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CHILDREN ADOPTED INTERNATIONALLY –  
EXAMINING DEVELOPMENT STATUS AT ARRIVAL  
AND AT SIX MONTH FOLLOW UP

A dissertation submitted in partial fulfillment of the requirements for the degree of  
Doctor of Philosophy at Virginia Commonwealth University

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## ABSTRACT

### CHILDREN ADOPTED INTERNATIONALLY – EXAMINING DEVELOPMENT STATUS AT ARRIVAL AND AT SIX MONTH FOLLOW UP

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

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In the past 5 years, almost 100,000 children have been internationally adopted. Research suggests that many of these children have growth and developmental delays, but few large scale studies have been completed. In the current study data obtained from a retrospective chart review of 534 children followed in the International Adoption Clinic at Cincinnati Children's Hospital Medical Center between 1999 and 2007 was analyzed. Prevalence of developmental delays and sensory processing issues initially and after 6 months in country, the relationship of delays/issues with previously identified risk factors, and the frequency of recommendations for early intervention (EI) and therapy services were all examined.

Results demonstrated the following:

1) Development: most children fell  $\geq 1$ SD below the mean in at least one developmental domain (Vineland Developmental Motor Scales) initially, however improvements in developmental scores were noted between initial and follow up visits. The number of children with a delay in at least one domain dropped from 58% (initial visit) to 44% (follow up). Developmental scores at six months had the strongest correlation with age at time of adoption; children adopted at older ages had lower scores at follow up.

2) Sensory processing: Infant/toddler sensory profile scores for children aged 1-3 were compared at initial and follow up visits. The percentage of children with atypical scores in at least one area of sensory processing decreased from 68% initially to 48% by follow up. Similarly, children  $\geq 3$  years of age demonstrated improvements in sensory processing; at follow up, only 15% had an atypical total score on the short sensory profile compared to 42% initially.

3) Referral: Referral data was available for 61% of children; of these approximately half received a recommendation for additional services. Most referrals were for EI services (31%); 22% received a referral to speech therapy, and 12% received referrals to PT and OT.

Consistent with other work, a significant number of internationally adopted children demonstrate delays in developmental skills and sensory processing abilities. Although improvements in these areas were generally noted, developmental delays and sensory processing issues remained for some children 6 months after adoption. Over half of the children received recommendations for additional services; this number increased for those with more significant delays.

## CHAPTER I – INTRODUCTION

Over the past 30 years, more than 250,000 children have been adopted in the US from foreign countries (Issues Brief, 2007). In recent years the majority of children have been adopted from China, Guatemala, Russia, Ethiopia and South Korea (US Department of State: Office of Children's Issues, n.d.). These children were available for adoption for many reasons including the loss of parents, abandonment, or extreme poverty (Issues Brief, 2007). Prior to their adoption many of these children were cared for in foster care, or institutions such as hospitals and orphanages. Unfortunately many of these institutions lack financial resources, and have staff to child ratios that are less than ideal. Additionally, many of the children available for international adoption are born to mothers who do not receive prenatal care and many are exposed in utero to drugs and alcohol (Miller, 2000).

At the time of adoption, international children are often malnourished and have growth delays. Miller (2000) collected data on 370 children with varied countries of origin and found that 30-50% had height, weight or head circumference measures below the 5<sup>th</sup> percentile. In earlier work, which looked at the development of 129 children adopted from 22 different countries, Miller and colleagues (1995) had shown that up to 50% of internationally adopted children were developmentally delayed. Although health and weight problems will often resolve rapidly, there is limited research regarding the

developmental outcomes of internationally adopted children and the reversibility of the delays is not guaranteed (Narad & Mason, 1994). The intent of the current study was to examine the developmental status of internationally adopted children at adoption and at sixmonths following arrival in country. In addition, the significance of these outcomes as related to eligibility/need for intervention was investigated. Subjects for this study were children attending the Cincinnati Children's Hospital Medical Center International Adoption Center (CCHMC – IAC) between 1999 and 2007. Findings from this study will add to the growing body of literature describing the presence of initial delays in growth and development in internationally adopted children. Further, the current study documented outcomes six months after arrival in country, and examined relationships between preadoptive conditions, anthropometric measures and developmental status, extending the limited longitudinal data currently available. Finally, this study examined eligibility/referral to therapy services in children adopted internationally, something that until now has not received attention in the literature.

## CHAPTER II: BACKGROUND INFORMATION AND LITERATURE REVIEW

### Background Information

Infant growth and development can be influenced not only by genetic potential and biologic factors, but also by factors such as maternal health and life style (prenatally), and socioeconomic status (postnatally). Interestingly, as discussed below, factors such as the environment, culture and ethnicity, and the opportunity for practice of motor functions may also influence development (deBarro, Fragoso, de Oliviara, Calbral-Filho, mail& de Castro, 2003; Mayson, Harris, & Bachman, 2007). Environmentally, geographic characteristics such as climate and topography may influence health (and subsequently development) as they impact the types of diseases to which children may be exposed (Knutson, Leavitt, & Sarton, 1995). Further, environmental conditions such as temperature may have an impact on early motor development, as colder temperatures may result in heavier clothing and more time spent indoors, reducing an infant's opportunity for motor activity and practice (Cintas, 1995). Focusing on ethnicity and culture, Kelly and colleagues (Kelly, Sacker, Schoon, & Nazroo, 2006) examined ethnic differences in the attainment of developmental milestones in 9-month old infants in the United Kingdom. These investigators found that Pakistani and Bangladeshi infants demonstrated delays in developmental skills which could be explained by socioeconomic factors and cultural traditions. Earlier work by Cintas (1995) had indicated that culturally

based parental expectations and caregiving practices can shape a child's development. Culturally based practices with the potential to influence motor development include the use of carrying slings that do not provide head support (challenging postural responses of the head and upper trunk) for neonates, or being held or propped in sitting or standing in the early weeks of infancy (Cintas, 1995). Based on variations in background and experience (as illustrated above), it would not be surprising if, even without the deprivation that many children experience prior to adoption, there are differences in the development of children adopted internationally.

#### Adoption Statistics

The number of international adoptions has risen significantly since the early 1990s. Adoptions surpassed 20,000 annually between 2002 and 2006 before declining slightly in recent years. In the past four fiscal years (2004 through 2008) the largest numbers of internationally adopted children have come from China, Guatemala and Russia. (US Department of State: Office of Children's Issues, n.d.). Most children adopted from China are girls (90%) because of China's population control policies, and close to 50% of children from both Guatemala and Russia are also female (Adoptive Families, n.d.). The majority of children adopted from each of these countries are adopted under the age of five years (94% of children from China, 96% of children from Guatemala, and 72% of children from Russia). One may expect these numbers to change significantly as China and Guatemala come into compliance with the Hague Adoption Convention on the Protection of Children and Co-operation in Respect of Intercountry Adoption, which established international standards of practice for intercountry adoption.

These standards include requirements that “convention countries” mandate that adoption service providers be accredited, disclose in writing and in advance the fees and expenses associated with adoption, and determine the eligibility of the child to be adopted, including meeting criteria for immigration to the United States. To date approximately 75 countries have joined this Convention which has significantly affected adoption procedures including those from the China, Guatemala and Russia. As of January 1, 2009 all adoption cases between the U.S. and China will be processed by China as Hague Inter-country Adoption Convention cases. Until compliance with the Hague Adoption Convention is assured the US is not processing new adoptions from Guatemala. Russia, however, is not currently a “convention country” and may therefore follow “non-Hague” convention procedures which simply afford those seeking to adopt less protection than that afforded to parents adopting from convention countries (US Department of State, Office of Children’s Issues, n.d.).

#### Theoretical Framework for Study

Older developmental theories such as the maturational theory viewed the central nervous system (CNS) as the driving force in development. In contrast, contemporary theories see the CNS one of many subsystems that interact to produce movement. Motor development researchers now recognize that development is influenced by many factors, both intrinsic and extrinsic to the individual (Aubert, 2008). Dynamical systems/action theory is one such contemporary theory. According to dynamical systems theory, no one body system (such as the CNS) is responsible for any specific domain of development. Instead, development in each domain unfolds as a result of the interaction of many

systems within the individual (nervous, musculoskeletal, integumentary and cardiopulmonary systems), in a task and environmental specific context. Movement is ‘self organized’ based on an interaction of all contributing subsystems with respect to the demands of the task and environment (Heriza, 1991). Systems theory, based on the work of Nicolai Bernstein, is another contemporary theory. It incorporates the concept of a distributed model of motor control in which the many subsystems within an individual share/distribute control based on the motor task and environmental context (Westcott & Goulet, 2005).

Some researchers (Shumway Cook & Woollacott, 2006) now advocate combining elements of multiple motor control theories into what they called a “systems approach” to explain the acquisition of motor skills. This approach incorporates the common components of the contemporary theories presented, and states that movement emerges as a result of an interaction between the individual, the task and the environment (Shumway Cook & Woollacott, 2006). Thus, development could be potentially affected by altering any or all of these areas. The implications of this approach are exciting when viewed in the context of international adoption in that a child’s post adoptive environment is often significantly enriched compared to their preadoptive placement and the tasks in this new environment differ substantially from those in the old. Thus, the “systems approach”, which acknowledges the importance of the individual but also recognizes the influence of task exposure and environmental circumstances in motor skill acquisition, is ideal to study motor development post adoption and will be used as a framework for the current study.

As previously stated, individual factors such as genetic and biologic characteristics influence infant growth and development, however the essence of these characteristics would not be expected to change based on adoptive status and thus cannot be used to explain the majority of developmental changes seen after adoption. In contrast, the expression of genetic and biologic characteristics is influenced by context; task requirements and environmental circumstances, both of which influence movement, are often significantly different pre and post adoption. In light of this, a further examination of extrinsic (environmental) preadoptive conditions which may affect development is warranted in order to understand changes in the task and environmental realms post adoption that may contribute to the resolution of health and developmental delays.

#### Pre-adoption Context

While there is considerable variation between countries, most typically internationally adopted children are not true orphans (with both parents deceased) but have been abandoned by their families due to parental illness, poverty, or the parents inability to care for the children (Miller, 2005). Many of these children were “given up” in the early years of life, a period of rapid brain growth and development (American Academy of Pediatrics, 2000). Often they have lived in institutions, although placement in foster care is becoming more common (Miller, 2005). Conditions in institutions are variable; many facilities lack funding, and the children often lived in crowded conditions, with poor hygiene, and inadequate nutrition (Miller, 2005). Care is typically provided by a large number of untrained providers, whose time and skills are inadequate to meet the needs of the children for whom they are caring (Narad & Mason, 2004). Neglect, not

uncommon in institutional care, can have lasting effects on all areas of child development and may result in attachment disorders, developmental delay, poor physical development, and antisocial behavior (Committee on Early Childhood, Adoption and Dependent Care, 2000). Thus, institutional care, while providing a lifesaving option for many children, places them at risk for growth and developmental delays (Mason & Narad, 2005).

Institutional living increases the children's exposure to infections, places them at greater risk for physical and emotional neglect and abuse, and often results in inadequate medical care and nutrition. That said, it must be acknowledged that institutional care is heterogeneous and varies widely both within and between countries.

In addition to the living experience of institutionalized children, the duration of institutionalization is also important with a positive correlation noted between time spent in an orphanage and the degree of delay (Mason & Narad, 2005; Miller, 2000). Although research indicates that the greater the length of time spent in institutions the greater the delays, it must be noted that much of the research was on children who came out of highly deprived environments and may not be applicable to general groups of internationally adopted children (Weitzman, 2003). In general the experience of the child, linked to the environmental context, is thought to be more important than the duration of institutionalization (Miller, 2000).

Children available for international adoption who have not been institutionalized often live with extended family or in foster care. For example, the majority of children adopted from South Korea have lived in foster homes, and foster care is also becoming more common in Guatemala, Romania and China (Miller, 2000). Although little is

written about the conditions in foster homes, there is some evidence that children adopted from foster care have better growth scores and less developmental delay than those adopted from orphanages (Wilson, Weaver, Cradock & Kuebli, 2008; Miller, Chan, Comfort & Tirella, 2005). Most Korean children are said to live in loving, attentive foster homes prior to adoption and subsequently are among the most developmentally normal adoptees (Miller, 2005). Also contributing to their health status is the fact that the children are typically well nourished and are followed by well trained physicians. Children from South Korea also typically arrive at young ages, generally younger than 9-months of age. Gross motor delays at the time of arrival in the USA are still common in this population however, and are thought to be due to restrictions in “floor time” and from being frequently carried by their foster parents (Miller, 2005).

#### Growth and Development of Internationally Adopted Children

Routinely, internationally adopted children will arrive into their adoptive families with developmental status that includes a variety of medical and developmental concerns including malnutrition and growth delays, behavioral issues, and delays in cognitive, motor and language skills. These delays are thought to reflect the deprived early environments of the majority of children (Mason & Narad, 2005; Miller, Kiernan, Mathers & Klein-Gitelman, 1995). For instance growth delays (including decreased height, weight and head circumference) may be the result of lack of food/inadequate diet, poor feeding techniques, depression, and other medical problems (Miller, 2000). Miller and colleagues (1995) assessed 129 internationally adopted children from 22 countries immediately on arrival in the USA. Their assessments revealed that only 50% of the

children were without developmental delays – 33% had gross motor delays, 40% had fine motor delays, 16% had cognitive delays and 18% had language delays. Delays ranged from slight to severe. Developmental disabilities were found to be related to growth retardation and other medical issues (Miller et al., 1995).

Although delays are common in the majority of internationally adopted children, there may be differences based on country of origin and the children's environment prior to adoption. Interestingly, many of the delays resolve once the children are adopted into loving, nurturing environments (Miller, 2005). In their study of 26 internationally adopted children Wilson and colleagues (2008) used the Bayley Scales of Infant Development – 2<sup>nd</sup> edition (BSID II) and the Ages and Stages Questionnaire (a parent report tool) upon initial assessment when children arrived in the United States and again approximately six months later. The children were adopted from six countries (China, Russia, South Korea, Guatemala, Ukraine and Vietnam), ranged in age from 5-36 months, and were adopted from either an orphanage (19 children) or foster care (7 children). They found that the children's average scores on both the cognitive and motor scales of the BSID II were within the range of mild delay. The average scores at the six month testing time point were within normal limits in both domains (Wilson et al., 2008).

Developmental delays in children adopted internationally may be multifactorial in origin, but environmental deprivation is thought to play a significant role. Young children are often swaddled and placed in supine, which while not harmful if used in moderation, does limit their ability to explore their bodies and environment (Cintas, 1995). Prone positioning is viewed as being important for the development of antigravity head, neck

and postural control as well as shoulder stability and if little time is spent in this position children may be less likely to develop the muscle strength initially necessary for many motor skills (Dudek-Shriber & Zalenzy, 2007). Time spent outdoors or even outside of a crib may be minimal or nonexistent, preventing the development of mobility and providing few opportunities for interaction. Toys may be unavailable, resulting in deficits in fine motor and perceptual skills (Miller, 2005; Johnson, Miller, Iverson, Thomas, Franchino & Dole et al., 1992). Language skills are also commonly delayed, predominately due to a lack of exposure (Miller, 2000). In general, individualized attention and environmental stimulation are limited and children need this stimulation to promote normal development (McGuinness & Dyer, 2006). Researchers examining time use in a Russian baby home found that children spent half of their time alone and often had no objects (toys, bottles, food) in their immediate presence (Tirella, Chan, Cermak, Litvonia, Salas & Miller, 2007). Other researchers have also documented that institutionalized children have less adult interaction. In a study of institutionalized infants in Eastern Europe it was noted that the children spent 70% of their waking hours alone, exactly the opposite of American children living with their families and attending day care (Daunhauer, Bolton & Cermak, 2004).

#### Impact of Country of Origin and Preadoptive Placement

Because country of origin and preadoptive placement are thought to significantly impact health and developmental status, many researchers have examined children adopted internationally from a regional perspective. In 1992, Johnson and colleagues examined the health of 65 children adopted from Romania. These children ranged in age

from 6 weeks to 73 months and the majority of them had spent their entire lives institutionalized. The results were disturbing; only 15% of this population was found to be both physically healthy and developmentally normal and the majority of these “normal” children (8/10) were under 6- months of age. Fifty three percent of the children had evidence of past/present hepatitis B exposure and 33% had intestinal parasites. Growth failure and developmental issues were also observed with 85% of children aged 6 months and above having abnormal developmental findings. Children demonstrated decreased gross motor activity and decreased strength and endurance as well as abnormal social emotional behavior such as retarded speech, gaze aversion and solitary play (Johnson, Miller, Iverson, Thomas, Franchino, & Dole, et al., 1992). Institutional care in Romania has been characterized by having an uneducated staff facing difficult working environments. Child to caregiver ratios are high and the children have limited stimulation. Although, current conditions may be different, a 1992 study (Rosenburg, Pajer & Rancurello) reported that 170 residents of a Romanian orphanage were cared for by only six day and three night attendants and news reports described caregiver to child ratios of 60:1 (Johnson et al 1992). Thus it is not surprising that Romanian children raised in institutions have more developmental deficits than those raised with their Romanian families (Smyke, Koga, Johnson, Fox, Marshall, Nelson, et al. 2007). Additionally researchers have found that caregiver quality is positively related to development, while the percent of life spent institutionalized is negatively related (Smyke et al., 2007). Persistent developmental delays, sensory dysfunction, and emotional/behavioral problems are common in children adopted from Romania (Cermak & Daunhauer, 1997;

Lin, 2005), although more recently health and development of adoptees have improved (Miller, 2005).

As previously discussed, in recent years the large majority of children have been adopted from China, Guatemala and Russia and pre-adoptive care in these three countries differs significantly. Foster care in Russia is rare and orphans are cared for in baby homes until the age of three and then transferred to orphanages. A small percentage of children from China reside in foster care prior to adoption, while in Guatemala foster care is common. Albers et al. (1997) examined the health and developmental status of 56 children adopted from Eastern Europe and the former Soviet Union and found growth delays were common; findings indicated that many children were more than one-standard deviation below the mean for weight (44%), height (68%) and head circumference (43%). The children also demonstrated developmental delays in gross motor (70%), fine motor (82%) and social emotional (53%) development when evaluated using the Peabody Developmental Motor Scales and/or the University of Michigan Early Intervention Developmental Profile (Albers, Johnson, Hostetter, Iverson, & Miller, 1997). Pomerleau and colleagues, (Pomerleau, Malcuit, Seguin, Belhumer, Germain, Amyot, et al., 2005) in examining the health status and development of children under 18 months of age adopted from China, East Asia and Russia, studied 123 children adopted into families in Canada. As part of this longitudinal study, the children were assessed within 1 month of their arrival into their adoptive country as well as three and six months later. Researchers collected anthropometric data (height, weight and head circumference), as well as information about developmental (motor and cognitive) skills. The Bayley Scales of

Infant Development were used to assess developmental status. With regard to the anthropometric data, the children from East Asia had higher percentiles for height and weight than those from Russia or China. Accordingly, children from Russia and China showed greater improvement in these areas over time. Children from East Asia also had the highest scores for both motor and cognitive development. In general, for all groups of children, scores were higher at three and six months than at initial testing. The height to age ratio (indicative of nutritional status) and head circumference were the anthropometrics that best explained the developmental scores at time of arrival. Consistent with other studies, age at time of adoption was also related to initial scores and improvement demonstrated after adoption. It is also important to note that even six months after adoption, developmental scores were not within normal ranges for all children (Pomerleau et al., 2005). Somewhat in contrast to these findings, Judge (2003) assessed development over time in children adopted from Eastern Asia and found that by 6 months following adoption 76% of children had no delays, or delays in only one area of development. This indicates a substantial improvement over time as, per parents recollection of their initial encounters with their children, 80% had delays in two or more areas. Judge found that the number of initial delays, time spent in an adoptive home and age at time of adoption were the best predictors of developmental “catch up”.

Examining the development of children adopted from China, Miller and Hendries (2000) found that, of 192 children examined in an international adoption clinic between 1991 and 1998, 73% had significant delays in at least one area of development. The majority of children in the study were female and their ages ranged from –two months to

almost 12.5 years. Almost 90% of the children were evaluated within two months of their arrival in the United States; 44% of the children had global delays. Gross motor delays (55% of children), fine motor delays (49%), and language delays (43%) were most common but delays in cognition (32%), social emotional skills (28%) and activities of daily living (30%) were also fairly frequently noted.

Children adopted from Guatemala have also been studied. Miller and her research team (Miller, Chan, Comfort, & Tirella, 2005) assessed the health, growth and developmental status of 103 children adopted from Guatemala. Because these children resided in a variety of settings prior to being adopted, the researchers were able to compare the status of those children adopted from foster care with those adopted from orphanages. The children ranged in age from three-months to nine years. Seventy one percent of children were evaluated within two months of their arrival in the United States. Height, weight and head circumference measurements, clinical neuromuscular development, and formal developmental testing (using either the University of Michigan Early Intervention Developmental Profile or the Mullen Scales of Early Learning) were conducted. Overall children under two years of age, regardless of pre-adoption placement, had better growth and developmental scores than older children. Most children were found to be doing well developmentally with scores ranging from the 80<sup>th</sup> to 92<sup>nd</sup> percentiles. Fourteen percent of children were found to have global developmental delay. In a comparison of children who were adopted from foster care and orphanages (children were matched for age at arrival, time from arrival to clinic visit and gender) growth scores were lower for those who had resided in orphanages. From the

developmental skills assessed (language, motor, cognitive and social emotional skills and activities of daily living) only scores for cognition were significantly different, with those who had resided in foster care having significantly higher scores than those who had resided in orphanages (Miller et al., 2005).

In 2009, after Guatemala closed international adoption, Ethiopia became one of the top three sending countries (Trends in International Adoption, n.d.). In contrast with children from the other top sending countries, children adopted from this region have been found to slightly older (average age four years) and reside more frequently with relatives instead of, or prior to, placement in orphanages. Additionally more than 50% were true orphans, often due to HIV (Miller, L.C., Tseng, B., Tirella, L.G., Chan, W, & Feig, E., 2008). A retrospective chart review of 50 children (Miller, et. al., 2008) revealed that anthropometric measures were near normal and significantly better than those of children adopted from China, Guatemala and Russia. Developmental skills (gross motor, fine motor and cognition as assessed with the Michigan Early Learning Developmental Profile or the Mullen Scales of Early Learning were found to be 86% percent of that expected for age. A negative correlation between age at time of adoption and cognitive development was noted.

In addition to global developmental assessments, several researchers have looked more specifically at sensory processing in children who are adopted from other countries. Similar to other aspects of development, internationally adopted children were found to have greater problems with sensory processing than typically developing peers (Cermak & Daunhauer, 1997). Additionally, the length of time institutionalized was associated

with the degree of sensory integration dysfunction. Researchers (Lin, Cermak, Coster, & Miller, 2005) commented that institutionalized children may be at risk for processing and interpreting sensory information given their limited sensory experiences and reduced opportunities for exploration and interaction. Based on survey data obtained from the adoptive parents of Romanian children, significant differences in sensory modulation were noted in individual sensory and behavioral domains when the Romanian children were compared to a control sample. The researchers attributed these differences to the critical impact of the environment on a child's sensory processing abilities (Cermak & Daunhauer, 1997). These results led the researchers to suggest that examination of sensory integrative function be included in the assessment of internationally adopted children, particularly if they are having difficulties with occupational performance and participation in home, school and community settings.

In summary, based on the literature presented, risk factors for developmental delay in internationally adopted children include malnutrition and growth delays, institutionalization (versus foster care), longer duration of institutionalization, environmental deprivation, and older age at time of adoption (Mason & Narad, 2005; Miller et al., 1995; Smyke et al., 2007; Wilson et al., 2008).

In light of the many deficits and delays common in children adopted internationally, developmental assessment of newly arrived children is recommended. This testing can identify type and severity of delays in order to identify areas that require intervention, serve as a tool for parental education regarding the normal developmental sequence, and provide a baseline from which to measure progress and recovery (Miller,

2000). For physicians, taking a “wait and see” approach to delays in growth and physical development may be most appropriate, except in severe cases, as many delays resolve spontaneously once in children are in their adoptive homes (Miller, 2005). However in light of the frequency of developmental delays in internationally adopted children identified at the initial assessment, more research regarding the prevalence and need for developmental intervention is appropriate. In a small study of 26 children, Wilson and colleagues (2008) assessed internationally adopted children using the Bayley Scales of Infant Development, Second Edition (BSID II). The children were assessed within two months of their arrival in the US and again six months later. Researchers found that at the initial visit 60-70% of the children fell in the range of mild to significant delay in both motor (PDI) and cognitive (MDI) domains but by the six month assessment percentages had decreased to 24 to 40%. In other words, of the 25 children assessed at six months (one child was not available for assessment), six demonstrated continued delays in motor skills (five mild/one significant) and nine demonstrated continued delays in cognitive skills (seven mild/two significant). None of the children in their study were receiving specialized early intervention or therapy services at their initial visit and only two of the children were enrolled in therapy (speech therapy) at their second visit. Other than this single study there is little to no documentation in the literature about developmental intervention services that internationally adopted children with delayed development receive. Unfortunately it is still unclear how to best distinguish transient delays from true developmental concerns in order to recommend services and more research is needed in this area (Wilson, et al. 2008).

## Early Intervention and Therapy Services

The federal government, through the authorization of the Individuals with Disabilities Education Act (IDEA), ensures that educational services are provided to children with disabilities throughout the nation. In addition to addressing the needs of school aged children, Congress, through IDEA Part C, also acknowledges a substantial need to “enhance the development of infants and toddlers with disabilities, to minimize their potential for developmental delay, and to recognize the significant brain development that occurs during a child's first three years of life” (US Department of Education, n.d.). Thus, the government provides financial assistance to states to provide comprehensive early intervention (EI) services for infants and toddlers with disabilities and their families, as well as for children under three years of age who would be “at risk” of having substantial developmental delay if they did not receive EI services. For the purpose of IDEA the phrase ‘infant or toddler with a disability’ refer to “an individual under three years of age who needs early intervention services because the individual 1) is experiencing developmental delays, as measured by appropriate diagnostic instruments and procedures in one or more of the areas of cognitive development, physical development, communication development, social or emotional development, and adaptive development; or 2) has a diagnosed physical or mental condition that has a high probability of resulting in developmental delay. ‘At risk’ infants and toddlers may also be included at the State's discretion (US Department of Education, n.d.). It is each states responsibility to determine eligibility for and provide early intervention services. In the state of Ohio these services are provided through the Ohio Department of Health and the

Help Me Grow program. Children qualify for early intervention services through Help Me Grow if they have a developmental delay in one or more areas as measured by a developmental evaluation tool or informed clinical opinion (Help Me Grow Eligibility Policy, 2004). In the state of Ohio children are eligible if they fall 1.5 standard deviations below the mean on one of the domains of the Battelle Developmental Inventory (a normative and criterion referenced developmental assessment that can be used with children from birth through age eight). Speech, occupational and physical therapy may be included in early intervention services provided through IDEA Part C, however children may also be referred for outpatient therapy regardless of eligibility through IDEA. As previously noted, however, there is little to no documentation in the literature about the number of internationally adopted children eligible or referred for early intervention and/or therapy services.

#### Purpose of the Study

The overarching purpose of this study was to build on previous research and develop a more thorough perspective of development in children following international adoption. Inherent in this purpose, this investigation assessed the need/referral for developmental intervention. This study is unique in that it examined a large database to assess the developmental status and course of children who are adopted internationally, both at arrival and at 6 month follow up. Further, this study attempted to define the prevalence and identify the characteristics of children referred for early intervention and/or therapy services.

The Cincinnati Children's Hospital Medical Center (CCHMC) has an international adoption clinic which specifically addresses the concerns of internationally adopted children and their families. The clinic offers medical evaluations for newly adopted children; these evaluations include a comprehensive medical, developmental and nutritional assessment, baseline laboratory tests, screening for infectious diseases and immunization recommendations (International Adoption Services, 2008). Children are typically seen within their first 1-2 months in the United States, with follow up visits three and/or six months later. The clinic staff utilizes several assessment tools to evaluate each child's developmental status – the Denver II, the Sensory Profile, and the Vineland Adaptive Behavioral Scales. The clinic, since its' inception in 1999, has evaluated a large number of internationally adopted children each year from countries such as Russia, Eastern Europe, China, Africa, and Central and South America. As such they have developed a large database of information from children adopted internationally which will be used to conduct the current study.

#### Significance of the Study

Upon arrival, many internationally adopted children demonstrate global developmental delays (Miller, 1995; Wilson et al., 2008; Johnson et al., 1992; Smyke et al., 2007; Judge, 2003; Miller & Hendrie, et al., 2000; Pomerleau et al., 2005; Albers et al., 1997). These delays may occur in the areas of gross motor, fine motor, cognitive or language skills and are commonly linked to environmental deprivation in their pre-adoptive environments. Although many of the delays are expected to resolve spontaneously once the children are adopted into loving homes and exposed to nurturing,

stimulating environments (Miller, 2005; Wilson et al., 2008; Judge, 2003; Pomerleau et al., 2005), more evidence is needed to guide clinicians in identifying children adopted internationally with continuing developmental delays, in need of developmental intervention. To date most published studies have used fairly small sample sizes, and by and large have looked at factors individually. Pomerleau and colleagues (2005), were able to compare developmental status across groups as well as analyze relationships between anthropometric, medical and developmental status, however their results are based on a relatively small number of subjects. A large cohort of international adoptees has been evaluated at the CCHMC – IAC (approximately 1500 - 1600 children), which provides a unique opportunity to further substantiate the developmental status of this population and further examine relationships between developmental status, nutritional status and pre-adoptive factors. This study has expanded upon the previously published research on the developmental status of internationally adopted children, both early after arrival and at approximately six months following adoption. Judge (2003) recommends that internationally adopted children who do not show continuous development, remain significantly delayed or whose parents have developmental concerns should be referred for services. Finally, this study examined the prevalence and characteristics of children who receive recommendations for early intervention and therapy services.

Currently there are approximately 30 international adoption medicine clinics operating in the United States (International Adoption Medical Clinics, n.d) each offering a variety of services and health care providers which may include physicians, neuropsychologists, occupational and physical therapists, counselors, nurses and social

workers. Research examining the developmental status and early intervention needs of internationally adopted children will support and assist these clinics in providing the most effective and efficient care for the children they serve. Additionally this information may guide current and future adoptive parents as they plan and provide for their newly adopted children.

## CHAPTER III - METHODOLOGY

### Design Overview

This study utilized existing clinical information obtained from patients at the CCHMC International Adoption Center (IAC) to address its' research aims. It utilized a exploratory retrospective chart review design, examining information previously collected from the patients seen at the CCHMC - IAC. International adoptees attending the IAC typically undergo an evaluation which includes a comprehensive medical, developmental and nutritional assessment, baseline laboratory tests, and screening for infectious diseases, thus this clinical information will be available in CCHMC – IAC medical records.

Experts recommend that internationally adopted children undergo developmental screening to assess their current level of skills and the need for any additional intervention, as well as to monitor ongoing development (Miller, 2005). Currently the CCHMC – IAC staff utilize three tools to assess development – the Denver II, the Sensory Profile, and the Vineland Adaptive Behavior Scales. The Denver II is a developmental screening tool designed to test a broad range of heterogeneous skills – personal-social, fine motor-adaptive, language and gross motor. It is an assessment that is administered to the child, although aspects of it can rely on parent report. The Denver II can be used with children from birth through six years of age. The Sensory Profile is a

caregiver questionnaire/parent report tool which assesses a child's responsiveness to sensory input which may be impacting functional performance. The Vineland Adaptive Behavior Scales can be completed via parent interview, as was done in the CCHMC – IAC. This scale assesses four domains of adaptive behavior – communication, daily living skills, socialization, and motor skills and can be used with children from birth through 18 years. While each of these tools contributes to a comprehensive assessment of developmental status, the Denver II has been found to have limited specificity and a high over-referral rate (Glascoe, F.P., Byrne, K.E., Ashford, L.G., Johnson, K.L., Chang, B. & Strickland, B., 1992) and its' results were not analyzed in this study.

#### Investigators

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Mary Staat, MD, MPH is the founder and director of the International Adoption Center at CCHMC as well as a clinician and research in the Division of Infectious Diseases. She is a board certified pediatrician and is also board certified in Infectious Disease and Preventive Medicine. She is an associate professor of Pediatrics at the University of Cincinnati and a faculty member of the Cincinnati Children's Hospital Research Foundation.

Shelly J Lane, PhD, OTR/L, FAOTA is Professor and Chair of the Department of Occupational Therapy at Virginia Commonwealth University and the Assistant Dean for

Research in the School of Allied Health Professions. Her current research focus is in the area of sensory processing and sensory processing disorders. Dr. Lane currently works with the International Medical Adoption Clinic at Virginia Commonwealth University, where she and a team of therapists assess developmental and sensory processing in newly adopted children. In addition, Dr. Lane has served on the Institutional Review Board at Virginia Commonwealth University for 6 years.

### Subjects

Records of all international adoptees evaluated at the IAC from November, 1999 through December 2007, seen for their initial evaluation within two months of arrival into the United States, and for their follow up visit within 6-8 months of their initial, were included in the final data analysis. The number of initial subjects was anticipated to be between 1500 and 1600 with approximately 50% of those having follow up (six month) data available.

### Methodology

CCHMC personnel extracted data from IAC patient records and occupational therapy evaluations and completed a data abstraction form (already approved by CCHMC). Data included general and preadoptive information including age at time of adoption, country of origin and preadoptive placement, post adoptive anthropometric measurements (height, weight and head circumference), and developmental assessment data (Vineland Adaptive Behavior Scales, Sensory Profile, and Denver II). Each subject was assigned a unique identifier. The key to identifying patient name, address, medical record number, and account number was kept separately in a locked location, and was

accessible only to the investigator and CCHMC study staff. An informed consent was not necessary since identifiers were removed by CCHMC IAC staff and the primary investigator before other researchers saw it. Since country of origin may be unique enough to be a potential identifier, those countries with less than ten adoptees were compiled into regions. Once data was gathered and identifiers are removed, statistical data analysis proceeded. All subjects with adequate data were included in the analysis. Relationships between country of origin, age at arrival in the US, preadoptive placement, anthropometrics and developmental status were examined. Developmental status (as measured by the Vineland) and sensory processing abilities (as measured by the Sensory Profile and Short Sensory Profile) upon arrival and at the six month follow up assessment were compared. Data from children who received recommendation and referrals for early intervention and/or direct therapy services was also examined to determine frequency of recommendations but also to identify the common characteristics of those who received referral and recommendations. For data analysis the statistical significance level was  $p \leq .05$ . The specific aims and hypotheses for the study, as well as the plan for data analysis are described below.

*Aim 1*

**To develop a data set/file of children seen in the International Adoption Clinic (IAC) between 1999 and 2007 inclusive of general descriptive characteristics, sensory and developmental scores and recommendations for developmental intervention in order to accurately characterize these children and compare developmental status at initial arrival in country and six months later.**

The developmental data was comprised of Vineland scores. There are four domains and a composite score, each of which has a standardized score ranging from 0-100. The sensory data consisted of Sensory Profile and Short Sensory Profile Scores. There are five sections of the Sensory Profile and seven sections in addition to a total score for the short sensory profile. Performance scores for these assessments are descriptive and categorical (for example “typical performance”). The general descriptive characteristics included age at time of adoption, anthropometric measures of height, weight, and head circumference, pre-adoptive placement, time institutionalized, gender, and country of origin, the majority of which may be considered “potential modifying variables/risk factors” which affect developmental and sensory status. Finally the developmental intervention recommendations included recommendations for referral to early intervention (EI), and/or direct physical, occupational and speech therapy (PT, OT, and SP) or other services.

### *Hypothesis*

It was hypothesized that developmental status as measured by the Vineland domain scores would improve from initial status to six month follow up in all children.

### *Statistical Analysis*

Descriptive statistics were utilized to describe the characteristics of children seen in the International Adoption Clinic. A paired t-test was used to examine the developmental status of the children initially and after six months in country. Additionally contingency tables were analyzed to examine categorical changes in developmental and sensory

processing data. Change scores were calculated and used to report degree of change from initial to follow up visit over time.

### *Aim 2*

**Investigate the relationships between the primary outcome measures (Vineland domain and Sensory Profile scores) and the “risk factors” in a population of children who are internationally adopted.**

Risk factors for developmental delay in internationally adopted children include malnutrition and growth delays, institutionalization (versus foster care), longer duration of institutionalization (greater than six months), and older age at time of adoption. Thus the relationship of these risk factors and actual developmental scores and sensory profile categories was examined.

### *Hypothesis*

It was hypothesized that, consistent with previous literature, anthropometric measures (weight and head circumference) indicative of nutritional status would be positively correlated with developmental test scores (Vineland domain scores); age at time of adoption will be negatively correlated with developmental test scores (Vineland domain scores); and institutionalization of greater than six month prior to adoption would be negatively correlated with developmental test scores (Vineland domain scoes).

### *Statistical Analysis*

Spearman correlations were used to examine the relationship between the risk factors and developmental and sensory profile scores at six months.

*Aim 3***Identify the characteristics of those children referred to direct therapy services.***Hypothesis*

Only a small percentage of children, including those with low developmental test scores (greater than one standard deviation below the mean in one or more domain) or low Sensory Profile scores after six months in country, will receive recommendations for direct therapy services.

*Statistical Analysis*

Descriptive statistics were used to describe the characteristics of those children referred for direct therapy services. An independent t-test was utilized to compare developmental scores (Vineland domain scores) of those children who received referrals for direct therapy services with those who did not receive referrals. Contingency tables were also analyzed to help understand the pattern of additional recommendations and referrals.

## CHAPTER IV - RESULTS

### Sample and Initial Characterization

One thousand five hundred and sixty three children were seen in the International Adoption Clinic (IAC) between its inception in 1999 and December of 2007. Of those children, approximately two-thirds did not meet the inclusion criteria and were excluded from the study. Ninety - nine children were excluded because they were over the age of six years; 167 children were excluded because their initial visit did not fall within two months of their adoption date; 742 children were excluded because they did not have a follow up visit or the visit did not fall within 5 to 8 months of the initial visit. Five hundred thirty-four children met the inclusion criteria for data analysis. In order to determine if this limited data was representative of the developmental characteristics of the population seen in the IAC, initial Vineland domain scores were compared between the children with and without follow up visits. Results indicate that there were significant differences between the two groups and that the children who did not return for follow up visit had higher developmental scores in the majority of the domains. Significant differences were found in the areas of communication ( $t(1196)=2.17, p=.05$ ), daily living ( $t(1195)=2.77, p=.006$ ) and socialization ( $t(1196)=2.38, p=.017$ ); only motor scores were not significantly different ( $t(11960)=1.62, p=.10$ ). The adaptive behavior

composite score, a summary score, was also significantly different between the two groups ( $t(1192)=1.95, p=.05$ ). One of the initial aims of this study was to accurately characterize children internationally adopted, with regard to general descriptive characteristics as well as sensory and developmental status. The difference in initial Vineland scores between those who did and did not return for developmental testing, indicates that the developmental status of the children included in this study may be lower than that of the population of children seen in the IAC as a whole. The difference between groups, however ranged only from 1.2 to 2.7 points which one could argue, although statistically significant, is too small to be clinically important. No information was collected with regard to adoptive or biological family demographics or socioeconomic status. Accurate information regarding prenatal and birth history was often not available and therefore these factors were not taken into consideration in this study.

#### Demographic Information

The children included in the analysis were adopted from 14 regions representing 23 different countries. Consistent with the literature, the largest numbers of children came from China, Guatemala and Russia (US Department of State: Office of Children's Issues, n.d.). Approximately 75% of the children were two years of age or younger at the time of their initial visit with an average age of 1.6 years. Slightly over half (57%) of the children were female (Table 1). Researchers have described growth delays as being relatively common in newly arrived internationally adopted children (Miller, 1995; Miller, 2005; Pomerleau et al., 2005) and the anthropometric data collected (weight,

Table 1 – Demographic Information by Country/Region of Origin

Region/Country of Origin	Participants		Age at Time of Adoption			Gender	
	N	%	<1 yr	1-3 yrs	3-6 yrs	M	F
<b>Africa</b>	<b>9</b>	<b>2</b>	<b>33</b>	<b>11</b>	<b>56</b>	<b>33</b>	<b>67</b>
<b>Asia/Pacific Rim</b>	<b>198</b>	<b>37</b>	<b>47.5</b>	<b>47.7</b>	<b>5</b>	<b>23</b>	<b>77</b>
China	117	22	41	56	2	7	93
India	14	3	43	49	7	21.5	28.5
Kazakhstan	24	4	46	45	8	58	42
South Korea	22	4	86	15	0	64	36
Vietnam	15	3	53	20	27	27	73
Other Asia/Pacific Rim	6	1	33	68	0	50	50
<b>Eastern Europe</b>	<b>224</b>	<b>42</b>	<b>19</b>	<b>60</b>	<b>21</b>	<b>56</b>	<b>44</b>
Bulgaria	12	2	0	8	4	33	67
Romania	12	2	8	42	49	67	33
Russia	180	34	23	62	16	56	44
Ukraine	16	3	0	57	43	69	31
Other Eastern Europe	4	1	25	50	25	25	75
<b>Latin America/Car</b>	<b>103</b>	<b>19</b>	<b>72</b>	<b>22</b>	<b>7</b>	<b>54</b>	<b>46</b>
Guatemala	101	19	73	21	6	54.5	45.5
Other Latin Am/Car	2	<1	0	50	50	50	50
<b>Total</b>	<b>534</b>	<b>100</b>	<b>40</b>	<b>47</b>	<b>13</b>	<b>43</b>	<b>57</b>

length and head circumference) in this study supports these findings. For the purpose of analysis, anthropometric measures (length, weight and head circumference) were organized into one of 5 ordinal categories,  $\leq 10\%$ , 10-25%, 25-50%, 50-75% and  $> 75\%$ . At the initial visit to IAC, 50% of children had weight measures that were less than or equal to the 10<sup>th</sup> percentile, 41% had length measures less than or equal to the 10<sup>th</sup> percentile, and 40% had head circumference measures that were less than or equal to the 10<sup>th</sup> percentile (Table 2). At least 50% of children adopted from the majority of regions had initial weight that fell at or below the 10<sup>th</sup> percentile (Table 3). These numbers may

Table 2: Anthropometric Characteristics at Initial Visit

Anthropometric Measure	Measurement Categories				
	≤10% (# of children; %)	10 - 25%	25 – 50%	50-75%	Greater than 75%
<b>Length (n = 532)</b>	219; 41%	137; 26%	107; 20%	44; 8%	25; 5%
<b>Weight (n = 532)</b>	267; 50%	117; 22%	92; 17%	35; 7%	21; 4%
<b>Head Circum (n = 499)</b>	201; 40%	112; 22%	115; 23%	42; 8%	29; 6%

Table 3: Anthropometric characteristics by country of origin

Region/Country of Origin	Percent with initial weight ≤ 10 <sup>th</sup> percentile	Percent with initial length ≤ 10 <sup>th</sup> percentile	Percent with initial head circumference ≤ 10 <sup>th</sup> percentile
<b>Africa</b>	<b>33%</b>	<b>44%</b>	<b>22%</b>
<b>Asia/Pacific Rim</b>	<b>49%</b>	<b>25%</b>	<b>32%</b>
<b>China</b>	51%	22%	30%
<b>India</b>	79%	57%	77%
<b>Kazakhstan</b>	63%	42%	30%
<b>South Korea</b>	14%	5%	18%
<b>Vietnam</b>	40%	13%	29%
<b>Other Asia/Pacific Rim</b>	67%	50%	50%
<b>Eastern Europe</b>	<b>59%</b>	<b>57%</b>	<b>42%</b>
<b>Bulgaria</b>	58%	50%	67%
<b>Romania</b>	50%	50%	25%
<b>Russia</b>	58%	57%	45%
<b>Ukraine</b>	75%	75%	73%
<b>Other Eastern Europe</b>	50%	33%	50%
<b>Latin America/Car</b>	<b>33%</b>	<b>37%</b>	<b>42%</b>
<b>Guatemala</b>	33%	36%	41%
<b>Other Latin Am/Car</b>	50%	100%	100%
<b>Total</b>	<b>50%</b>	<b>41%</b>	<b>40%</b>

be significant in that there is some evidence nutritional status is related to development

(Pomerleau et. al., 2005). Examination of gender differences indicated that 55% of boys

and 46% of girls had weight measures less than or equal to the 10<sup>th</sup> percentile, 54% of boys and 31% of girls had length measures less than or equal to the 10<sup>th</sup> percentile and 38% of boys and 43% of girls had head circumference measures less than or equal to the 10<sup>th</sup> percentile.

According to the literature, the majority of internationally adopted children reside in institutions (orphanages, hospitals, baby homes) prior to their adoption, although in some countries placement in foster care is common (Miller, 2000; Miller, 2005). Of the 534 children in this study, 439 (82%) were institutionalized in an orphanage or hospital prior to their adoption, 194 (36%) spent some time at home, and only 145 (27%) were placed in foster care. A large percentage of the children in this study (392 children or 73%) were institutionalized in an orphanage or hospital for greater than 6 months. Between country differences in preadoptive placement and length of institutionalization were noted. Children were placed in foster care only in China, Guatemala, Romania, South Korea, and other Asia/Pacific Rim countries. Additionally Guatemala and South Korea were the only 2 countries in this study where the majority of children were not institutionalized in an orphanage or hospital for greater than six months (Table 4).

#### Initial Developmental and Sensory Processing Scores

Developmental delays in newly arrived internationally adopted children are well documented (Miller et al., 1995; Johnson et al., 1992; Wilson et al., 2008; Miller & Hendries 2000, Judge, 2003; Albers et al 1997). The results of this study support those findings. Although the average standard score in each of the Vineland Adaptive Behavior

Table 4: Preadoptive Placement by Country/Region of Origin

Region/Country of Origin	Preadoptive Placement (%)			Institution for > 6 month
	Orph/Hos	Home	Foster	
	<b>P</b>			
<b>Africa</b>	<b>100</b>	<b>78</b>	<b>0</b>	<b>89</b>
<b>Asia/Pacific Rim</b>	<b>91</b>	<b>43</b>	<b>27</b>	<b>72</b>
<b>China</b>	91	52	25	82
<b>India</b>	100	36	0	86
<b>Kazakhstan</b>	100	13	0	92
<b>South Korea</b>	68	23	100	0
<b>Vietnam</b>	100	40	0	60
<b>Other Asia/Pacific Rim</b>	100	83	33	64
<b>Eastern Europe</b>	<b>99</b>	<b>29</b>	<b>4</b>	<b>98</b>
<b>Bulgaria</b>	100	17	0	92
<b>Romania</b>	83	25	67	75
<b>Russia</b>	100	32	0	99
<b>Ukraine</b>	100	13	0	100
<b>Other Eastern Europe</b>	100	25	0	100
<b>Latin America/Car</b>	<b>26</b>	<b>36</b>	<b>82</b>	<b>21</b>
<b>Guatemala</b>	25	36	83	20
<b>Other Latin Am/Car</b>	100	50	0	100
<b>Total</b>	<b>82%</b>	<b>36%</b>	<b>27%</b>	<b>73%</b>

Scale domains fell within or very close to one standard deviation of the mean, further examination revealed that the majority of children had scores that fell more than one standard deviation below the mean in at least one category. In each individual domain a fairly large number of the children demonstrated at least a delay ranging from 31 (socialization) to 47 (adaptive behavior composite) percent (Table 5). Only initial Vineland motor scores showed statistically significant gender differences ( $t(519)=2.49$ ,  $p=.01$ ) with girls scoring better than boys, however the mean difference between groups

Table 5: Initial Vineland Scores (Category of Score by Frequency)

Vineland Domain	Vineland Domain Score and Frequency (Number of children/%)			
	Greater than 2 SD below the mean	Between 1 and 2 SD below mean	Below the mean but within 1 SD	Above the mean
<b>Comm (N=500)</b>	65/13%	153/31%	203/41%	79/16%
<b>D Living (N=499)</b>	44/9%	149 /30%	181/36%	125/25%
<b>Social (N=500)</b>	47/9%	105/21%	153/31%	195/39%
<b>Motor (N=498)</b>	62/12.5%	132/26.5%	271/54%	33/7%
<b>Adapt Beh (N=496)</b>	82/16.5%	147/30%	186/37.5%	81/16%

was less than three points. There were differences noted between countries and these have also been reported below (Table 6).

Sensory processing issues in internationally adopted children have also been reported in the literature (Cermak & Daunhauer, 1997; Lin et al, 2005) and sensory processing skills were examined as part of this study. Scores from either the Sensory Profile or Short Sensory Profile were used to determine sensory processing abilities. Scores for the infant/toddler sensory profile were available only for those children three years of age and under, seen in the IAC between 2003 and 2007 limiting the number of subjects with data available to approximately 230. Scores on the infant toddler sensory profile may fall into 1 of 5 categories - definite difference underresponsive (> 2 SD above the mean), probable difference under responsive (between one and two SD above the mean), typical (within one SD of the mean), probable difference over responsive (between one and two SD below the mean), and definite difference over responsive (>2 SD below the mean). At their initial assessment a large percentage (68%) of younger children had an atypical score in at least one area of sensory processing; however when

Table 6: Initial Mean Vineland Scores by Country

Region/Country of Origin	Initial Mean Vineland Domain Scores: Communication (Comm.), Daily Living (D Living), Socialization (Social), Motor (Motor) and Adaptive Behavior Composite (Adapt Beh)				
	Comm	D Living	Social	Motor	Adapt Beh
<b>Total:</b> (mean± SD)	85.3± 13.6	88.7±14.2	92.1±15.2	84.8±12.8	84.6±14.4
<b>Africa</b>	76	78	80	77	73
<b>Asia/Pacific Rim</b>					
<b>China</b>	87	90	96	85	86
<b>India</b>	85	90	92	84	83
<b>Kazakhstan</b>	89	93	97	87	89
<b>South Korea</b>	98	101	103	93	98
<b>Vietnam</b>					
<b>Other Asia/ Pacific Rim</b>	85	87	94	82	83
<b>Eastern Europe</b>					
<b>Bulgaria</b>	73	74	75	78	70
<b>Romania</b>	72	74	78	73	70
<b>Russia</b>	82	86	88	84	81
<b>Ukraine</b>	67	72	72	67	65
<b>Other Eastern Europe</b>	82	87	90	82	84
<b>Latin America/Car Am/Car</b>					
<b>Guatemala</b>	95	98	100	91	95
<b>Other Latin Am/Car</b>	59	51	64	56	53

you examine the individual domain scores, the majority (range from 65 - 85%) of these younger children had sensory processing section scores that were considered typical (Table 7). For those children with atypical scores in the auditory, visual, vestibular and oral sensory processing areas, more children were over-responsive than under-responsive indicating that they are more sensitive to environmental stimulation than their peers.

Table 7: Initial Sensory Profile Scores for Children 0-3 years

Sensory Profile Sections	Sensory Profile Scores by Category				
	Definite difference more: over-responsive (# of children; %)	Probable difference more: over-responsive	Typical	Probable difference less: under-responsive	Definite difference less: under-responsive
<b>Auditory processing (n=232)</b>	14; 6%	34; 15%	170; 73%	13; 6 %	1; <1%
<b>Visual processing (n=231)</b>	4; 2%	51; 22%	170; 74%	4; 2%	2; 1%
<b>Tactile processing (n=231)</b>	1; <1%	8; 3%	194; 85%	24; 10%	4; 2%
<b>Vestibular processing (n=230)</b>	16; 7%	61; 27%	149; 65%	3; 1%	1; <1%
<b>Oral sensory processing (n=231)</b>	11; 5%	22; 10%	189; 82%	7; 3%	2; 1%

Only in the area of tactile processing were a larger percentage of children under-responsive, indicating that they may seek/require greater tactile sensory input.

An additional 38 children over the age of three had been evaluated using the short sensory profile; for these children categorical scores of typical, probable difference or definite differences in each of seven areas, as well as a total score, were obtained from their IAC records. The percentage of these older children obtaining a typical score in each category ranged from 50 to 84%. Scores indicating where on the continuum the children with atypical scores fell (over-responsive to under-responsive) were not available in this group (Table 8).

Table 8: Initial Short Sensory Profile Scores for Children 3 Years and Over

Short Sensory Profile Sections	Short Sensory Profile Initial Scores by Category		
	Typical	Probable Difference	Definite Difference
<b>Tactile sensitivity (n=37)</b>	27; 73%	8; 22%	2; 7%
<b>Taste/Smell sensitivity (n=37)</b>	27; 73%	3; 11%	7; 19%
<b>Movement sensitivity (n=37)</b>	31; 84%	3; 8%	3; 8%
<b>Underresponsive/Seeks sensation (n=38)</b>	19; 50%	9; 24%	10; 26%
<b>Auditory filtering (n=37)</b>	22; 59%	12; 32%	3; 8%
<b>Low Energy/Weak (n=38)</b>	32; 84%	1; 3%	5; 13%
<b>Visual Auditory Sensitivity (n=37)</b>	29; 78%	7; 19%	1; 3%
<b>Total Score (n=38)</b>	22; 58%	10; 26%	6; 16%

#### Developmental Changes Over Time (Vineland Adaptive Behavioral Scales)

Environmental deprivation is thought to be one of the chief causes of developmental delay in internationally adopted children and most children are expected to rapidly achieve developmental milestones once placed in an enriched environment after adoption. For the 534 children in this study developmental evaluations were compared at the children's initial and six month follow up visits. The hypothesis was that developmental status as measured by the Vineland Adaptive Behavioral Scales domain scores would improve from initial status to six month follow up in all children. Significant differences were found between initial and follow up scores in all Vineland domains when compared using paired t tests ( $t(494-498)=4.5$  to  $13.9$ ,  $p=.0001$ ). The

number of children with a reported delay in at least one Vineland domain dropped from 58% at the initial visit to 44% at the follow up examination. For the purpose of assessing meaningful change, developmental skills were categorized into one of four groups – scores falling >2 standard deviations below mean, scores falling between one and two standard deviations below the mean, scores falling less than one standard deviation below the mean, and scores falling at or above the mean. Contingency table analysis comparing categories at initial and six month follow up visits was completed for each of the Vineland domains. Change scores were also examined. Summarized results for each individual domain are presented below.

When examining categorical changes in communication scores from the initial and six month follow up visits the results showed that 47% of children stayed within the same category, 43% improved and 10% received lower scores (Table 9). As would be expected, the percentage of children improving declined as initial scores approached normal expected values. For example, 75% of children whose initial communication scores fell more than two standard deviations below the mean improved by at least one category by the six month follow up; in contrast only 30% of children whose initial scores fell within one standard deviation below the mean improved. Overall significant improvements in scores were noted. At the initial visit 218 children (44%) were more than one standard deviation below the mean but by the six month follow up visit that number had fallen to 129 (26%). In other words by the time of the follow up examination 74% of children had scores which fell within normal expected values (within one standard deviation of the mean) or above. The mean change score was 6.25 points.

Table 9: Initial and Follow Up (FU) Communication Scores by Category

<b>Communication (n = 500)</b>	>2 standard deviations below mean	b/w 1 and 2 standard deviations below mean	Below the mean but within 1 std deviation	Above the mean
<b>Initial comm. Scores (# of children; % of total)</b>	65; 13%	153; 31%	203; 41%	79; 16%
<b>FU comm. Score</b>	21; 4%	108; 21%	235; 47%	136; 27%

Results for the other domains were fairly similar to those for communication. In the daily living domain 48.5% of children stayed within the same category, 32% improved and 19.5% received lower scores. At the initial visit 193 children (39%) were more than one standard deviation below the mean but by the six month follow up visit that number had fallen to 117 or 24% (Table 10). Although the results show that daily living scores declined in a fairly high percentage of children, the majority of those children had initially scored above the mean and most stayed within typical values (within one standard deviation of the mean). In this domain the mean change score was 2.17 points.

Table 10: Initial and Follow Up Daily Living Scores by Category

<b>Daily Living (n=499)</b>	>2 standard deviations below mean	b/w 1 and 2 standard deviations below mean	Below the mean but within 1 std deviation	Above the mean
<b>Initial D Living score</b>	44; 9%	149; 30%	181; 36%	125; 25%
<b>FU D Living score</b>	14; 3%	103; 21%	290; 58%	92; 18%

Socialization scores for the children were slightly better than in other domains. Initially only 30% of children had scores which fell more than one standard deviation below the mean, decreasing to 17% by the follow up visit. Fifty four percent of children stayed within the same category, 32% improved and 14% declined from initial to 6 month follow up visits. The mean change score was 3.13 points (Table 11).

Table 11: Initial and Follow Up Social Scores by Category

<b>Social (n=500)</b>	>2 standard deviations below mean	b/w 1 and 2 standard deviations below mean	Below the mean but within 1 std deviation	Above the mean
<b>Initial social scores</b>	47; 9%	105; 21%	153; 31%	195; 39%
<b>FU social scores</b>	12; 2%	71; 14%	215; 43%	202; 40%

Examination of motor scores reveals that at the initial visit 194 children (39%) were more than one standard deviation below the mean. This number declined at the follow up visit to 106 children (21%). In terms of motor status, 45% of children improved their motor status, 8% declined, and 47% stayed the same. Of all domains, change scores for motor skills were the highest at 7.35 points (Table 12).

Table 12: Initial and Follow Up Motor Scores by Category

<b>Motor (n=498)</b>	>2 standard deviations below mean	b/w 1 and 2 standard deviations below mean	Below the mean but within 1 std deviation	Above the mean
<b>Initial motor scores</b>	62; 12%	132; 27%	271; 54%	33; 7%
<b>FU motor score</b>	26; 5%	80; 16%	254; 51%	138; 28%

The adaptive behavior composite score is made up of items from each of the other four domains and is used to describe an individual's level of overall functioning. At the

initial visit 229 (46%) children were functioning below one standard deviation below the mean but by the time of the follow up visit this number had decreased to 148 (30%). The average change score in the adaptive behavior composite between initial and follow up visit was 5.0 points. Thirty-nine percent of children improved in their categorical adaptive behavioral score, 52% stayed the same and 9% declined (Table 13).

Table 13: Initial and Follow Up Adaptive Behavior Composite Scores by Category

<b>Adaptive Behavior (n=496)</b>	<b>&gt;2 standard deviations below mean</b>	<b>b/w 1 and 2 standard deviations below mean</b>	<b>Below the mean but within 1 std deviation</b>	<b>Above the mean</b>
<b>Initial adapt beh score</b>	82; 17%	147; 30%	186; 38%	81; 16%
<b>FU adapt beh score</b>	19; 4%	129; 26%	243; 49%	105; 21%

In summary, as hypothesized, significant positive differences were found between initial and follow up scores in all domains of the Vineland. A fairly large percentage of children (32 - 45%), and particularly those in the lowest developmental categories, demonstrated improved categorical scores, although other children's scores stayed essentially the same or even declined. Average change scores ranged from 2 (daily living domain) to 7 points (motor domain) (Table 14). By the time of the follow up visit, 70% of children scored within typical ranges on the Vineland Adaptive Behavior Composite, a measure of overall functioning. Average scores in all domains were within one standard deviation of the mean.

#### Sensory Processing Changes Over Time (Sensory Profile)

Infant/toddler sensory profile categorical scores for the approximately 200 children with complete data were also compared at initial and follow up visits. The percentage of

Table 14: Average Vineland Scores and Change Scores by Domain

	Comm	D Living	Social	Motor	Adapt
<b>Average Initial Vineland Score</b>	85.3 ±13.6	88.7±14.2	92.1±15.2	84.8±12.8	84.6±14.4
<b>Average Follow Up Vineland Score</b>	91.6±12.2	91.1±10.8	95.2±12	92.1±12.1	90.1±12
<b>Mean Change</b>	6.3±10.3	2.2±11.3	3.1±10.6	7.3±11.7	5.0±14.4

\*all differences were statistically significant  $p < .0001$

children with atypical scores in at list one area of sensory processing decreased from 68 to 48%. Contingency table analysis revealed that in all categories on the Sensory Profile except oral-sensory processing more children fell within the typical range at follow up than at the initial visit. The greatest improvement was seen in the area of vestibular processing where 58 children (30%) demonstrated improvement while only 12 children (6%) declined. The least improvement was noted in oral sensory processing. In this category fewer children fell within the typical range at follow up than at initial visit and while 14% demonstrated an improvement in abilities, 16% demonstrated a decline. Overall by the follow up visit in each sensory processing domain over 80% of children scored within the typical range skills (Table 15).

For those children over three assessed with the Short Sensory Profile, increased numbers of children fell in the 'typical' category in the majority of areas with the exception of visual processing and low energy/weak where the numbers remained stable (Table 16). In these older children the category of under responsive/seeking sensation stands out as, even by follow up, only 41% of children scored in the typical range. Overall 85% of children had a typical score on the Short Sensory Profile total score.

Table 15: Sensory Profile Scores – Comparison Between Initial and Follow Up Visits

Sensory Profile Section and Score		Definite difference (over-responsive)	Probable difference (over-responsive)	Typical	Probable difference less (under-responsive)	Definite difference less (under-responsive)
<b>Auditory processing (n=198)</b>	Initial	10; 5%	27; 14%	150; 76%	10; 5%	1; <1%
	FU	5; 3%	26; 13%	160; 80%	6; 3%	1; <1%
<b>Visual processing (n=197)</b>	Initial	4; 2%	44; 22%	145; 74%	4; 2%	0
	FU	1; <1%	32; 16%	158; 80%	6; 3%	0
<b>Tactile processing (n=197)</b>	Initial	1; <1%	7; 4%	167; 85%	19; 10%	0
	FU	0	5; 3%	177; 90%	15; 8%	0
<b>Vestibular processing (n=196)</b>	Initial	15; 8%	53; 27%	126; 64%	2; 1%	0
	FU	6; 3%	13; 7 %	173; 88%	4; 2%	0
<b>Oral sensory processing (n=197)</b>	Initial	9; 5%	18; 9%	166; 84%	3; 2%	1; <1%
	FU	6; 3%	19; 10%	161; 81%	9; 5%	2; 1%

#### Relationship Between ‘Risk Factors’ and Developmental and Sensory Processing Scores

In addition to assessing change in developmental status over time, one of the goals of this study was to investigate the relationships between the developmental scores (Vineland domain scores) and the “risk factors” in this population of children. Risk factors were considered to be low anthropometric measures, older age at time of adoption, and institutionalization of greater than six months. Nonparametric statistics (Spearman rank correlation) were then used to analyze the relationship between these risk factors and developmental status as measured by the Vineland and significant

Table 16: Short sensory profile scores – Comparison Between Initial and Follow Up

Short Sensory Profile Sections and Score		Typical	Probable Difference	Definite Difference
<b>Tactile sensitivity (n=27)</b>	Initial	20; 74%	6; 22%	1; 4%
	FU	24; 89%	3; 11%	0
<b>Taste/Smell sensitivity (n=27)</b>	Initial	21; 78%	3; 11%	3; 11%
	FU	23; 85%	4; 15%	0
<b>Movement sensitivity (n=27)</b>	Initial	21; 78%	3; 11%	3; 11%
	FU	25; 93%	2; 7%	0
<b>Underresponsive/Seeks sensation (n=27)</b>	Initial	9; 33%	5; 19%	13; 48%
	FU	11; 41%	9; 33%	7; 26%
<b>Auditory filtering (n=26)</b>	Initial	16; 62%	8; 31%	2; 8%
	FU	20; 77%	3; 12%	3; 12%
<b>Low Energy/Weak (n=27)</b>	Initial	24; 89%	0	3; 11%
	FU	24; 89%	1; 4%	2; 7%
<b>Visual Auditory Sensitivity (n=27)</b>	Initial	20; 74%	6; 22%	1; 4%
	FU	20; 74%	7; 26%	0
<b>Total (n=26)</b>	Initial	15; 58%	6; 23%	5; 19%
	FU	22; 85%	2; 8%	2; 8%

relationships were found, although the strength of the associations varied (Table 17).

Table 17: Correlation Coefficients for Initial Vineland Scores and Risk Factors

	Comm	D living	Social	Motor	Adapt Beh
<b>WT 1 (weight)</b>	.24*	.25*	.16**	.26*	.25*
<b>HC 1 (head circumferences)</b>	.07	.11***	.11**	.17**	.11**
<b>HT 1 (height)</b>	.34*	.31*	.34*	.33*	.37*
<b>Age at time of adoption</b>	-.80*	-.76*	-.75*	-.51*	-.80*
<b>Institutionalized for greater than 6 months</b>	-.41*	-.37*	-.34*	-.30*	-.42*

\* $p \leq .001$ , \*\* $p \leq .01$ , \*\*\* $p \leq .05$

The majority of relationships were statistically significant and, as hypothesized, there was a positive correlation between weight, height and head circumference and

developmental scores and a negative correlation between age and time of adoption and institutionalization of greater than six months. Based on guidelines provided by Portney and Watkins (2000) who suggest that correlation values of .50 to .75 be considered moderate to good however, only age at time of adoption had moderate to strong relationship with initial developmental scores. Additional results showed that children who had been institutionalized for greater than six months had lower composite scores when compared to those who had not ( $t(517)=-7.3, p=.0001$ ). Children who had not been institutionalized for an extended period scored an average 12.6 points higher on the Adaptive Behavior Composite than those who had not. Preadoptive placement was also considered. Analysis comparing Vineland Adaptive Behavior composite scores revealed significantly lower scores for children who had been in a hospital or institution prior to adoption and those who had not ( $t(517)=-6.5, p=.0001$ ) while children in foster care had better composite scores than those not in foster care ( $t(517)=6.1, p=.0001$ ). Children could have been in more than one site prior to adoption which could confound the analysis.

Spearman rank correlations were also used to examine the relationship between the initial sensory processing categorical scores and the suspected risk factors and the only significant relationships ( $p \leq .05$ ) found were the relationship between age at time of adoption and auditory and tactile processing abilities. These correlations were weak (Table 18).

#### Characteristics of Children Referred to Early Intervention or Therapy Services

Referral data was also collected for those children seen in the IAC between 2003

Table 18: Correlation Coefficients for Initial Sensory Processing Categorical Scores and Risk Factors

	Auditory	Visual	Tactile	Vestibular	Oral-sensory
<b>WT 1 (weight)</b>	.008	-.04	-.23	.19	-.16
<b>HC 1 (head circumferences)</b>	.01	.01	-.05	.10	-.04
<b>HT 1 (height)</b>	.18	-.12	-.02	.02	.06
<b>Age at time of adoption</b>	-.15***	.01	-.15***	-.02	-.05
<b>Institutionalized for greater than 6 months</b>	-.11	-.03	-.02	-.09	-.08

\*\*\*significant at  $p < .05$

and 2007 ( $n=328$ ). The children were considered to have been referred for services if documentation by the occupational therapist stated that the family should consider obtaining additional services related to sensorimotor skills/development and/or feeding, or if a recommendation was made to continue services the child was already receiving. This included school recommendations as well as recommendations to consult additional medical specialties such as orthopedics. A moderate percentage of children received recommendation/referrals from the IAC for additional services at either their initial or follow up visits. One hundred seventy-four of the 328 children for whom we had referral data (53%) received some type of referral/recommendation to obtain or continue additional services. The largest percentage (31%) of children were referred for EI services. Twenty-two percent of children received a referral to speech therapy, 12% of children received referrals to PT and 12% received referrals to OT (Table 19). Additional referrals to school services, specialized areas and clinics including orthopedics, feeding team, limb deficiency clinic, plastic surgery, behavioral specialists and plagiocephaly

Table 19: Frequency of Referrals

	<b>Early Intervention</b>	<b>Physical Therapy</b>	<b>Occupational Therapy</b>	<b>Speech Therapy</b>	<b>Other</b>
<b>Number;% of children referred</b>	103; 31%	40; 12 %	39; 12%	71; 22 %	34; 10%

clinic were seen in small numbers of children and for the purpose of analysis these were combined; 10% of children received referrals in this category. Of those referred for EI services, 72% had a low or atypical score in at least one area of the Vineland or Sensory Profile at their follow up visit. Additionally, an analysis of contingency tables in each domain indicated that of those with the lowest scores (greater than two standard deviations below the mean), 67 – 80% received recommendations to obtain additional services.

When examining referral to individual disciplines, 95% of the children referred to OT, 82% percent of the children referred to PT, and 90% of the children referred to SP had low or atypical scores at their six month follow up visit. Additionally there was a significant difference in Vineland domain scores between those who were referred to direct therapy services (OT, PT, SP) and those who were not. Although the percentage of referrals and recommendation was higher than initially anticipated in general these results support the hypothesis that only a small percentage of children, including those with low developmental test scores or atypical sensory profile scores at 6 months, will receive recommendation direct therapy services. Typically, children in the IAC are not followed beyond their 6 month follow up visit, therefore there is no way to determine how many of the children actually received early intervention or direct therapy services.

## CHAPTER V: DISCUSSION

More than 250,000 children have been internationally adopted into the United States in the last 30 years (Issues brief, 2007). Researchers have attempted to characterize this group with regard to pre-adoptive circumstances as well as physical and developmental status in order to better understand the issues and concerns related to international adoption, however to date large scale results have not been reported. This study describes a relatively large and diverse group of internationally adopted children, adding to the literature a more thorough perspective of the developmental status and sensory processing abilities of international adoptees. Further, the relationship between risk factors and both development and sensory processing is examined. Finally, this investigation is unique in its' examination of perceived developmental intervention needs as measured by the prevalence of recommendations to early intervention and therapy services, something not previously examined in the literature

### Summary of study population

In comparing the population of children in this study to that of other fairly large studies, the diversity of origin appears similar (Pomerleau et al., 2005; Miller et al., 1995) and, as anticipated, there were between country differences noted in age and gender. Similar to other studies, (Pomerleau et al., 2005) the majority of children were adopted at under 2 years of age, with Guatemala (73%) and South Korea (86%) adopting out the

largest percentage of children under one year of age. Slightly more than half of the adopted children (including 90% of children adopted from China) were female. Between 40 and 50% of the children's initial anthropometric measures of height, weight and head circumference fell below the 10<sup>th</sup> percentile. These anthropometric measures also appear to support previous research which reported that between 30 and 50% of children internationally adopted had height, weight and head circumference measures that fell below the 5<sup>th</sup> percentile (Miller, 2000). These similarities with previously reported literature, allow one to feel confident that the population of children included in this study are fairly representative of the general population of internationally adopted children. One must be aware however that this demographic is constantly changing and therefore new research consistently needed; in 2009 Ethiopia replaced Guatemala in the top 3 sending countries after Guatemala halted new adoptions in 2008 (Trends in International Adoption, n.d.).

#### Frequency of Developmental Delays

Although the average initial Vineland scores were fairly high, further examination of these scores demonstrated that many caregivers considered children to have delays in at least one domain. In fact, 58% of children had a mild or greater delay in at least one of the Vineland domains; this percentage is slightly higher than in previous research which reported delays ranging from 16-40% (Miller, 1995). More recently in a smaller study, Wilson and colleagues (2008) also found that mean scores on both the mental and physical indexes on the Bayley Scale of Infant Development fell in the range

of mild delay. These researchers described a larger percentage of children (60-70%) with delays, more consistent with the results of the current study. Previously (Raggio & Massingale, 1993), the Vineland Adaptive Behavior Scales and the Bayley Index had been compared and researchers found a moderate to good correlation ( $r=.59$ ) between scores on the two assessments suggesting that a comparison of the results of these studies is appropriate. It is important to note two limitations to the data collected for this study: 1) the Vineland is a parent report tool, and it is possible that at the initial visit to the IAC parents had been with their children a limited amount of time. As such, parents may not have known whether their child could do some of the items on the Vineland, thereby lowering their score; 2) the Vineland scores included for analysis in this study were *only* for children attending both initial and six month follow up visits. Thus, scores reported here may be lower than those of the children seen in the IAC as a whole. Based on initial statistical analysis, children with better initial developmental scores were less likely to return for follow up and therefore the full group of children with strong developmental scores and trajectories may not have been included in the current study. It is important to note however, that the point differences between the two groups were very small. Other researchers have not reported a lack of complete follow up data as a concern (Pomerleau, 2005).

In all Vineland domains average initial scores for children in this study fell within, or very close to, one standard deviation of the mean. Examination of scores across domains showed that internationally adopted children received the highest scores in the

areas of socialization and daily living which, after further reflection, seems logical and had also been reported in the literature (Miller, 2005) One might expect that, given a limited number of caregivers, children raised in institutional environments gain independence in everyday tasks out of necessity, thus scoring well in activities of daily living. In younger children, under the age of three, there is little variety in daily living tasks assessed on the Vineland; the tasks are primarily focused on self feeding with a few dressing activities included, thus once these skills are mastered, the children would score well in this area. After the age of 3, more difficult dressing tasks (snapping, zipping, buttoning) and hygiene activities such as potty training and hand washing are included. Miller (2005) reports that institutionalized children are trained carefully and early in these activities, thus high scores would have been expected. High socialization scores may also be reflective of the limited number of caregivers; children would learn quickly that those who are happy, engaging and affectionate garner the most adult attention and interaction, and subsequently try to display these characteristics. Miller (2005), a pediatrician experienced in international adoption, states that many internationally adopted children are exceptionally engaging and sociable, and that some excel in imitation skills (a skill assessed on the Vineland in multiple age ranges in children under seven). Additionally sharing, turn taking and cleaning up are also initiated early in institutionalized children (Miller, 2005). Finally, Miller (2005) describes a phenomenon known as 'indiscriminate friendliness' in which children respond to any adult as long as their needs or wishes are met (Miller, 2005) but does not report it's prevalence. The

Vineland may not be able to distinguish between those children with strong social skills and those with indiscriminate friendliness; thus both groups of children may demonstrate high scores in the area of socialization.

In many orphanages toys are limited and there are few opportunities to be outdoors and play; children may also suffer from a lack of nurturing physical contact (Miller, 2005). Other investigators (Wilson, 2008; Pomerleau, 2005) suggest therefore, that the developmental status of internationally adopted children will improve once they are placed in a comparatively enriched environment. In light of this perhaps, more important than status at initial arrival in country, is the children's developmental course once they have spent time in their new home. Several researchers have looked at developmental changes across time. Wilson et. al., (2008) studied 26 internationally adopted children initially and after a period of six months. These researchers reported that 60-70% of children in their study had mild to significant delays initially, but that this percentage had dropped to 25-40% by their six month follow up assessment. Pomerleau et al.(2005) in a study of 123 internationally adopted children also described increased mental and physical development scores after children were with their adoptive families in country for three and six months.

In the current study, there was a statistically significant positive change in Vineland scores between initial and six month follow up visits in all domains. Domain change scores ranged from an average of 2.2 points (daily living domain) to 7.3 points (motor domain). There was a moderate to good negative correlation between initial

Vineland scores and change scores for each domain, indicating that those children with the lowest initial scores demonstrated the greatest amount of change. In this case one must consider whether these changes indicate true improvement or simple regression toward the mean. Other researchers have addressed this issue (Pomerleau et al., 2005) and concluded that the changes in the children in their study represented real change, as age at time of arrival and nutritional status were found to explain part of the variance.

Statistical significance, especially in large samples, unfortunately does not always tell one whether or not meaningful change occurred (Sainani, 2009), so further examination must be completed. On the Vineland Adaptive Behavior Composite Score, a score designed to represent overall functioning, the percentage of children scoring within normal range increased from 54% at the initial visit, to 70% by follow up. An examination of categorical changes also serves to emphasize the clinical importance of the changes. Analysis of contingency tables demonstrates that, in the area of motor skills for example, slightly over 1/3 of the children whose scores fell in the ‘significantly delayed’ range (at least 2 SD below the mean) improved two categories to ‘normal’; an improvement of this magnitude reflects a change of more than 15 points. These changes in motor skills may reflect a mastery of skills due to environmental differences. Children may not have had opportunities to climb and play in their pre-adoptive environments, or had exposure to toys like balls, slides and tricycles. Given this ‘enrichment’ in their environments, along with the potential for typical development, children thrive and gain skills according to their developmental level. Interestingly, it was in this area (motor

skills) that the largest percentage of children (5%) still had significant delays at the six month follow up.

Although this research cannot tell us exactly which individual skills in each domain were mastered, one must consider what they globally represent. For a young child these developmental gains reflect greater interaction and independence. Across domains children may change from no verbal interaction with their new parent, to calling a parent mama or dada or show physical affection by giving them a hug, when previously they would not. They may move from not being potty trained at the age of 3 to relative independence in this area. Significant milestones such as eating or moving independently may be attained.

However, it is important to note that regardless of the improvements in most children's scores, mild to significant delays remained for some children at the 6 month follow up visit. This is also consistent with other researchers who found some children had delays even 6 month post adoption (Pomerleau et al., 2005; Wilson et al., 2007). By the 6 month follow up examination, the largest percentage of delays (outside of the composite score) appeared in the communication domain. This seems logical as many of the items in this domain are language related, and the majority of children would still be in the process of acquiring their English skills. Change scores were highest in the area of communication and motor skills, the two domains with the lowest initial scores.

Communication skills could be expected to change rapidly with improving mastery of the English language and as discussed above, progress in motor skills may reflect the

children's increased play opportunities and exposure to new environments.

Comparatively large numbers of children (24%) also had delays in activities of daily living at follow up and the change scores were small in this area. One could hypothesize that this early in the post adoptive process, parents were still reveling in caring for their newly adopted children and encouragement of increased independence in these daily living skills was not a priority.

#### Sensory Processing Abilities and Changes Over Time

Lin and Daunhauer (1997) studied sensory processing abilities in 73 children between the ages of three and six who had been adopted from Romania. The average length of institutionalization for the children was 13 months. They found that the Romanian children had significantly different sensory processing scores than a control group in 5 of 6 sensory processing domains (touch, movement-avoids, movement seeks, vision and audition) and in 4 of 5 behavioral domains (activity level, feeding, organization and social emotional). Similar scores in sensory processing between groups were noted only in the taste and smell domain. Unfortunately these investigators did not report specific numbers or percentages of children with sensory processing or behavioral issues, making the results somewhat difficult to compare with those of this study. It should also be noted that the children in the Lin and Daunhauer investigation were considered to come from highly deprived environments which may help to explain the significant problems seen in sensory processing. Weitzman (2003) has noted that research on children from highly deprived environments may not be applicable to general groups

of internationally adopted children; there can be a significant amount of variability in institutional conditions (Miller, 2005).

Conceptually there are similarities between the findings of Lin and Daunhauer and the current investigation. Here a high percentage (68%) of children had sensory processing concerns in at least one area at initial arrival although this number declined by the follow up visit (48%). There is evidence of sensory sensitivity at a rate of approximately 25% within each of the domains (tactile, taste/smell, auditory, movement). However, even at the initial visit, the majority of scores in each domain were considered typical. The current study differs from that of Lin and Daunhauer in the diversity of the population examined. While Lin and Daunhauer looked only at children from Romania, the current study examined a much more diverse population. This may suggest internationally adopted children demonstrate inconsistencies in sensory processing across domains, perhaps based on country of origin and associated pre-adoptive environmental conditions. The role of these variables warrants additional investigation.

The majority of children in this study were under the age of three years and their young age may explain, in part, the high percentage of children with typical domain scores. Earlier adoption means less time in pre-adoptive environment. Older age at time of adoption and longer length of institutionalization are considered risk factors for long term developmental delays, and potentially for sensory processing differences as well. In the current study risk factors were not found to be linked to sensory processing scores, for children under age three; this analysis did not include examination of sensory processing

and risk for the older children. In the small group of older children (3-6 years old) examined here, the percentage of those with atypical sensory processing scores in each domain was initially higher than similar scores for the younger children, ranging from 16 – 50%. The percentage of children with increased sensitivity in each of the sensory domains ranged from 16 - 31% and interestingly, in contrast with the previous research, the highest percentage of children demonstrated sensitivity to taste/smell. In contrast to the noted sensory sensitivities, 50% of the older children were under-responsive or sensory seeking. This means that these children sought more sensory input, or sought input that was more intense than would be considered typical. Thus, in this study, children demonstrated both over- and under-responsiveness to environmental sensory input.

In understanding the sensory processing deficits and strengths found in this study, it is important to consider what the available scores on sensory processing actually indicate. The Infant and Toddler Sensory Profile (Dunn, 2002) scores available for this study included auditory, visual, tactile, vestibular and oral sensory processing. These categorical scores reflect the degree of sensory over- and under- responsivity in each sensory domain, and more generally for the mouth. The Short Sensory Profile (Dunn, 1999) scores provide similar information for tactile, visual auditory, taste/smell and movement but includes additional categories (under responsive/seek sensation, auditory filtering and low energy/weak). These additional categories are more complex, and

suggest that the children may have both under- and over-responsiveness to sensations in the environment.

Sensory processing abilities can be placed on a continuum from over-responsive (sensory sensitivity) to under-responsive (sensory seeking). Further examination of the data from those children (under age three) with atypical sensory processing scores indicated that in the majority of areas the children were over-responsive. One may hypothesize that this sensory sensitivity developed as a result of limited exposure and sensory stimulation in the children's preadoptive environments (Cermak & Dahnauer, 1997; Lin et. al., 2005). Only in the area of tactile processing were more children found to be under rather than over-responsive.

Results examining changes in sensory processing abilities over time showed that in children under three, more fell within the typical range at follow up, as compared to the initial visit, in all categories with the exception of oral-sensory processing. Similarly, for those children over three, increased numbers of children fell in the 'typical' category in the majority of areas. Only in the areas of auditory filtering and visual processing were the numbers of typically scoring children decreased or unchanged.

Investigating the links between sensory processing and institutionalization, other researchers (Lin et al., 2005) had described a relationship between poorer performance in the areas of sensory discrimination and sensory processing as a foundation for praxis (as measured by the Sensory Integration and Praxis Test (SIPT) (Ayres, 1988), along with sensory modulation (as measured by the Developmental and Sensory Questionnaire) in

those with institutionalized for long periods. Researchers compared groups of children institutionalized for over 18 months (longer institutionalized – LIH) to those institutionalized for less than six months (shorter institutionalized – SIH). Children institutionalized for longer periods (LIH) were found to have lower performance on the vestibular proprioception, visual, and praxis components of the SIPT. Children who had been institutionalized for less than six months (SIH) had scores comparative to the SIPT normative sample (Lin et. al., 2005). The LIH group was also found to have more problems on the sensory domains of the Developmental and Sensory Processing Questionnaire in the categories of Touch Seeks and Touch Total, Movement Seeks and Movement Total, Vision and Audition, than the SIH group. The SIH group scores as compared to normal were not reported. This study was completed on children of Eastern European origin over the age of four, who had been with their adoptive families for an average of 3-5 years, making clear comparison with the current findings somewhat challenging. It is also important to note that the SIPT measures sensory integration and processing as a foundation for sensory discrimination and perception, and motor planning. In contrast the sensory profile/short sensory profile measure sensory modulation. Thus, the evaluations look at different aspects of sensory processing.

The current study also examined the relationship between sensory processing scores and suspected risk factors. Results indicated that there were significant correlations only between age at time of adoption and auditory and tactile processing at the initial visit. By follow up the only significant relationship was between age at time of

adoption and visual processing. The strength of the relationship in each instance, although significant, would be considered weak (based on the correlation coefficients). Based on the results of this study, researchers are unable to statistically explain differences in sensory processing abilities among the internationally adopted children in this study. As previously discussed, other investigators have linked institutionalization to sensory processing/modulation concerns. In the current study, researchers were unable to document institutional conditions but even what was considered prolonged institutionalization (greater than six months) appears fairly short when compared to other research (Lin et al., 2005). Additionally, the population of children in other studies (Cermak and Daunhauer, 1997; Lin et al, 2005) has been older. Overall this study strengthens research suggesting that younger age at time of adoption and shorter periods of institutionalization may circumvent the development of significant sensory processing deficits. Further investigation in the area is warranted.

#### Relationship Between Risk Factors and Developmental Scores

All the risk factors examined (with the exception of head circumference as related to communication) were shown to have a significant relationship with initial Vineland Scores. The strongest relationship was a negative correlation between age at time of adoption and developmental scores. A moderate negative correlation with length of institutionalization (negative correlation) was also present. Anthropometric measures did not have as strong a correlation with developmental status as either age at time of adoption or length of institutionalization. This is somewhat surprising as other researcher

have reported anthropometric measures (specifically height/age ratio) indicative of nutritional status to be moderately related to cognitive and motor development (Pomerleau et al, 2005). These investigators were able to look specifically at children who fell below the 5<sup>th</sup> percentile in height, weight and head circumference, something the data in this study did not permit; perhaps at these extreme ranges of malnutrition, its' impact on development is more apparent.

Pomerleau et al., (2005) reported that regardless of preadoptive conditions or country of origin, age at arrival appears to be important to health and developmental status. Investigators stated that children adopted at younger ages have better developmental scores and better improvement after adoption. Miller et al., (2005) also found that whether Guatemalan children were adopted from orphanages or foster care, age at time of adoption was inversely correlated with developmental scores for cognition, language and activities of daily living. As previously discussed, the results of this study support this finding – age at time of adoption had the strongest correlation (negative) with developmental scores.

Previous literature has reported negative circumstances and subsequently the negative effects of prolonged institutionalization (Miller, 2005; Mason & Narad, 2005; Wilson et al., 2008). The results of this study are fairly consistent with this literature. In this study a higher percentage of children institutionalized for greater than six months had very low anthropometric measures (falling at or below the 10<sup>th</sup> percentile) when compared to those not institutionalized for an extended period. Additionally prolonged

institutionalization was significantly and negatively correlated with developmental scores. Further analysis demonstrated that there was a significant difference in initial Vineland domain scores between those who were and were not institutionalized for greater than six months. Although the differences had declined by the six month follow up (ranging from 4 points in the motor domain to 10.7 in the social domain), they were still significant. Although significant, these delays do not appear to be as profound as some previously reported (Johnson, et al., 1992). Possibly, (and hopefully) this may be due to an improvement in institutional conditions following negative media attention in the 1990's.

Preadoptive placement also appeared to have a significant role in development. Children who had been placed in an orphanage/hospital had significantly lower Vineland scores in all domains when compared to those who had not. Difference in average Vineland scores ranged from 8 to 13 points. As may then be expected, children who had been placed in foster care had significantly higher Vineland scores than those who had not with mean differences ranging from 7 to 10 points. These differences were still significant when comparing Vineland scores at six month follow up visits. Previous investigators had reported higher scores for children from foster care on mental/cognitive (Miller et al., 2005; van den Dries et. al., 2010) and motor (van den Dries et al., 2010) measures. Similar to the results of this study, these differences were present at both initial and follow up visits (van den Dries, et.al., 2010). Overall, there are strong indications that preadoptive placement significantly impacts developmental skills. The long term impact

is not clear but evidence supports that differences are still apparent six months after adoption.

Developmental abilities also differ by country of origin. In part this can be explained by between-country variations in preadoptive placement and circumstances, length of institutionalization and age of adoptees (Pomerleau et al., 2005; Miller, 2005). However it is also likely that prenatal conditions, such as in utero alcohol and drug exposure, may have an impact. Although fetal alcohol syndrome has been identified in internationally adopted children from almost every sending country, it is more prevalent in Russia, Ukraine, and countries previously part of the Soviet Union, and is also fairly common in other Eastern European countries (Miller, 2005). Prenatal drug exposure in internationally adopted children has not been well documented (Miller, 2005). Due to the lack of reliable prenatal history in internationally adopted children in this study, it is not possible to definitively determine the influence of these factors on this population, but it seems reasonable to hypothesize that they could be contributing to variations in developmental scores between countries that are not explained by other risk factors.

When comparing groups of adoptees from China, Russia and East Asia, investigators (Pomerleau et. al., (20005) reported that children from East Asia had the highest mental and motor development scores followed by those from China and then Russia.; little information about prenatal conditions in this population was available. The current study also reported between country differences in developmental scores among the largest groups of adoptees. Initial Vineland scores ranged from 91-100 in those

adopted from Guatemala, from 85-96 in those adopted from China, and from 81-88 in those adopted from Russia. In general, children adopted from Eastern European and African countries appear to have lower developmental scores than those adopted from Latin America and Asia. In attempting to explain these between country differences it is important to recognize that those in Eastern European and African countries also have fewer children placed in foster care/more children placed in orphanages, more children institutionalized for extended periods, and a larger percentage of children adopted at older ages. The inter-relationships between the aforementioned risk factors make it difficult to determine the individual impact of a single variable; for example country of origin is often related to preadoptive placement and experiences, and length of institutionalization confounded with age at time of adoption (Pomerleau et. al, 2005)

#### Recommendations for Developmental Intervention

Although delays have been documented, little research exists about the need for and use of developmental services in the population of internationally adopted children. Wilson et al., (2005) investigated 26 internationally adopted children. These investigators reported that although 60-70% of children demonstrated developmental delays at the time of their initial assessment, none were receiving any type of developmental services; at the time of this initial visit the adopted children had been home on average less than 1 month. Even without any type of intervention, by the time of the follow up assessment, mean scores for both the mental and physical indexes of the Bayley Scales of Infant Development were within normal limits and the percentage of children with documented

delays had dropped to 25 - 40%. On the Ages and Stages Questionnaire (Bricker, D., Squires, J., & Mounts, L. (1995). ) 31% of parents rated their children as developmentally normal across all domains (communication, gross motor, fine motor, problem solving, personal/social and the most reported area of concern was communication (27% of children) (Wilson, 2006). Although more than a quarter of families had concerns about communication, at the time of follow up only 8% of children had been enrolled in speech therapy services. The investigator stated that the only other consistently identified enrichment activity was a home based enrichment program that had been recommended to families at their initial visit.

Overall, few researchers have studied the prevalence of therapy needs/services in internationally adopted children. In this current study the incidence of early intervention and therapy referrals was examined; 53% of children received a recommendation or referral to obtain additional services at either their initial or follow up visit. As would be expected, the large majority of children referred for services had low scores on at least one domain of the Vineland or atypical sensory profile scores. With regard to referrals, results showed that the largest percentage of children (31%) had early intervention (EI) services recommended. EI services typically include a multidisciplinary evaluation and, based on the results of this evaluation, additional health, educational, and therapeutic services may be provided. Of those referred for EI services, 72% had a low or atypical score in at least on area of the Vineland or Sensory Profile at their follow up visit. Vineland scores, however, were not significantly different between those who had

received recommendations for EI and those who had not, therefore it is difficult to say what may have been the impetus for the referral – perhaps parental concerns or the professional opinion of the therapist or physician. Unfortunately there was also no way to determine how many families acted on the recommendations, or, in the case of early intervention services which are run by the states, how many children qualified for services. Twenty-two percent of children received a referral to speech therapy, which seems appropriate as results indicate that 25% of children had delays in the communication domain at the time of the follow up assessment. Twelve percent of children received referrals to PT and 12% received referrals to OT. These numbers of OT and PT referrals do not as accurately reflect the number of children with delays that one might expect to be referred; at the follow up examination 24% of children had at least mild delays in daily living skills and 21% in gross and/or fine motor skills; perhaps physicians and therapist may have been taking a wait and see approach if progress was evident. Based on the data available it was not always possible to identify differences in children with delays who had received referrals from those who had not. Appropriately, the large majority of children with significant delays at the follow up received recommendations for additional services. Results also indicated that there were differences in Vineland scores between those who did and did not receive recommendations for direct therapy services including occupational, physical, and speech therapy services. Again, as with the early intervention data, there is no way to determine how many children actually received therapy evaluations and/or services.

### Study Limitations

All retrospective studies have, inherent in their design, a limitation in the control of data collection and this study is no different. Additionally this study relied on data collected from two examination tools – the Vineland Adaptive Behavioral Scales and the Sensory Profile, both of which rely on parent report. Particularly at the initial visit one may expect there to be issues with the accuracy of this data as the parent may not have had the chance to observe their newly adopted child performing many of the activities, or the child may not be comfortable enough in their new environment to demonstrate their full range of skills. Thus the true worth of this initial developmental assessment has been called into question, and it can be difficult to be certain that changes from initial to follow up visits represent true change (Miller, 2000); still supporters argue that formal developmental assessment identifies areas and severity of delay, assists parents in understanding their child's capabilities and needs, and allows a baseline for measuring progress over time (Miller, 2000).

Overall, this research provides strong support for previous evidence which has documented the initial presence of delays in internationally adopted children. However, one must acknowledge that the children whose data were included in the analyses for this study may not be truly representative of the population of internationally adopted children seen in the IAC as a whole. A large number of children were excluded from the study due to a lack of follow up data, and it seems likely these families may have decided not to return for follow up because they had no concerns about their adoptive children,

especially since, as a group, children who did not return had higher initial Vineland scores than those who did return. Additionally, while this research substantiated the importance of several of the risk factors such as age at time of adoption and prolonged institutionalization on developmental outcomes, the statistical analysis did not however account the inter-relationships between the risk factors.

In those areas where this study had the potential to contribute significantly new information, specifically sensory processing abilities and referrals/recommendations, additional limitations were noted. First, sensory profile data was available for only a limited number of subjects and the data that was available was categorical. Second, in terms of referral data and recommendations for additional services, it was not possible to definitively determine at what time period the recommendations were made, or if the families chose to follow the recommendations. Additionally, larger percentages of children had delays than received referrals and recommendations for additional services, yet researchers were unable to capture differences in children that may have prompted a referral in one case but not the other. Finally, investigators acknowledge that the referral data was more difficult to capture from the documentation as the location and format of this information was less consistent across records; additionally families could have received referrals for developmental services from other medical providers (that were not documented in the IAC), thus the number of referrals and recommendation received by these children may be underestimated.

### Directions for Future Research

The presence of developmental delays in internationally adopted children has been well documented, as has an improvement in developmental skills over time. It is important to remember however that not all children attain normal levels of functioning in the short term. This study also pointed out between country differences that should be considered. Future research may focus on how to ascertain which children have, or are at risk for, significant and prolonged delays and which services, if any, may assist in remediation of these delays. Further examination of the characteristics of the children receiving recommendations for therapy services and identifying the outcome of these services may also assist providers in making appropriate recommendations.

### Conclusion

International adoption continues to be prevalent in the United States with almost 13,000 children being adopted in 2009 alone (Trends in International Adoption, n.d). Internationally adopted children enter the country with diverse backgrounds and experiences but as a whole, often demonstrate delays in developmental skills. (Miller, 1995; Wilson, 2006; Wilson et. al. 2008; Pomerleau, et. al. 2005). Length of institutionalization, age at time of adoption and pre-adoptive placement are often described as risk factors, and the results of this study substantiate these findings. Sensory processing difficulties have also been identified (Cermak & Daunhauer, 2005) and were found to be present, in at least one area, in the majority of the children in this study. Although improvements in these areas are generally noted, developmental delays and sensory processing issues are still present in some children six months after adoption and

range in frequency and severity (Wilson, 2006; Wilson et. al. 2008; Pomerleau, et. al. 2005). Management of these delays and issues has not been previously described in the literature. Investigators in this study found that over half of the children were receiving recommendations for additional services and that the number increased for those with more significant delays. The referral data obtained in this study is the first step to better understanding the need for and utilization of developmental intervention service in internationally adopted children with ongoing developmental and sensory processing needs and serves as a foundation for future study. Additionally this information may prove valuable to clinicians as they counsel and support newly adoptive parents and care for their children.

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## VITA

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