A CASE STUDY OF INTERVENTION WITH AN AT-RISK PRESCHOOL CHILD

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This study evaluates archival data from a home intervention with an at-risk preschool child and her family. The intervention model studied was created by the Developmental Research Lab at Texas Christian University. Data was collected prior to and during the first 4 weeks of intervention to assess change in parent-child interaction, behavior and neurochemical profile. Measures used include coding of videotape recordings of the intervention, neurotransmitter levels taken via subject urine samples, Child Behavior Checklist, Parent Stress Index, and ACTeRS Parent Form. Results suggest positive change in parent-child interaction, behavior and neurochemical profile. However, consistent growth was not observed in several neurochemical results. Future studies should assess the entirety of the home intervention model and with a larger sample size.
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CHAPTER 1
INTRODUCTION

Children are openly vulnerable from their conception and beyond to a wide array of influences. A child’s genetic code and environment impact his/her development by filtering the impacting factors to which he/she is exposed (Deater-Deckard, Ivy, & Smith, 2005). However, children are a population without much control of the stimuli, whether positive or negative, entering their world and are at risk for being exposed to experiences or biological influences that will negatively affect future growth. Children exposed to risk are more susceptible to physical and behavioral disorders that may present challenging situations for their family (Laucht, Schmidt, & Esser, 2004; Nelson, Stage, Duppong-Hurley, Synhorst, & Epstein, 2007).

While traditional intervention methods have been used successfully by some families for their at-risk children, many other families find traditional modalities to be ineffective, perhaps even exacerbating the symptoms (Smith, Howard & Monroe, 2000; Vitello, Branch, & Jensen, 1995). Researchers and interventionists have studied and tested many alternative intervention models with varying levels of success. Several studies have shown great promise with new intervention methods of family-tailored home programs that allow opportunities for the parents to learn and be the “healer” (Barth, Crea, John, Thoburn, & Quinton, 2005; Hughes, 2004). However, many parents of at-risk children who struggle with extreme difficulty often find these intervention models do not comprehensively address the challenges they face (K. Purvis, personal communication, February 6, 2006).

This thesis focuses on the use of a home intervention model for an at-risk preschool-aged child. The intervention model consists of various research and experience-based components that have been integrated into an intervention model which holistically address the child’s needs.
Terms

The following terms are defined operationally for this study.

1. Attachment: The psychological bond formed between a child and caregiver (usually a parent). The quality of this bond can enhance or hinder a child’s later development and has long-lasting effects (Bowlby, 1969).

2. At-risk child: A child who has greater than average risk for later developmental disruptions because of endured trauma or neglect, in utero or otherwise (Lester, Boukydis, & Twomey, 2005).

3. Externalizing behavior: Behavior patterns characterized by aggression, impulsivity, heightened physical activity, defiance, or antisocial interactions (Henshaw, 2003).

4. Home program: Treatment protocol carried out within the home setting of the patient (Federici, 2001).

5. Internalizing behavior: Behavior patterns characterized by anxiety, depression, and social withdrawal (Henshaw, 2003).


7. Self-regulation: The ability to control one’s activity level and state of alertness, as well as one’s emotional, mental, or physical responses to sensations; self organization (Kranowitz, 2005).

Limitations of Study

A case study has several intrinsic limitations. Because it is an in-depth study of one individual, the results are less transferrable than those for a large, quantitative study (Leedy &
Ormond, 2005). With such an in-depth study of an individual and her family, there is more room for biased subjective analysis on the part of the researcher.

Summary

A group of at-risk children may not respond to traditional methods of treatment, but may respond to a home-based family intervention (Barth et al., 2005; Hughes, 2004; Smith et al., 2000). This case study evaluates the effectiveness of a home intervention model with an at-risk preschool child. The results may reveal future direction for intervention and study.
CHAPTER 2
LITERATURE REVIEW

Human development is influenced through a dynamic relationship between both genetic and environmental factors. Humans are not born with a set course in life; instead, individual development is shaped by an infinite variety of experiences and genetic inclinations (Deater-Deckard et al., 2005). Within this influence of both nature and nurture lies the possibility to be exposed to negative stimuli. Children are a particularly vulnerable group to negative experiences and risk factors beyond their control (Nelson et al., 2007).

Although children may experience risk at many life stages, this literature review focuses on prenatal experiences and how subsequent function is affected in addition to examining intervention models for at-risk children and their families.

Risk Factors for Children

Children are open to risk from prenatal development forward; therefore, exposure to risk can be grouped into three categories: prenatal risk, natal risk and postnatal risk. Prenatal risk includes exposure to substances and experiences in utero that have the possibility to negatively impact development. Natal risk includes any risk garnered through the birth process. Postnatal risk includes all internal and external events that could harmfully influence functioning. Postnatal events incorporate not only personal factors such as physical capability, but also all external factors such as contact with others and environmental stimuli. Postnatal risk factors such as abuse and neglect have deep impact on children. In addition, the family dynamic within which a child belongs has great influence as this provides the earliest environment for a child to learn
self regulation, social interaction, trust, and communication (Nelson et al., 2007). Prenatal risk is the primary focus of this study.

**Prenatal Risk**

Prenatal influences may shape the development of a child by affecting the ways through which biological and psychological growth and development take place. The time a fetus spends in utero includes rapid growth vital to future development, such as the differentiation of cells into their various tasks. The fetus is vulnerable to the physiological environment impacted by what the birth mother experiences or consumes during pregnancy. Research studies have evaluated the effect of this early environment on later development in both animals and humans (Shonkoff & Phillips, 2000). Patterns have emerged from these studies suggesting exposure to certain substances or experiences (including the time of and length of exposure) affects specific brain functions for the developing fetus. Harmful substances (also known as teratogens) or experiences during this critical window of development can drastically alter brain structure and function (Gunnar & Kertes, 2005).

**Substance Use**

There are several research studies (Chiriboga, 2000; Church, Crossland, Holmes, Overbeck & Tilak, 1998; Lidow, 1998; Ronnekleiv, Fang, Choi, & Chai, 1998) on both humans and animals evaluating the prenatal effects of various substances; however, human studies uniformly acknowledge the difficulty in separating the substances in studying their individual effects. Most women who engage in substance use during pregnancy use more than one substance; thus, it is difficult to disentangle the effects resulting from each substance (Claussen
Scott, Mundy, & Katz, 2004; Lester et al., 2005; Nassogne, Evrard, & Courtoy., 1998). Animal studies evaluating the effect of one substance at a time provide more information regarding the individual effects of substances used during pregnancy (Lester et al., 2005). These studies must be interpreted with caution when transferring the results of animal studies to humans, but they help clarify the relationship between substance use and resulting disrupted development.

Ingestion of alcohol during pregnancy has been found to negatively affect the developing fetus (Freundlich, 2000). The effects that alcohol may have are dependent on the amount, timing and length of exposure in utero (Lester et al., 2005). They also differ based on the growth processes occurring at that period of fetal development (Gunnar & Kertes, 2005). For example, heavy exposure to alcohol during the first trimester may cause various facial deformities as the facial structures develop and come together during this stage. Research indicates that exposure during the second and third trimesters is likely to impair brain function and growth. Research also suggests that exposure to binge drinking events may be more harmful than low dose exposure over a longer period of time (Shonkoff & Phillips, 2000).

Prenatal alcohol exposure can alter or dampen brain function by (a) modifying the agents and mechanism for the transfer of information between the brain and body and (b) causing structural damage to portions of the brain, such as the frontal cortex. These changes in neurofunction and structure alter the way the brain interprets stimuli and may be outwardly expressed through maladaptive behavior. Prenatal alcohol exposure can also cause physical deformities, such as smaller head size (microcephaly) and facial structure abnormalities. Children with prenatal alcohol exposure that results in compromised neurofunction and an outward physical deformity are identified as having Fetal Alcohol Syndrome. In 1996, the U. S. Institute of Medicine developed a new term for children with prenatal alcohol exposure who do
not outwardly exhibit physical deformities but who have compromised neurofunction — alcohol related neurodevelopmental disorder. This term is increasingly used in academic fields as a descriptor for the many children with prenatal alcohol exposure who do not exhibit a physical deformity but exhibit other symptoms (Shonkoff & Phillips, 2000).

The use of tobacco by the birth mother during pregnancy may alter several neurotransmitter pathways and the ability for synapses to relay signals to each other in the child’s brain, thus negatively affecting the brain’s ability to intake and export information to the body (Ernst, Moolchan, & Robinson., 2001; King, Tenney, Rossi, Colamussi, & Burdick., 2003). Tobacco use by the birth mother appears to have a direct relationship with challenges exhibited by the child, such as externalizing behaviors, attention challenges, impulsivity, and IQ (Ernst et al., 2001) and is associated with depressed motor, sensory, and cognitive abilities (King et al., 2003).

The maternal use of illegal drugs, primarily cocaine, has been widely studied as illegal drug use in the United States has increased. Studies suggest the effects of the illegal drug consumed depend on the type of drug used, amount of use, and timing of use during pregnancy (Arendt, Minnes, & Singer, 1996; Lester et al., 2005; Groze, 1996)

Several animal studies have measured the level of cocaine in the amniotic fluid of cocaine-exposed pregnant animals and found it to be higher than normal in fetal blood levels, indicating that cocaine is eliminated more slowly in amniotic fluid. This exposure is especially detrimental during the first two trimesters of fetal development, an important period for cardiovascular and neurotransmitter development and when the fetus is in direct contact with the amniotic fluid (Nassogne et al., 1998; Woods, 1998). Direct exposure to cocaine at sensitive periods of prenatal development may have deleterious effects on the physiological systems of the
fetus. Although the mechanism for this effect is not directly known, Chiriboga (2000) and
Nassogne et al. (1998) suggest several possible causes for this negative effect. Cocaine has the
pathophysiological effect of restricting blood flow (i.e. hypoxia) resulting in decreased blood
flow to the uterus, thereby decreasing the amount of oxygen and nutrients that the fetus receives
from the mother. Another possible cause is that cocaine hinders dendrite development in the
brain, resulting in poorly developed neural pathways. The observed effects include altered
neurotransmitter function and neurostructure, altered sensory function, neurobehavioral
challenges, microcephaly (small head), low birth weight, and increased heart rate and blood
pressure (Arendt et al., 1996; Chasnoff et al., 1998; Church et al., 1998; Lester et al., 2005;
Lidow, 1998; Nassogne et al., 1998; Richardson, 1998; Ronneklev et al., 1998).

Prenatal exposure to teratogens can have a wide continuum of negative influences on the
child. Research studies have shown that it can have damaging physiological and neurological
effects (Arendt et al., 1996; Chasnoff et al., 1998; Ernst et al., 2001; Shonkoff & Phillips, 2000)

Maternal Stress

In addition to harmful substances, maternal stress appears to impact the fetus by bathing
the developing brain in the hormones associated with the stress response, perhaps altering the
way the fetus will later react to stress hormones and its ability to self regulate (Gunnar & Kertes,
2005; Nelson & Bosquet, 2005). One study suggests that early and consistent stress hormone
exposure in utero lowers the threshold at which the brain will initiate a fear or stress response
(Shonkoff & Phillips, 2000). This reflects the deleterious effects on neurobiological function that
may result in long-term dysfunction with self-regulation (Gunnar & Kertes, 2005; Heim &
Nemeroff, 2001).
Prenatal Effects on Neurofunction

Prenatal development is a period rich with growth of body systems that can be affected by maternal ingestion of various substances and experiences that a fetus passively absorbs. The fetal brain becomes increasingly intricate and efficient – the complexity of this growth opens the brain up to many possible alterations because of exposure to abnormal experiences and substances. Although the direct mechanism for system alteration is not known for several substances, some studies show that disruptions in prenatal development have a wide continuum of effects on neurofunction based on the timing of exposure (Johnson, 1997; Shonkoff & Phillips, 2000).

Direct change has been observed in both the function and amount of substances used for information transmission in the brain. These substances work in harmony to modulate the communication between the brain and body. Some substances increase output and are termed excitatory; other substances decrease output and are described as inhibitory. Exposure to prenatal risk factors has been observed to disrupt the balance of these substances, throwing off the checks and balances system of the brain and altering the communication pathways between the brain and body (Johnson, 1997; Kranowitz, 2005).

Sensory Processing and Socio-Emotional Deficits

The human body senses are continually taking in input that is organized and interpreted by the brain and expressed outwardly as motor output. Dr. A. Jean Ayres, the creator of sensory integration theory, described the brain as a “sensory processing machine” (Kranowitz, 2005, p. 56). How the brain organizes and interprets such input information is dependent greatly on one’s experiences and how they have affected the brain’s capability to input (Bundy, Lane & Murray,
The expansion and growth of neural connections is widely accepted to rely on both passive and active environmental input (Gunnar & Kertes, 2005; Nelson & Bosquet, 2005). Negative environmental input can disrupt these neural connections and their function in relaying, organizing, and interpreting sensory input. For example, harmful substances taken by a birth mother have shown to depress neurodevelopment and result in sensory processing deficits in the child (Jirikowic, 2003; Kane-Wineland, 2002).

Faulty sensory processing capability can be outwardly expressed in a wide continuum of behavioral symptoms, such as being uncooperative or socially avoidant. These behaviors may be messages proclaiming the underlying neurological dysfunction resulting from poorly developed or maladaptive neural connections altered by prenatal influences (Kranowitz, 2005). Several studies have illustrated a strong relationship between prenatal substance exposure and challenging behavior in children (Ernst et al., 2001; Gunnar & Kertes, 2005; King et al., 2003; Olney, Wozniak, Jevtovic-Todorovic, & Ikonomidou, 2001). For example, some children with sensory processing difficulties primarily struggle with the ability to modulate sensory input; that is, the brain is unable to maintain a balance between excitatory and inhibitory input and the child is unable to respond or transition in an appropriate way. Sensory processing difficulties can externally appear as many behaviors such as aggression, withdrawal, avoidance or hyperactivity (Kranowitz, 2005; Bundy et al., 2002).

Many at-risk children, due to neurological challenges, have a difficult time establishing secure attachment with a parent (Zeanah & Smyke, 2005). Studies by Cassidy and Shaver (1999) and Juffer, Bakersmans-Kranenburg, and Van IJzendoorn (2005) report detrimental effects of insecure attachment, in particular, on the development of a child as it negatively affects the motivation of the parents and peers to form nonreciprocal attachment. Children who have
disorganized attachment tend to be emotionally and socially stunted and may fail to ever develop secure attachment during their life (Hughes, 1999).

**Intervention**

*Traditional Methods*

Traditional intervention methods used with at-risk children for their challenges include in-office treatment such as therapy and administration of psychotropic medication with hopes of improving or managing the challenges these children present (K. Purvis, personal communication, February 6, 2006; Smith et al., 2000). However, there are children for whom these methods are not effective and may be harmful. Smith et al. comment that many at-risk children may not be responsive to traditional methods of intervention because of their behavior patterns. In addition, research evaluating the effects of psychotropic medication in children notes differences that these medications have in children as compared to adults. Studies on animals have suggested that there is an interaction between psychotropic medication and the developing brain, which may permanently affect neurochemical function (Vitiello et al., 1995). Concerns that traditional methods are not only ineffective but may be harmful for at-risk children prompted professionals to develop and evaluate alternative modes of treatment.

*Alternative Models*

Kaplan, Crawford, Gardner, & Farrelly (2002) and Kaplan, Fisher, Crawford, Field & Kolb (2004) studied the use of nutritional supplements with children and evaluated their effectiveness with ameliorating rage and behavioral challenges. In one study, Kaplan and associates found that the introduction of a nutritional supplement to children with a history of
mental disturbances significantly improved mood and anxiety. For these children, positive and significant differences in child behavior were found (Kaplan et al., 2004). Another study found significant improvements in improving mood and decreasing anger in two school-age boys with the introduction of a vitamin and mineral supplement. Long-term behavioral balance for these two boys was achieved through the administration of a maintenance dose of this supplement (Kaplan et al., 2002).

Several studies have evaluated the use of attachment-based intervention strategies with families in hope that significant findings would lead to a more comprehensive intervention for at-risk children. Hughes (2004) proposed that attachment-based treatment may best address the complexity of factors for foster and adoptive children, who are inherently considered at-risk. Dozier and Albus (2000) also proposed an attachment-based intervention for foster and adoptive parents of infants with insecure attachment behavior that uses home education, videotaped vignettes, assignments, and individualized discussion to assist parents in understanding, interpreting, and planning responses to their infant’s attachment behavior. However, study results differ in supporting short or long-term interventions. Van Ijzendoorn, Juffer, and Duyvestteyn (1995) found expansive long-term interventions to be less successful than behavior-based short-term interventions. On the other hand, Stams and his colleagues (2001) in their longitudinal study found long-term interventions to be more successful.

Home-based interventions and parent training models have been the focus of several studies. Professionals who work with parents of autistic children have developed and studied the efficacy of home intervention and training programs in improving adaptive skills and the parent-child relationship by teaching parents to be the home intervention facilitator. McClannahan, Krantz, and McGee (1982) describe a model in which the parents are trained to be the therapist
and facilitator by a program supervisor. In this model, parents are guided in identifying behavior themes and designing an intervention program for their child at home and at school. A study in 1998 (Ozonoff & Cathcart) evaluated the use of a structured home intervention model focused on skill development with both a treatment and control group of children ages 2 to 6 diagnosed with autism. The treatment group received 4 months of home intervention and made considerable progress as compared to the control group. Having a caregiver present during intervention or treatment supports the child in integrating new constructs and provides ample opportunity for verbal and non-verbal interaction as well as treatment (Hughes, 2004).

While many intervention models for at-risk children have found success using certain strategies such as nutritional supplementation, focus on attachment strategies, or training the parent to be the therapist, these models do not appear to address a complete view of the family’s needs. At-risk children need interventions that are comprehensive and integrate the context of the family (Barth et al., 2005).

**Texas Christian University (TCU) Home Intervention Model**

The TCU home intervention model was developed in response to growing concern for the population of at-risk children who were unresponsive to other intervention methods and draws from the findings of other intervention models and work of professionals. The home intervention model grew out of (a) the TCU Developmental Research Lab (DRL) results from their sensory and attachment focused summer program for at-risk children, (b) consultation with Dr. Ronald Federici, a neuropsychologist based in Virginia, who created a home program protocol for particularly challenging post-institutionalized children, and (c) the expertise of professionals working with at-risk children and their families (K. Purvis, personal communication, February 6,
A protocol for the TCU home intervention model is included in Appendix A. The DRL found their summer program, designed to holistically address the unique needs of at-risk children, yielded dramatic positive results by immersing the children in a sensory and attachment-rich environment. Parents reported new attachment behaviors, prosocial behaviors, and increased eye contact with their family members (Purvis & Cross, 2005). This home intervention model utilizes concepts used in the summer program based on the positive growth observed in participants. The TCU home intervention model trains and empowers the parent to be the healer while respecting and meeting the needs of the child (K. Purvis, personal communication, February 6, 2006).

Conceptual Components

The TCU home intervention model has 3 guiding principles: empowering, connecting, and correcting. These principles direct all parent-child interaction in this intervention model.

**Empowering**

Empowering the child is meeting his physical needs to maximize his capability to benefit from intervention practices. Occupational therapy elements are utilized by the clinical interventionist to guide the parent and child in building strategies to enhance growth by wholly addressing the sensory needs of the family. A key occupational therapy program adapted for the TCU model is from the “How does your engine run?”: Alert Program for Self-Regulation developed by Williams and Shellenberger (1994). The Alert Program is an approach by which the intervention team ascertains “which sensory strategies support children’s optimal performance and identify sensory sensitivities that hinder their performance” (Bundy et al., 2002,
One family activity adapted from the Alert Program is the creation of a “self engine meter” (similar to a speedometer on a car) that is posted in the house to use throughout the day. For example, the parent may state his/her engine is running a bit low and change his/her meter to reflect a low level of energy or the child may say his/her engine is running “just right”.

Depending on what each family member notes her engine level to be (low, high, or just right), activities are adapted to meet their sensory needs in order to get their engine “just right” (Williams & Shellenberger). The clinical interventionist guides the parent in employing cycles of physical activity and cool down with snack, meal and sleep breaks in addition to modeling sensitivity to the child’s behavior that may indicate the child has a sensory need to be addressed. Snacks that are alerting (sour or tart taste) or calming (chewy) are sometimes selected based on the child’s behavior. Physical activities are selected to provide the child opportunities to receive sensory input in a managed way that helps her organize cognitive and motor output. The child is taught self-regulation skills through observing how the clinical interventionist and parent address sensory needs, such as deep-breathing activities after high energy activities or eating a crunchy textured snack (K. Purvis, personal communication, January 18, 2006).

Neurotransmitter tests, collected using subject urine samples, are used to more comprehensively describe neurochemical influences on the subject’s behavior. Neuroscience, Inc., provides the analysis of neurotransmitter levels to the DRL. The neurotransmitter tests assist in customizing the home program to the individual child’s needs based on levels of and balances between excitatory and inhibitory neurotransmitters and how they compare to normative neurochemical levels (K. Purvis, personal communication, February 6, 2006). Neuroscience, Inc., in partnership with the clinical interventionist, may recommend amino acid supplementation based on abnormal neurotransmitter balances. Neuroscience, Inc., terms this
Targeted Amino Acid Therapy™ (TAAT), which is the administration of substances containing precursors for substances the body uses in building neurochemical substances. If the family chooses to participate in TAAT™ as part of the home program, the clinical interventionist and family physician oversee the administration of the Neuroscience TAAT™ protocol designed for the subject. TAAT™ serves as a home program compliment to support the neurochemical needs of the subject, which can make other program components more successful (K. Purvis, personal communication, February 6, 2006). In a DRL study, TAAT™ used with 97 children and without a simultaneous behavior intervention revealed positive changes in neurochemistry and behavior such as less anxiety, aggression, and more normative neurotransmitter results (Purvis, Kellermann, Cross, Kellermann, Huisman, & Pennings, 2006).

**Connecting**

A primary goal of the home program is to aid the child and parent in constructing strong bonds of attachment. The home program, instructed and supervised by the clinical interventionist, is facilitated by the child’s parent(s) who serves as the primary therapeutic agent. Through the program, the child’s fear is addressed and he/she is reinforced to rely on and trust his/her parent to meet his/her needs. His/her parent serves as the “safe base”. For example, within the first level of intervention, the child must remain in close proximity of the parent at all times. Outside social interactions are not allowed, thus giving the parent and child uninterrupted, focused time. The parent helps supplement the construction of attachment by interacting in a playful and empathetic way with her child (Federici, 2001; K. Purvis, personal communication, February 6, 2006).
Correcting

The correcting principle leads the parent to provide opportunities to their child to practice appropriate and adaptive behavior as well as develop emotion identification skills. Parents utilize varying levels of response to the child’s behavior that match the severity of behavior. For example, a child who is non-compliant at first request would elicit a more playful response from the parent than a child who is non-compliant at third request. The parent uses different strategies for each response. The first response to non-compliance would be playful and stated in a light tone. The second response to non-compliance would be spoken more slowly and with a deeper voice tone. The third response to non-compliance would be spoken with great seriousness and deep intonation. The levels of response provide auditory reinforcement as to the severity of behavior the child is exhibiting (K. Purvis, personal communication, January 18, 2006).

Short behavioral scripts are used to immediately reinforce positive behavior or redirect in appropriate behavior. For example, if the child is not giving proper eye contact during verbal interaction, the parent asks the child “give me your eyes” to encourage eye contact. Role play between parent and child using puppets provides an opportunity to practice appropriate behavior in a non-confrontational way. The child is asked to identify the inappropriate and appropriate behaviors of the puppet and then create a scenario in which the puppets show good behavior. In addition, parent and child shift roles occasionally, allowing the child to be the parent and vice versa, providing an opportunity for the child to learn the perspective of others. In addition, the clinical interventionist coaches the parent in engaging the child in open verbal communication patterns (K. Purvis, personal communication, January 18, 2006).

For non-compliant or aggressive behavior, the clinical interventionist models for and trains the parent in a therapeutic hold technique that requires the child to calm herself while
being safely restrained. The hold may be practiced with the child before an actual hold is necessary so the child understands the action. Non-compliance or aggressive behavior induces the use of a hold, in which the child is held until he/she is calm, and then for an additional 5 minutes. The parent sits with the child sitting in front, both facing the same direction. The parent holds each of the child’s hands with the respective opposite hand, resulting in the child’s arms crossed in front. If necessary, the parent’s legs can be placed over the child’s legs for further restraint. A hold must be done without aggression by the parent in a physically firm yet gentle manner. The parent does not engage in verbal interaction or eye contact with the child during a hold with the exception of stating, “When you are calm plus 5 minutes, I can let you up”. After the child has demonstrated calm behavior plus 5 minutes, the parent places the child in a nurture “cuddle” and talks with the child about why the hold was necessary and what would require the use of another hold in addition to opening communications for the child to share his/her feelings about what happened. Parents must always be trained and supervised in the therapeutic holding technique by the clinical interventionist before using it with their child. The purpose of the therapeutic hold is to maintain the safety of the child and family, help the child relinquish control, calm down, and to reinforce attachment to the parent. As the home intervention progresses, the parent may choose to use time outs as an alternative method before utilizing the therapeutic hold. The parent uses a timer to visually reinforce the limit to the child. The amount of time for time out may increase as the child’s capability to self regulate increases (Federici, 2001; K. Purvis, personal communication, January 18, 2006).

The home intervention is videotaped, not only for data collection, but also for the purpose of visual reinforcement of model components for the child and parent. The videotaped segments
are used in helping the subject problem-solve and correct behavior patterns by asking the child how she might change what happened (K. Purvis, personal communication, January 18, 2006).

Home Intervention Structure

The home intervention progresses through 3 levels. The initiation of level 1 marks the two-day stay by the clinical interventionist who generally stays overnight at the family home during the first night of program. The primary focus of level 1 is to build a structure within which the parent and child may rebuild bonds of attachment. This level is designed to offer ample opportunity for the child to learn to trust the parent. Because of the emphasis on building a trust-filled attachment bond between parent and child, the child must remain within an arm-length distance of the parent at all times. The child may not leave the proximity of the adult during this level. Interaction with persons outside of the home program is prohibited. Parents guide and direct the child’s activities and play during each day. Families delineate new family rules by writing them on paper and placing them somewhere highly visible so the child and parent can revisit them several times during the day for reinforcement (Federici, 2001; K. Purvis, personal communication, January 18, 2006).

Level 2 introduces the use of a simple reward system for behavior reinforcement and provides opportunities for the child to interact with limited social contacts with parental supervision. The focus of this level is re-education and re-training. A plan is made with the child for each week, charting out goals and objectives. Completion of tasks earns the child a “token” or reward (Federici, 2001; K. Purvis, personal communication, February 6, 2006).

Level 3 provides the child with opportunities to spend time away from his/her parents and make activity choices. The primary goal of this level is to strengthen positive decision making
and responsibility and increase the child’s self-control. Verbal communication is very important during this level to help the child identify and verbalize emotions (Federici, 2001; K. Purvis, personal communication, February 6, 2006).

A child stays within level 1 for a minimum of 4-6 weeks. Movement to higher levels may occur when the child has mastered the level concepts and has had stable behavioral patterns for at least two weeks. A violation of family rules, created during the beginning of the home program, results in returning to a previous level. All children who have participated in the home program regress to lower levels at some point. The frequency of regression typically lessens as the amount of time within the home program increases (Federici, 2001; K. Purvis, personal communication, February 6, 2006).

Summary and Conclusions

At-risk children have a complex array of challenges that may fail to be addressed by traditional intervention methods. Several studies have shown promise in non-pharmaceutical and home based intervention methods. Analysis of the TCU home intervention model is needed to evaluate its effectiveness with at-risk children. This study examines the use of the TCU home intervention model and focuses on the following research questions:

1. What is the effect of this home intervention model on parent-child interaction?
2. What is the effect of this home intervention model on the child’s behavior?
3. What is the effect of this home intervention model on the child’s neurochemical profile?
CHAPTER 3

METHODOLOGY

This study evaluates archival data taken from pre-intervention and the first 4 weeks of a TCU home intervention program provided for a preschool-aged female child and her mother. This period only spanned level 1 of the TCU home intervention model. Several measures were administered to gather information about parent-child interaction, the child’s behavior, and the child’s neurochemical profile before and during the 4-week period.

Participant

The participant, Cindy (pseudonym), is a domestically-adopted female child, age 3 years at the time of data collection. She and her family live in a metropolitan area in the southwest United States. Her family includes her adoptive mother and father and one brother, a domestically-adopted 6-year-old male of no genetic relation to the participant. Cindy resides with her adoptive mother and primary caregiver, Tori (pseudonym), and her brother.

Cindy was born 10 weeks prematurely and was delivered by Cesarean section. She weighed 3 pounds and 8 ounces according to birth records. Her premature birth necessitated that she remain in the hospital for one month post birth for medical treatment and observation. Her birth mother reported to the hospital that she was homeless, had used cocaine within the previous 24 hours, and had smoked during pregnancy. She does not report alcohol use; however, hospital officials suspected maternal alcohol use and use of cocaine and tobacco throughout pregnancy.

Tori stayed in the United States during Cindy’s hospital stay and brought her home to England at hospital release. Cindy’s birth mother relinquished parental rights to Tori at Cindy’s
birth. Tori took Cindy to a pediatrician in England on a regular basis who documented that the infant was “thriving, responsive, and happy”.

Tori reports her perception of Cindy’s behavior is that her behavior was developmentally appropriate until 16 months of age. Tori noticed unusual physical activity with her daughter and observed her running continuously during trips to the park, without self-monitoring of energy level or body temperature. At this time, the family moved from England to Texas. Around her second birthday, Tori took Cindy to visit a psychologist because of the child’s abnormally high activity level. According to Tori, this doctor communicated to the adoptive mother that he was unable to assist her and subsequently referred her to a neurologist. The neurologist suggested that Cindy should be medicated with three Ritalin doses a day. Tori felt there were other options and decided against medication.

Tori approached an early childhood intervention program with the city school district when Cindy was 2 years and 4 months old. Professionals from the intervention program came into their home to conduct observation of play and parent-child interaction. These professionals included a social worker and occupational therapist. Their documentation notes impulsivity and aggression and suggests less stimulation as a solution. It was also suggested that physical activity be encouraged for appropriate sensory input to provide the child with opportunities to engage in organized play. Specific sensory suggestions made included providing deep tissue massage and swinging activities. Training was provided to Tori to learn to communicate while on Cindy’s physical level and how to provide appropriate choices. However, the intervention program did not make mention of abnormal or maladaptive play by Cindy. The program staff concluded that Cindy did not qualify for special services.
Tori reports that Cindy had demonstrated dangerous behavior on a frequent basis by this time. This included running into the street without regard for vehicles, climbing over fences to get away from adults, and violent behavior toward her brother and peers. She appeared to have little auditory comprehension of parental guidance and redirection, acting without regard for self or others.

During Cindy’s early childhood, Tori reports she had strong support systems in place to assist her with her daughter and coping with her challenges. The mother and father were separated at the time of observation, with Tori living at home with their two children and the father living in a separate home. The father interacted with the children on a weekly basis.

Dr. Ronald Federici, a child and adolescent neuropsychologist based in Virginia, suggested, after an hour-long clinical assessment of Cindy, that the subject has characteristics of Fetal Alcohol Syndrome, auditory processing disorder, ADHD, visual/spatial learning disorder, profound language delay, and possible autistic spectrum disorders. The subject has not had an official clinical neuropsychological workup (K. Purvis, personal communication, February 6, 2006).

The participant was selected for the home program research project by TCU by DRL staff. Tori was referred to the DRL by a psychologist due to Cindy’s severe behavioral challenges endangering herself and her family.

Measures

The measures used include the coding of videotapes taken during intervention, neurotransmitter profiles via urine samples of the child taken by the mother (analyzed by Neuroscience, Incorporated), the Child Behavior Checklist (CBCL) (Achenbach, 1991), the
Parent Stress Index (PSI) (Abidin, 1995), and the ADD-H Comprehensive Teachers Rating Scale
Parent Form (ACTeRS Parent Form) (Ullmann, Sleator, Sprague, & MetriTech, Inc. Staff,
2000). These measures or collection instruments were provided to the participant’s mother by
DRL staff. The CBCL, PSI, and ACTeRS scales were completed by the mother within her home,
separately from research personnel. These measures were collected either by the mother mailing
the instruments to the DRL or during home intervention visitation. Tori collected urine samples
from Cindy early in the morning on collection days and independently mailed the samples to
Neuroscience, Inc., for analysis. Neurotransmitter reports generated by Neuroscience, Inc., based
on the received urine samples were provided to the DRL.

Videotape Coding Scheme

Videotapes were made during the first 4 weeks of the home intervention by research
assistants on days they were present with the family. The research assistants alternated days
videotaping the family. Videotaping was completed using equipment from the DRL and was set
up in a non-obtrusive manner in the family home. Care was taken to not unnecessarily influence
the home program intervention or the subject’s behavior because of the process or location of
videotaping. The research assistants randomized the tape order to avoid bias in deducing the
week of intervention as they had personally observed the home intervention. Each tape was
assigned a random number and measured one hour of videotaped intervention.

The research assistants, with the assistance of DRL staff, developed a videotape coding
scheme for coding the videotapes collected. The coding scheme was developed for the purpose
of describing changes in behavior and parent-child interaction. Behavior and parent-child
interaction changes were measured through coding expressive behavior and various aspects of
parent-child interaction during the home program, such as compliance to adoptive mother’s verbal direction, nurturing touch towards the adoptive mother, and eye contact (see Appendix B). Non-compliance was measured by counting the number of times a request was given to Cindy by her adoptive mother or the clinical interventionist before Cindy became compliant. In reflection of intervention principles, more than 3 requests necessitated either a therapeutic hold or time out, depending on the level of intervention. Touch between Cindy and Tori was counted as either adult- or child-initiated and given a quality rating depending on if the touch was spontaneously provided, done at request, or given as part of a therapeutic hold. Eye contact was measured by counting interactions in which eye contact was made, either with or without verbal prompt, in addition to interactions in which eye contact was not made. The instance and quality of aggressive behavior was measured by counting the incident and determining whether the behavior was spontaneous, done at request as an example of bad behavior, done within a therapeutic hold, or done within play.

In order to develop consistency in videotape coding, the research assistants viewed 2 hour-long tapes and coded separately. Afterward, the coding sheets were evaluated to measure whether the coders matched in observing the same number of events, the same quality of events, and attributing the same code for events. The coders observed that one had observed more specific actions and the other had observed more generalized behavior occurrences in the tape. The coders reviewed the tapes together and discussed what their observations were to clarify how an event was defined and what quality code would be attributed to actions observed. After re-watching the original tapes, the coders separately coded an additional 2 hours of tape to measure for interrater reliability. Interrater reliability was measured at .70 for this coding scheme by calculating the Cohen’s Kappa between the coders’ scores attributed to events viewed in the
tapes. After a research assistant individually coded 6 hour-long tapes in random order, the coders once again coded separately another hour of videotape to calibrate the coding accuracy of the research assistant after coding a larger amount of videotape. A satisfactory calculated Cohen’s Kappa (.70 or higher) between the two coding sheets was obtained at .72, and a research assistant then coded the remaining 4 hours of tape individually.

**Neurochemical Profile**

Neurotransmitter levels were gathered through urine samples collected by the parent from the child. The urine samples were shipped to and analyzed by Neuroscience, Inc. The eight neurotransmitters evaluated in these samples are epinephrine, norepinephrine, dopamine, serotonin, glutamate, gamma aminobutyric acid (GABA), histamine, and phenylethylamine (PEA). Neuroscience Inc., as part of their neurochemical profile analysis, provides normative ranges for a similarly aged child compared to the subject. These normative ranges are provided in the unit measurement used to quantify amounts of the particular neurotransmitter in urine. For example, µg/gCr represents micrograms of measured substance per gram creatinine present.

Epinephrine (also known as adrenaline) acts as an excitatory neurotransmitter and hormone and assists with focus and attention. Epinephrine is observed to normally occur in children between 8-12 µg/gCr. Norepinephrine is also an excitatory neurotransmitter that assists with attention and focus. The normative norepinephrine range for a child is 35-60 µg/gCr. Dopamine is an excitatory transmitter and plays a significant role in feelings of pleasure and reward, memory, and motor control. The normative dopamine range for a child is 110-175 µg/gCr. Serotonin is an inhibitory neurotransmitter that is considered a regulator of many neural pathways that oversee mood, compulsive behavior, anxiety, and other emotions. Serotonin is
normally observed in children between 150-200 µg/gCr. GABA acts as an inhibitory neurotransmitter, and its foremost role is to prevent over stimulation. It works to compensate for glutamate, an excitatory neurotransmitter. The normative range for GABA in a child is 1.5-4 umol/gCr. Glutamine is an amino acid that is a precursor to glutamate and assists with intestinal function. The normative glutamine range for a child is 150-400 umol/gCr. Glutamate is a primary excitatory neurotransmitter and assists with memory and learning. It is observed to normally occur in children between 10-35 umol/gCr. PEA is another excitatory neurotransmitter and promotes energy and good mood. The normative PEA range for a child is 175-450 nmol/gCr (NeuroScience Inc., 2007).

Child Behavior Checklist (CBCL)

The CBCL assesses two areas of child behavior: internalizing and externalizing behaviors. The instrument provides an overall score, a score for each area of behaviors (internalizing and externalizing), and individual scores for 8 subscales. The Externalizing subscales are Delinquent Behavior and Aggressive Behavior. The Internalizing subscales are Social Withdrawal, Somatic Complaints, and Anxiety/Depression. The other subscales are Social Problems, Thought Problems, and Attention Problems. Each of the CBCL’s 113 questions are measured on a scale of 0-2, with 0 = “not true”, 1 = “somewhat or sometimes true”, and 2 = “very true or often true”. Subscale results with t scores that fall between 67 and 69 (95th to 98th percentile) are considered in borderline clinical range and t scores of 70 (98th percentile) or higher are considered in clinical range. In a study of 53 children ages 4-11, the instrument author measured Cronbach’s alpha values across the subscales for test-retest reliability results that
ranged between .62 and .92. In addition, construct validity, measured by correlating the CBCL against similar instruments, ranged between .59 and .88 (Achenbach, 1991).

*Parent Stress Index (PSI)*

The PSI is used to describe the family system and identify possible family challenges. The instrument evaluates three areas: child domain, parent domain, and life stress. The measure also provides a total stress score. The child domain portion of the PSI contains the following subscales: Distractibility/Hyperactivity, Adaptability, Reinforces Parent, Demandingness, Mood, and Acceptability. The parent domain subscales are Isolation, Attachment, Health, Role Restriction, Depression, and Spouse. Examples of questions include, “My child does not like to be cuddled or touched very much,” and “I enjoy being a parent”. Most response options are within a 5 point scale, from strongly agree to strongly disagree, and several questions are answered in multiple choice or yes/no form. Each response scored is given a point value and each subscale score is the collective sum of response scores from applicable questions. These totals are plotted on a percentile chart with specific values aligning with percentile ranks. These percentile ranks range from 1st to 99th percentile, with higher percentiles indicating more extreme behavior or stress. The PSI has high internal consistency and test-retest reliability. The reliability coefficients for each domain (parent and child) as well as the total stress score were .90 or higher in a normative sample analyzed by the authors of the instrument, and the test-retest reliability as evaluated by 4 separate studies had relatively high coefficients for each domain as well as the total stress score (Abidin, 1995).
ACTeRS Parent Form

The ACTeRS Parent Form provides an opportunity to gather information about the child and his/her behavior outside of clinical or school settings as reported by the parent. This measure utilizes parent report of child behavior to describe the attention capability of the child and consists of 25 questions, each with an answer scale from 1 (“almost never”) to 5 (“almost always”). These questions address five separate areas: Attention, Hyperactivity, Social Skills, Oppositional Behavior, and Early Childhood. The Hyperactivity, Oppositional Behavior, and Early Childhood scales have reversed scoring, i.e., a higher score is a more negative response. For example, within the Attention scale, a high score for “works well independently” would be more positive. However, within the Oppositional Behavior scale, a higher score for the prompt, “defies authority”, would be more negative. The Attention scale is scored from 7 (low level of attention ability) to 25 (high level of attention ability). The Hyperactivity scale is scored from 5 (low level of hyperactivity) to 23 (high level of hyperactivity). The Social Skills scale is scored from 9 (low level of social skills) to 25 (high level of social skills). The Oppositional Behavior scale is scored from 5 (low level of oppositional behavior) to 18 (high level of oppositional behavior). The Early Childhood scale is scored from 5 (less difficult early childhood) to 22 or higher (more difficult early childhood). The ACTeRS form has tested with high internal consistency, interrater agreement, and test-retest consistency (Ullmann et al., 2000).

Procedure

Case study data collection took place pre-intervention and during the first 4 weeks of a TCU home intervention. This period only included level 1 of the TCU home intervention model. Measures were completed by the parent before initiation of intervention to provide pre-
intervention information and during the home intervention. A model timeline of when measures should be completed within the first 4 weeks of the home intervention is provided in Appendix C. However, the collection of measures in this particular home intervention did not parallel the model timeline. The CBCL was administered twice before the intervention began and only one PSI and ACTeRS were gathered. In addition, the intention was for this case study to evaluate data from the entire home intervention period; however, the subject and her family members contracted influenza during the fifth week of home intervention. Measure administration and collection ceased at this time. Therefore, the archival data available for analysis only included pre-intervention and the first 4 weeks of home intervention.

The home program intervention preparation began one month prior to the home program with collection of the first urine sample by Tori. Tori also completed the first CBCL one month prior to home program as well. The second pre-program urine sample, second CBCL, and PSI were collected two days prior to beginning the home program.

The clinical interventionist stayed overnight from the first day to the second day of home program for the purpose of family observation and assistance. Research assistants visited the first and second day to videotape the home program. For 2 days of each subsequent week during the 4-week period, the clinical interventionist with research assistants visited the family home to continue intervention training and guidance. Video were made for an average of 3 hours each day by research assistants. Urine samples were collected by Tori 2 weeks and 4 weeks after beginning the home program. The ACTeRS Parent Form was collected during the fourth week of intervention.
The adoptive mother was the caregiver present during the home program intervention. The father was trained in program concepts and skills during a visitation by the clinical interventionist.

The child was identified only by subject number and first name (for secondary form of ID). Names and other contact information were not released. Neuroscience reports were sent by subject number only. Child histories were reported to Neuroscience by subject number only. All reports were returned privately. All assessments and instruments were identified using a code number, and the master list of code numbers was kept separate from the instruments. Research materials and data were kept in the DRL in locked file cabinets. Access to the lab was restricted to DRL staff. Personally identifiable data was not disclosed to anyone outside of the research team. Human subject research approval to use the archival data was granted by the Institutional Review Board at the University of North Texas and Texas Christian University.

Analysis

Analysis of archival data consisted of evaluating the measure results and using them to describe change in the participant from pre-intervention through the first 4 weeks of home intervention. Traditional quantitative analysis is not available with this case study because numerous data were not collected with the single subject.

Change in parent-child interaction and behavior was measured by using coded videotape scores collected. The sum of codes respective to a specific behavior was calculated as percentage of behavior observed. Change in Cindy’s neurochemical profile was examined by taking her results and comparing them with normative neurotransmitter ranges for a similarly-aged child over the intervention period. The CBCL, PSI and ACTeRS measures were used to describe the
participant and her adoptive mother and were not used to measure change during the intervention.

Summary

This study examined archival data collected from this preschool-aged female child and her adoptive mother during pre-intervention and the first 4 weeks of a home intervention. This period only spanned level 1 of the TCU home intervention model. Change in the subject was measured using coded videotapes of parent-child interaction during intervention and neurotransmitter tests from the child. The CBCL, PSI, and ACTeRS measure results were used to describe the subject and her adoptive mother.
CHAPTER 4

RESULTS

The results of this study are taken from videotapes of the intervention, neurotransmitter tests, and measures administered to the adoptive mother (CBCL, PSI, and ACTeRS). While the administration and collection of these results do not mirror the model timeline of data collection for the first 4 weeks of the TCU home intervention model, they do show change in the participant and describe the state of the participant and her adoptive mother.

Descriptive Measures

Child Behavior Checklist

The results from both one month and two days prior to intervention are similar. One month prior to intervention, Cindy tested in normal range for internalizing behavior and in clinical range for externalizing behavior. She scored in borderline clinical range for both attention problems and aggressive behavior subscales. All other subscale scores were in normal range. Two days prior to intervention, Cindy tested in normal range for internalizing behavior and in clinical range for externalizing behavior. However, she scored in borderline clinical range in three subscales: attention problems, aggressive behavior, and delinquent behavior. All other subscale scores were in normal range.

Parent Stress Index

The child domain section of the PSI as completed by Tori had several considerably high scores. A higher percentile score indicates more severity. All were above the 85th percentile, and 5 out of 6 subscales were above the 95th percentile. However, the parent domain section had
lower scores. The Attachment and Depression subscales were at 10th percentile and Competence, Isolation, and Health were all within 70-80th percentile. However, two high subscale scores were for Role Restriction and Spouse, 85th and 99th percentile respectively. The life stress score was in the 90th percentile. The total stress score was between the 95th and 99th percentile.

ACTeRS Parent Form

The results from ACTeRS all showed a degree of severity in Cindy’s outward behavior as reported by Tori. The Early Childhood score of 12 suggests a moderately difficult early childhood. The Attention score (14) suggests low attention ability. The Oppositional Behavior score (11) suggests a high level of oppositional behavior. The Hyperactivity score (18) suggests very high level of activity. The Social Skills score (13) suggests Cindy has a very low level of social skills.

Parent-Child Interaction and Behavior

The interaction between Tori and Cindy was documented through videotapes taken during the home program intervention. Several key areas of parent-child interaction were specified as codes attributed to the behavior observed. The incidences of each behavior code were calculated as percentages observed within the entire grouping of behavior codes. For example, out of all incidences of compliance behavior on a certain date, 50% were compliance at 1st request, 30% were compliance at 2nd request, and 20% were compliance at 3rd request. The number of codes counted by date is shown below in Table 1.
### Table 1

**Parent-Child Interaction and Behavior Codes Counted by Day Collected**

<table>
<thead>
<tr>
<th>Compliance</th>
<th>1st Day</th>
<th>2nd Day</th>
<th>2nd Week</th>
<th>3rd Week</th>
<th>4th Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Request</td>
<td>28</td>
<td>10</td>
<td>43</td>
<td>15</td>
<td>49</td>
</tr>
<tr>
<td>2nd Request</td>
<td>25</td>
<td>15</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>3rd Request</td>
<td>20</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Hold</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Time Out</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Nurturing Touch</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult Initiated</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Child Initiated</td>
<td>18</td>
<td>3</td>
<td>10</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td><strong>Quality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spontaneous</td>
<td>13</td>
<td>3</td>
<td>11</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>At Request</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Within hold or post hold</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Eye Contact</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No eye contact</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Eye contact with verbal prompt</td>
<td>37</td>
<td>5</td>
<td>15</td>
<td>16</td>
<td>11</td>
</tr>
<tr>
<td>Eye contact without verbal prompt</td>
<td>24</td>
<td>5</td>
<td>30</td>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td><strong>Aggressive Behavior</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spontaneous</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Within hold</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Play</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Cindy’s compliant behavior, as demonstrated in Figure 1, grew towards becoming compliant with fewer requests over the period of intervention observed. Percentage of compliance on the 1st request increased from 36.7% on the first day of intervention to 74.2% on the last day. Percentage of compliancy on the 2nd request decreased from 32.3% to 24.2%.
Percentage of compliance at 3rd request was nearly eliminated by the end of intervention, decreasing from 26.4% to 1.5%. Holds were observed on the first day of intervention and in the third week. Time outs were observed on one day of intervention in the third week.

![Figure 1. Percentages of compliant behavior observed.](image)

The amount of nurturing touch observed between Cindy and Tori shifted between child initiated and adult initiated touch throughout the intervention. Child initiated and adult initiated touch shared an almost equal amount of observation for the majority of the intervention period; however, child initiated touch accounted for most of nurturing touch observed on the first day and last day of the intervention period and increased from 73.8% to 79.2%.
Spontaneous touch behavior increased over the intervention period from 56.2% on the first day of intervention to 75% on the last day. Nurturing touch behavior at request slightly decreased, from 30.7% to 25%. Nurturing touch within a hold or post hold was observed on the first day and third week of intervention.

Figure 2. Percentages of nurturing touch observed.

Figure 3. Percentages of touch quality observed.
Cindy’s prompted eye contact decreased significantly from 56.9% to 21.3% over the intervention period, as her eye contact without any verbal prompt grew from 37.2% to 55.8%. Her observed lack of eye contact also increased, from 37.4% to 55.8%.

Cindy’s observed aggressive behavior was within the first three weeks of the intervention period. Half of aggressive behavior on the first day of intervention was within a hold and half was spontaneous aggressive behavior. This was also the case in the third week of intervention. 100% of aggressive behavior on the second day of intervention was spontaneous. There was no observed aggressive behavior in play.

*Figure 4. Percentages of eye contact observed.*
Figure 5. Percentages of aggressive behavior observed.

Neurochemical Profile

While Cindy tested below optimal range for epinephrine (8-12 µg/gCr) one month prior to intervention, she tested slightly within range two days prior (8.4 µg/gCr). Her range slightly exceeded optimal range after two weeks of intervention (12.8 µg/gCr), and after four weeks, her epinephrine level had decreased to 7.8 µg/gCr.

Figure 6. Epinephrine results in comparison to normative range.
Cindy’s norepinephrine level tested above optimal range during the entire intervention period. However, her initial result from one month before intervention of 107.3 µg/gCr decreased to 78.8 µg/gCr in the fourth week, bringing her closer to the optimal range of 35-60 µg/gCr.

*Figure 7. Norepinephrine results in comparison to normative range.*

The dopamine results for Cindy, with the exception of the test two days prior to intervention, were above the optimal range of 110-175 µg/gCr. She initially tested outside the optimal range at 205.4 µg/gCr one month prior to intervention and ended with a result of 215.3 µg/gCr.

*Figure 8. Dopamine results in comparison to normative range.*
As seen in Figure 9, Cindy’s serotonin test results varied widely over the span of the intervention period. She tested higher than the optimal range of 150-200 µg/gCr one month prior to intervention with a result of 322.3 µg/gCr. Two days prior to intervention, she tested below range at 100.3 µg/gCr. Two weeks into program, her serotonin level rose to 285.8 µg/gCr and four weeks into program, it had dropped to 133.2 µg/gCr, her result closest to optimal range.

![Serotonin results comparison](image)

Figure 9. Serotonin results in comparison to normative range.

Cindy tested above optimal range for GABA (1.5-4 umol/gCr) for the majority of the intervention period. One month prior to intervention, she tested at 7.3 umol/gCr. She tested much closer to optimal range two days prior to intervention at 4.1 umol/gCr. However, two weeks into program, her GABA level had increased to 9.3 umol/gCr and dropped to 7.1 umol/gCr four weeks into program.
Cindy’s glutamine results show a trend of decreasing toward the optimal range (150-400 umol/gCr) over the intervention period. She initially tested with a result of 1169.8 umol/gCr and ended the intervention period testing with a result of 535.6 umol/gCr, slightly more than half of her original result.

**Figure 10.** GABA results in comparison to normative range.

**Figure 11.** Glutamine results in comparison to normative range.
The glutamate test results for Cindy varied widely and increased significantly toward the end of intervention. She tested slightly above optimal range (10-35 umol/gCr) before intervention (51.9 umol/gCr one month prior and 37.7 umol/gCr two days prior). However, two weeks into program, her glutamate level jumped to 138.9 umol/gCr and by the fourth week had elevated to 178.5 umol/gCr.

![Bar chart showing glutamate results over time with comparison to normative range.](image)

**Figure 12.** Glutamate results in comparison to normative range.

Cindy tested above optimal range for PEA (175-450 nmol/gCr) during the duration of the intervention period. One month prior to intervention, Cindy tested at 556.5 nmol/gCr. One week into program, her PEA level increased to 1660.3 nmol/gCr. Her PEA level decreased closer to optimal range by the fourth week of intervention at 919.2 nmol/gCr.
Figure 13. PEA results in comparison to normative range.

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<tr>
<th>Neurotransmitter Result</th>
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<td>nmol/gCr</td>
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CHAPTER 5
DISCUSSION

Parent-Child Interaction and Behavior

The videotape scores of parent-child interaction illustrate positive growth in both Cindy’s behavior and the relationship between her and Tori. Cindy’s behavior became more adaptive and appropriate over the intervention period. She became more compliant with directions from intervention authority figures. She used self-prompted eye contact more frequently as time progressed. Her reactions with aggressive behavior decreased as well. These changes suggest a shift toward reliance and trust in the intervention authority figures, namely her mother Tori in addition to an improved self-regulatory capacity. In addition, while the data shows Cindy sought out nurturing touch on a fairly consistent basis, her mother initiated nurturing touch more frequently in the middle of the intervention period. It is possible that this shift in Cindy’s behavior prompted Tori to initiate more opportunities for nurturing touch with Cindy. The increase in spontaneous nurturing touch also suggests that both parties, Cindy and Tori, felt more at ease with seeking and providing nurturing touch. These positive transformations provide support to the suggestion by Dozier and Albus (2000) that an intervention using home education can support attachment between mother and child.

Neurochemical Profile

Several neurotransmitter levels gradually shifted closer to the normative level over the intervention period; however, other results had wide variability that did not conclude with a consistent progression toward the normative level. One clear finding is the imbalance of Cindy’s excitatory and inhibitory neurotransmitters before intervention. Seven out of eight
neurotransmitters tested outside of normative level one month before intervention. In addition, glutamine tested abnormally higher than normative level. High levels of glutamine may indicate an imbalance between excitatory and inhibitory substances (NeuroScience Inc., 2007). However, two days prior to intervention, four out of eight neurotransmitters tested outside of normative level and four fell within normative level. These results are strange considering intervention principles would not be implemented within the home for two more days. It is possible results collected prior to intervention were affected by family or environmental factors. The initial neurotransmitter test was taken in early December, a season of high activity and stimulation level for many children. However, the results one month prior to intervention reveal that Cindy’s excitatory neurotransmitters and inhibitory neurotransmitters both tested above normative range. Testing would customarily reveal that neurotransmitters which work to balance each other would have an inverse relationship. However, Cindy’s serotonin was much higher than the normative level one month prior to intervention. Serotonin plays a role of regulator among neurotransmitters when in optimal amount (NeuroScience Inc., 2007) and the lack of regulation between her inhibitory and excitatory neurotransmitters is possibly connected to her extremely high level of serotonin.

If the results from one month prior to intervention were influenced by family or environmental factors, it is also possible the results from two days prior may be a more accurate reflection of Cindy’s normal neurotransmitter levels. Cindy’s reported active behavior before intervention indicates that a researcher would likely see high levels of excitatory neurotransmitters and low levels of inhibitory neurotransmitters. The results from two days prior to intervention reflect this expectation in that both serotonin and GABA tested below or within optimal range and all excitatory neurotransmitters within or above range.
A curious finding is the shift in neurotransmitters that occurred between two days prior to program and two weeks into program. Both inhibitory neurotransmitters increased above optimal range and several excitatory neurotransmitters increased as well, including epinephrine, dopamine, glutamate, and PEA. Norepinephrine is the sole excitatory neurotransmitter that decreased between two days prior and one week into program. The lack of predictable relationship between her inhibitory and excitatory neurotransmitters could be linked to her poorly regulated serotonin levels, as serotonin regulates many other neurotransmitters (NeuroScience Inc., 2007).

The results from four weeks into intervention reveal more consistent change for several neurotransmitters and continued variability for others. Several excitatory neurotransmitters decreased between week two and week four, including epinephrine, norepinephrine, dopamine, and PEA. Several of these results remained out of optimal range but gradually drew closer over the intervention period. However, glutamate increased between week two and week four. Serotonin decreased considerably between week two (above optimal range) and week four (below optimal range) and GABA, while above optimal range, decreased between week two and week four.

One surprising result is the gradual decrease of GABA’s precursor, glutamine, over the intervention period and the sharp increase of glutamate over the intervention period as GABA compensates for glutamate activity. GABA, which serves as the inhibitory partner to glutamate’s excitatory properties (NeuroScience Inc., 2007), followed in proportion to glutamate with the exception of week four as glutamate increased but GABA decreased.

Cindy’s increase in glutamate from the beginning of the intervention to the fourth week is of concern. An event that causes a large increase in glutamate may cause the death of neurons
(Sapolsky, 2000). Such an event would usually be physically or emotionally traumatic (NeuroScience Inc., 2007); therefore, it is a concern that Cindy would have such an increase at the 2nd week and 4th week of the intervention as it implies she experienced trauma during the intervention period.

Descriptive Measures

The descriptive measures, the CBCL, PSI, and ACTeRS Parent Form, confirmed other findings from the videotape coding and neurochemical profile but reveal more in-depth information about the subject and her mother. Based on the neurochemical findings, it is not surprising to see predominantly externalizing behaviors with high scores. Even with the intervention sandwiched between the completion of the CBCL, PSI and then the ACTeRS, the results show that Cindy has serious difficulty with hyperactivity, attention ability, and oppositional or aggressive behavior. Her scores on these measures suggest she has much room for growth in learning adaptive skills for social interaction and the academic environment. However, the results also suggest that Tori is committed to parenting Cindy in spite of the challenges Cindy presents.

The PSI yielded a more in-depth picture of Tori. Her self reported scores show that she perceives herself as being well attached to Cindy and has low levels of depression. However, her scores suggest she feels very restricted and not supported by her spouse in her role of parenting Cindy. The total stress score is predictable considering the current family challenges, such as parental separation, and is heavily influenced by her reported lack of support from spouse and Cindy’s behavior challenges.
Themes

The results of Cindy’s coded behavior and neurotransmitter levels show several important parallel themes. Outside of the variability and inconsistency seen in several results, her general growth is positive. Her growth toward compliancy, attunement, and more appropriate social interaction suggests a stronger attachment to Tori and reliance on her as the caregiver (Bowlby, 1969). In addition, her increasing use of words to express needs (informally observed) demonstrates a move toward better self regulation and awareness. Her neurotransmitter results reinforce these observations in that the majority grew closer to optimal level and could be linked to the decrease in her challenging behavior over the intervention period.

However, while the coded behavior shows a trend toward becoming healthy and adaptive, the research team observed that Cindy had a particularly hard time using her newly acquired skills when compromised physically or emotionally. Her serotonin levels varied widely and showed sharp increases and decreases at each test period. Serotonin serves as a chief regulator for healthy neurofunction and these unstable changes suggest her brain has a difficult time in managing many tasks (NeuroScience Inc., 2007). The inconsistent balance and abnormal levels of Cindy’s excitatory and inhibitory transmitters as tested within the intervention suggests the program components as used within the four week period may not be sufficient to support her neurochemical needs.

Cindy’s high activity level is illustrated in addition to her reported behavior and the observations of the research team by her neurotransmitter levels. Anxiousness and hyperactivity are symptoms of elevated epinephrine, norepinephrine, dopamine, and PEA (NeuroScience Inc., 2007), all of which had elevated levels during the intervention period.
Implications

This study suggests that in-home intervention customized to the child’s needs that simultaneously enables the parent to become a “healer” can be beneficial. The consistent growth seen through the videotape coding suggests that the program components positively change parent-child interaction and behavior. However, the wide variability in Cindy’s neurotransmitter levels proposes that she may require a longer intervention period and possibly supplemental neurochemical support in order to more fully meet her needs. Based on her prenatal experience, it is possible she has compromised neurofunction that necessitates additional reinforcement.

While the DRL has conducted many home program interventions, this is the first in a series of home interventions to be assessed with a variety of measures. The DRL staff has observed positive change in previous home programs, but this is the first study to document positive change in parent-child interaction, the child’s behavior, and the child’s neurochemical profile through various measures administered during pre-intervention and the first 4 weeks of intervention. These results are similar to findings from the first 4 weeks of other TCU home interventions. This intervention model has generated much interest in the professional community and has the opportunity to offer hope and healing to families (K. Purvis, personal communication, April 26, 2007; J. Pennings, personal communication, June 13, 2008).

Limitations

This study has several limitations, the foremost being it is a case study of 1 child. The qualitative analysis of the subject and her data cannot be generalized to a larger population because of the specificity with which children experience risk and the home program application customized to a child.
In addition, video coding left room for bias on the part of the primary researcher with regard to the specific behavior events observed and the codes assigned to them. While interrater reliability was established, many tapes were coded individually by one research assistant, and environmental factors might have affected the quality and consistency of coding. Although the coding scheme was designed with the intention to measure behaviors specific to parent-child interaction and the intervention, the coding scheme did not allow room to evaluate other realms of behavior. Thus, the process of video coding was for the purpose of counting and identifying the quality of behaviors listed on the coding scheme. Other behaviors may have been evaluated had the coding scheme allowed more opportunity to do so.

Components of the home intervention may have influenced the results in introducing novel experiences to the subject. The instructions for urine sample collection instruct the parent to collect the sample first thing in the morning. This may not have happened precisely with each collection and neurotransmitter levels might have been affected by a difficult night’s sleep or the occurrence of something stressful between waking up and urine collection. The presence of new people and a new schedule also might have induced stress for the subject.

Furthermore, this case study intended to evaluate data from the entire home intervention with administration of measures at regular intervals for use in measuring change. Because all family members contracted influenza, the home intervention protocol was suspended to provide time for them to heal. This suspension disrupted data collection. Therefore, all data came from pre-intervention and the first 4 weeks, which comprised only of level 1 of the home intervention model. The occurrence of illness reflects parenting in real life and may have provided an opportunity for the continuance of data collection that more closely resembles parenting in that
context. While many variables affect the results of a home intervention, perhaps the inclusion of all data, regardless of disruption, is a more accurate representation of families today.

Ideally, the analysis of this home intervention model would include the analysis of measures collected pre-intervention through the conclusion of the intervention every two weeks. Because the research assistants personally interacted with the subject and family in addition to collecting data, neutral analysis of the data was impossible. Preferably, videotape of the home intervention would have been taken during all hours of the day, from pre-intervention to post-intervention. The videotapes would have been coded by someone neutral to the home intervention to provide a more pure view of parent-child interaction and subject behavior. The coding scheme would allow room to include new behaviors that emerge during the home intervention and would contain more codes for more specific behavior analysis.

In addition, in the ideal circumstance of collecting data from across an entire home intervention period, one would have data from purely just the home intervention and from the home intervention with TAAT™. These two distinct portions of the home intervention should be compared to each other to note the unique effects of the behavioral intervention and TAAT™.

Future Directions

While home program intervention models have been studied in the past, these results reinforce this particular TCU model’s effectiveness in positively changing parent-child interaction and behavior. More research is needed to evaluate the effect of this home program model on parent-child interaction, neurochemical profiles, and behavior in families who have at-risk children. Future studies should assess the effect of longer intervention length. In addition, the analysis of data from a larger sample size would provide more support for this model.
APPENDIX A

PROTOCOL FOR TCU INTERVENTION MODEL
Guiding Principles

Empowering
Encompasses supporting the child’s physical needs in order to maximize his capability through the use of:
• Managed sensory input through physical activities
• Blood sugar maintenance through regular meals and snacks
• Proper hydration
• TAAT™ if necessary (dependent on neurotransmitter testing results)

Connecting
Guides the interaction between parent and child to support the construction of attachment through the use of:
• Behavior matching
• Close emotional and physical proximity

Correcting
Parent provides the child opportunities to learn appropriate, adaptive behavior through the use of:
• Levels of response to behavior, i.e. response matches severity of behavior. For example, failure to comply the first time would elicit a more playful response than failure to comply the third time.
• Parent provision to child of opportunity to “redo” behavior the right way
• Role playing exercises
• Behavior rehearsal
• Positive reinforcement
• Watching and discussing the child’s behavior in intervention videotapes

Structure

Level 1 – Adults Only

Children remain in level 1 for minimum of 4-6 weeks
Symptoms and problems must be absent for at least two weeks before moving to level 2

Components:
• No interaction with peers or outside stimulation such as television or toys
• Close physical proximity at all times (also at bedtime, if child necessitates support during transition)
• Complete supervision by primary caretakers
• Therapeutic hold technique

Level 2 – Early Family Integration

Children remain in level 2 for minimum of 4-6 weeks
Regression necessitates moving back to level 1

Components:
- Schedule and activities still managed by parents
- Incentive system introduced for satisfactory behavior or task completion
- Given some freedom and privileges as earned through incentive system
- Close parental supervision of performance and progress

Level 3 – Increasing Self-Control

Graduation out of program can occur with sustained time in Level 3
Regression to Level 2 may be necessary in order to allow child opportunity to be closer to parents, have more manageable expectations, and perhaps be reminded of program principles
Regression to Level 1 is an option if child becomes out of control or violates rules

Components:
- Brief time periods away from primary caretakers
- Can choose activities for self
- More complex incentive system requiring more investment to earn tokens
- Privileges, freedom, and activities based on tokens earned from incentive system
- Outside social interaction permitted
APPENDIX B

CODING SHEET
### Compliance

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#### Quality of Nurturing/Reassuring Touch

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### Aggressive Behavior

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APPENDIX C

MODEL MEASURE TIMELINE
Model Timeline of 1st 4 Weeks of Intervention
REFERENCES


