TeachME PROFESSIONAL DEVELOPMENT
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Infant-Toddler Development and School Readiness

Overview

This report summarizes research about development during the first 3 years in order to highlight areas that are foundational for later school readiness and success. This information can be used as a guide by programs to inform their practices and policies and to help programs think about their own theories of change and what outcomes they are most focused on improving for young children. Research and theory provide some general principles that guide the understanding of the relationship between infant/toddler development and school readiness. These principles include:

- Children are active participants in shaping their own development.
- Relationships and experiences are the primary ways development occurs.
- Development is complex and transactional, meaning that the child affects the environment while the environment affects the child in ongoing and cyclical ways.
- Development and learning occur in multiple systems or contexts, including the family, early care and education programs, and broader culture.
- All areas of development are interrelated.
- There are vast individual differences in rates of development among children.
- Birth to age 3 is a distinct developmental period that is the foundation for later development.

With these principles in mind, the report reviews research that considers the impact of development across five school readiness domains developing during the first three years of life:

- perceptual, motor, and physical development
- social and emotional development
- approaches to learning
- language and communication
- cognition[1]

[1] These domains are consistent with those identified for infants and toddlers in the Head Start Early Learning Outcomes Framework (Office of Head Start, 2015).

The research reviewed leads to the following conclusions:

- Infancy/toddlerhood is the time when foundations of school readiness begin—adults who interact with infants and toddlers must be aware of the opportunities that exist to support these early developing skills and abilities in young children.
- The unique developmental characteristics of infants/toddlers require age-appropriate strategies for supporting school readiness.
- Supporting school readiness during the infant/toddler period requires attention to all developmental domains.
- Infant and toddler development is individual and embedded in family, culture, and other societal influences. Programs and policies should acknowledge, respect, and respond to these multiple influences on infants' and toddlers' development.
- Program design and implementation should be informed by current research on infant and toddler development.
- Professional development for early childhood educators and caregivers examining the specific skills needed to support infant and toddler development must be a priority.
- Families, the general public, and policy makers must be made aware of the unique opportunities to lay the foundation for later school success during the first years of life.
- Cross-systems collaboration is required for early care and education to meet its true potential to support the development of infants and toddlers.
- Further research is needed. Current research supports the conclusion that school readiness begins in infancy and is supported by a range of high-quality comprehensive services available to infants, toddlers, and their families. The next step is to research what components of programs and interventions are especially critical for producing desired outcomes in specific children.

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Executive Summary

This report summarizes research about development during the first three years in order to highlight areas that are foundational for later school readiness and success. This information can be used as a guide by programs to inform their practices and policies and to help programs think about their own theories of change or strategies for continuous improvement and what outcomes they are most focused on improving for young children. Until recently the term *school readiness* has typically been applied to preschool-aged children, but it is now increasingly being used in relation to infants and toddlers. With this shift comes the knowledge that birth to age 3 is a time of unparalleled growth and change that provides special opportunities to support school readiness, and school readiness for this age group must be defined with those particular characteristics in mind.

Research and theory provide some general principles that guide the understanding of the relationship between infant/toddler development and school readiness. These principles include:

- Children are active participants in shaping their own development.
- Relationships and experiences are the primary ways development occurs.
- Development is complex and transactional, meaning that the child affects the environment while the environment affects the child in ongoing and cyclical ways.
- Development and learning occur in multiple systems or contexts, including the family, early care and education programs, and broader culture.
- All areas of development are interrelated.
- There are vast individual differences in rates of development among children.
- Birth to age 3 is a distinct developmental period that is the foundation for later development.

With these principles in mind, we turn to the five school readiness domains—perceptual, motor, and physical development; social and emotional development; approaches to learning; language and communication; and cognition[2]—and consider findings from research across these domains that develop during the first 3 years of life.

Perceptual, Motor, and Physical Development

This domain involves growth and change in the following areas: weight and length; motor skills; perceptual development; brain development; and physical well-being and general health. Infants and toddlers grow significantly in both length and weight. It is important to monitor how individual children grow compared to typical development, as this monitoring can highlight potential developmental problems and allow for early intervention to remedy or reduce the impact on early development and learning. Motor skills development encompasses both gross and

[2] These domains are consistent with those identified for infants and toddlers in the Head Start Early Learning Outcomes Framework (Office of Head Start, 2015).

fine motor skills. By using these skills to explore and engage with the world, infants and toddlers build their knowledge and make strides in development. Gains in perceptual development, which encompass vision, hearing, smell, taste, and touch, also allow infants to use their senses to explore and gather information about their world. As with motor skills, because exploration is a foundation for learning, early perceptual development supports school readiness.

Physical development also includes brain development, and research is clear that the brain makes more neural connections from birth to age 3 than at any other time. Early interpersonal experiences and environmental factors set the stage for brain development and can promote positive development. Research also highlights harmful environments and factors that can impede positive physical development. These include abuse and neglect; living in poverty; food insecurity; obesity; lack of immunizations; and environmental threats, such as lead, pesticides, household chemicals, asbestos, air pollution, and tobacco smoke. Finally, some recent research suggests a link between physical health and school readiness, with suboptimal health predicting vulnerability at school entry.

Social and Emotional Development

This domain, the foundation for children's mental health and well-being, includes the core concepts of temperament; emotional and behavior regulation; attachment; and friendship. Researchers have proposed a number of components of temperament. All of these include a dimension that relates to qualities of the infants' social and emotional approach to the world. The research reviewed in this section highlights the important role of early social-emotional development in laying a foundation for school readiness. Temperament is often viewed as one of the core elements of a larger construct of "personality" or what makes an individual unique. Children's temperament can influence their relationship with caregivers in child care, their experience in care, and their sensitivity to the effects of the environment.

Research also shows that the ability to regulate one's emotions is a critical aspect of school readiness and is intimately tied to children's ability to regulate their own behavior. Finally, children's attachment styles can also impact school readiness, with children with secure attachments demonstrating better outcomes, both socially and academically. While children attach first to caregivers as infants and toddlers, as they mature, their early attachment relationships form the foundation for the development of friendships with same-age peers. Peer sociability, or friendship, is an important component of school readiness because the ability to get along well with others is a prerequisite to many activities in kindergarten and beyond.

Approaches to Learning

Approaches to learning include both social and cognitive developmental skills as they relate specifically to learning experiences and within educational settings. The emerging research linking learning behaviors in infancy and toddlerhood to later school readiness has focused on interest and persistence. Interest and persistence are both related to temperament and both enhance school readiness by providing opportunities to learn. Research also shows that maternal behaviors can support and enhance interest and persistence in infants and toddlers.

Executive functioning is also considered part of approaches to learning. Executive functioning is a term used to describe many abilities, including the ability to delay gratification, think before reacting, figure out where to direct attention in order to learn and be safe, and remember things that have been learned before. These important abilities allow children to learn, explore the world, and be successful in school and relationships. Executive functioning abilities have been linked with school success in math and reading, communication, and social-emotional skill.

As noted above, some of the behaviors understood to be part of approaches to learning, including persistence, attention, memory, and executive functioning, overlap

with other developmental domains. While development is often divided into categories, such as cognitive or social development for ease of discussion, in reality, development is holistic with milestones in one area influencing another, especially with infants and toddlers.

Language and Communication

Concepts important to language and communication include early communication efforts; receptive and expressive language abilities; joint attention; language environments; and individual variation in language development. Early communication efforts such as looking, crying, and babbling are crucial because they begin the developmental progression to later language abilities. Expressive language abilities begin later than receptive abilities, but vocabulary size by age 2 can have implications for later language development and school readiness. Joint attention episodes, which include an adult and child working together on a shared interest, are important for language development. While the adult is initially responsible for successful joint attention episodes, as infants grow, they develop pointing skills and the ability to focus on both the object and the social partner involved in the joint attention experience and can begin to take the lead. Toddlers with better joint attention skills develop language more rapidly and have better receptive and expressive language at 30 months. Moving beyond joint attention, the importance of the overall language environment directly experienced by the child is highlighted. Finally, there is great variability in how different children develop language. These individual variations in language development can often make it hard to know when a child truly has a language delay. During these early years, professionals tend to be more concerned when apparent delays are evident in *both* understanding (receptive language) and speaking (expressive language).

Cognition

Concepts important to cognition include information-processing mechanisms (attention, memory, categorization); imitation; and pretend play. The growth in children's language abilities results, in part, from changes in underlying cognitive abilities known as information-processing mechanisms, which include attention, memory, and the ability to form categories or connections between information stored in memory (categorization). Focused attention provides a strong foundation for later development and has been found to be one of the strongest predictors of later school success. Information processing mechanisms (i.e., attention, memory, and categorization) provide the foundation for the emergence of higher-order cognitive skills, including executive functioning. Again, the research findings highlight the general developmental principle that all areas of development are interrelated.

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Conclusion

The research reviewed leads to the following conclusions:

- Infancy/toddlerhood is the time when foundations of school readiness begin—adults who interact with infants and toddlers must be aware of the opportunities that exist to support these early developing skills and abilities in young children.
- The unique developmental characteristics of infants and toddlers require age-appropriate strategies for supporting school readiness.
- Supporting school readiness during the infant/toddler period requires attention to all developmental domains.
- Infant and toddler development is individual and embedded in family, culture, and other societal influences. Programs and policies should acknowledge, respect, and respond to these multiple influences on infants' and toddlers' development.
- Program design and implementation should be informed by current research on infant and toddler development.
- Professional development for early childhood educators and caregivers examining the specific skills needed to support infant and toddler development must be a priority.
- Families, the general public, and policy makers must be made aware of the unique opportunities to lay the foundation for later school success that exist during the first years of life.
- Cross-systems collaboration is required for early care and education to meet its true potential to support the development of infants and toddlers.
- Further research is needed. Current research supports the conclusion that school readiness begins in infancy and is supported by a range of high-quality comprehensive services available to infants, toddlers, and their families. The next step is to research what components of programs and interventions are especially critical for producing desired outcomes in specific children.

Introduction

The purpose of this report is to summarize the most relevant research describing the foundations of school readiness that develop during the first 3 years of life. This document is written for a wide range of practitioners, including teachers, home visitors, program directors, and professional development providers, as well as policy makers.

There are several reasons why this report is timely:

- The majority of infants and toddlers are now enrolled in early care and education programs and research shows that participation in high-quality infant/toddler programs produce short- and long-term positive outcomes related to later school readiness for all children, especially those who are at risk for school failure (Administration for Children and Families (ACF), 2006; Federal Interagency Forum on Child and Family Statistics, 2011; Li, Farkas, Duncan, Burchinal, & Vandell, 2013; Love, Chazan-Cohen, Raikes, & Brookes-Gunn, 2013; NICHD Early Child Care Research Network, 2005; Olds et al., 2007; Ramey & Campbell, 1991);
- Recent research provides a better understanding of the significant contributions of the first 3 years of life to later school readiness and lifelong success (Center on the Developing Child, 2007; Shaklee & Fletcher, 2002; Shonkoff & Phillips, 2000); and
- There is growing interest from policy makers in enhancing child outcomes through investments in early childhood education, including programs that serve infants and toddlers and their families (ACF, 2014; Cohen, Gebhard, Kirwan, & Lawrence, 2009).

It is important to note that this report focuses on typically developing infants and toddlers. Resources for working with infants and toddlers with special needs are listed at the end.

What Is School Readiness for Infants and Toddlers?

Until very recently, the majority of work in school readiness has focused on the preschool period. In fact, the term *school readiness* itself is controversial when applied to infants and toddlers. School readiness often brings about the idea of formal academics; for example, letters and numbers presented in ways that are not developmentally appropriate for babies. However, as the term *school readiness* became more broadly defined and the research base documenting the important foundations for later learning established during the birth through age three period expanded, families, programs serving infants and toddlers, and policy makers have increasingly accepted that school readiness begins in infancy. One benefit is the ability to align with preschool and elementary school guidelines for a more seamless approach to birth through age 8 education.

While the term *school readiness* is increasingly being used in relation to infants and toddlers, a large body of research suggests that birth to age 3 is a unique developmental period and so school readiness for this age group must be defined and described differently than it is for older children. Just think about how an infant is born with little control of its body, reliant on others for eating and other bodily functions, with only basic abilities to communicate. Then only a few years later, that same infant is capable of independently moving around, completing self-care tasks such as eating, and using complex speech. As shown by these examples, infancy is characterized by rapid growth and development of concepts, attitudes, skills, and abilities that are foundational for current development, later success in school, and lifelong learning (Early Head Start National Resource Center, 2012). Another characteristic of this age group is the reliance on parents and other adults. While all humans are reliant on others, this is especially true of babies. Thus, the infant/toddler period represents an opportunity for parents and non-parental caregivers to support young children's optimal development and to set a positive path and direction for lifelong success.

The History of "School Readiness"

In 1990, the U.S. President and state Governors established eight National Education Goals (National Education Goals Panel, 1997). As stated by the National Education Goals Panel (NEGP, 1991), their first goal was that "by the year 2000, all children in America will start school ready to learn." The adoption of this goal focused our nation's attention on school readiness with "ready to learn" becoming a national mantra (High, 2008).

Many efforts were undertaken to define and measure school readiness and typically these efforts focused on preschool-age children. At this time, readiness was defined as including three aspects: the readiness of the individual child, the readiness of schools for children, and the readiness of the family and broader community to support optimal early development (High, 2008; NEGP, 1991). Although schools' readiness for children and the opportunities provided by families and the broader community are essential components of school readiness and success, this report is more narrowly focused on areas of child development that research has shown are important foundations for school readiness. Thus, this report focuses on foundations of school readiness developing in the young child, recognizing that this development is dependent on social relationships and the experiences of infants/toddlers in their families and other contexts.

The NEGP (1991) definition of school readiness within the child has been very influential. They view readiness as consisting of five important developmental domains, including:

- Physical well-being and motor development
- Social and emotional development
- Approaches to learning
- Language development
- General knowledge and cognitive development

These five broad domains have been used as a foundation for more recent work establishing frameworks and outcomes for early childhood programs. For example, the *Head Start Early Learning Outcomes Framework: Ages Birth to Five* (Office of Head Start, 2015) aligns with and builds on the NEGP's five domains listed above. Specifically, the NEGP's five domains serve as the core for identifying essential areas of development and learning for birth to 5 year olds. The *Head Start Early Learning Outcomes Framework* is designed to guide the selection and implementation of curriculum, learning materials, and daily activities, as well as intentional teaching practices (Office of Head Start, 2015).

Elements of these five NEGP domains are also evident in documents guiding work with infants and toddlers in additional settings beyond Early Head Start programs. For example, the NEGP developmental domains listed above are reflected in most states' early learning guidelines (ELGs) established for infants and toddlers (Scott-Little, Kagan, Frelow, & Reid, 2008). ELGs describe "the knowledge, skills, and dispositions adults seek to foster within children" (Scott-Little et al., 2008, p. 1). States established ELGs in response to the 2002 federal *Good Start, Grow Smart* initiative and while it focused on early literacy and math concepts of children ages 3 to 5, many states developed ELGs that addressed other domains such as social-emotional development and included guidelines for children birth through age 5 (Child Care Bureau, n.d.).

As a result, several organizations have recently issued guidance and developed resources for programs, practitioners, and families on how to think about and offer services to support the foundations of school readiness in infants and toddlers. For example, in 2013, the National Association for the Education of Young Children (NAEYC) published a book entitled *Developmentally Appropriate Practice: Focus on Infants and Toddlers* devoted to defining and applying the concept of developmentally appropriate practice for teachers and caregivers working in infant and toddler programs (Copple, Bredekamp, Koralek, & Charner, 2013). The Office of Head Start has also provided guidance to programs through developing the *Framework for Programs Serving Infants and Toddlers and Their Families* (HSS/ACF/OPRE, 2006) and *The Parent, Family, and Community Engagement (PFCE) Framework* (HSS/ACF/OHS, 2011). These and other helpful resources are listed at the end of this document. States have also recently published expectations for infants, toddlers, and their caregivers and, to date, 47 states have early learning guidelines (ELGs) for infants and toddlers (National Center on Child Care Quality Improvement, 2013).

As noted above, the infant/toddler period is an opportunity to support young children's optimal development and to set a positive path for school readiness and life-long success. It is also true that all opportunities involve risk. A risk with applying the concept of school readiness to infants and toddlers is the temptation to push down understandings and practices developed with preschoolers to younger children. To avoid this risk, attention to the unique developmental characteristics of infants and toddlers is required.

That is the purpose of this report—to summarize research about development during the first three years to highlight areas that are prerequisites or foundational for later school readiness and success. This information can be used as a guide by programs to inform their practices and policies and to help programs think about their own theories of change and what outcomes they are most focused on improving for young children.

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Guiding Developmental Principles

Decades of research and theory have produced some general principles of development that are an important starting place for understanding the relationship between infant/toddler development and school readiness. These principles include:

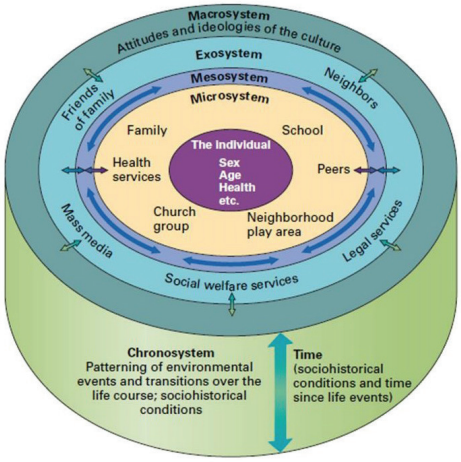
- **Children are active participants in shaping their own development.** Infants and toddlers seek out interaction with others through eye contact, babbling, or physical proximity and by their responses to the attention of others (Bronfenbrenner & Morris, 2006; Cox, Mills-Koonce, Propper, & Gariepy, 2010; National Scientific Council on the Developing Child, 2004). Plus, children get different reactions from others depending on their individual characteristics. For instance, a fussy, unpredictable toddler may experience fewer sensitive interactions and teaching behaviors with both mothers and child care providers, depending on the fit with the parents' or caregivers' personality (Klein & Feldman, 2007).
- **Relationships and experiences are the primary ways development occurs.** Infants and toddlers develop through adult-child and child-child relationships and through exploring their world, both alone and with others. Sensitive, caring, and stable relationships with significant adults serve as primary mechanisms for the healthy development of young children. These relationships are the starting place for language, social, emotional, and cognitive

development—and we have recently learned that these relationships are literally shaping the structure of the developing brain (National Scientific Council on the Developing Child, 2004).

- **Development is complex and transactional.** Children and their contexts shape each other in ongoing and cyclical ways—referred to as the transactional model of development (Sameroff, 2009). For example, each child is raised in a cultural context that shapes all aspects of development, but the child's particular familial or cultural context may also affect the larger community context over time in complex ways. The same environmental factors can affect different children and families in different ways. Likewise, different environmental factors can have a similar effect on children. Thus, it is difficult to always identify what causes a specific behavior (Bradley, Chazan-Cohen, & Raikes, 2009). For example, the stress of living in poverty can impact parenting behavior that, in turn, impacts children by shaping their language and behavioral development. However, language delays or behavior problems may be linked to many factors besides poverty.
- **Development and learning occur in multiple systems or contexts, including the family, early care and education programs, and broader culture.** Infants and toddlers develop as the result of the direct interactions they have with the people in their world (family, friends, non-parental caregivers), as well as the indirect influences, including community resources, policies in parental work settings, state child care policies, and many more physical, social, and interactional environments (Bronfenbrenner & Morris, 2006; Cox et al., 2010). Within these multiple systems and contexts, parents are children's first and most influential caregivers and teachers.
- **All areas of development are interrelated.** During the infant/toddler period, the domains of development (i.e., physical development, cognitive development, and social development) are less distinct than at older ages. Development in one domain influences development in other domains. For example, an

Theoretical Framework

According to Bioecological Systems Theory, children's development is shaped by an interconnected network of systems (Bronfenbrenner & Morris, 2006). Experiences in families (or microsystems) are shaped by interactions between home and child care (mesosystems), and a parent's work environment (exosystem), as well as shared economic conditions across a neighborhood or larger community (macrosystem). In addition, the impact of these interconnected systems varies across time or historical context (chronosystem). Participation in high-quality child care, for example, has been shown to have differential impacts for children living in low-income and high-income families, with greater gains evident for children living in poverty. Emerging findings suggest the influence of high-quality child care may be stronger for children living in poverty if they start attending as infants and toddlers rather than preschoolers (Yazejian, Bryant, Freel, Burchinal, & Educare Learning Network (ELN) Investigative Team, 2015), demonstrating the importance of timing. In addition, best outcomes occur when children attend high-quality care in both the infant/toddler and preschool periods (Li, Farkas, Duncan, Burchinal, & Vandell, 2013; Chazan-Cohen, Kisker, Raikes, Love, Klute, & Faldowski, 2013).



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infant's developing communication skills impact their ability to engage in social interactions. Therefore, developmental domains cannot be considered in isolation from each other. The dynamic interaction of all areas of development must be considered when planning for and interacting with all children, especially infants and toddlers.

- **There are vast individual differences in rates of development among children.** Each child has a unique rate of growth and development. Some children may have a developmental delay or disability requiring adaptations for these children to be successful in achieving a particular developmental outcome.
- **Birth to age 3 is a distinct developmental period that is the foundation for later development.** Periods of rapid growth and change, such as infancy, offer the greatest opportunities for experiences or interventions to influence the course of development (Raikes, Love, & Chazan-Cohen, 2004). The relationships and experiences that influence development from birth through age 3 can have a profound and lasting impact. For example, experiences during infancy affect the architecture of the brain or the way the brain is "wired" (Center on the Developing Child, 2007), as well as how the brain works, including how fast it thinks, how it makes connections and remembers, how it pays attention to information, and how it forms ideas, concepts, and understandings (Rose, Feldman, Jankowski, & Van Rossem, 2008).

The foundations for all the school readiness domains—physical well-being and perceptual/motor development; social and emotional development; approaches to learning; language development and communication; and cognitive development—are formed during birth to age 3. The remainder of this report is devoted to highlighting important findings from research across the school readiness domains that develop during the first 3 years of life.

Domains of School Readiness

The commonly accepted definition of a child's school readiness consists of development in five domains (NEGP, 1991; OHS, 2015), including:

- perceptual, motor, and physical development
- social and emotional development
- approaches to learning
- language and communication
- cognition[3]

Each domain is presented below with a summary of current research describing the foundations of school readiness that emerge during the first three years of life. We emphasize infant and toddler development in areas known to be critical for later school readiness.

Perceptual, Motor, and Physical Development

This domain of school readiness involves growth and change in:

- Weight and length
- Motor skills

[3] These domains are consistent with those identified for infants and toddlers in the Head Start Early Learning Outcomes Framework (Office of Head Start, 2015).

- Perceptual development
- Brain development
- Physical well-being and general health

The average American newborn weighs a little more than 7 pounds and is approximately 20 inches long (Gonzalez-Mena & Eyer, 2012). Growth in weight and length occur rapidly during infancy. By the end of the first year of life, an infant typically triples his or her birth weight and grows 6 to 9 inches in length (McMullen, 2013). Although physical growth slows during the second year, a typical child will quadruple his or her birth weight and grow an additional 3 to 5 inches in length (McMullen, 2013). Although each child is unique, changes in weight and length are generally predictable (Gonzalez-Mena & Eyer, 2012). Families, caregivers, and medical staff should monitor growth in weight and length, and charts describing typical development are widely available to assess how an individual child's growth compares to age expectations (Gonzalez-Mena & Eyer, 2012). This monitoring is important because it can highlight potential developmental problems and allow for early intervention to remedy or reduce the impact on early development and learning.

As noted above, physical development also includes changes in motor skills. Motor development has two aspects. Gross motor development, or large muscle development, involves the large muscles of the arms, legs, and back essential for sitting, walking, running, and climbing. Fine motor development, or small muscle development, includes the small muscles of the fingers and hands essential for grasping, buttoning, cutting, and writing. Fine motor development also includes the small muscles in the tongue and lips that are related to language development, specifically the ability to produce language or talk. The examples noted—walking, climbing, cutting, writing, talking—and other similar motor skills enable the infant to explore and engage in the world. This exploration and engagement is how the infant/toddler builds their knowledge and develops, and thus serve as an important foundation to school readiness.

Some of the earliest research in the field of child development was devoted to recording and documenting norms or averages for children's motor development. This research revealed that overall early motor development occurs in an orderly and predictable sequence, but at differing rates for individual children (Copple et al., 2013). For instance, the age range that is considered normal for children to first crawl is from 5 to 11 months of age and for walking is 9 to 17 months of age. Research shows that infants and toddlers differ from one another in both gross and fine motor development more than preschoolers differ from one another (Darrah, Senthilselvan, & Magill-Evans, 2009). Thus, while motor milestones are helpful, practitioners and families should recognize that not all infants and toddlers achieve milestones at the listed average age and that an individual child's history, experiences, and opportunities must be kept in mind (Copple et al., 2013; Darrah et al., 2009). Furthermore, milestones can be influenced by cultural beliefs and family expectations. For instance, although we in the United States expect all children to crawl and then walk, some cultures, including Jamaican and Mali, do not encourage crawling and therefore, most children go from sitting directly to walking (Hopkins & Westra, 1988).

Perceptual development encompasses vision, hearing, smell, taste, and touch. Gains in perceptual development allow infants to use their senses to explore and gather information about their world. As noted earlier, because exploration is a foundation for learning, early perceptual development also supports school readiness. If an infant

has hearing or vision problems, the ability to learn through exploration may be hampered (National Center on Birth Defects and Developmental Disabilities (NCBDDD), 2014). This highlights the importance of early intervention for these and other perceptual or sensory issues to facilitate development and school readiness. As noted by NCBDDD (2014), the earlier a child with hearing loss or vision problems starts getting services, the more likely they are to achieve their full potential.

Recent research has focused on the interrelationships between physical development and developmental outcomes in other domains related to school readiness. For example, regardless of age, when a child begins walking, there is an associated increase in language development—both receptive and expressive (Walle & Campos, 2014). Campos et al. (2000) describe independent movement (i.e., crawling and walking) as "a mobilizer that changes the intrapsychic (i.e., within the mind or internal) states of the infant, the social and nonsocial world around the infant, and the interaction of the infants with that world" (p. 151). In other words, independent movement, while not the cause of development in other areas, sets the stage for the infant to have different and expanded interactions and experiences that, in turn, lead to development in a variety of areas important for school readiness.

Physical development also includes brain development. Advances in neuroscience since the 1990s have revealed much about the developing brain during the first 3 years of life. Newborns have more than 100 billion neurons or nerve cells. However, to develop, the formation of interconnections among these neurons is essential. It has been well documented that the brain makes more neural connections from birth to age 3 than at any other time. Connections that are not used or repeated disappear through a natural process of pruning. However, connections that are repeated or accompanied by strong emotions grow sturdier and persist (National Scientific Council on the Developing Child, 2005).

Contemporary brain research confirms much of what practitioners and families have intuitively known—"that it is the quality of the environment, of early experiences, and of relationships that is the most critical contributor to ensuring strong, healthy developmental outcomes for infants and toddlers" (Copple et al., 2012, p. 33). There is a growing consensus based on recent research that early interpersonal experience and environmental factors literally shape the trajectory of brain development, with outcomes observed in childhood and adulthood (Luby & Rogers, 2013; Luby et al., 2012). These findings support the recognition of "the critical importance of the early caregiving relationship (the child-caregiver dyad) in healthy child development" (Luby & Rogers, 2013, p. 12).

There is a growing consensus based on recent research that early interpersonal experience and environmental factors literally shape the trajectory of brain development, with outcomes observed in childhood and adulthood.

There is also a growing body of research that identifies environments that are harmful for the brain development of young children. Not surprisingly, extreme abuse or neglect leads to undergrowth in brain areas needed for higher thinking abilities while leading to overdevelopment in areas associated with fear (Nelson, 2000; Tottenham et al., 2010). These brain changes are likely the reason why children who have experienced early abuse are more likely to develop mental health and health problems later in life.

While abuse and neglect occur in all types of families, research indicates that poverty can also negatively impact early brain development. A recent study (Hanson et al., 2013) that repeatedly examined measures of brain development in young children between 5 months and 4 years of age found that socio-economic status (SES) was related to rates of growth of brain regions associated

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with impulse control, attention, and executive functioning. Although infants from low-income families started with similar amounts of brain mass as their more advantaged peers, their rate of growth was slower, resulting in less brain volume than their peers from middle- and high-income families by toddlerhood. The authors noted, "as infants aged—and presumably had increased exposure to the effects of their environments—the differences in brain volume between poor children and those with greater resources widened" (Hanson et al., 2013, p. 5). Additionally, increased behavior problems reported in the preschool years were related to these smaller brain volumes. As indicated earlier, supportive and sensitive relationships and enriched environments are thought to be the key to healthy brain development and the realization of the child's innate social and cognitive abilities (Luby & Rogers, 2013). Additionally, sensitive relationships and enriched environments can buffer children who grow up in poverty from adverse brain development (Luby & Rogers, 2013; Luby et al., 2012).

Physical well-being and general health are also important components of this domain of school readiness. Prenatal development, factors associated with the birth process, and maternal health affect the physical health and development of a newborn. For example, research completed in Australia has shown that compared to their full-term counterparts, children born very preterm (defined as less that 30 weeks of gestational age or birth weights less than 1,250 grams) demonstrate higher rates of problems across the five school readiness domains at age 5 (Roberts, Lim, Doyle, & Anderson, 2011). It is important to note that other indicators, such as parental income, could not explain the delays that very preterm children showed. While Bauer and Msall (2010) note that more research is needed in the U.S. to fully understand the impact of prematurity on later school readiness, the authors highlight the importance of developmental monitoring and intervention, such as that available through Early Head Start, for premature children living in poverty because these young children experience heightened risk due to the combination of prematurity and poverty. Although a full discussion is beyond the scope of this report, resources on pregnancy, prenatal development, prematurity, and mothers' pre-conceptual health are listed at the end of this report.

Independent movement, while not the cause of development in other areas, sets the stage for the infant to have different and expanded interactions and experiences that, in turn, lead to development in a variety of areas important for school readiness.

Relative to physical well-being, a common problem that often starts in infancy is obesity. In addition to the health risks, research demonstrates that obesity and being overweight are associated with poorer levels of academic achievement and school performance when children are in formal schooling (Taras & Potts-Datema, 2005). Although obesity has recently declined for children ages 2 to 5, childhood obesity rates remain high in the U.S. (Center for Disease Control & Prevention (CDC), 2012) and research has demonstrated that more than half of the overweight children ages 2 to 20 became overweight before the age of 2 (Harrington et al., 2010).

Additionally, research suggests that one cause of obesity is infant care practices. Recent research indicates that infants who are fed formula are approximately 2 and a half times more likely to be obese by age two than infants who are breastfed for the first 6 months of life (Gibbs & Forste, 2014). The introduction of solid food prior to 4 months of age and putting infants to sleep while drinking a bottle are other practices associated with childhood obesity (Gibbs & Forste, 2014). Research summarized by the U.S. Department of Agriculture (Health and Human Services, 2010) documents that a healthy diet and eating practices, combined with daily age-appropriate physical activity, can effectively reduce obesity, being overweight, and chronic disease later in life.

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For infants and toddlers, healthy practices include feeding by a consistent caregiver/teacher, encouraging breastfeeding, encouraging self-feeding, and providing age-appropriate foods and serving sizes. These practices, which can be implemented in homes or programs, reduce the risk of obesity and contribute to healthy physical development, one of the components of school readiness. Additional specific recommendations can be found in *Preventing Childhood Obesity* (American Academy of Pediatrics, American Public Health Association, & National Resource Center for Health and Safety in Child Care and Early Education, 2012), a comprehensive set of standards outlining evidence-based practices in nutrition, physical activity, and screen time for early care and education, including infant and toddler care.

Food insecurity, defined as limited or uncertain availability of enough food, is also a threat to infant and toddler development. In their study of food insecurity and developmental risk in young children 4 to 36 months of age living in low-income households, Rose-Jacobs et al. (2008) found that 21% of the infants/toddlers at five pediatric clinics across the U.S. lived in food-insecure households. Additionally, these researchers found that infants and toddlers from low-income households with food insecurity were more likely than those from similar households with food security to be rated at developmental risk. Based on these findings, Rose-Jacobs et al. note that policies to address food insecurity may also improve early development and later school readiness.

In addition to providing healthy eating, good nutrition, and exercise, caregivers can support the physical well-being and health of infants and toddlers by ensuring access to supports while limiting exposure to threats. Supports include immunizations. Except for children with allergies to an ingredient in the vaccine or those with weakened immune systems, almost all children can be safely vaccinated (CDC, 2014). As noted by the CDC (2014), the recommended childhood immunizations are designed to protect children from 14 serious diseases with vaccine administration starting in infancy when children are most vulnerable. Protection from these serious diseases means less risk of long-term disabilities associated with some of the diseases and healthier children—both associated with school readiness. Additionally, there are numerous threats to young children's health present in the environment, many of which are commonly found in the home or neighborhood (National Institute of Environmental Health Sciences (NIEHS), 2011). Examples include lead, pesticides, household chemicals, asbestos, air pollution, and tobacco smoke, among others. These and other similar substances have been linked to death through poisoning, respiratory conditions including asthma, cancer, and SIDS—sudden infant death syndrome (Hoffman & Henken, 2002). Lead poisoning from lead paint and plumbing has been associated with learning disabilities, reduced attention spans, hyperactivity, and brain damage, especially in children under age 6 (Hoffman & Henken, 2002). These consequences highlight the responsibility of families and caregivers to protect and limit exposure of infants and toddlers to these environmental health hazards.

For infants and toddlers, healthy practices include feeding by a consistent caregiver/teacher, encouraging breastfeeding, encouraging self-feeding, and providing age-appropriate foods and serving sizes. In addition, caregivers can support physical well-being and health in infants and toddlers by ensuring access to supports (such as immunizations) while limiting exposure to threats (such as lead and tobacco smoke).

Relatively little research has focused on general or overall physical health and school readiness and academic outcomes (Hair, Halle, Terry-Humen, Lavelle, & Calkins, 2006). However, some recent research sheds light on the relationship between health problems and school readiness. In a Canadian study, Janus and Duku (2007) found that young children's below average health was strongly predictive of vulnerability at school entry. In fact,

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these researchers found that a combination of health, demographic, and socioeconomic factors (i.e., below average health, being a boy, and living in a family with low income) increased a child's likelihood to be "unready" for school entry more strongly than other factors. Hair and colleagues (2006), using a large nationally representative U.S. sample, found that children exhibiting health risks, including atypical weight (over- or underweight), less developed fine and gross motor skills, and some form of a limiting condition or disability at kindergarten entry, demonstrated poor academic (math and reading) and child outcomes (ratings of general health) at the end of first grade. Although these studies did not focus exclusively on infants and toddlers, they do highlight emerging findings which document that physical well-being and motor development are important components of school readiness. Hair and colleagues (2006) stress the wisdom of investing in a broad range of early childhood programs that support not only the educational components of school readiness, but also emphasize young children's health in order to limit the days children miss programming due to illness.

Campbell and colleagues (2014) recently reported evidence suggesting that early childhood interventions have the potential to prevent disease and promote health in both the short and long term. When examining the health-related outcomes of one of the most widely cited early childhood intervention programs designed for young children living in poverty, the Carolina Abecedarian Project, these researchers found that during preschool and childhood, males who attended the high-quality early childhood program had healthier weights than similar boys who did not attend the high-quality program as infants and toddlers. The negative impact of obesity on school readiness and later school achievement was noted above. Even more compelling, Campbell and her colleagues, using new biomedical data collected when the children who attended, and did not attend, the Abecedarian Project were in their 30s, found that infants and toddlers randomly assigned to attend the high-quality birth to age 5 program demonstrated significantly lower numbers of risk factors for cardiovascular and metabolic diseases in their mid-30s. Although the impact was especially strong in males, in their 30s, both the men and women who attended the high-quality Abecedarian program were healthier than similar infants and toddlers who did not. Although the specific reasons for these findings could not be isolated (i.e., was it the improved access to health care, the nutrition education), this new research adds to the growing literature documenting the comprehensive and long-lasting benefits of high-quality early childhood programs beginning at birth for children growing up in poverty.

Social and Emotional Development

Healthy social and emotional development, the ability to form and sustain positive relationships and to experience and express emotions, is often viewed as the foundation for children's mental health and well-being. As highlighted in *Guiding Developmental Principles* (pp. 10-12), relationships and experiences are the primary mechanisms through which development and learning occur. Infants and toddlers develop in the context of adult-child and child-child relationships and through exploring their world, both independently and with others. The research reviewed in this section highlights the important role of early social-emotional development in laying a foundation for school readiness. Surveys of kindergarten

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teachers have shown that problems in social-emotional skills are noted as frequently as academic and cognitive issues as reasons children are not ready for or successful in kindergarten (Rimm-Kaufman, Pianta, & Cox, 2000). We will discuss a few core concepts, including:

- Temperament
- Emotional and behavioral regulation
- Attachment
- Peer relationships

The earliest roots of social and emotional development are present even before birth—when individual differences in temperament can be seen (DiPietro, Hodgson, Costigan, & Johnson, 1996; DiPietro et al., 2002). These differences—which can be thought of as the relatively stable, biologically based way that infants behave, react to new situations, and function—are an important influence on social and emotional development. Researchers have proposed a number of components of temperament. (See Table 1). All include some dimensions that relate to infants' activity level and to qualities of the infants' social and emotional approach to the world. Thomas and Chess (1977) captured this in the "quality of mood," ranging from more positive to more negative, while Rothbart (1981) and Buss and Plomin (1975) refer to emotionality. Temperament is often viewed as one of the core elements of a larger construct of "personality" or what makes an individual unique.

This early research formed the basis for grouping young children's temperament into three different categories:

- easy or flexible: children with positive affect, who were generally calm and regular in their sleeping and eating routines;
- difficult: children who were fussy and irritable, lacking a regular rhythm to their sleeping and eating; and
- slow to warm up: children whose initial approach to novel situations was to withdraw, but who would gradually engage in a more positive way after a short time.

TABLE 1

Components of Temperament Proposed by Researchers

Thomas & Chess, 1977

- Activity
- Rhythmicity
- Distractibility
- Approach/Withdrawal
- Adaptability
- Persistence
- Sensory Threshold
- Intensity
- Mood

Rothbart, 1981

- Activity Level
- Positive Emotionality
- Fear
- Distress to Limitations
- Soothability
- Duration of Orienting

Buss & Plomin, 1975

- Emotionality
- Activity
- Sociability

About two-thirds of children could be characterized into one of these three groupings. The majority of children are considered "easy" (Berk, 2012).

An infant's temperament is important as it relates to the degree of "goodness of fit" with caregivers and the environment. Much of the early research in this area focused on the degree of synchrony between the parents and their infants, but recently more researchers have looked at the goodness of fit between infants and toddlers and their child care environments (De Schipper, Tavecchio, Van IJzendoorn, & Van Zeijl, 2004; Pluess & Belsky, 2009). For example, De Schipper and colleagues conducted a study that looked at the relationship between temperament and children's well-being, and the extent to which child care environments can influence this relationship. Research has consistently found that children with more difficult temperaments have more emotional and behavioral problems in child care. As expected,

De Schipper and colleagues found that the infants and toddlers with the more difficult temperaments had lower levels of well-being; and they found that instability in child care arrangements was particularly problematic for those children with more difficult temperaments. Children with difficult temperaments who experienced instability in child care had higher rates of internalizing symptoms (e.g., withdrawal, depression, anxiety).

There is growing evidence that differences in sensitivity to the effects of the environment may mean that some children are affected more by inadequate caregiving, but high-quality caregiving can also have a stronger effect on them than less sensitive children (Boyce et al., 1995; Ellis, Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2011). Some infants will be more sensitive to the effects of the environment, for example, doing less well when exposed to unstable child care arrangements (as noted above); but these children may also do even better when placed in high-quality, stable care with access to sensitive caregivers. Sensitive caregiving, by parents and caregivers, is "characterized by warmth, consistency and responsiveness" to the cues of infants and toddlers (Hartz & Williford, 2015, p. 109). Intrusive interactions, on the other hand, are more often driven by the needs and interests of the adult and are disruptive to the infant or toddler.

Pluess and Belsky (2009) examined the relationship between infant temperament and behavior problems in children enrolled in the longitudinal National Institute for Child Health and Development child care study of almost 1,000 U.S. children. Consistent with the theory of differential susceptibility: infants who were rated by their mothers with difficult temperaments also had the highest levels of behavior problems and lowest levels of social skills when they were in low-quality child care. Furthermore, the children with high negativity who were in the highest quality child care had the lowest levels of problem behavior and the highest levels of social skills—even higher than the children with easy temperaments. These findings underscore the importance of providing high-quality child care for all infants and toddlers, but especially those who may be at higher risk for problem behaviors due to their temperament. Caregivers can support infants and toddlers with difficult temperaments by providing opportunities for physical activity, and individualized help with transitions and soothing, as well as recognition and labeling of their emotions (Allard & Hunter, 2010; Velderman, Bakermans-Kranenburg, Juffer, & van IJzendoorn, 2006).

High-quality and stable child care is important for all infants and toddlers, but especially to those who may be at higher risk for problem behaviors due to their temperament.

Another important aspect of social-emotional development during the first 3 years of life is an infant's growing capacity to experience, express, and then regulate his/her emotional state. One of the first emotions that very young babies express is "distress" (Lamb, Bornstein, & Teti, 2002). This more generalized negative expression is quickly replaced by more specialized emotions such as anger, sadness, fear, or disgust as the infant approaches 3 to 4 months of age. Likewise, positive emotions also become more specialized as the

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infant matures, with the first smiles elicited in the first 4 to 6 weeks of life, and babies as young as 3 to 4 months laughing in response to social stimuli. Caregivers foster much of this through social exchanges during face-to-face play and interactions. As infants approach their first birthdays, they have learned to understand the emotional expressions of others. This ability leads to their tendency to seek out adults' assistance in interpreting cues—especially in unfamiliar or ambiguous situations. This is often referred to as "social referencing."

As infants display a broader range of emotions, there is a growing need to learn how to regulate their emotions. As children move from infancy into toddlerhood, there is a shift from relying on adults to help with emotional regulation to internalizing skills to self-regulate (Calkins, 1994). During infancy, the focus is on safety and security, with adults providing direct intervention and physical soothing. But, as children's language skills emerge, the task shifts to labeling emotions and teaching children to "manage distress, control impulses and delay gratification" (Calkins, 1994, p. 53). The ability to regulate one's emotions is a critical aspect of school readiness and intimately tied to young children's ability to regulate their own behavior (Smith-Donald, Raver, Hayes, & Richardson, 2007).

Infants' and toddlers' interactions with caregivers are tied to their social-emotional development. In fact, much of what is considered at the core of social and emotional development in the first few years of life is determined, in large part, by the quality of the infant's attachment to their primary caregiver or caregivers. John Bowlby's (1969) early work championed this idea. He believed that the child builds an internal belief or as he called it, an internal working model of relationships, him/herself and others in the world. In other words, the child either believes that the world is a safe place in which his or her needs will be met and themselves as worthy of love and care, or that the world is a less secure or predictable place where it is not always clear that needs will be met and that they themselves may not be worthy of love. Children secure in the belief in the world as a safe place are likely to seek out a caregiving adult when they are distressed and are comforted by physical contact. Those who are insecure in their belief in the world as a safe place are more likely to avoid adults when they are stressed, try to cope on their own, or not be soothed when comfort is offered by an adult. While a child's internal working model can be modified after infancy, stability of these working models is typical (Waters, Merrick, Treboux, Crowell, & Albersheim, 2000). Bowlby described four phases of the development of attachment, based largely upon the infants' emerging capacities in their physical, cognitive, and language development. These phases are summarized in Table 2 on the following page.

Much of what is considered at the core of social and emotional development in the first few years of life is determined, in large part, by the quality of the infant's attachment to their primary caregiver or caregivers.

Through the warm, sensitive, and responsive interactions of the infant and his or her primary caregiver during the first 2 years, a child's attachment style is formed. It is important to note that cultural norms and expectations can also play a part in what behaviors reflect "secure" and "insecure" attachment. In studies of American children, the majority of children are "secure" (about 65%). While they may be distressed by a parent leaving them in an unfamiliar place

TABLE 2

Four Phases of Attachment (Bowlby, 1969)

PHASE	AGES	KEY ELEMENTS
Indiscriminate Social Responsiveness	Birth to 2 months	Infant solicits caregiving using innate cues (crying and later smiling) Caregiving is accepted from anyone Infant begins to associate caregiving with relief from hunger and pain
Discriminating Sociability	2 months - 7 months	Infants begin to show a preference for specific caregivers and respond differentially to them Infants begin to gain a sense of trust that their needs will be met promptly Normally will not protest when separated
Attachment	7 months - 24 months	Infant/toddler will actively seek out preferred caregiver Will protest separation Uses attachment figure as secure base for exploration Seeks proximity during times of stress
Goal-corrected Partnerships	24 months - 36 months	Children can take adults' needs into account and can tolerate periods of separation Stability of attachment quality is achieved

As summarized in Kelly, J. B., & Lamb, M. E. (2000). Using child development research to make appropriate custody and access decisions for young children. Family Court Review, 38, 297-311.

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with a stranger, they are able to be comforted and soothed when the parent returns, leaving them ready to explore the world. Insecure children typically show one of two types of behavior when left alone in an unfamiliar place with a stranger. They either are "resistant," showing distress when the parent leaves, but not being comforted when the parent returns (about 10-15% of children) or "avoidant" (about 20% of children), not appearing distressed when the parent leaves (although studies have shown that their heart rate does go up) and not seeking out the parent when he/she returns (Ainsworth, Blehar, Waters, & Wall, 1978; Belsky & Rovine, 1988).

Children who have been exposed to early trauma—especially abuse or neglect by a primary caregiver—may also develop "disorganized" attachment. Children with this attachment style often demonstrate contradictory behaviors when distressed, fear of the parent, and sometimes freezing in place and neither approaching nor withdrawing. This latter attachment style is associated with poor long-term outcomes; but recently interventions to help these children have been developed and tested (see, e.g., Bernard et al., 2012).

On the very extreme end of attachment issues, psychiatry has defined a category of pathological behaviors called indiscriminate attachment disorder. This term refers to

a very small percent of children, who have experienced severe neglect or abuse. These children appear to have no special attachment relationship with parents or teachers and do not display a healthy fear of strangers. They may be seen seeking out unfamiliar visitors to the classroom, greeting them with exuberant hugs and other behaviors most often seen with parents. If a teacher or caregiver has a concern about attachment behaviors, discussing these concerns with trained individuals such as mental health consultants is recommended.

In general, children with secure attachments have better outcomes, both socially and academically, although an insecure attachment early in life certainly does not imply a doomed outcome (Sroufe, 2005). "Researchers have consistently found early security to predict children's later social competence with peers and interactions with friends, internalizing and externalizing behaviors, and emotion regulation" (Thompson, 2008, p. 292). These social-emotional skills are important for children's adjustment to school, engagement in learning, and subsequent school success (Domitrovich, Moore, Thompson, & the CASEL Preschool to Elementary School Social and Emotional Learning Assessment Workgroup, 2012). Associations between attachment security and cognitive/academic outcomes are more indirect, with early secure attachments being associated with later parental involvement with schoolwork and better teacher-child relationships, which, in turn, influenced school success (Thompson, 2008).

If a teacher or caregiver has a concern about attachment behaviors, discussing these concerns with trained individuals such as mental health consultants is recommended.

While Bowlby hypothesized that children had only a primary attachment to a mother figure, modern attachment theorists believe that children have multiple attachment figures within and outside of their families, with child care providers being important attachment

figures (Friedman & Boyle, 2008; Goossens & van IJzendoorn, 1990). Infants and toddlers can form distinct attachment relationships with mothers, fathers, and other caregivers when they experience warm, sensitive, and responsive interactions.

In fact, children in more stable child care arrangements have been found to have more secure relationships with their non-parental caregivers. For example, in one study, 91% of children who had been with their caregiver in child care for more than 1 year had a secure attachment with that caregiver as compared to 67% of those who had been with their caregiver for 9 to 12 months and 50% of those who had been with their caregiver for 5 to 8 months (Raikes, 1993). Furthermore, non-parental caregiver behavior has been found to be related to attachment behaviors. When caregivers interact more and are more positive with children, children show more secure attachment behaviors (De Schipper, Tavecchio, & Van IJzendoorn, 2008; Elicker, Fortner-Wood, & Noppe, 1999).

As children mature, their attachment relationships form the foundation for the development of friendships with same-aged peers. Peer sociability is an important component of school readiness, because the ability to get along well with others is a prerequisite to many activities in kindergarten and beyond. Very limited research has examined the developmental foundations of peer relationships for infants and toddlers. One early study by Howes (1983) examined the pattern of friendships in a

small group of infants, toddlers, and preschoolers in child care. Because of the age of the children being observed, the research team defined friendship in behavioral terms: "(1) mutual preference; (2) mutual enjoyment; and (3) ability to engage in skillful interactions" (p. 1042). All three of these had to be observed in order to call the pair of children friends. The children were observed multiple times during the school year and the friendship ratings were validated by teacher ratings. There were several themes noted in the development of friendship patterns across the three age groups. Infants had fewer peers with whom they had stable friendships; and the majority of their interactions were focused on the exchange of objects. Toddlers had more stable friendships than infants, and the toddlers also added to their friendship groups with some additional friends with whom they interacted—but had less frequent and sustained contact. Toddlers' interactions were not restricted to objects, but did not involve as much verbal interactions as seen in the older preschool group. As the children's verbal abilities improved, this led to the emergence of fantasy play, which was seen mostly in the older preschoolers. As the complexity of the interactions increased, so too did the number of friendships that were maintained. Peer relationships become an important component of school readiness as the children get closer to age 4; and social skills also correlate closely with approaches to learning.

Forming healthy attachments and relationships with family members, care providers, and peers provides the developing infant and toddler a secure base and context from which to explore the world and build knowledge. With basic trust and developing abilities to focus attention, as well as regulate mood and behavior, the result of early social-emotional development from birth through age 3 sets young children on a path to arrive at school secure, confident, and eager—ready to learn.

Approaches to Learning

Approaches to learning is an umbrella term that includes a variety of behaviors such as paying attention, working independently, and curiosity—attributes that are typically called "learning behaviors" in psychological and educational research. When applied to infants and toddlers, foundations leading to the emergence of important learning behaviors or features of approaches to learning include:

Forming healthy attachments and relationships with family members, care providers, and peers provides the developing infant and toddler a secure base and context from which to explore the world and build knowledge. With basic trust and developing abilities to focus attention, as well as regulate mood and behavior, the result of early social-emotional development from birth through age 3 sets young children on a path to arrive at school secure, confident, and eager—ready to learn.

- Interest
- Persistence
- Executive functioning

Increasingly, both practitioners and researchers are viewing these behaviors as key indicators of school readiness (Martin, Ryan, & Brooks-Gunn, 2013). Although viewed as important, the body of existing research with infants and toddlers is small. *Approaches to learning* was coined to label a collection of behaviors that are related to preschool children's school readiness. Thus, more of the research has focused on preschool-age children. Additionally, some of the behaviors understood to be part of approaches to learning, including persistence, attention, memory, and executive functioning, overlap with other developmental domains. In fact, persistence is often identified as an aspect of temperament and was noted above in the social-emotional section of this report. Attention, memory, and executive functioning will be discussed below in the cognitive development section. Thus, approaches to learning is a concept that illustrates the interrelated nature of development discussed previously in the *Guiding Developmental Principles*.

Approaches to learning includes both social and cognitive developmental skills as they relate specifically to learning experiences and within educational settings. It is a good reminder that often development is divided into categories, such as cognitive or social development, for ease of discussion when, in reality, development is holistic with milestones in one area influencing another, especially with infants and toddlers.

As noted at the beginning of this section, the emerging research linking learning behaviors in infancy and toddlerhood to later school readiness has focused on interest and persistence. It has been noted that interest, or a child's initial engagement demonstrated through curiosity and exploration, and persistence, the ability to maintain engagement, represent two distinct aspects of learning behaviors (Martin et al., 2013). Both should enhance school readiness by providing more opportunities to learn. Interest and persistence emerge during the first year of life and are related to temperament. Specifically, interest is related to reactivity, or the intensity and content of a child's response, and persistence is an aspect of self-regulation (Martin et al., 2013). Martin et al. (2013) studied the development of interest and persistence from infancy through age 5 in a sample of low-income children. Overall, they found that both interest and persistence at age 3 predicted children's later academic and school readiness skills at age 5.

Often development is divided into categories, such as cognitive or social development, for ease of discussion when, in reality, development is holistic with milestones in one area influencing another, especially with infants and toddlers.

The study (Martin et al., 2013) also highlights the important role of early supportive parenting defined as sensitivity—accurately interpreting and promptly responding to child's signals—and simulation of cognitive development—using appropriate teaching behaviors to expand the child's abilities. Results demonstrated that maternal supportiveness at age 1 predicted higher child interest and persistence at age 2. Similarly, greater maternal supportiveness at age 2 predicted higher child interest and persistence at age 3. Both interest and persistence were more responsive to supportive parenting between ages 1 and 2 than between 2 and 3. This demonstrates the early emergence of these important components of school readiness in response to maternal behavior. Importantly, it also shows that maternal sensitivity had its biggest impact at earlier ages. Interestingly, they also found that supportive parenting facilitated the development of both interest and persistence more than the child's characteristics impacted the nature of parenting. Although the researchers (Martin et al., 2013) acknowledge that children's characteristics have an impact on parent-child relationships, the results of this study highlight the importance of parental caregiving in the child's early development of interest and persistence. Thus, these early emerging learning behaviors are shaped by early caregiving behaviors and perhaps other adult/environmental influences. Martin and colleagues (2013) note the importance of enhancing children's curiosity, interest, and enthusiasm for learning, as well as promoting attention for developing school readiness in infants and toddlers.

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Martin and colleagues (2013) found that supportive parenting facilitated the development of both interest and persistence more than the child's characteristics impacted the nature of parenting.

Executive functioning is also considered part of approaches to learning. Executive functioning is a term used to encompass many abilities, like the ability to delay gratification, think before reacting, figure out where to direct attention in order to learn and be safe, and remember things that have been learned before. These important abilities allow children to learn, explore the world, and be successful in school and relationships. Recent research indicates that executive functioning skills emerge in toddlerhood and show moderate stability by age 4, with continual development and refinement occurring for several years (Cuevas & Bell, 2014; McGuigan & Núñez, 2006; Morasch & Bell, 2011). Executive functioning depends on the maturation of the pre-frontal cortex of the brain, which occurs throughout childhood, adolescence, and even into early adulthood (Cuevas & Bell, 2014). At the same time, the development of executive functioning abilities are also influenced by both characteristics of the child (i.e., attachment security, and gender) and parent-child interactions (i.e., sensitive, non-intrusive engagement) (Bernier, Carlson, Deschênes, & Matte-Gagné, 2012; McGuigan & Núñez, 2006; Rhoades, Greenberg, Lanza, & Blair, 2011). Bernier, Carlson, and Whipple (2010), for example, found that toddlers scored higher on tests of executive functioning when their parents encouraged autonomous or independent behavior. Girls have outperformed boys on more demanding tasks that combine working memory with inhibition or the ability to keep from using an automatic response (McGuigan & Núñez, 2006).

Executive functioning abilities have been linked with school success in math and reading, communication, and social-emotional skills (Bernier et al., 2010). In a diverse sample of toddlers, working memory, or the ability to keep relevant information in the mind to solve problems, was found to predict classroom engagement, as well as achievement, in kindergarten. Specifically, working memory scores at 29 and 41 months predicted kindergarten classroom engagement, number knowledge, and receptive vocabulary beyond that explained by gender, verbal and nonverbal intelligence, and socioeconomic status (Fitzpatrick & Pagani, 2011).

Language and Communication

Communication skills that emerge early begin to set the stage for later language competence and school success. Concepts important to language development include:

- Early communication efforts
- Receptive and expressive language abilities
- Joint attention
- Language environments
- Individual variation in language development

Very early communication skills, like looking, crying, cooing, babbling, and later gestures, begin the developmental progression to later language abilities. Newborns make eye contact with adults to initiate communication and use crying to indicate physical needs and discomfort. Cooing, vowel-like sounds such as "oooooo", begins around 2 months and babbling, which includes the addition of consonants like "bababa or dadada", appears around 6 months (Berk, 2012). The use of gestures such as pointing to communicate typically emerges around 9 months of age. Older infants and toddlers can not only be taught gestures to use but invent their own to communicate requests ("pick me up"), actions ("waving bye-bye"), and naming objects ("a sniffing gesture to stand for flowers"), as well as identifying feelings and emotions of themselves and others (Vallotton, 2008).

Receptive language, understanding and responding to spoken words, is evident early in infancy. Newborns and very young infants respond differently when words are spoken directly to them rather than just overheard in conversations (Soderstrom, 2007). During the first few months of life, infants respond when someone calls

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their name and children as young as 6 months appear to understand the meaning of words such as “mommy, daddy, hands, and feet” (Soderstrom, 2007). Expressive language abilities, using words to communicate, emerge later than receptive language. The pattern of learning language described here is similar for children learning one or two languages at the same time (Bialystok, Craik, Green, & Gollan, 2009; Fuligini, Hoff, Zepeda, & Mangione, 2014). Children typically say their first word somewhere between 10 and 12 months of age (Soderstrom, 2007). The first words toddlers learn typically include words that serve a social function like “bye-bye”, as well as words related to people and animals, objects that move like cars and trucks, and familiar actions, but rarely include words for objects that just sit there like furniture (Berk, 2012). Similar to children’s motor development, there are variations by culture in the type of words learned first. English-speaking toddlers typically learn more words that name objects first, and Chinese-, Korean-, and Japanese-speaking children typically learn more words for actions and social functions first (Berk, 2012). Between 18 and 24 months, toddlers begin putting two words together into simple sentences such as “Katy up.” From 12 to 24 months, children’s language skills take off with tremendous increases in both how fast and how accurately they use and understand language. These increases hold true for both English- and Spanish-learning toddlers (Fernald, Marchman, & Weisleder, 2013).

Vocabulary size by age 2 is a significant milestone in development with implications for later language abilities and school readiness. Children with smaller vocabularies by their second birthday are at risk for continuing vocabulary weaknesses and challenges with literacy-related skills (Core, Hoff, Rumichie, & Senor, 2013; Fernald et al., 2013). Parents and other caregivers can encourage language development by responding to the communication attempts of infants and toddlers. The relationships between vocabulary size and later language abilities hold true for bilingual children as well (Core et al., 2013). However, the relationship is language-specific, so a smaller vocabulary in English is associated with delays in English but not Spanish language abilities.

“Findings from studies of dual language learners (DLLs) from 0 to 3 years show that the pace of dual language development depends on the amount and quality of language input children receive” (Fuligini, Hoff, Zepeda, & Mangione, 2014, p. 13). Children learning two languages at the same time do not usually hear the same amount of each language and the amount of each language heard is linked to the children’s vocabulary and language use (Core et al., 2013). “Children for whom a second language constitutes less than 25% of their input, according to parental report, tend not to acquire that language” (Hoff, 2006, p. 65). Dual language development is best supported by infants’ and toddlers’ ongoing engagement with native speakers in each language (Fuligini et al., 2014). This support for dual language development is important because research is starting to show cognitive advantages in infants and toddlers for learning two languages with the use of deferred imitation or the ability to remember and copy the actions of others when the model is no longer present (Brito & Barr, 2012) and the development of flexible learning (Kovács & Mehler, 2009). Flexible learners are able to remember and use correctly more than one rule structure at a time.

Language development emerges from interactions between the infant and responsive adults. In order for language abilities to develop, interested adults must respond to the communication attempts of the young child. Joint attention episodes, which include an engaged

adult and child combined with a shared interest in what is immediately present, are an important mechanism for language development (Adamson, Bakeman, & Deckner, 2004). In joint attention episodes, the adult starts by noticing what is currently capturing the infant's attention and comments accordingly. The adult's response begins a back-and-forth exchange between caregiver and child. The important starting point in each episode is whatever is capturing the attention and focus of the young child. Children, especially under 19 months of age, show much more rapid vocabulary development when their mothers use language that is related to objects of interest to the child rather than language that attempts to redirect the child's attention (Hoff, 2006).

Early in children's development, the adult is primarily responsible for successful joint attention episodes. However, in the second half of the first year, two abilities emerge that shift some of the power to the child and change the nature of the interactions. The development of pointing at this time provides an intentional communication strategy for the infant (Colonnesi, Stams, Koster, & Noom, 2010). Babies are now able to direct the parent's attention by pointing to a nearby toy. In addition, sometime between 9 and 15 months of age, young children develop the ability to focus on both the objects and the social partner involved in the joint attention experiences (Adamson et al., 2004). Toddlers are able to keep playing with a toy while inviting the parent into conversation about the toy. Toddlers with better joint attention skills develop language more rapidly and have better receptive and expressive language scores at 30 months (Hoff, 2006; Morales et al., 2000). It is important to keep in mind, however, that children vary greatly in their attempts to initiate joint attention episodes, as well as their responses to the communication efforts of adults (Vallotton, 2012).

Moving beyond joint attention, the overall language environment directly experienced by the child impacts language abilities at age 3 (Hoff, 2006). Just hearing talk between adults or listening to television is not enough. Children must be active participants in ongoing conversations linked to their interests. By age 3, children

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from low-income households have heard 30 million fewer words than children from higher-income households (Hart & Risley, 2003). Differences in both the type and number of words heard, number of questions asked, and conversations held explain much of these vocabulary differences reported for children growing up in low-income or dual-language homes (Core et al., 2013; Fernald et al., 2013; Hoff, 2006). Enhancing the language environments of all young children by using a variety of words and open-ended questions that encourage verbal exchanges is very important as children who have smaller vocabularies by the end of the infant/toddler years can be at risk for ongoing challenges with language and literacy learning and school success (Core et al., 2013; Fernald et al., 2013; Hart & Risley, 1995).

It is important to remember, however, that there is great variability in when children speak and how fluent they are with language. For instance, most children experience a steady increase in word production until age 2, although about 20% of children experience a spurt during the

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second year instead of the typical steady climb (Ganger & Brent, 2004). Differences are, in part, due to the expectations of others, the child's own personality, and the number of languages a child is learning. As noted above, the social environment and how much adults talk with children make a big difference. These individual variations in language development can often make it hard to know when a child truly has a language delay. During these early years, most professionals are more concerned when apparent delays are evident in both understanding (receptive language) and speaking (expressive language). When in doubt, seeking consultation or a language assessment can help determine what action to take, if any. It is important to pay attention to language and emerging vocabulary, because we know that the number of words a child knows at age 3 is very predictive of how they do later in school (Hart & Risley, 1995).

Cognition

Foundational cognitive abilities important for later school success are established early in infancy. Concepts important to cognitive development include:

- Information-processing mechanisms—attention, memory, categorization
- Imitation
- Pretend play

In addition to the social interactions with responsive adults discussed earlier, the growth in children's language abilities also results from changes in underlying cognitive abilities known as information-processing mechanisms (Berk, 2012). Some of these mechanisms include attention, memory, and the ability to form categories or connections between information stored in memory (categorization). Active engagement and play with toys and other objects helps infants and toddlers notice or pay attention to information in the world around them (Berk, 2012).

Focused attention or the ability to really notice people, events, activities, and objects is an important starting point for later development and has been found to be one of the strongest predictors of later school success (Duncan et al., 2007; Wass, Scerif, & Johnson, 2012). By 6 months of age children living in poverty already show challenges with their focused attention abilities (Clearfield & Jedd, 2013). The development of children's interest or focused attention skills can be supported by providing play materials that can be actively used in a variety of ways (Clearfield & Jedd, 2013; Richards, 2010). For example, blocks can be used to stack and knock down; to fill and empty containers; and to build structures, animals, or people, as well as to play pretend. Young children show more focused, complex play and better language abilities when they engage in free-play opportunities with toys instead of more adult-directed tasks with the same materials (Girolametto, Weitzman, Lieshout, & Duff, 2000; Kwon, Bingham, Jeon, & Elicker, 2013).

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Infants and toddlers learn information about the features of objects and actions as they play. This information is then stored in memory. Infants' memory abilities from 6 to 9 months of age and onward look very much like those of older children and adults, although they get more effective with age (Berk, 2012; Moher, Tuerk, & Feigenson, 2012). Characteristics of both the environment and the child affect the ability to recall information from memory (Dixon et al., 2012). For example, infants and toddlers who have a harder time focusing their attention are bothered more by noise and other distractors around them and, in turn, have more difficulty with recall memory.

Categorization is one way that young infants and toddlers organize and recall the information stored in memory (Berk, 2012; Horst et al., 2009). Infants and toddlers vary greatly in their ability to sort or organize concepts into categories and make connections (Ellis & Oakes, 2006). Familiarity or experience with objects, animals,

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and people affects children's ability to organize and categorize (Berk, 2012). Infants start sorting into groups based on the overall look of objects, animals, or people, while young toddlers use more details like color, shape, or texture. Adults can help by describing various features and characteristics of toys and other experiences when playing with infants and toddlers. Young toddlers can also sort objects by how they are used and adults can help by showing how objects work when they play with children (Booth, Schuler, & Zajicek, 2010).

These information-processing mechanisms (i.e., attention, memory, and categorization) provide the foundation for the emergence of higher-order cognitive skills known as executive functioning, previously discussed in the Approaches to Learning section. For example, attention abilities at 5 months are related to executive functioning at 24 and 48 months of age (Cuevas & Bell, 2014). These types of research findings highlight the general developmental principle that domains of development are interrelated with development in one domain, in this case, cognitive, influencing development in other developmental domains. They also support the conclusion that supporting school readiness requires attention to all developmental domains.

Cognitive development for infants and toddlers not only starts with these internal information-processing mechanisms but also with the ability to pay attention to social cues. As most parents quickly learn, infants and toddlers are able to imitate or copy the actions and words of those around them. Imitation is a very important strategy to help young children learn about their world (Yang, Bushnell, Buchanan, & Sobel, 2013). A classic study by Meltzoff and Moore (1977) showed that very young infants are able to imitate adult's facial expressions. Six-week-old infants are even able to engage in deferred imitation by making the facial expressions the next day when they see the same person again (Meltzoff & Moore, 1994). Toddlers between 12 and 15 months are able to modify what they have learned by imitation with one object to different situations (generalizability). Generalizing imitated actions to different situations is important so that young children's learning is not limited to first-hand

experiences only (Yang et al., 2013). For example, toddlers learn how to drink out of all types of cups and not just cups that look exactly like the first cup they used. Growth in this skill is associated with changes in both memory and the ability to organize information into categories.

The development of these imitation abilities is particularly evident in children's pretend or symbolic play. The emergence of the ability to pretend or take the perspective of someone else is an important cognitive milestone (Osório, Meins, Martins, Martins, & Soares, 2012). Somewhere around their first birthday, young toddlers are often observed pretending to feed baby dolls with bottles or spoons. Adults have several important roles in the development of pretend play. With young toddlers, they often initiate the activity and help children understand the imaginary nature of the play (Berk, 2012). By participating in pretend play episodes with children, adults help the play last longer and become more complex (Berk, 2012). Adults have to balance playing a role in the play and offering suggestions for the story line without taking over the play.

Conclusions

The research summarized in this report demonstrates that school readiness begins in infancy, with the developmental foundations established during the birth to age 3 period shaping later school readiness and lifelong success. The increased number of infants and toddlers enrolled in early care and education programs, coupled with the increased focus of policy makers on the potential of investments in the birth to age 3 period to make a difference in the lives of young children and their families, necessitate examining the lessons that can be drawn from current research to inform our practices and policies. The following conclusions are offered, based on the research reviewed in this report, to inform high-quality, research-based programming and policy for young children, birth to age 3, and their families.

- **Infancy/toddlerhood is the time when the foundations of school readiness begin.** The foundations of school readiness develop during the period from birth to age 3. Thus, it is important to use the research knowledge summarized in this report to develop a strong foundation from the start of a child's life. Research supports the conclusion that it is easier to build a firm foundation than it is to remediate problems, such as language delays, after they are established.
- **The unique developmental characteristics of infants and toddlers require age-appropriate strategies for supporting school readiness.** As was discussed repeatedly in this report, the infant/toddler years are a unique developmental period offering parents and non-parental caregivers a window of opportunity to support young children's optimal development and to set a positive path for both school readiness and lifelong success. Given the unique developmental characteristics of infants and toddlers highlighted in this report, an important implication is that techniques and strategies to foster school readiness are different than those appropriate with older children. Infants and toddlers develop through adult-child and child-child relationships and through exploring their world, both alone and with others. Relationships and exploration are the starting points for physical, language, social, emotional, and cognitive development, as well as school readiness skills. Thus, school readiness is strengthened by programs and policies that support development of strong parent-child and caregiver-child relationships, as well as opportunities for hands-on exploration with objects.
- **Supporting school readiness during the infant/toddler period requires attention to all developmental domains.** Development during the infant/toddler years is holistic, with development in one domain impacting development in another. This report highlighted multiple examples from recent research. For example, shared interactions between adults and infants support language development, cognitive development (e.g., joint attention), and social development (e.g., turn-taking). In addition, a developmental achievement in one domain (e.g., joint attention) supports the development of skills in another (e.g., language development). Thus, programs and policies to support school readiness in infants and toddlers should address all domains of development, not narrowly focus on certain aspects, such as cognitive development or school-based outcomes such as literacy and math.
- **Infant and toddler development is individual and embedded in family, culture, and other societal influences.** Programs and policies should acknowledge, respect, and respond to these multiple influences on infants' and toddlers' development. Examples discussed in this report include the importance of recognizing and responding to differences in individual rates of development and temperamental characteristics through individualizing interactions. Family and cultural influences must also be recognized and supported. For example, non-parental caregivers can support continued home language development for dual language learners. Programs and policies for infants and toddlers must embrace the reality that one size does not fit all!

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- **Program design and implementation should be informed by current research on infant and toddler development.** Repeatedly, the current research highlights the role of social exchanges between interested, engaged adults and infants and toddlers as important for many domains of development impacting later school readiness. Relationships among caregivers, children, and families are fostered by policies for reasonable group sizes and ratios, as well as practices such as continuity-of-care where children and caregivers stay together for a lengthy period of time.
- **Professional development for early childhood educators and caregivers must be a priority.** Teachers and caregivers need professional development that helps them understand the importance of the research summarized in this report, and what it means for their daily interactions with infants and toddlers. Research shows caregiver language that specifically describes children's emotions, actions, and interactions is important for facilitating development in many areas. For example, caregivers need to understand the importance of talking *with* (not at or to) infants and toddlers even before the infant is able to communicate clearly and effectively. Professional development, offered through a variety of delivery systems, should be focused on knowledge of infant/toddler development and how to support optimal school readiness skills.
- **Families, the general public, and policy makers must be made aware of the unique opportunities to lay the foundation for later school success that exist during the first years of life.** The research reviewed in this report is important for a variety of groups. Families need this information to provide optimal interactions and learning environments for their infants and toddlers at home. The general public needs to know how to support families with young children from birth through age 3 and to advocate for supportive policies and practices in our society. Policy makers need to know this information to inform their development of policies and mandates related to infants, toddlers, and their families. Thus, it is recommended this report and similar resources, such as those listed at the end of this report, be widely disseminated to varied audiences.
- **Cross-systems collaboration is required for early care and education to meet its true potential to support the development of infants and toddlers.** Collaboration among several groups, including families, early care providers, early intervention services, health systems, family support programs, and policy makers, is needed to build school readiness in infants and toddlers. Several initiatives at the federal and state levels have begun to build these collaborations, but more are needed. Comprehensive, collaborative, systemic efforts require a shared vision, effective communication, and policies and programs that support key collaborators, individually and collectively, in playing their part. Thus, strong leadership is required. However, we all can play an important role. All people who care about infants and toddlers can advocate for research-based practices to be implemented in programs and policies.
- **Further research is needed.** As discussed above, the current research is helpful in informing our efforts as families, caregivers, citizens, and policy makers. Current research supports the conclusion that school readiness begins in infancy and is supported by a range of high-quality comprehensive services available to infants, toddlers, and their families. The next step is to research what components of programs and interventions are especially critical for producing desired outcomes. As stated by Raikes, Love, and Chazan-Cohen (2004), "The more we know, the better prepared children will be for school from the beginning" (p. 23).

The goal of this report was to highlight key research findings related to the foundations of school readiness with infants and toddlers. This review has been selective and the reader is encouraged to consult the resources listed on the following pages for additional information. ■

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"This document was developed from the public domain document: Developmental Foundations of School Readiness for Infants and Toddlers: A Research to Practice Report - Horm, D., Norris, D., Perry, D., Chazan-Cohen, R., and Halle, T., Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services (OPRE Report # 2016-07)."