCs) was utilized. The DC measures the domains of language, motor, social/behavioral, and cognition, as well as overall developmental status.

The group of children prenatally substance-exposed were compared to a group of children with normal developmental histories on the five domains identified in the DC. Multivariate analysis of covariance procedures indicated a significant difference between the two groups.
on all five domains.

The group of children with prenatal substance-exposure were then compared to two groups of children with established disabilities. One group exhibited speech/language disorders and the other group consisted of children receiving early intervention services and carried the qualifying labels of learning disabled, emotionally disturbed, and developmentally delayed. Multivariate analysis of covariance procedures indicated differences among the three groups, with a significant difference found on the domain of cognition. Post-hoc analysis verified a significant difference between the group of children with prenatal substance-exposure and the children with speech/language disorders on the domain of cognition.

The results of this study suggest that young children with prenatal substance-exposure progress developmentally at a rate far below their normally developing age-mates. When compared to children with established disabilities, however, no significant differences were evidenced, except on the domain of cognition.

The results further imply that if early intervention services are warranted, the children with prenatal substance-exposure would be appropriately served with children with established disabilities, with particular attention paid to developing cognitive abilities.
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CHAPTER I

INTRODUCTION TO THE STUDY

Background

Drug abuse is not a new phenomenon. Specialists in the treatment of drug use and abuse have long known the pervasive effects and destructive elements associated with addiction. In recent years, however, the attention of researchers, interventionists, and educators interested in this topic has undergone a shift in focus. A stark realization has occurred: the effects of drug abuse have reached far past the abusers and are affecting their children throughout the lifespan.

Substance-exposed infants and young children are the most recent victims in the destructive cycle of drug abuse. They comprise a large and constantly growing population requiring treatment in newborn nurseries, neonatal intensive care units, and early intervention programs (Weston, Ivins, Zuckerman, Jones, & Lopez, 1989). Many of these infants and children face physical (Chasnoff, 1987; Chasnoff, Burns, & Burns, 1987; Cherukuri, Minkoff, Feldman, Parekh, & Glass, 1988; Dixon, 1989; Frank, 1990; Schneider, Griffith, & Chasnoff, 1989) developmental (Dixon, Bresnahan, & Zuckerman, 1990; Fink, 1990; Gittler,

Accurately determining the incidence and prevalence of substance-exposed children is extremely difficult. Many researchers have sought to quantify incidence and prevalence, with varying results. The seminal research was conducted by Dr. Ira J. Chasnoff and his associates at the National Association for Perinatal Addiction and Research Education (NAPARE) (1988). In his study, Chasnoff reported a maternal drug abuse rate of 11%. Similar figures were reported by the Senate Select Committee on Children, Youth and Families in 1989. According to findings cited in a majority of the research studies examined, however, drug use among pregnant women, and all women of child-bearing age, appears to be on the rise (Gittler, 1990; Ostrea, 1989).

Drug use by pregnant women does not confine itself to members of minority groups or persons of low socioeconomic status. Rather, research indicates that it crosses all social, economic, racial, and ethnic boundaries (Gold, 1987). It is noted, however, that social factors often
influence prevalence rates. For example, an African-American mother who abuses drugs during her pregnancy is ten times more likely to be reported to authorities than her Caucasian counterpart (Chasnoff, Landress, & Barrett, 1990).

Drug use during pregnancy has the potential of affecting children prenatally, perinatally, and postnatally, as well as at differing rates and degrees. Existing research on the effects of prenatal substance exposure ranges in tone from dramatic to subdued. On one hand, these children have been described as a "bio-underclass" by Douglas Besharov (1989), former director of the National Center on Child Abuse. He describes substance-exposed children as "a cohort of children whose combined physiological damage and extreme socioeconomic disadvantage could foredoom them to a life of inferiority" (p. 19). Marilee Rist (1990), senior editor of The American School Board Journal, describes the situation as follows: "Like the Angel of Death descending on the firstborn in Old Testament Egypt, crack has just begun to do its deadly work, producing tens of thousands of blameless children each year who, by biology and environment, are cast into a world devoid of nearly every hope..." (p. 24). Others believe that the incidence of prenatal substance exposure is so widespread that formation
of special classes for this population in unadvisable, for there would be no children left to serve in regular education (Somerville, 1990).

Conversely, some researchers believe that too much attention has been placed upon the adverse effects of prenatal substance exposure without considering the studies which have found negligible outcomes (Koren, Shear, Graham, & Einarson, 1989). A number of child development experts also paint a more hopeful picture for substance-exposed children, citing that much of the adverse effects noted can be overcome through early intervention programs (Chasnoff, Griffith, Freier, & Murray, 1992; Schneider & Byrne, 1984; Shores, 1991; Toufexis, 1991; Weston et al., 1989).

Research literature has documented a number of early developmental indicators and outcomes for prenatally substance-exposed infants and young children. A four-year study indicated that 42% of these children exhibited language delays and articulation problems, 37% were highly distractible, and 26% demonstrated behavioral problems such as hyperactivity, aggression, and sensitivity to external stimulation (Shores, 1991). As children prenatally substance-exposed reach the age to enter preschool and kindergarten settings, they are being compared to children exhibiting such exceptional characteristics as learning disabilities (Lewis, 1986), autism (Blakeslee, 1989), behavioral disorders (Viadero, 1989), speech and language
impairments (Dixon, 1990), and attentional disorders (Brazelton, 1990).

With this convoluted and confusing set of descriptors for substance-exposed children emerging in the literature, the question becomes: Can a pattern of developmental characteristics be substantiated for this population? Will the developmental characteristics displayed by substance-exposed children be markedly different from those of normally developing children or children with other, established disabilities?

Purpose

The purpose of this study is to further explore the developmental characteristics of young children prenatally substance-exposed. By determining early developmental indicators in the cognitive, linguistic, motoric, and social/behavioral domains, it becomes possible to compare substance-exposed children to children with normal developmental histories, and explore similarities and dissimilarities among developmental profiles. If differences are found, the developmental characteristics of children with prenatal substance-exposure will be compared to children with established disabilities. These comparisons allow for possible identification of a developmental pattern, and speculation as to where this
population of children could best be served within the educational system.

For the purposes of this study, a substance-exposed child will be identified as a youngster who has endured the effects of prenatal exposure to substances, other than tobacco and alcohol alone, which are known to be detrimental to the developing fetus. For the children identified in this study, medical histories indicated cocaine and/or crack cocaine as the primary source of drug exposure during the pregnancy.

In pure research situations, it would be preferable to identify a specific drug (i.e., cocaine), and determine its singular effects. In reality, however, the single substance abuser does not exist (Jones & Lopez, 1988; Weston, et al., 1989). Research has supported the concept that most individuals who regularly abuse drugs are instead users of multiple types of substances (Harpring, 1990). This is also the case for the pregnant drug abuser. As with other drug users, maternal drug users are likely to use more cigarettes and alcohol than average persons, both of which have been shown to perversely affect unborn children (Chasnoff, 1991; Streissguth, 1986). As the detrimental substances contained in cigarettes and alcohol are not considered drugs per se, this study will utilize the term "substance-exposed" in an effort to explore the effects and combination of effects of all potentially
damaging substances on the developing child, recognizing that the effects of cigarettes and alcohol are most likely present as well. For all substance-exposed children in this study, cocaine and/or crack cocaine were the primary source of drug exposure. This study will exclude, however, children with recognized Fetal Alcohol Syndrome (FAS), as this condition carries an established set of developmental characteristics that have been well documented (see for example, Shaywitz, Cohen, & Shaywitz, 1980).

Significance

This study seeks to determine if there exists an identifiable pattern of developmental characteristics for young children who have been prenatally substance-exposed. The characteristics emerging from this study will be compared to the developmental indicators of non-substance-exposed, normally developing children. If the developmental characteristics of the substance-exposed children are found to be similar to those of the non-substance-exposed, normally developing children, then the plausibility of educational interventions for children with prenatal substance-exposure taking place within regular education may emerge as a viable option.

If significant differences are found between the substance-exposed children and the normally developing children, the developmental indicators for the children
with substance-exposure will be compared with the
developmental characteristics of children with established
exceptional characteristics in order to determine if any
similarities exist. This exploration will aid in planning
effective intervention strategies for substance-exposed
children, for if similarities do exist between these
children and children with an established disability,
existing special education programming options may possibly
be utilized to provide educational interventions.

The possibility exists that, after all comparisons are
made, substance-exposed children will present developmental
indicators which separate them from other established
groups. If this proves to be the case, then the need for
specialized interventions based upon the needs which emerge
may be explored.

Limitations

Threats to validity are a concern for all researchers
(Kerlinger, 1986; Pedhazur, 1982). With this particular
study, four areas of concern are discussed.

The first threat to validity involves the
aforementioned phenomenon of multiple, or poly-drug use.
It would be very difficult to accurately determine the
effects of specific drugs, or the combinations of those
drugs, upon developing children (Harpring, 1990). For
example, it would be virtually impossible for a researcher
to study the effects of cocaine alone since most cocaine
abusers use alcohol, even if alcohol use is not directly reported. Additionally, reliance on self-reports by medical personnel often compounds the problem.

A second threat to validity involves sample identification. Since much of the developmental history relies on the self-reports of the mother, accuracy cannot be guaranteed. Due to the often illegal and personal nature of this issue, individuals are often reluctant to admit to drug abuse, or, if they do admit substance usage, may grossly under report actual frequencies or amounts (Little, Snell, Klein, & Gilstrap, 1989).

A third area of concern relates to the small sample size inherent in the study of prenatal substance abuse. Accurate identification of a substantial number of substance-exposed children may prove difficult. Small sample sizes often result in suspicious findings (Hinkle, Wiersma, & Jurs, 1988; Kerlinger, 1986). Though limited in scope, this study will meet the minimum requirements for sample size for the statistical methods chosen for data analysis.

A fourth validity threat lies in separating the effects of prenatal substance exposure from the environmental effects of drug use in home settings. During a recent gathering of the International Council for Exceptional Children (April, 1991, Atlanta, Georgia),
several researchers reported on this phenomenon. Other researchers have discussed possible conflicts in this area (Dixon, Bresnahan, & Zuckerman, 1990).

Definition of Terms

1. **Abuse**: To use wrongly or improperly; misuse (Mish, 1983).

2. **Addiction**: Refers to drug or alcohol dependence which is marked by continued use when hazardous or with negative consequences; much time spent in pursuit of the substance; inability to control use; loss of usual activities; development of a tolerance and requiring greater quantities (Kronstadt, 1989).

3. **Crack**: Rock or crystal form of cocaine, usually smoked in a pipe.

4. **Illicit drugs**: Chemical substances which are prohibited by law (Abadinsky, 1989).

5. **Legal drugs**: Chemical substances which are not prohibited by law, including prescription medicines prescribed by a doctor for the person consuming them; legal drugs include substances such as alcohol, caffeine, and nicotine (Abadinsky, 1989).

6. **Neonate**: A newborn infant (Kronstadt, 1989).

7. **Perinatal**: Referring to the period around birth, usually from birth to 28 days after birth (Kronstadt, 1989).
8. **Placenta**: The organ that houses the fetus and allows for the exchange of oxygen, nutrition, wastes, and chemicals between the mother and fetus (Kronstadt, 1989).

9. **Postnatal**: Time in the child's life taking place subsequent to birth (Mish, 1983).

10. **Premature**: An infant born before 37 weeks gestation (Kronstadt, 1989).

11. **Prenatal**: Occurring, existing, or taking place before birth (Mish, 1983).

12. **Substance-exposure**: Presenting the effects of exposure to substances which are documented to alter the functioning of an individual without the individual actually ingesting the substance (Harpring, 1990). For the purposes of this study, substance-exposure denotes as the primary source of exposure crack and/or crack cocaine, realizing that other substances were most likely abused as well.

13. **Toxicological screening**: A laboratory test of bodily fluids, urine, blood, or hair used to detect the presence of certain substances (Kronstadt, 1989).
CHAPTER II

REVIEW OF THE LITERATURE

The problems of infants born to substance abusers have been recognized for many years. During the 1960's and 1970's, the children of heroin addicts inhabited neonatal wards, and infants born prenatally exposed to alcohol have been studied extensively.

More recently, however, an increase has been reported in the overall number of drug abusers (Elmer-DeWitt, 1989), along with a change in the demographic characteristics of the "typical" drug abuser. While during the 1960's and 1970's drug users were primarily male, the 1980's have brought an increasing number of women into the world of substance abuse, most of whom are of child-bearing age (Gittler, 1990). The percentage of women as a proportion of all persons who tested positive for drug use was 40% in 1988, compared to 25% in 1972 (Elmer-DeWitt, 1989). This trend appears to be continuing during the present decade, and brings to the forefront the possibility of detrimental effects of drug abuse on the children born to these women. This review of the literature will focus on the following topics: (a) limitations of existing research, (b) incidence and prevalence, (c) characteristics of pregnant drug
abusers, (d) prenatal effects of drug exposure, (e) perinatal effects of drug exposure, and (f) postnatal effects of drug exposure.

Limitations of Existing Research

At the present time, research efforts have been largely unsuccessful in substantiating a definitive set of developmental outcomes for children with prenatal substance exposure. Researchers attempting to isolate the effects of a single drug or combination of drugs on a developing child are hindered in their efforts by numerous confounding variables.

First, many studies rely on the self-reports of users in order to determine the amount and frequency of drug use during pregnancy. These self-reports can be inaccurate, resulting in study conclusions that may not be representative. For example, in testimony before the U.S. House Select Committee on Children, Youth, and Families (1989), it was reported that of 117 women identified as substance abusers during pregnancy, 24% denied using drugs, despite the fact that they had tested positive on urine tests at least once during their pregnancies.

Compounding the potential unreliability of maternal self-reports is the occurrence of false-negative and false-positive test results obtained from the infants. In one documented study of babies whose mothers used crack, 25% of the infants displayed withdrawal symptoms but had negative
urine screening results, while another 35% had positive screens and no symptoms of withdrawal using a more sensitive urine drug test (Cherukuri, Minkoff, Feldman, Parekh, & Glass, 1988). One estimate suggests that toxicology screening may in fact fail to identify up to 50% of all infants prenatally exposed to drugs (Ostrea, 1989).

Many research studies predicting postnatal outcomes of children prenatally exposed are based upon the findings of studies involving animals. Quite often, animal studies can elucidate the mechanisms by which drug exposure damages a developing human child, but, due to the species, strain, and individual differences, generalizing the results of animal studies to humans can involve errors, false positives, and false negatives. Lewis (1987) cites research related to thalidomide testing, which during animal studies revealed only occasional teratogenicity among 10 strains of rats, 15 strains of mice, 11 breeds of rabbits, two breeds of dogs, three strains of hamsters, and eight species of primates. This drug’s effect on a developing human child, however, has proven to be much more devastating and pervasive than was found among the strains and species of animals studied.

Another source of limitation lies in the environmental factors affecting the expectant mother and her unborn child. Prenatally, factors such as poor nutrition, lack of
prenatal care, co-existing diseases (such as sexually transmitted diseases (STDs)), maternal psychopathology, and a drug-seeking lifestyle can all affect the woman and can maintain varying influences on the eventual outcomes of the child (Chasnoff, 1989; Lockwood, 1990).

Postnatally, the environmental conditions under which most of these children develop are often associated with negative outcomes. Infants born to drug addicted mothers may be sent home with the mother, placed in foster care, or left abandoned in the hospital. The National Council on Disability (NCD) (1990), estimates that 50-75% of the infants go home with the mother or another relative, and 30-50% go into foster care or become "boarder babies," meaning they remain in hospital settings due to a lack of available foster care. Placement of an infant in any of these settings may have negative effects on developmental outcomes.

Although foster care may seem less than an ideal situation for any child, in some instances allowing a child to go home with a drug using mother is more dangerous. Unfortunately, an addict's primary concern may be obtaining the drug rather than providing adequate infant care (Howard, et al., 1989; University of Minnesota, Center for Early Education and Development (UMCEED), 1990). This has the potential to threaten a child's safety, for the mother may expose the infant to dangerous drug subcultures.
An environmental problem specifically associated with maternal drug addition to crack involves the fumes produced when the substance is smoked. An infant is exposed to this "second-hand" smoke, which is known to cause physiological damage such as seizures (Bateman & Heagarty, 1989). This is particularly endangering when the family lives in a confined space with poor ventilation.

Another potential difficulty with sending an infant home with a drug abusing mother is that many of these women lack basic parenting skills and suffer from personal mental and physical problems. To compound these problems, behavioral difficulties often exhibited by substance-exposed infants indicate the caretaking responsibilities associated with these infants may be extremely stressful (Weston, et al., 1989). The resulting frustration may place an infant at risk for abuse, neglect, and/or abandonment (Howard et al., 1989; Kantrowitz, Wingert, DeLa Pena, Gordon, & Padgett, 1990; Schneider et al., 1989; UMCEED, 1990).

The effects of substance exposure can be compounded positively as well as negatively by postnatal factors (Lockwood, 1990). A substance-exposed infant provided with a positive physical and social environment, adequate health care, early intervention services, and other support measures may develop better than one not exposed prenatally.

Further complicating the ability to draw generalizable conclusions from existing research is the fact that there is much variation in the ways in which an infant may be affected by prenatal substance exposure. Effects depend on the types of drugs used, amounts ingested, stages of pregnancy in which the drugs were used and the frequency of drug use. The fetus' response to substance exposure is also related to the expectant mother's ability to metabolize and tolerate the drug, which depends upon various physiological and genetic factors particular to the mother (Lockwood, 1990).

Incidence and Prevalence

No one agency or research team can conclusively state how many infants are affected by prenatal exposure to harmful substances, but reliable estimates do exist. The National Institute on Drug Abuse reported that 5 million women of child-bearing age used illicit drugs in 1989, including 1 million cocaine users and 4 million marijuana users. In some urban areas, cocaine is the most frequently used illicit drug among these women (Adams & Durell, 1984; Pollin, 1985). The figures cited do not include the usage rates of legal substances, such as nicotine and alcohol, by women of child-bearing age.
Epidemiological studies of drug usage in the United States have shown that, between 1976 and 1985, visits to the emergency room for cocaine abuse increased more than fifteenfold, with many of these individuals being young women, some of whom were pregnant (Colliver, 1987; National Institute on Drug Abuse, 1987). Consequently, the number of infants born prenatally exposed to drugs has increased dramatically.

The most frequently cited national estimate of the number of substance-exposed newborns emerges from a 1988 nationwide survey of 36 hospitals conducted by the National Association of Perinatal Addiction, Research, and Education (NAPARE). Based on this study, it was estimated that 11 percent of all newborns, or roughly 375,000 infants, had been substance-exposed before birth (Chasnoff, 1988). Incidence figures varied among the individual hospitals, with a range of 0.4% to 27%. A 1989 survey by the U.S. House of Representatives Select Committee on Children, Youth, and Families stated that 11% of pregnant women used illicit drugs resulting in an estimate of 370,000 annual births of substance-exposed infants. In some inner city areas, the prevalence rates are much higher. Some hospitals are reporting that 50% of women giving birth are testing positive for illicit drug use (National Institute on Drug Abuse, 1989). A Detroit hospital, utilizing meconium (fetal fecal material) testing, reported 42% of
their deliveries in 1989 as being substance-exposed (Ostrea, 1989).

Though incidence figures tend to vary depending upon such factors as the public or private status of the hospital, current estimates are well above the originally cited 11%. In public clinics, 16.3% of deliveries tested positive for substance exposure as compared to 13.1% of the live births in private institutions (Chasnoff, Landress, & Barrett, 1990).

Another study, conducted in 1988 by the U.S. House of Representatives Select Committee on Children, Youth, and Families, surveyed 18 hospitals (14 public and 4 private) in 15 large urban areas. At 15 of the 18 hospitals surveyed, births of substance-exposed infants had tripled or nearly tripled since 1985. The survey further revealed that the proportions of newborns that had been prenatally exposed to drugs ranged from 4-18%.

These statistics include infants who have been prenatally exposed to a variety of drugs, including crack, cocaine, heroin, methadone, amphetamines, phenylcyclidine hydrochloride (PCP), and marijuana. Some researchers suggest that the estimates should be interpreted judiciously, since many of the surveys are biased by reliance on hospitals located in major metropolitan areas.
and may not be representative of hospitals in the nation as a whole (Besharov, 1989).

Many researchers believe, however, that these figures represent a substantial underestimation of the incidence of prenatal substance exposure due to several important factors (Gittler, 1990). First, hospitals and physicians, particularly those in the private sector, do not routinely and systematically assess pregnant women and new mothers for drug use. Secondly, hospitals and physicians do not routinely and systematically assess newborns for the effects of prenatal substance exposure, and, since the babies born drug exposed may appear healthy, in utero drug exposure may go undiagnosed. Finally, methods of assessing drug use during pregnancy, as well as methods for detecting perinatal substance exposure, lack consistency with regard to standardized methods for screening and testing women and infants for the presence of drugs. Hospitals implementing uniform screening and testing procedures indicate that the numbers of infants born prenatally substance-exposed is 3 to 5 times higher than current percentage estimates would suggest (Ostrea, 1989).

Characteristics of Pregnant Drug Abusers

During their pregnancies, substance abusing women are reporting the usage of many different drugs, including cocaine, crack, heroin, PCP, and marijuana. Surveys published between 1967 and 1982 indicate that the most
commonly abused substances were alcohol, tobacco, marijuana, heroin, and cocaine (Goldman, 1980; Hill & Kleinberg, 1984). Some women surveyed report abusing ten or more different substances during their pregnancies. During the 1980’s, there was a dramatic increase in the use of cocaine for all socioeconomic classes, races, ages, and sexes (Gold, 1987). Cocaine now surpasses heroin as this country’s leading street drug (Tarr & Macklin, 1987), and in the last five to seven years, crack, a relatively pure and inexpensive form of cocaine, has emerged as a favored drug among young women (Gittler, 1990).

Existing reports suggest that mothers of substance-exposed infants, particularly those abusing crack and cocaine, are typically in their twenties and thirties rather than adolescents and teenagers. Most often, these women are not first time mothers (Gittler, 1990).

Women who are substance abusers often have irregular menstrual cycles (attributed to the physiological correlates of drug abuse, such as malnutrition), and, as a result of this irregularity, may not realize that they are pregnant (Chasnoff, 1987). Consequently, by the time the woman realizes that she is pregnant, the fetus may have sustained considerable damage.

Many substance abusing women have an established history of physical, sexual, or emotional abuse, and one or
both of their parents are likely to have abused alcohol and/or drugs. It is also likely that the expectant drug abuser will be in general poor health, and often diseases such as hepatitis, herpes (or other sexually transmitted diseases), cirrhosis, or acquired immunodeficiency syndrome (AIDS) will be present (Chasnoff, 1987).

Research has demonstrated that prenatal care contributes directly to the health and well-being of the fetus (Kelley, Walsh, & Thompson, 1991). Cherukuri, et al. (1988) report that up to 60% of substance abusing women do not seek prenatal care. Economic reasons, lack of awareness, or fear of prosecution if drug use is detected by caregivers often contribute to the lack of adequate medical attention (Frank, 1990).

Fear of prosecution is a viable cause for concern for many expectant drug abusers. For example, in July of 1989, a Florida mother was convicted of delivering cocaine to her unborn child through the umbilical cord. In another case, a judge in Washington, D.C. ordered an expectant addict to jail for the duration of her pregnancy after she tested positive for cocaine use while awaiting trial on theft charges (Moss, 1988). Some may argue that these women deserve to be prosecuted, as it is difficult to maintain moral objectivity concerning women who appear so callously indifferent to the welfare of their unborn children. The avenue of prosecution, however, tends to treat the
symptoms of drug abuse, rather than addressing the underlying causes.

To further confound the effects of drug abuse, many women who abuse substances live in stressful environments, characterized by abusive and/or dysfunctional relationships (Gittler, 1990). They typically suffer from low self-esteem, and many feel guilt and shame for their plight. Often these women feel powerless over their situations and lack the necessary coping and parenting skills to provide a safe, stable environment for their infants (Griffith, 1990; Weston, et al., 1989).

In all likelihood, the expectant substance abuser has used several different drugs during her pregnancy. An individual who abuses only a single substance simply does not exist (Weston, et al., 1989). It is common for a substance abuser to utilize a combination of drugs, each with its particular effects, in order to maintain or alter the feelings experienced by the drug. Consequently, most substance abusers, including those who are pregnant, are known as "polydrug users" (Harpring, 1990), meaning multiple substances may be ingested within any given period of drug use.

Although cocaine, and its derivative, crack cocaine, have been identified as the drug of choice by most women of childbearing age, including expectant drug users, it is not
uncommon for a cocaine abuser to smoke more cigarettes and ingest more alcohol than abusers of other drugs (Koren, Feldman & MacLeod, 1990). The detrimental effects of these substances on a developing child has been well documented. In addition to these legal substances, the typical cocaine abuser is apt to use marijuana and benzodiazepines (Chasnoff, 1987). Along with alcohol, marijuana and benzodiazepines tend to alleviate the depression that often follows the cocaine high. Other substances often abused include lysergic acid diethylamide (LSD), opiates (heroin), and PCP. The combination of substances used during pregnancy makes clear cut distinctions with regard to effects on an infant extremely difficult.

Prenatal Effects of Drug Exposure

The number of drug abusers in this country is rising, and, consequently, the number of substance-exposed children is growing at an alarming rate. Harpring (1990) has identified three categories of effects suffered by children prenatally exposed to drugs. They are:

1. addiction—a newborn child undergoes withdrawal, after which it may grow and develop more or less normally, as if addiction had not been a part of prenatal development;

2. toxicity—the toxic effects of the drug cause direct injury to a developing child while in utero;
3. teratogenicity—more complex than addiction or toxicity, teratogenic effects may or may not appear at birth. These effects involve structural damage of some sort, but drugs that act on metabolic, endocrine, or central nervous system functions may not cause symptoms to emerge until childhood or adolescence. At this point in the development of medical technology in the area of prenatal drug abuse, it is extremely difficult, if not impossible, to determine which drugs, in which combinations, will result in which future outcomes.

During the prenatal period, the placenta does not protect a developing child from substances taken by an expectant mother, as was once believed (Fink, 1990). Instead, many drugs pass freely across the placenta to the fetus. Drugs such as cocaine, crack, and heroin that act on the central nervous system easily cross the placenta from maternal to fetal circulation (Lewis, Bennett, & Schmeder, 1989). In the fetus, drugs are metabolized differently than in adults. For example, cocaine and its metabolites are cleared from adult urine in approximately 24 hours, whereas the drugs remain from four to six days in the urine of neonates (Chasnoff, 1987). An infant may continue to be exposed to the drug through reingestion, as it remains in the amniotic fluid in the form of norcocaine, a highly active metabolite with a high level of penetration into the central nervous system (Schnieder, Griffith, &
Chasnoff, 1989). Because the norcocaine is water soluble, it does not readily pass back into the woman’s system for excretion.

Cocaine acts primarily on the central nervous system as a stimulant, while peripherally causing vasoconstriction (constriction of the blood vessels), tachycardia (irregular heart rhythm), and a rapid rise in blood pressure. These effects are believed to occur in both the expectant mother and fetus, and may explain the increased rates of spontaneous abortion, abruptio placentae (separation of the placenta from the uterus), and in utero cerebrovascular accidents associated with cocaine use during pregnancy (Bingol, Fuchs, & Diaz, 1987). Further, the dramatic decrease in uterine blood flow associated with cocaine use often results in fetal hypoxia (lowered levels of oxygen), which can lead to a variety of complications (Hurt, 1989), including inhibited cellular growth (Free, Russell, Mills, & Hathaway, 1990).

The greatest damage to the fetus from substance exposure occurs during the first trimester (UMCEED, 1990). In a 1988 study conducted by Dixon and Bejar, 39% of a sample of 28 infants prenatally substance-exposed showed areas of hemorrhagic cerebral infarcts, meaning certain areas of the brains of the infants showed tissue damage related to the discharge of blood and blood clots. An
increased number of prenatal strokes, caused by the bursting blood vessels in the fetus' brain, have also been attributed to maternal drug use (Dixon, 1989; Frank, 1990; UMCEED, 1990).

A number of other fetal teratogenic effects have been attributed to maternal drug use. Substance exposure may cause intrauterine growth retardation (Schneider, et al., 1989), which results in an infant having decreased body mass and a smaller than normal head circumference (Chasnoff, 1986; Cherukuri et al., 1988). Small head circumference is suggestive of lowered brain mass and consequent diminished cognitive capabilities (Harpring, 1990).

Prenatal substance exposure may also result in the deformation of limbs and the malformation of the kidneys, lungs, heart, urinary tract and genitals of an infant (Chasnoff, 1987; Little, Snell, Klein, & Gilstrap, 1989). In addition, substance exposure is theorized to cause damage to the central nervous system and digestive system of a developing child (Dixon, 1989; Frank, 1990; UMCEED, 1990). Frank cautions, however, that research in this area is not conclusive, and additional medical research is needed for confirmation.

Perinatal Effects of Drug Exposure

According to the Office of the Inspector General (1990), approximately 18% of substance-exposed infants are
born with complications that require significant medical interventions at birth. As cited earlier, many drugs constrict the blood flow to the uterus, which can result in an infant that is small for gestational age (Free et al., 1990). These infants often are malnourished, with small head circumference and retarded brain development (Chasnoff, 1986; Cherukuri et al., 1988).

Additionally, many substance-exposed infants are born prematurely, further increasing their risk for perinatal and postnatal difficulties (Chasnoff, Burns & Burns, 1987; Chasnoff, Griffith, MacGregor, Dirkes & Burns, 1989; Finneghan, 1988; Shores, 1991). This condition increases the risk of compromised developmental outcomes.

Infants born to substance abusing women may be full-term, but weigh substantially less than normal. This condition, known as low birth weight (LBW), is characterized by an infant weighing less than 5.5 pounds at birth, and has been shown to produce detrimental outcomes (Kitchen, 1991). Compared to babies of normal birth weight, LBW infants are far more likely to suffer neurodevelopmental difficulties, including cerebral palsy and seizure disorders. Further, these infants are 40 times more likely to die during the first year of life (Harpring, 1990).
Immediately following birth, substance-exposed infants have been observed with conditions such as hypothermia (abnormally low body temperature), tachycardia, and breathing abnormalities (Chasnoff, 1986). In addition, these infants are often irritable, tremulous, and deficient in visual functioning (Harpring, 1990). They display irregular sleeping patterns, poor state control, increased muscle tone, poor feeding patterns (Schneider, et al., 1989), as well as a high rate of sudden infant death syndrome (SIDS). One study indicates a 15% rate of SIDS, compared with 0.3% among the general population (Lewis, Bennett, & Schmeder, 1989).

Postnatal Effects of Drug Exposure

Throughout infancy, a child exposed prenatally to drugs shows a number of signs of atypical development. The magnitude of the problem becomes increasingly dramatic with the realization that many substance-exposed children are not identified at birth due to a lack of overt or directly observable signs. Not all children exposed to drugs prenatally are born with addictions. Some enter the world relatively "clean," but may have sustained injury as a result of exposure to some level of drug use by the mother. Other children may look perfectly normal at birth, but gradually display symptoms that indicate previous exposure. This variety of possible effects makes
identification and intervention an extremely challenging endeavor.

Although these infants may not require medical treatment substantially different from non-substance-exposed infants, they often present a range of characteristics which provide challenges to caregivers. These children may not demonstrate the effects of substance exposure until the age of two to three years (Office of Inspector General, 1990). Consequently, these youngsters may not be brought to the attention of professionals until developmental, behavioral, or learning problems emerge when they encounter a structured educational system such as day care, preschool, or kindergarten.

Through research studies medical and educational professionals have sought to establish a set of developmental characteristics for substance-exposed children. These studies have substantiated difficulties in the following developmental areas: (a) cognitive, (b) language, (c) motor, and (d) social/behavioral.

Cognitive Development

Although early cognitive assessments have indicated the mental abilities of substance-exposed children lies within the average range (Gittler, 1990; Harpring, 1990; Kronstadt, 1989), several negative developmental indicators have emerged. Substance-exposed children have been described as having difficulty processing and integrating

During learning situations, these children often need extended time in order to complete simple tasks, for they tend to perseverate during simple problem-solving activities. Frustration and irritability are characteristic during structured learning tasks (Gittler & McPherson, 1990), and substance-exposed children often show overall decreased task completion as well as the inability to demonstrate mastery of tasks previously learned (Cole, Jones & Sadofsky, 1990). Incidental learning is also difficult for substance-exposed children, which can lead to the lack of development of many important pre-academic skills (Los Angeles Unified School District (LAUSD), 1990), as well as delayed development of reading and mathematical abilities (Hill & Tennyson, 1986).

Language Development

A prenatally substance-exposed child is at increased risk for developing communication deficits (Harpring, 1990; Howard, et al., 1989; Jacobsen & Shubat, 1991). In a study by Shih, Cone-Wesson, and Reddix (1988), maternal cocaine
abuse was shown to adversely affect the development of the auditory system, placing a child at risk for hearing difficulties and subsequent speech and language delays.

Overall delays in both receptive and expressive language have also been reported (Dixon, Bresnahan, & Zuckerman, 1990; Gittler, 1990; LAUSD, 1990). During early language development, substance-exposed children tend to have fewer spontaneous vocalizations and an overall delay in acquiring early vocabulary. There is a decreased use of acquired words to communicate wants and needs, as well as prolonged infantile articulation during the preschool years (Cole, Jones, & Sadofsky, 1990; Griffith, 1990; Poulsen, Cole, Ferrara, & Jones, 1990). Substance-exposed children may also be unable to follow simple oral directions that are appropriate for the developmental level.

Motor Development

As a result of prenatal exposure to harmful substances, affected children may exhibit varying degrees of fine and gross motor delays as well as spatial relationship difficulties. During infancy, many substance-exposed children do not demonstrate the flexibility of motor movement typical of average infants. They tend to lie in excessively extended postures with movements of the extremities being jerky and stiff (Schneider & Chasnoff, 1987). While the infants may reach for objects, the presence of tremors in the upper extremities may have an
impact on early development of eye-hand coordination. These early motor deficits inhibit tactile exploration of the environment which can contribute to delays in developing appropriate body image and motor planning abilities (Schneider, Griffith, & Chasnoff, 1989). Early motor delays not only affect the quality of movement, but may also impact how an infant relates to parents, caregivers, and the environment in general (Lewis, Bennett, & Schmeder, 1989).

During the toddler and preschool years, a substance-exposed child often exhibits delays in developing such basic gross motor behaviors as running, climbing, jumping, catching, and throwing. Affected fine motor development includes difficulty in manipulating small objects when stacking or stringing, completing puzzles, and buttoning large buttons, as well as difficulty in controlling the movements necessary for cutting and writing (Cole, Jones, & Sadofsky, 1990). Substance-exposed children may walk into stationary or moving objects or have difficulty judging distance, moving too close or too far away from target objects (LAUSD, 1990).

Social/Behavioral Development

This area of early development of substance-exposed children has received the greatest research attention. During infancy, these children are said to exhibit
hypersensitivity, irritability, and difficulty in establishing appropriate cycles of wakefulness and sleep (Huntington, Simeonsson, Bailey, & Comfort, 1987; Thomas, Chess, & Korn, 1982; Weston, et al. 1989). Due to depressed interactive abilities, bonding with a substance-exposed infant is often a frustrating experience for the parents. Compound these problems with the poor parenting skills exhibited by many substance abusing mothers, and the parent-infant attachment and bonding process becomes even more challenging. This factor is believed to be reflected in later difficulties a child may exhibit in building and maintaining satisfactory personal relationships (Schneider, et al., 1989).

It is reported that substance-exposed infants demonstrate poor responses to their environments for at least the first two to three months of life (Chasnoff, Burns, & Burns, 1987). By four months of age, many will be able to smile and interact, but irritability and difficulty in handling may persist (Schneider & Chasnoff, 1987).

Research conducted on toddlers and preschoolers prenatally substance-exposed has shown that these children tend to engage in significantly less representational play than other children. For example, play for a substance-exposed child is often characterized by scattering, batting, and picking up and putting down toys rather than sustained combining of toys and fantasy play. In an
unstructured, free play situation, researchers found that when self-organization, self-initiation, and follow-through were required without the intervention of an examiner, the substance-exposed toddlers showed striking deficits (Howard, et al., 1989).

These same researchers found that substance-exposed children often fail to demonstrate strong feelings of pleasure, anger, or distress. Many exhibit unstable attachments, indiscriminately avoiding or clinging to caretakers and strangers.

Difficulties have been noted in concentrational abilities, and hyperactivity and impulsivity are often reported. Further, substance-exposed children may have problems transitioning from one activity to another, coping with unstructured activities, and relating socially with others (LAUSD, 1990).

Upon entering school, substance-exposed children have been noted to experience a number of social and behavioral difficulties. These children continue to have difficulties concentrating on tasks and organizing their behavior, as well as developing appropriate peer and adult relationships (Kantrowitz, et al., 1990). High rates of emotional disturbances and behavior disorders have been associated with prenatal substance-exposure (Howard, et al., 1989).
This is far from an exhaustive list of developmental characteristics for children with prenatal substance exposure, and all children identified as part of this population will not demonstrate the entire range of indicators listed. Further, an established set of developmental characteristics has not emerged from the currently existing research. It has been predicted, however, that 42-52% of the population of prenatally substance-exposed children will need some sort of special education services upon entering school (Howard, et al. 1989, General Accounting Office, 1990).
CHAPTER III

METHODOLOGY AND PROCEDURES

This study was conducted in order to establish a set of developmental characteristics for prenatally substance-exposed children with the intention of comparing their characteristics with those of children with normal developmental histories as well as those of children with established disabilities. This section will present information related to the methodology and procedures followed to accomplish this study. The organization is as follows: (a) research questions, (b) subject selection, (c) instrumentation, (d) data collection, and (e) data analysis.

Research Questions

As demonstrated in current research literature, considerable uncertainty exists with regard to the developmental outcomes of young children born prenatally substance-exposed. This situation calls for further exploration of the topic. This study was conducted in order to address this need, and was guided by the following research questions:

1. Do children who were prenatally substance-exposed differ from non-substance-exposed children with normal developmental histories on language development, motor development, social/behavioral development, cognitive
development, and/or overall developmental status as measured by the Developmental Checklist of the Developmental Observation Checklists?

2. If significant differences are found with regard to research question #1, do children who were prenatally substance-exposed differ from non-substance-exposed children with speech/language disorders, and/or children being served in early intervention programs on language development, motor development, social/behavioral development, cognitive development, and/or overall developmental status as measured by the Developmental Checklist of the Developmental Observation Checklists?

Subject Selection

The children selected for this study that comprise the target group of children prenatally substance-exposed were obtained through various agencies in both Texas and New Mexico. Permission to gather developmental information was granted by the director of a therapeutic preschool serving children prenatally substance-exposed and their families in Albuquerque, New Mexico, as well as from a private speech and language pathologist in the Dallas area. Developmental information for other substance-exposed children was obtained through a public agency serving at-risk children as well as children with special needs and their families in the Ft. Worth area. The determination of substance-exposure was documented by the individual agency through
the use of each agency's established criteria. In all cases, parental admission of substance abuse during pregnancy was the primary means of verification. Cocaine and/or crack cocaine was identified as the primary source of drug-exposure during pregnancy. Permission was granted from the Institutional Review Board of the University of North Texas to exempt this study from further review.

Subjects comprising the comparison group of normally developing children as well as those with established disabilities were drawn from the original standardization sample of the Developmental Observation Checklists. The age range of all groups of children was eleven through sixty months.

Instrumentation

For the population of children prenatally substance-exposed, established research suggests that standardized tests administered in a structured, artificial setting result in suspicious and invalid findings (Office of Inspector General, 1990). A preferred method of gathering data is through observation of the children in natural settings. This situation provides a more valid measurement of the targeted developmental indicators for the subjects under study (Shores, 1991). For these reasons, an instrument was chosen which utilizes an observational format with information gathered from sources familiar with
the typical behavior of the child. This instrument is the Developmental Checklist (DC) of the Developmental Observation Checklists (DOCs) (Hresko, Miguel, Sherbenou, & Burton, 1992). This measurement was chosen based upon its ability to differentiate among developmental characteristics in the linguistic, motoric, social/behavioral, and cognitive domains. The DC also provides a measurement of overall developmental status. The DC utilizes a total of 475 items to measure developmental levels across the five domains. The language component utilizes 190 items, the motor component 188, the social/behavioral domain 144, and the component for cognition 218.

The DC has also demonstrated the ability to differentiate among normally developing children and those with established disabilities on the developmental domains addressed. Additionally, the DC is structured to gather information from parents and caregivers familiar with the typical behavior of the child, thus enhancing the validity of the results (Rosetti, 1990).

The DOCs utilizes a multidimensional, systems approach to assessment, which has been demonstrated as an effective paradigm for assessing at-risk populations, particularly when dealing with children below age three. It allows for a comprehensive examination of the child's early developmental skills during the first years of life.
The DC assesses the developmental strands of cognition, language, motor, and social/behavioral individually as well as comprehensively. This allows for close examination of each developmental area while providing information about overall developmental status. Since a child’s developmental skills are intricately interrelated, with deficits in any one area having the potential to impact development in other areas, the utility of such an approach is apparent.

Normative data for the DCs, which includes the Developmental Checklist, is based on a sample of over 1,000 children from birth through age 6-0 from thirty states across the nation. The characteristics of the subjects relative to gender, urban/rural residence, race, geographic region, parental occupation, ethnicity, and age were taken into consideration, with many of the demographic characteristics of the normative sample comparing directly to the population of the United States as reported in the 1990 version of the Statistical Abstract of the United States.

Reliability estimates for the DCs component scores, including the DC component score, were obtained using the techniques of coefficient alpha, scorer reliability, and test-retest. For the Developmental Checklist, an alpha coefficient of .99 was obtained, with alpha levels of .98
for the cognitive component, .97 for the language component, .97 for the motor component, and .98 for the social/behavioral component reported. According to A Consumer's Guide to Tests in Print (Hammill, Brown, & Bryant, 1989), for a test to be considered reliable for clinical and diagnostic use, reliability coefficients must approximate or exceed .80 in magnitude, with coefficients of .90 or above being considered the most desirable. The DOCs, as well as the DC and the individual developmental components, far exceed this established standard.

The validity of the DOCs was established through a variety of techniques. The authors examined content validity, criterion-related validity, construct validity, and face validity. To ensure adequate content validity, items selected for the DOCs were carefully chosen to maintain an adequate representation of the subject matter. Statistical analysis of the test items' discrimination ability was performed, with high values reported across all domains. Criterion-related validity studies were conducted, comparing the DOCs with such external sources as the Denver II (Frankenburg, Dodds, & Archer, 1990). All correlation coefficients emerging from these validity studies were significant beyond the .01 level, indicating acceptable ranges of criterion-related validity.

Construct validity of the DOCs was established by several methods. Since the Developmental Checklist of the
DOCS is a measure of developmental abilities, performance should be related to chronological age and experience. Statistical analysis revealed that mean scores increased as the subject's age increased, with a correlation of .91 emerging. Additionally, the DC is a measure of native and acquired abilities. Therefore, it should differentiate between normal or typical children and children who have exceptional characteristics in the cognitive, linguistic, motoric, and social/behavioral domains.

To determine this premise, the DC was administered to several different groups of children with various exceptionalities. Their performance was compared to the performance of normally developing children, with results indicating that the DC provided an adequate measure of group differentiation.

Data Collection

Data were collected during the late spring of 1992. Data collection required completion of the Developmental Checklist protocols by a parent or direct caregiver for each subject in the study. Developmental Checklist testing materials were distributed to the appropriate personnel, and all test forms were returned to the researcher upon completion. All subjects remained anonymous, as no names or other identifying information was included on the test forms. Personnel completing the Developmental Checklists
provided the child's gender, age, and ethnicity, and
similar information was gleaned from the original normative
sample of the DOCS.

Data Analysis

The research questions posed in this study relate to the
ability to establish significant developmental differences
between children who are prenatally substance-exposed and
those with normal developmental histories as well as
children with established disabilities. Information was
gathered from the results of a developmental observation
checklist, focusing on cognitive, linguistic, motoric, and
social/behavioral domains, as well as overall developmental
status.

When considering data analysis procedures appropriate
for these types of comparisons, univariate methods of
analysis were inappropriate due to the tendency of such
methods to affect the level of statistical significance
(Pedhazur, 1982), increase analysis-wise alpha levels
(Cliff, 1987), and inhibit the interaction of the
characteristics under study (Pedhazur, 1982). Based on
these limitations, a multivariate method of analysis was
chosen.

Upon analyzing appropriate options for statistical
analysis, a multivariate analysis of variance technique was
considered a logical choice. Due to the need to consider
the difference in raw score values as a function of the age
of the subjects, it became necessary to include age as a covariate in the analysis.

Multivariate analysis of variance (MANOVA), and, by extension, multivariate analysis of covariance (MANCOVA), is a generalization of analysis of variance to a situation where there are several dependent variables. This statistical technique will test whether mean differences among groups on a combination of dependent variables are likely to have occurred by chance. MANOVA has a number of advantages over a repeated measures ANOVA design. First, by measuring several dependent variables, the researcher improves the chance of discovering what changes as a function of the different independent variables. A second advantage is the protection against inflated Type I error due to multiple tests of correlated dependent variables. Finally, MANOVA may reveal differences among the groups on the various dependent measures that are undetectable by separate ANOVAs (Tabachnick & Fidell, 1989).

A MANOVA/MANCOVA analysis will create a new dependent variable from the set of existing dependent variables which will maximize the group differences. The new dependent variable will be adjusted for differences on the covariate.

In non-experimental research, MANCOVA provides statistical matching of groups when random assignment to groups is not possible. Prior differences among groups are
accounted for by adjusting the dependent variables as if all subjects were equal on the covariate.

The initial phase of this study utilized a two-group approach to multivariate analysis of covariance. Subjects were assigned to one of two a priori defined groups: prenatally substance-exposed and non-prenatally substance-exposed, normally developing. The independent variables (scores obtained on each developmental domain as well as an overall developmental score) were analyzed to determine if the two groups could be differentiated on the basis of the outcome scores.

Since differences were detected, a secondary analysis was performed comparing the children with prenatal substance-exposure to children with established disabilities. Two groups of children with disabilities were chosen for the comparison. The first group was composed of children with speech and language disorders. Since this disability is typically clearly defined and identifiable at early ages, and many children are provided differentiated therapy for speech and language disabilities alone, it emerged as a logical comparison group.

The second group was comprised of children with established disabilities currently being served in early intervention programs. The areas of disability included learning disabilities, emotional and behavioral disorders, and general developmental delays. Since most early
childhood intervention programs serve children in a non-categorical fashion, and preschool-aged children with prenatal substance-exposure demonstrating the need for intervention services would receive instruction in this type of environment, this emerged as a logical composite comparison group.

For this study, all statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) (Norusis, 1988), multivariate analysis of covariance option. The five dependent measures (linguistic, motoric, social/behavioral, cognitive, and total) were compared to the levels of disability (substance-exposed and normally developing in the first analysis, and substance-exposed, speech/language disordered, and children with disabilities receiving early intervention services in the second analysis).
CHAPTER IV

PRESENTATION OF THE FINDINGS

The purpose of this study was to determine if children with prenatal substance-exposure display developmental characteristics which are significantly different from normally developing children and/or children with established disabilities. To achieve this goal, the developmental characteristics of a group of children identified as prenatally substance-exposed was measured using the Developmental Checklist (DC) of the Developmental Observation Checklists (DOCs). The results of the assessments were compared to a group of children with normal developmental histories, based on information from the same instrument.

A secondary analysis was conducted, comparing the children with substance-exposure to children with established disabling conditions, again using the Developmental Checklist. The findings of the study are presented as follows: (a) description of the subjects, (b) tests of assumptions, (c) overall findings of significance, and (d) summary of findings.

Description of Subjects

The subjects for the study (N=45 for each group) included children with prenatal substance-exposure,
children with normal developmental histories, and children with established disabilities including speech and/or language disorders, learning disabilities, emotional disturbance, and generalized developmental delays. The age range for all groups was eleven months through sixty months. To the maximum extent possible, groups were matched on age and gender.

Developmental information for the children in the prenatally substance-exposed sample was gathered from three sources. The largest number in the sample (N=22) were from a therapeutic preschool serving at-risk children and their families in Albuquerque, New Mexico. Information on fifteen children was gathered from a public agency serving both at-risk children and children with disabilities in Ft. Worth, Texas, while eight subjects were among the patients of a private speech and language pathologist in Dallas, Texas.

Information on the sample of children with normal developmental histories, as well as those with established disabilities, was gleaned from the original normative data gathered during the standardization of the DQCs. Permission was granted from the test authors to utilize their original data and to reproduce record sheets for use in data collection.

Only a limited amount of demographic information was available for the subjects. Information regarding family
income, as well as the descriptive characteristics of the parents, was unavailable. Age, gender, and ethnicity of the subjects are reported in Table 1. Children with prenatal substance-exposure are denoted by SE, children with normal developmental histories by Normal, children with speech and language disorders by S/L, children with learning disabilities by LD, children with emotional disturbance by ED, and children with generalized developmental delays by DD.

Table 1 presents the demographic characteristics of all groups included in the study. Since the group of children with prenatal substance-exposure were the most difficult to obtain, their demographic variables were taken into account and the group of children with normal developmental histories were matched on age and gender. An attempt was made to match on ethnicity as well, but no Native American children were included in the sample of normally developing children.

When compiling the data for the group of children with established disabilities, the sample group of children with disabilities from the original DOCs standardization was not large enough to permit matching on demographic variables. Data from groups of children with the established disabilities of speech/language disorders, learning disabilities, emotional disturbance, and developmental
delays were compiled, taking into consideration the age range under study.

Table 1

**Age, Gender and Ethnicity**

<table>
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<tr>
<th></th>
<th>SE</th>
<th>Normal</th>
<th>Group S/L</th>
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<th>ED</th>
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<td>42</td>
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</tr>
</tbody>
</table>

**Gender**

- Male: 22, 22, 17, 9, 10, 12
- Female: 23, 23, 28, 5, 4, 15

**Ethnicity**

- Anglo/European: 26, 30, 30, 9, 7, 9
- African American: 7, 7, 9, 5, 4, 3
- Hispanic/Latin: 8, 8, 6, 0, 3, 5
- Native American: 4, 0, 0, 0, 0, 0
From the available data on children with speech/language disorders, a random sample was drawn to equal a total sample size of 45. All children in the sample were receiving therapy for speech and language disorders at the time of data collection. No attempt was made to match on age or gender.

For the remaining comparison group, available data on children with learning disabilities and emotional disturbance were collapsed with that of 17 children from the total sample of children with developmental delays. These categories of disability typically comprise the majority of children receiving early intervention services, and are fairly equally distributed. All subjects included in the third comparison group were enrolled in early intervention programs at the time of data collection.

Tests of Assumptions

Before conducting the multivariate analysis of variance, the data were analyzed to verify the assumptions of multivariate normality, homogeneity, and linearity. Significance tests for MANCOVA are based on the multivariate normal distribution. Multivariate normality implies that the sampling distributions of the means of the dependent variables are normally distributed. According to Tabachnick and Fidell (1989), a sample size that produces 20 degrees of freedom for error in the univariate case should ensure robustness, as long as sample sizes are equal.
and a two-tailed test is used. In this study, each univariate case exceeds the recommended 20 degrees of freedom, sample sizes are equal, and a two-tailed design is utilized.

MANCOVA analysis is particularly sensitive to the presence of outliers. Scatterplots were generated and the data screened for the presence of outliers. One case was rejected as a result of the analysis.

The multivariate generalization of homogeneity of variance for individual dependent variables is the homogeneity of variance-covariance matrices. The assumption is that variance-covariance matrices within each cell of the design are samples from the same population variance-covariance matrix. In MANCOVA, this assumption is tested through a generalization of a Monte Carlo test of robustness (Hakstian, Roed, & Lind, 1979). If sample sizes are equal, robustness of the significance tests is expected. All cells in this study are equal in size.

MANCOVA assumes a linear relationship among all pairs of dependent variables as well as all dependent variate-covariate pairs. Deviations from linearity tend to reduce the power of significance tests. Scatterplots were examined and through observation linear relationships were verified.
It is assumed in MANCOVA that covariates are measured without error; they are perfectly reliable. According to Tabachnick and Fidell (1989), when using age as a covariate, reliability is not an issue.

The inter-correlation of dependent variables is a concern within a MANCOVA. When correlations among dependent variables are high, one dependent variable can be a near-linear combination of other dependent variables, leading to redundant information. Given the nature of the dependent variables in this study, it was expected that a high degree of interdependence would be evidenced. Since this interdependence is a natural phenomenon, no attempt was made to artificially induce independence, particularly since the applicability of this study was to real world situations.

Overall Findings of Significance

A complete evaluation of the data collected on the 180 subjects was conducted using the Statistical Package for the Social Sciences (SPSS) (Norusis, 1988), utilizing the multivariate analysis of covariance option (MANCOVA), with age in months as the covariate. Alpha levels for significance were set at $p < .05$. The initial data analysis compared two groups on the basis of level of disability (either prenatally substance-exposed or normally developing), on five dependent measures of the Developmental Checklist of the DOCs. This study was
concerned with the main effects comparisons resulting from level of disability, not the effects of interactions. Relevant information from the initial analysis appears in Table 2.

Table 2

<table>
<thead>
<tr>
<th>Source</th>
<th>Wilks' F</th>
<th>Hypo. df</th>
<th>Error df</th>
<th>Sig. F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disability level</td>
<td>14.62</td>
<td>5</td>
<td>83</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Inspection of the information presented in Table 2 reveals a transformation of Wilks' Lambda of .52864 to an exact F statistic of 14.62, with 5,83 degrees of freedom. The F value was significant beyond the .001 level of probability.

Since the initial analysis revealed a significant difference between the two groups based upon the level of disability (either prenatally substance-exposed or normally developing), univariate F-tests were conducted to determine which of the dependent variables accounted for the significant difference. Relevant information from this analysis appears in Table 3.

An analysis of the data presented in Table 3 indicates that the two groups differed significantly on the domains of language, motor, social/behavioral, cognition, and overall developmental status. All F values were
Table 3

**Univariate F-tests**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hypothesis MS</th>
<th>Error MS</th>
<th>F</th>
<th>Sig. F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>38994.59</td>
<td>634.21</td>
<td>61.49</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Motor</td>
<td>15549.46</td>
<td>369.58</td>
<td>42.07</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Social/Behavioral</td>
<td>10102.01</td>
<td>214.95</td>
<td>47.00</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cognition</td>
<td>35941.08</td>
<td>587.20</td>
<td>61.21</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Overall</td>
<td>142857.34</td>
<td>2676.25</td>
<td>53.38</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

df 1, 86

significant beyond the .001 level of probability. These findings indicate that the scores derived on the prenatally substance-exposed children were significantly different from those of the children with normal developmental histories.

After data analysis revealed a significant difference between the two groups across all five domains, means were computed to determine which group received higher scores. All mean values have been adjusted to account for subject age, and are reported in Table 4.

Table 4 reports information on group mean performance across all five domains under study. Inspection of the data reveals that the children with prenatal substance-exposure performed significantly lower than the group of children with normal developmental histories on all five variables. An overall analysis of the data collected leads
Table 4

Adjusted Means for Two Groups on the Dependent Measures

<table>
<thead>
<tr>
<th>Domain</th>
<th>SE</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>120.14</td>
<td>162.00</td>
</tr>
<tr>
<td>Motor</td>
<td>130.18</td>
<td>156.60</td>
</tr>
<tr>
<td>Social/Behavioral</td>
<td>104.44</td>
<td>125.75</td>
</tr>
<tr>
<td>Cognition</td>
<td>136.41</td>
<td>176.60</td>
</tr>
<tr>
<td>Overall</td>
<td>316.79</td>
<td>396.92</td>
</tr>
</tbody>
</table>

to the following conclusions: On a scale of developmental status measuring language, motor, social/behavioral, cognitive, and overall development, children with prenatal substance-exposure obtain scores which are significantly different from children with normal developmental histories. Therefore, to answer the research question, "Do children who were prenatally substance-exposed differ from non-substance-exposed children with normal developmental histories on language development, motor development, social/behavioral development, cognitive development, and/or overall developmental status as measured by the Developmental Checklist of the Developmental Observation Checklists?", the response is affirmative on all five domains. The probability that the results occurred by chance is less than .01.
Since the children with prenatal substance-exposure were found to differ significantly from children with normal developmental histories on all five domains, a secondary analysis was conducted to compare the children with substance-exposure to children with established disabilities.

Three groups were established for the second phase of data analysis. The first group was comprised of the original sample of children with prenatal substance-exposure, and the second group included children with speech and/or language disorders who were receiving therapy for their disabilities. Since it was impossible to obtain a statistically adequate sample size to form groups of children with other distinct disabling conditions, a third composite group was formed composed of children currently being served in early intervention programs for children with disabilities. Current trends in service provision call for early intervention programs which are cross-categorical in nature; children with many different disabling conditions receive instruction together. The children in the third comparison group carried the qualifying labels of learning disabled, emotionally disturbed, and developmentally delayed. This is a relevant comparison group, since preschool children with prenatal substance-exposure in need of early intervention services
would likely receive instruction in this type of environment.

The secondary analysis was concerned with the comparison of scores on the five dependent measures taking into account level of disability. The initial multivariate test of significance appears in Table 5.

Table 5
Multivariate Test of Significance

<table>
<thead>
<tr>
<th>Source</th>
<th>Wilks' F</th>
<th>Hypo. df</th>
<th>Error df</th>
<th>Sig. F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disability level</td>
<td>2.08</td>
<td>10</td>
<td>252</td>
<td>.026*</td>
</tr>
</tbody>
</table>

*p<.05

The data presented in Table 5 reports a transformation of Wilks' Lambda of .83517 to an approximate F statistic of 2.08, with 10,252 degrees of freedom. An analysis of the value of F reveals that the three groups differed significantly from each other at a probability level of .026, which exceeds the accepted level of .05.

Once initial significance was established, univariate F-tests were conducted to explore the difference among the groups across the five developmental domains. Information gathered from this data analysis is presented in Table 6.

Individual F-tests run on each univariate indicated a significant difference among the three groups on only one dependent variable, cognition. None of the other dependent variables yielded significant results.
Since a significant difference on one dependent variable was detected, it was necessary to conduct a post-hoc analysis to determine which group mean differences contributed to the significant findings. Adjusted means were computed, and Tukey's HSD analysis was conducted. Mean scores for the three groups appear in Table 7.

Tukey's procedure yielded a value for the group mean difference of 3.35, which exceeds the critical tabled value of 3.31 at the $p<.05$ level of significance. Therefore, the group mean for the children with substance-exposure differed significantly from the group mean for children with speech/language disorders on the construct of cognition. No significant findings existed when comparing other group means. Therefore, to answer the research question, "Do children who were prenatally substance-
Table 7

Adjusted Means for Three Groups on the Dependent Measures

<table>
<thead>
<tr>
<th>Domain</th>
<th>SE</th>
<th>S/L</th>
<th>ECH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>120.14</td>
<td>141.27</td>
<td>134.13</td>
</tr>
<tr>
<td>Motor</td>
<td>130.18</td>
<td>148.23</td>
<td>137.32</td>
</tr>
<tr>
<td>Social/Beh.</td>
<td>104.44</td>
<td>117.46</td>
<td>111.12</td>
</tr>
<tr>
<td>Cognition</td>
<td>136.41</td>
<td>158.79</td>
<td>150.25</td>
</tr>
<tr>
<td>Overall</td>
<td>316.79</td>
<td>363.99</td>
<td>341.83</td>
</tr>
</tbody>
</table>

exposed differ from non-substance-exposed children with speech/language disorders, and/or children being served in early intervention programs identified with emotional disturbance, learning disabilities, or developmental delays on language development, motor development, social/behavioral development, cognitive development, and/or overall developmental status as measured by the Developmental Checklist of the Developmental Observation Checklists?", the response is affirmative beyond the p<.05 level of significance when comparing the children with substance-exposure to the children with speech/language disorders on the construct of cognition.

Summary of Findings

In the initial analysis, children with prenatal substance-exposure were compared to children with normal developmental histories on five developmental domains of
the Developmental Checklist of the Developmental Observation Checklists. Initial results of the multivariate analysis of covariance revealed significant differences between the two groups. Further analysis revealed significant differences on all domains, including language, motor, social/behavioral, cognitive, and overall developmental status. All differences were significant beyond the $p<.05$ level.

A second analysis was conducted, comparing the children with prenatal substance-exposure to children with speech/language disorders and children with established disabilities receiving early intervention services. From this effort it was discovered that an overall difference existed among the three groups. Further analysis of the data revealed a significant difference in the area of cognition. Differences existed on other domains, but not to a significant degree.

A post-hoc analysis was conducted to determine which group means differed on the construct of cognition. The performance of the group of children with prenatal substance-exposure was significantly lower than the performance of children with speech/language disorders. All differences found in the secondary analysis were significant beyond the $p<.05$ level.

Therefore, the answers to the research questions posed in this study are as follows:
Research Question #1: "Do children who were prenatally substance-exposed differ from non-substance-exposed children with normal developmental histories on language development, motor development, social/behavioral development, cognitive development, and/or overall developmental status as measured by the Developmental Checklist of the Developmental Observation Checklists?"

Answer: Children with prenatal substance-exposure display developmental characteristics which are significantly different from children with normal developmental histories on the domains of language development, motor development, social/behavioral development, cognitive development and overall developmental status.

Research Question #2: "Do children who were prenatally substance-exposed differ from non-substance-exposed children with speech/language disorders, and/or children being served in early intervention programs identified with emotional disturbance, learning disabilities, or developmental delays on language development, motor development, social/behavioral development, cognitive development, and/or overall developmental status as measured by the Developmental Checklist of the Developmental Observation Checklists?"

Answer: On the domain of cognitive development, children with prenatal substance-exposure differed significantly
from children with speech/language disorders. No significant differences were found among the three groups on any other developmental domain.
CHAPTER V

DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

The purpose of this research study was to determine if developmental indicators exhibited by children with prenatal substance-exposure were substantially different from children with normal developmental histories. If differences were found, further analyses would be conducted to determine if the developmental indicators of the children with prenatal substance-exposure differed from children with speech/language disorders and/or children receiving early intervention services.

Developmental information on all groups was gathered using the Developmental Checklist of the Developmental Observation Checklists. This checklist separates developmental indicators into five domains: language, motor, social/behavioral, cognitive, and overall developmental status. Information on the children with prenatal substance-exposure was gathered from sources in Albuquerque, New Mexico; Dallas, Texas; and Ft. Worth, Texas. Information on the children with normal developmental histories as well as children with disabilities was gleaned from the original normative data of the Developmental Observation Checklists. Children included in the study were between the ages of eleven and
sixty months.

Research is sparse with regard to exploring a broad range of developmental indicators for children with prenatal substance-exposure. This study was conducted in an effort to address that need through a comparative analysis involving children with prenatal substance-exposure, children with normal developmental histories, and children with established disabilities. This section will present the results of the study, implications drawn as a result of the findings, and possible directions for future research.

Results of the Study

Before the results of this study are presented, a general statement of caution should be made. As with any research study, findings are generalizable only to the extent that the characteristics of the groups under study are similar to those of the comparison population. Within the population of children with prenatal substance-exposure, much diversity exists. It is virtually impossible to determine quantity, duration, frequency, and drug (or drugs) of choice of pregnant drug users. Multiple possible comparisons of these variables exist, and many maternal drug users are either unwilling or unable to share information.

It is also virtually impossible to separate the effects of prenatal substance-exposure from the effects of
the postnatal drug-using environment. No attempt was made in this study to control for either of these factors, so results should be interpreted and generalized with discretion.

The initial phase of the study compared children with prenatal substance-exposure to children with normal developmental histories on five developmental indicators derived from the Developmental Checklist of the Developmental Observation Checklists. A multivariate analysis of covariance (MANCOVA) was conducted, with results indicating overall differences between the two groups on the newly created dependent variable generated by MANCOVA at a significance level beyond $p<.05$.

When univariate F-tests were conducted to determine differences between the two groups on each of the five dependent measures, significant differences were reported on all of the dependent variables, including language, motor, social/behavioral, cognitive, and overall developmental status. An examination of the adjusted means for each of the two groups revealed that the children with prenatal substance-exposure scored significantly lower than the children with normal developmental histories on all five dependent measures.

These findings suggest that significant developmental differences exist between children with prenatal substance-
exposure and normally developing children. Across all domains, the developmental levels of the substance-exposed children fell significantly below the levels exhibited by children with normal developmental histories.

A secondary analysis was conducted to compare the children with prenatal substance-exposure to children with speech/language disorders and children currently receiving early intervention services displaying the qualifying conditions of learning disabled, emotionally disturbed, and developmentally delayed. The same developmental checklist was used, and the same five developmental domains served as dependent measures.

A multivariate analysis of covariance was again instituted, and the newly created dependent variable generated by MANCOVA revealed significant differences among the three groups. Univariate F-tests were run to determine along which domains significant group differences existed. The analysis reported a significant difference on the domain of cognition, leading to a post-hoc analysis to examine group mean performances. Tukey’s HSD procedure was used, and a significant difference was detected between the children exhibiting speech/language disorders and the children with prenatal substance-exposure, with the lower scores attributed to the substance-exposed group.

No significant differences were found among the three groups on other domains, but an interesting pattern
emerged. Across all five dependent measures, including language, motor, social/behavioral, cognitive, and overall developmental status, the children with prenatal substance-exposure consistently scored lower than the other two groups included in the analysis.

These findings suggest that overall, children with prenatal substance-exposure have levels of development which are significantly lower than normally developing children. When compared to children with established disabilities, however, the differences are much less dramatic. The substance-exposed children display levels of development which are lower than children with speech/language disorders and children receiving early intervention services, but, with one exception in the area of cognition, not significantly so.

Implications

With recent studies confirming the continued use of illicit drugs by pregnant women (Ostrea, Brady, Gause, Raymundo, & Stevens, 1992; Schutzman, Frankenfield-Chernicoff, Clatterbaugh, & Singer, 1991), the incidence of children with prenatal substance-exposure does not appear to be on the decline. Recent research has, however, begun to paint a less dismal picture than had originally been predicted. A follow-up study currently underway at Northwestern University in Chicago suggests that, at ages
3, 4, and 5, more than 90 percent of the substance-exposed children currently enrolled in early intervention programs test within the normal range on standard measures of cognitive aptitude. Delays in language development, as well as difficulties in attending and concentrating, continue to persist in 30-40 percent of the children (Chasnoff, Griffith, Freier, & Murray, 1992). It is important to note, however, that these children have enjoyed the benefits of early intervention services. No follow-up research has been conducted on children for whom intervention was not available.

The results of this study mirror many of the current research findings as well as substantiate the current trends in treating the population of children prenatally substance-exposed. Developmentally, these children are quite different from normally-developing children without substance-exposure prior to birth. Indicators on the major developmental domains of language, motor, social/behavioral and cognition, as well as overall developmental status, point to a generalized delay in early development. Although the results of this study should be interpreted judiciously, these conclusions suggest that early educational experiences within the regular education tract may not be an appropriate placement option. Certainly, these findings present a strong case for early intervention services for children with prenatal substance-exposure.
When comparisons are drawn between the children with prenatal substance-exposure and children with established disabilities, the differences diminish significantly. Developmentally, the substance-exposed children seem to be more closely aligned with the children for whom classical disabling conditions have been identified, specifically the conditions of speech/language disorders, learning disabilities, emotional disturbance, and developmental delay. Again, these findings present a persuasive argument for the inclusion of children with prenatal substance-exposure in currently existing early intervention programs. A word of caution, however. No classification or intervention should be instituted based on the presence or absence of substance-exposure alone. Each child should be evaluated individually to determine personal developmental status before any intervention program is instituted.

Research has demonstrated that early intervention tends to ameliorate the effects of prenatal substance-exposure (Chasnoff, et al., 1992; Toufexis, 1991), and it is preferred that interventions be developed without attempting to establish a new category of disability. To do so would only serve to further stigmatize and alienate these children from the mainstream (Harpring, 1990; Shores, 1991). Early intervention services are also more cost effective; for every dollar spent in early intervention,
three will be saved in later public education costs (Britcher, 1991).

While there is no concrete agreement on the most effective vehicle for the provision of services to children with prenatal substance-exposure, most indications point to a model which includes the family (Shores, 1991). Ideally, substance-exposed children and their families need services which are coordinated jointly through several agencies. To be most effective, staff should be trained so that sensitivity to cultural, environmental, and economic differences is insured (National Association of State Directors of Special Education, Inc. (NASDSE), 1992).

The findings of this study indicate that the developmental levels of children with prenatal substance-exposure fall considerably below those of children with normal developmental histories. In fact, substance-exposed children display developmental characteristics which are more closely aligned with children with established disabilities, particularly when compared to children with speech/language disorders, learning disabilities, emotional disturbance, and developmental delays. The implications of these findings point strongly to the need for provision of early intervention services. Interventions should focus on all developmental domains, but specific attention should be given to strengthening cognitive skills, including problem-solving and information organization. Further,
intervention strategies should focus not only on the child, but include the child's family as well.

Recommendations for Future Research

As cited earlier, substance abuse among pregnant women does not appear to be waning. The need for further research to determine the effects prenatal substance abuse on the unborn child remains pressing. Specifically, research should be conducted which delves more deeply into the individual developmental characteristics of children with prenatal substance-exposure. Perhaps by employing both quantitative and qualitative methods of study more information can be gathered on the individual differences of children within this group.

Within the body of existing research in this area there currently exists few means for accurately identifying the extent of substance-exposure during pregnancy. Attention should be focused on developing standardized methods for gathering this type of data, possibly allowing for sub-typing within the group of children with prenatal substance-exposure.

As the group of prenatally substance-exposed children continues to grow and mature, research efforts should target for comparison a variety of intervention techniques for efficacy. Many early intervention services, particularly those targeting children below the age of
three, are home-based. Under this model, an interventionist visits the home and works with both the child and parent on building developmental skills. Unfortunately, for many children with prenatal substance-exposure, environmental conditions exist which preclude the effectiveness of this model. Alternative intervention strategies may need to be explored which would increase the opportunity for growth and improvement of the child's developmental skills. Research efforts should target these concerns.

Little research has been conducted which follows children with prenatal substance-exposure through the developmental period. Longitudinal studies which follow a group of substance-exposed children throughout their educational careers would aid in determining the long-term effects of drug exposure as well as the efficacy of early intervention and subsequent educational programming.

Finally, and most importantly, research efforts should focus on the differentiation of prenatal substance-exposure from the effects of the prenatal and postnatal environment. Most studies have been unsuccessful in this effort, which makes any inferences about causal relationships extremely perilous. This is an area in dire need of further exploration if educators and service providers are to understand the full impact of prenatal and postnatal drug use on substance-exposed children.
According to NASDSE (1992), children exposed to illicit drugs while in utero may face a life of struggle, not only due to potential physical and emotional damage, but also as a result of societal perceptions. These children have been branded as "Crack Babies," "The Lost Generation," "The Shadow Children," and countless other terms that convey a message of hopelessness and despair. Children with prenatal substance-exposure are far from hopeless and should not be dismissed. These children can fully participate in society and lead rewarding, fulfilling lives given proper health care, supportive social services, and quality educational interventions.
REFERENCES


