Bright from the Start

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What the New Brain Research Tells Us About Prevention and School Readiness

Summer 1998

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Bright from the Start:

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Executive Summary

Bright from the Start

What the New Brain Research Tells Us About Prevention and School Readiness

Children are bright from the start. They are born "ready to learn," and in the very first days of life, they begin building knowledge about the world–taking in and organ izing all of the stimuli their senses provide. But too often, their natural curiosity and ability are blunted in their early months and years. By the time they reach age five, virtually all of our children should be ready to benefit from schooling. But research shows that one in five Florida kindergartners do not meet expectations for school readiness.

What can Floridians to do ensure that the newborn who comes into the world today will be ready to learn and succeed in tomorrow's world? What kinds of policies and practices will meet the essential requirements for healthy child development in the earliest years? Today, decision makers are in a better position than ever before to answer these questions. New research has shed light on the importance of the early years and brought home the importance of prevention.

New Research, New Understandings

Neuroscience is now confirming what parents, grandparents and teachers have long suspected: young children's day-to-day experiences in the first years of life have a decisive, long-lasting impact on their achievement as older children and adults. Over the last decade, scientists have discovered that the early years are filled with both extraordinary promise and considerable risk. They offer greater opportunities to promote healthy development and school success but are more fraught with risk than we ever knew.

Thanks to intensive research in the biological and behavioral sciences, as well as sophisticated new brain–scan technologies, scientists now have a much more detailed understanding of how children's brains work and how they develop. They have shown that early learning actually changes the physical structure of the brain. This means that early experiences can have a profound, lifelong impact, not only on children's intellectual development but on their emotional well-being and social adjustment as well. But the early years are rife with risk as well as opportunity. Negative experiences or the absence of appropriate stimulation can have an especially powerful impact on children's development.

Today there is growing recognition that the path to school success does not begin when a child reaches the age of five or six. It begins at birth, or even before. By focusing on children's health and development in the early years, it is possible to improve their learning later on.

In particular, young children's chances for later school success are affected by the quality of the care they receive; the settings that are created for them by parents and other caregivers; the attachments they form with the adults who care for them; and the stimulation they experience. These factors can dramatically affect an individual's life trajectory.

Major Challenges

In recent years Florida has launched efforts to improve results for young children and their families, and these initial investments are beginning to pay off. In fact, in a number of critical areas such as prenatal care and immunization rates, our state is making greater strides than the nation as a whole. In addition, preventive health services are available to more Floridians, pregnancy outcomes have improved, and the quality of early care and education has been enhanced.

These gains are important, but difficult challenges remain. According to the *1998 Kids Count Data Book* published by the Annie E. Casey Foundation, Florida places 44th in a national ranking of children's overall well-being. This poor showing reflects a sharp increase, over the last

decade, in the number of children living in poverty. Recent knowledge about young children's brains help to explain why poverty can have such an adverse effect on early development. Many of the risk factors that undermine healthy brain development–poor nutrition, stress, environment, maternal depression, prenatal exposure to toxic substances, and insecure attachment to caregivers–are associated with or intensified by poverty.

Florida can do better. Every one of these problems has been studied exhaustively. Every one of them has been successfully addressed somewhere in the nation if not in the state. Both researchers and practitioners know a great deal more than ever before about how to protect children's health and safety, promote healthy development and learning, break the cycle of poverty, and reduce crime. We know how to prevent developmental delays and school failure.

In fact developmental scientists now believe that a large number of the state's special–education placements are almost totally preventable. Numerous studies bear this out. For example, scientists at the Centers for Disease Control have concluded that at least half of all cases of mild mental retardation are preventable. Prevention produces substantial savings for taxpayers. Research shows that the cumulative costs of special services to age 18 are 20 to 30 percent lower when begun at birth than when begun at age six.

Focus on Prevention

There is growing consensus, among scientists, child development experts, educators and policy makers that a key to better results for young children is ensuring that their parents have the resources and knowledge they need to do a good job. Recent brain research shows that emotional, social and intellectual learning are all linked, and that a secure attachment to a responsive, warm caregiver is crucial to healthy development. Policies that help to strengthen the bond between caregivers and children–including parent education programs that help parents respond to their babies' cues, voluntary home visitation programs, family leave for new parents, training for child–care providers, and on-site child care for working parents–can therefore become important elements in a comprehensive education reform program.

Parent education is an especially important form of prevention. No responsibility is more awesome, no task more difficult, than raising a child. Parenting is an around-the-clock job requiring bottom-line responsibility and life-and-death decision-making. Yet mothers and fathers are expected to perform well with no experience, no training and no supervision. A recent survey conducted by Zero to Three confirms that few first-time parents feel fully prepared for their new role. The youngest and least financially secure feel particularly unprepared. Effective parent education programs such as Healthy Families are crucial elements in Florida's prevention strategy.

In summary, research from many fields, including neuroscience, sends an urgent, unambiguous message: public investments in children's healthy development and education cannot wait until children reach age five or six. Study after study indicates that to optimize early childhood development, investments must begin early–even before birth, they must allow for sustained effort, they must be comprehensive, and they must be guided by a commitment to quality.

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Introduction: From Day One

Chances are that right now, somewhere in Florida, a new baby is coming into the world. He arrives with remarkable abilities and potential. On his very first day of life he can search the room with his eyes, and he can visually trace the edges of a triangle. As he nurses, he uses every sense-vision, hearing, touch, taste and smell-and he actively tries to make sense of this rush of sensory experience. From day one he organizes his perceptions, learning how his parents look and feel and how they give care.[1] He is able to make associations, and, within a few days he begins to suck at the mere sight of a nipple.[2] He is smarter, more competent, more curious and more alert than scientists ever expected.

Ready to Learn

Children are bright from the start. They are born "ready to learn," and, in the very first days of life, they begin building knowledge about the world-taking in and organizing all of the stimuli their senses provide. But their natural curiosity and ability are too often blunted in their early months and years. By the time they reach age five, virtually all of our children should be ready to benefit from schooling. But research shows that one in five of Florida's kindergartners does not meet expectations for school readiness. In 1994-95 nearly 13,000 Florida children, ages three to five, were not considered ready to progress to the next level or grade.[3]

To be sure, many children in Florida and across the nation grow into very able learners. But a recent study by the Carnegie Corporation of New York documented a widespread pattern of educational underachievement that affects American children of diverse cultural, linguistic and racial backgrounds. According to *Years of Promise*, "millions of children are not achieving as much or as well as they could, in school or out; they are not coming close to mastering the concepts, knowledge, and skills they will need to succeed later in life."[4]

The Carnegie report adds that the pattern of underachievement is especially stark for those children not receiving the teaching and support they should have at home, in school settings or in their neighborhoods. Children in low-income communities are especially affected. A large body of research shows that children raised in families with low socioeconomic status do worse in school than children raised in families with high socioeconomic status-in terms of intellectual and social development, behavior problems and delinquency.[5]

These research findings add up to a real and disturbing developmental slide that occurs all too often in the preschool years. This slide threatens the well-being of the state and the nation. It is often difficult to reverse; studies

show that by the time they reach the third grade, children tend to be set in achievement trajectories that can last the rest of their school careers and affect their success as adults.[6]

What can Floridians do to ensure that the newborn who comes into the world today will be ready to learn and succeed in tomorrow's world? What kinds of policies and practices will meet the essential requirements for healthy child development in the earliest years? Today, decision makers are in a better position than ever before to answer these questions. New research has shed light on the significance of the early years and brought home the importance of prevention and early intervention.

The New Brain Research

In recent years the fields of neuroscience and child development have flourished beyond any prior expectation. Thanks to unprecedented scientific and technological breakthroughs, scientists have learned more about human brain development over the last decade than was discovered in the previous several centuries.[7] Their findings are stunning–dramatic enough, in fact, to inspire cover stories in both Time and Newsweek, coverage by every major news outlet, and a historic conference at the White House that gathered neuroscientist, early childhood educators, and policy makers.

Through these and other channels, neurobiology is beginning to find its way into mainstream America. The research is complex. Its terminology and its sheer volume can be daunting. But the message is clear. Neuroscience is now confirming what parents, grandparents and teachers have long suspected: young children's day-to-day experiences in the first years of life have a decisive, long-lasting impact on their achievement as older children and adults. Scientists have shown that early experience affects how the brain is "wired," influencing an individual's long-term intellectual, social and emotional capacities.[8]

This is a good news/bad news story. The good news is very good. Brain research has shown that early learning actually changes the physical structure of the brain. This means that early experiences can have a profound, lifelong impact not only on children's intellectual development, but also on their emotional well-being and social adjustment. Because young brains are so active and so flexible, the early years offer greater opportunities to promote healthy development and school success than scientists–or parents–ever realized.[9]

The bad news: because young brains are so active and so flexible, the early years are more fraught with risk than we ever knew. Negative experiences, or the absence of appropriate stimulation, can have an especially powerful impact on children's development. A wide range of factors—poor maternal health, inadequate prenatal care, poor nutrition, lack of appropriate stimulation, abuse and neglect, parental substance abuse, substandard child care, and prolonged maternal depression-can all undermine healthy growth and learning, including early brain development.[10]

Today, thanks in part to wide media coverage of new brain research, the once–wide gap between scientific knowledge and public understanding is beginning to shrink. Florida has been a leader in educating the public about what this research means for young children and the adults who care for them. Decision makers across the state are increasingly turning their attention to prevention. To a greater extent than ever before, efforts to strengthen educational results for all of Florida's children are emphasizing healthy development in the early years, beginning even before birth. Indeed the state's first goal for education reform and accountability calls upon communities and schools to "collaborate to prepare children and families for children's success in school."

Bright from the Start is the first of three policy papers which build on the key findings of recent brain research, showing how new insights can be used to help Florida's children get off to a good start-at home, in early care and education settings, and in their communities. This paper focuses on prevention, highlighting policies and practices that can sustain children's promise in the early years, sidestep problems, yield long-term savings, and promote success by age six. The second, entitled *Windows of Opportunity*, focuses on intervention, showing how efforts to identify and address developmental problems or delays in a timely way can benefit all of Florida's children and

their families. The third, *Quality Counts*, focuses on the importance of quality in early care and education.

I. Florida's Children

Florida has launched efforts in recent years, to improve results for young children and their families, and these initial investments are beginning to pay off. In fact, in a number of critical areas, Florida is making greater strides than the nation as a whole.

Accomplishments

Floridians can be proud of these achievements:[11]

• *Health insurance has been extended to more children.* The approval of the plan was accompanied by the passage of HB4415–The Florida Kidcare Act of 1998. In combination, these two events make it possible for children from birth through age 19 who are U.S. citizens or qualified non-aliens living in families earning up to 200 percent of the federal poverty level to be covered by health insurance. Children's Medical Services will serve children age 0-19 who have special health–care needs and are eligible for Medicaid or Title XXI. Healthy Kids, Inc. will expand its enrollment of school-age children and younger siblings in participating sites. Medikids, administered by the Agency for Health Care Administration, will cover ages 0-5; employer-sponsored coverage will be available to children 0-19 and Medicaid eligibility for ages 15-19 is expanded up to 100 percent of poverty. Some 254,000 previously uninsured children ages 0-19 will have health insurance as a result of these measures.

• *Preventive health services are available to more Floridians*. Florida's Medicaid contract with HMOs has been enhanced. It now includes many preventive maternal and child health services, a performance-based quality assurance system, and report cards. MediPass, a primary care case management program for Medicaid enrollees, has been expanded throughout the state.

• *Our pregnancy outcomes have improved.* Between 1985 and 1995, the state's infant mortality rate improved by 34 percent-a greater improvement than the nation as a whole.[12]

• *We have achieved near-universal prenatal care.* Over the past five years the number of mothers receiving prenatal care has increased steadily. In 1994, 98.9 percent of Florida's babies were born to mothers who had received prenatal care.

• *We have raised our immunization rate.* Florida's immunization rate for two-year-olds has increased significantly. Kindergarten and Head Start immunization programs have contributed to boosting the state's immunization rates. In 1994, 97 percent of kindergartners and 92 percent of Head Start children had been immunized.

• *We have a higher-than-average preschool enrollment.* While the 1993 national figure for three- to five-year-olds enrolled in preschool was 60 percent, Florida's rate was 65 percent.[13] In Florida, as in the United States as a whole, 63 percent of children under the age of six live with working parents.[14]

• *We have improved the quality of early care and education.* Florida has made progress toward improving quality, in part by requiring child-care centers to have at least one credentialed staff member for every 20 children.

Major Challenges

These gains are important and impressive. They reflect the hard work and commitment of many Floridians. At the same time we cannot afford to flinch in the face of the difficult challenges that remain. In particular, Florida needs to redouble efforts to promote school readiness, preparing children for reading and the other academic and social challenges of elementary school. Despite intensive education-reform efforts, our children continue to lag behind the nation in many areas, including reading and mathematics achievement and the high school graduation rate.[15] Since reading is the foundation for so much later learning, it is particularly worrisome that in 1994, only 23 percent of Florida's fourth graders scored at or above the

proficiency level set by the National Assessment of Educational Progress.[16] The average score for Florida's fourth graders was below the national average.[17] Efforts to strengthen these results must begin early. There is mounting evidence that education–reform initiatives will not take hold unless they begin when children's learning begins–in the first days, months and years of life.[18]

Today there is growing recognition that the path to school success does not begin when a child reaches the age of five or six. It begins at birth, or even before. By focusing on children's health and development in the early years, it is possible to improve their learning later on.

According to the *1998 Kids Count Data Book* published by the Annie E. Casey Foundation, Florida places 44th in a national ranking of children's overall well-being.[19] This poor showing reflects a number of interrelated factors.[20]

The Impact of Poverty. There has been a sharp increase, over the last decade, in the number of children living in poverty. In fact children under the age of six constitute the poorest segment of Florida's population. Here are the facts:

The number of children living in poverty has increased. Between 1985 and 1995, there was a 14 percent increase in the number of children living in poverty while the nation as a whole showed no change.

Our percentage of very poor children is much higher than the national average. Twelve percent of the state's children (compared with 9 percent nationwide) live in very low-income families-those whose incomes fall below 50 percent of the poverty level.

These trends are especially troubling in light of recent brain research, which helps to explain why poverty can have such a detrimental effect on early childhood development and school success. We now know that brain development is affected by young children's environments and experiences–including not only nutrition and safety, but also the quality of their attachment to parents or other caregivers, the level of stress they experience day by day, and the amount of appropriate stimulation they receive. Many of the risk factors that undermine healthy brain development-poor nutrition, stress, environment, maternal depression, prenatal exposure to toxic substances, and insecure attachment to caregivers-are associated with or intensified by poverty.[21] Research shows that poverty and the living conditions that result from poverty are associated with poor results at every stage of early development: poor-quality relationships with caretakers in infancy; behavior problems in preschool; and poor social, emotional, behavioral and academic functioning in elementary school.[22] Like other mothers and fathers, low-income parents want to safeguard their children's health, raise them in stimulating environments, and make the best possible arrangements for their care, but their options are often very limited. Employed parents with very low incomes may not be able to afford to live in safe neighborhoods, buy nutritious food, pay for health care or health insurance premiums, or afford high-quality early care and education programs.

Children's Health. A number of public health trends, including poor pregnancy outcomes and limited access to health care, further contribute to the state's low ranking:[23]

Infant mortality rates, while improved, remain unacceptably high, especially for nonwhite babies. In Florida, nonwhite infants are twice as likely to die as white babies.

Nonwhite infants are also twice as likely to have a low birth weight, placing them at greater risk for health problems and developmental delays. Today more and more babies are born with low birth weights. The upward trend holds both for Florida and the nation as a whole. Our state's increase of 3 percent from 1985 to 1995 was less than the increase for the nation as a whole, but Floridians can take little comfort in that fact because our baseline was already unacceptably high. The bottom line: Florida ranks 35th in the nation with respect to low birth-weight babies and our rate (7.7 percent) remains higher than the national rate (7.3 percent).[24]

Many of our children are uninsured or underinsured. In 1994, 18 percent of Florida's children lacked health insur-

ance, compared with 13 percent nationwide.[25] As noted in the previous section, Florida has made recent progress in this area but more needs to be done. Health insurance is often too expensive for low-income families and many insurance policies limit benefits.[26] Too many of Florida's children still lack coverage: in 1997, an estimated 31,485 children born in 1995 did not have insurance.[27] Some who have coverage rely on private-pay and employer-based plans, which may be weak in the areas of prevention and primary care. Florida has model legislation requiring insurers regulated by the state to cover well-child-care visits, but many insurers are not required to be regulated by the state.

Adolescent Parenthood. A steep rise in the number of children born to young, single mothers is a third area of concern, especially since these children generally face economic hardship.[28]

• *The percentage of births to unmarried mothers has risen dramatically.* Between 1980 and 1994, the percentage of births to single mothers increased by 126 percent (compared with a 45 percent increase in total births).

• *More than a third of our children are born to single mothers.* More than a third of Florida's babies are born to single mothers. In the decade leading up to 1995, there was a 20-percent increase in the number of children living in single-parent homes in Florida. This increase was slightly larger than that for the nation as a whole.[29]

• *The number of births to teen mothers has increased.* Between 1980 and 1994, births to mothers under the age of 20 increased by 9 percent. In 1994, nearly 14 percent of all births in the state were to teen mothers.

• *The number of births to very young mothers is on the rise.* Between 1985 and 1995, births to mothers ages 15 to 17 rose by 8 percent.[30]

Juvenile Crime. In recent years, Florida has witnessed, an alarming increase in juvenile crime. Between 1985 and 1995, the state's juvenile violent-crime arrest rate rose by 68 percent (although the absolute number of teens arrested went down).[31] Admittedly, juvenile crime is sparking concern throughout the nation, but Florida has the nation's second highest rate of violent crime. School violence has also increased, particularly in the state's urban counties.[32]

We Can Do Better

This list may seem overwhelming, and the danger is that, in the face of such hard facts, the public may despair, give up on the children, or blame their families. The clear message to Floridians must be: we can do better. Both researchers and practitioners know a great deal more than ever before about how to protect children's health and safety, promote healthy development and learning, break the cycle of poverty and reduce crime. We know how to prevent many kinds of developmental delays and avert many cases of school failure. Florida researchers have estimated that with sufficient and sustained prevention efforts (including teen pregnancy prevention, family planning, comprehensive health care, preschool, and early intervention), the number of students in the state needing special education could be cut in half, from more than 22,000 to under 11,000.[33] Researchers looking at national data have reached similar conclusions. For example, scientists at the Centers for Disease Control have concluded that at least half of all cases of mild mental retardation are preventable.[34] Prevention produces substantial savings for taxpayers. Research shows that the cumulative costs to age 18 of special services end up being 20 to 30 percent lower when begun at birth than when begun at age six.[35]

We know that prevention works. We know that the cost of inaction is very high-especially when untreated risk conditions lead to costly health care and special-education services. The key is to invest up front.

If Floridians had the means to prevent a childhood disease and failed to make it available to all of our boys and girls, we would certainly be at fault. While we cannot completely prevent school failure, it is indeed in our power to take steps that will improve results for millions of children. We must not let them down.

II. New Research, New Understandings

A child begins learning about himself and the world from the moment he takes his first breath. Parents and teachers have long known that the early years are important. Scientists are now able to prove that they are right. They are producing evidence that children grow and develop at a faster rate in the preschool years than at any other time of life. Their brains are more active and more flexible in the first three years than they will be during any other span in the human life cycle.[36]

Nature and Nurture

Thanks to intensive research in the biological and behavioral sciences, as well as sophisticated new brain-scan technologies, scientists now have a much more detailed understanding of how children's brains work and how they develop. Everything they tell us about brain development suggests that early experiences can have a profound, lifelong impact not only on children's intellectual development, but also on their emotional well-being and social adjustment. Specifically, young children's chances for later school success are affected by the quality of the care they receive, the settings that are created for them by parents and other caregivers, the attachments they form with the adults who care for them, and the stimulation they experience. These factors can dramatically affect an individual's life trajectory.[37]

Scientists have found that brain development during the first three years is more rapid, more extensive and more vulnerable to experience than was ever suspected. Of course heredity plays a role in determining an individual's capacities. Genes have a powerful influence over personality, temperament and the kinds of intelligence an individual may have.

But, as parents can attest, children are more than the sum of their genes. No two human brains are alike because the particular experiences young children have affect the way their brains develop. Brain development is a complex dance between nature and nurture. Some scientists believe that the role of experience is most decisive in the early years and gradually diminishes over time. One study supported by the National Institute for Mental Health (NIMH) suggests that in infancy, the relative contributions of experience and heredity to cognitive growth are 80 percent and 20 percent, respectively.[38]

Brain Basics

Babies come into the world with all of the genetic coding needed to guide their brain development. They are biologically primed for learning, and recent studies suggest that young children are also biologically primed for emotional well-being.[39]

Newborns' brains are far from finished; the brain is the last organ in the body to mature. At birth infants possess nearly all of the billions of brain cells, or neurons, they will need for a lifetime of thinking, learning and communicating. If brain development has proceeded normally in the womb (as it usually does), by the time a child is born every neuron has arrived at the right place at the right time and is ready to go to work. But most of a newborn's neurons are not yet activated because they have yet to be hooked up into the complex networks needed for complex functioning. The formation of these networks-the "wiring" of the brain's complex circuitry-does not happen automatically. It is not entirely preprogrammed. It instead depends on input from the outside world in the form of experience.[40]

The brain is stimulated with each new experience. This stimulation takes the form of chemical-electrical impulses that leap between neurons forming connections. As these impulses race from neuron to neuron, they form neural pathways. The next time the same kind of experience occurs, the same connections are again activated or "fired." Impulses find their way along the same pathway, strengthening the connections in the process.

Neurons do not connect one-on-one. Depending on their function and circuitry, each neuron can form any-

where from 10 to 10,000 connections. A newborn has relatively few connections, within the span of three years his brain will form roughly 1,000 trillion connections.[41]

The brains of young children are astoundingly busy. It is no wonder that parents of young children swap stories of breathtaking cognitive leaps that seem to take place overnight. The leaps are real, and they are the result of new connections which enable young children to master new skills, absorb new knowledge and make increasingly sophisticated sense of their worlds. And these connections are reinforced each time they are used.

In the early years a child's brain produces many more connections than it will need in adulthood. By the age of three, children's brains have formed twice as many connections as they will need when they are grown. From the ages of three to ten, the number of connections stays high and remains relatively stable. Then, as children approach adolescence, there is a turnabout: the brain begins to discard excess connections. Scientists speak of this process as *pruning*. They have discovered that pruning is not a random process. Those connections that have been strengthened through repeated use tend to remain; those that have not been used at all, or frequently enough, tend to be eliminated. In this way brain development is truly a "use it or lose it" process.[42]

The elimination of connections may sound worrisome, but, as connections are pruned, neural networks actually become more efficient. College students have far fewer connections than toddlers, but they are better able to analyze and synthesize new information. On the other hand, once pruning begins in earnest–somewhere around the onset of puberty–the brain loses some of its early flexibility. It becomes less vulnerable to experience. This explains why it is far easier for children to master a second language before adolescence than after. It explains why young children recover more easily from certain kinds of brain injuries than adults. And it explains why learning basic skills tends to be more difficult after the elementary years.[43]

Learning certainly continues throughout the life cycle. People of all ages can gain new competencies or improve old ones. But recent brain research shows that there are critical periods-windows of opportunity-when certain areas of the brain undergo active development. During these periods the brain is particularly efficient at mastering a certain kind of skill or adapting to a new situation. By the same token, there are stretches of time when the absence of stimulation, or negative experience, can be especially damaging.[44]

This has enormous implications for preventive care. Here are some examples:

• Abuse or neglect is traumatic for people of any age, but may have especially adverse and lasting effects when it occurs early in life. Efforts to prevent child abuse must therefore begin even before children are born.[45]

• Cognitive growth proceeds more rapidly when young children are spoken to and read to on a regular basis. When children have few language experiences in the early years, or when hearing problems are not identified early, their language development and cognitive growth may be delayed or impaired.[46]

• If a young child's cataracts are not removed soon enough, the part of the brain that controls vision will not have the input it needs to make the appropriate connections. The child may not be able to see even after the cataracts are removed.[47]

• Maternal depression appears to have no lasting effect on a baby if it abates during his first six months of life, but serious maternal depression is likely to have a negative impact on children from six to eighteen months of age. It is therefore important to identify and treat depression early.[48]

• If basic reading skills are not mastered in the elementary grades, they can certainly be learned through later remediation but progress is likely to be slower and more labored.[49] Some other kinds of skills such as riding a bicycle or mastering a musical instrument are learned more easily if begun in the elementary grades.

The Simple Things

The upshot of research on critical periods is this: time is of the essence. But parents need not rush their children's development. There is no need to recite the alphabet to an infant or buy flash cards for a three-year-old. It makes no sense, from the standpoint of neuroscience, to "hothouse" kindergartners by giving them rigorous academic programs before their brains are ready to handle them. It is "the simple things" that promote healthy brain development in young children-warm, responsive care; talking and singing; expressions of affection. Whether the caregiver is a parent, a grandparent, or a child care provider, these are the interactions that foster not only cognitive growth, but also emotional and social development.[50]

III. Focus on Prevention

Recent brain research has crucial implications for how decision makers think about, plan and deliver services to young children and their families. Scientists have shown that when children form strong, secure attachments to the adults who care for them, they are more likely to enjoy good health[51] and success in school.[52] Policies that help to strengthen the bond between caregivers and children-including parent education programs that help parents respond to their babies' cues, voluntary home–visitation programs, family leave for new parents, training for child-care providers, and on-site child care for working parents-can therefore become important elements in a comprehensive education-reform program.

In the policy arena the message is urgent and unambiguous: public investments in children's healthy development and education cannot wait until age five or six. Study after study indicates that to optimize early childhood development, investments must begin early (even before birth), they must allow for sustained effort, they must be comprehensive, and they must be guided by a commitment to quality.[53]

Prevention Before Birth

Promoting Responsible Parenthood. Just as public investments in children's development and learning cannot wait until they reach the kindergarten classroom, investments in parents' development and learning cannot wait until they reach the labor room. Promoting responsible parenthood begins with access to information. Adolescents and young adults need opportunities-in school and in their communities-to learn about the responsibilities, pleasures and challenges of parenthood, as well as factual information on child and brain development.[54]

Voluntary Family Planning. Voluntary family planning is another important aspect of prevention before conception. Research shows that children flourish when they are wanted. In contrast, children of unplanned and unwanted pregnancies are at higher risk for abuse, neglect and poor birth outcomes such as low birth weight and infant mortality.[55] In Florida one-fourth of all births are to women who did not plan to become pregnant. It is often assumed that unplanned pregnancies occur primarily among teen mothers, when in fact the problem is more common among adults. It has been estimated that only 15 percent of the risk for unwanted or unplanned pregnancies is among adolescents.[56]

Prospective parents who want to plan their families or space their children need information and family-planning services. When accompanied by quality health care, planned childbearing has been shown to reduce the likelihood of infant mortality and low birth weight, increase the likelihood of breastfeeding, and reduce later delinquency and drug abuse. These results, in turn, save money for taxpayers. In Florida family planning has been shown to save between $6.12 and $13.53 for every dollar in public expenditures.[57]

Preconception Care. At present, medical advice related to childbearing generally begins once a woman is pregnant. Preconception care is still a relatively new practice. But research has established the value of a medical visit and evaluation when pregnancy is contemplated. This provides the opportunity for a complete family and per-

sonal history, physical examination and the identification or discussion of conditions that might require special consideration. Medical conditions that affect expectant mothers and their babies such as high blood pressure or diabetes can be identified, discussed and treated. Prospective parents can be counseled about the impact of prescription medications, smoking, drinking and drug abuse. Preconception care can also shed light on substances that–taken early enough–can protect their babies' health and development. For example, if prospective mothers took folic acid before they become pregnant, half of the neural tube defects that afflict babies each year could be avoided.[58] Good nutrition is always beneficial but is especially vital for women of childbearing age.

The case for preconception care is now sufficiently strong that some employers are beginning to provide it on-site. For example, a Chicago Bank, First Chicago NBD, offers on-site preconception health risk assessment and prenatal education. The program has resulted in substantially fewer C-section rates (28 percent vs. 19 percent) and a slightly lower rate of low birth weight (4 percent vs 3 percent). The bottom line: shorter disability absences and a 24-percent drop in health–care costs per delivery.[59]

Drug and Alcohol Treatment. Prospective parents need to know about the risks of substance abuse before they conceive. Women who are dependent on drugs or alcohol during their childbearing years,are in urgent need of treatment for their own sake and that of their babies. This is especially important in light of new research on fetal brain development. Scientists now know that crucial phases of brain development take place in the first weeks of pregnancy, when women may be unaware that they are expecting. Just weeks after conception, certain cells must make their way to their predetermined position in the cortex–the part of the brain that is largely responsible for learning and reasoning. These cells must journey to the right place at the right time in the right order.[60] In the vast majority of pregnancies, this journey, which scientists call *neuronal migration*, occurs just as it should. Even in utero, however, a high-risk environment can jeopardize healthy development.

Research shows, for example, that if a fetus is exposed to cocaine while neuronal migration is taking place, some neurons may go astray. In some cases this may result in disabilities such as epilepsy. Prenatal exposure to cocaine has been associated with delayed or impaired motor development, as well as problems with attention, information processing, learning and memory–any one of which can jeopardize school readiness and success.[61] These findings are particularly disturbing in view of evidence suggesting that a significant percentage of women who receive care in inner-city clinics–in one study as many as half–have used cocaine or crack during their pregnancies.[62]

Using cocaine and other drugs during pregnancy is obviously very hazardous, but personal habits that may seem less risky such as smoking and drinking also jeopardize healthy development. Babies born to alcoholic mothers are at the risk for developing fetal alcohol syndrome which can give rise to a number of serious impairments, including mental retardation, behavioral problems, and impaired linguistic, perceptual and fine motor skills. Researchers have estimated that 32 percent of infants born to heavy drinkers, and 14 percent of infants born to moderate drinkers, suffer serious impairments. Scientists suspect that factors associated with alcoholism—such as poor nutrition, smoking, and frequent falls—contribute to these poor results.[63]

Smoking Cessation. Smoking during pregnancy affects early development in other ways. Recent studies suggest that prenatal nicotine exposure may affect early brain development. A study of eight-year-old boys whose mothers smoked at least half a pack of cigarettes a day during pregnancy found that they were eight times more likely than boys in a comparison group to be identified by their teachers as having behavior problems.[64] According to another study, prenatal exposure to nicotine may affect attention and behavior regulation, and that in turn may undermine cognitive functioning and academic achievement.[65]

Prenatal Care. Studies consistently report that the most significant factors affecting a newborn's birth weight and general well-being are the health of the mother and the care she receives during pregnancy. When pregnant

women receive late or infrequent prenatal care, their babies are at risk. Adequate prenatal care not only promotes overall development and reduces risks for a variety of developmental disabilities, but it can prevent babies from suffering the effects of undetected and untreated maternal conditions such as high blood pressure.[66]

Women who have not stopped smoking, drinking or using drugs before conception need counseling and help to protect their babies. Some may need help with stress reduction. Research is beginning to suggest that prenatal stress can have a far–reaching impact on emotional development, lasting into adulthood, by affecting the endocrine system—one of the body's important regulatory mechanisms.[67]

Prenatal care also reduces the chances that a baby will be born with a low birth weight. This is a very important goal. In Florida and throughout the nation, low birth weight is the leading cause of infant death (before the age of one). Low birth weight presents immediate and potentially serious risks for a newborn; it also increases the likelihood that a baby will encounter problems in the future. When a newborn weighs in at less than 5.5 pounds, she is about three times more likely to encounter serious health and developmental difficulties, including chronic respiratory problems, hearing and sight deficiencies, and learning disabilities.[68] Given that low birth weight is associated with inadequate nutrition and maternal smoking (among other factors) both the need for and the potential impact of parent education is considerable.

Prevention During Infancy

Compared with other primates, human beings are born with very undeveloped brains. This helps to ensure the survival of our species. Other primates can only live in a particular environment, or niche, that meets their particular needs. But humans are much more flexible because our brains develop in the world, in contact with the environment. This helps individuals adapt to a wide variety of conditions and settings.

Parent Education and Family Support. For a newborn, "the world" means Mom, or whoever is the main caregiver. In study after study researchers have reached the same conclusion: children thrive when they have secure and loving relationships with the adults who care for them.[69] No responsibility is more awesome, no task more difficult, than raising a child. Parenting is an around-the-clock job requiring bottom-line responsibility and life-and-death decision-making. And yet mothers and fathers are expected to perform well with no experience, training or support. A recent survey conducted by Zero to Three confirms that few first-time parents feel fully prepared for their new role. The youngest and least financially secure feel particularly unprepared.[70] Parent education programs with proven effectiveness such as Healthy Families are therefore crucial elements in Florida's prevention strategy.

A growing body of research has begun to explore the impact of parent-child attachment on development and well-being throughout the life cycle. Several recent studies strongly suggest that the quality of a child's attachment to primary caregivers has a significant impact on social development and competency throughout life.[71] Secure early attachments may also be a key to preventing juvenile violence. Scientists have found that the quality of the mother-child bond has a strong, sustained impact on a child's regulatory capacities, particularly the ability to display and modulate emotions.[72]

Finally, a secure early attachment appears to make children more resilient, helping them withstand stress and thrive despite the detrimental effects of poverty. When the research team of Egeland, Carlson and Sroufe looked into what made some children more resilient than others growing up in similar circumstances, they discovered that the most critical factor was children's secure attachment with their caregivers, followed by the level of caregivers' knowledge of child development, the availability of social support for parents/caregivers, and access to mental health services, particularly for those parents who had experienced abuse and/or neglect in their own childhoods.[73] Here again, prevention hinges on knowledge and access.

Parent education and family support projects, especially those that include voluntary home visits, have been shown to prevent developmental delays as well as social and emotional problems among children to mothers and fathers at risk for parenting problems. Such programs can help parents learn to read and respond to their young children's cues and signals, create safe and stimulating environments for their young children, make good child-care arrangements when they go back to work, and become more confident caregivers.

Well Baby Care. Prenatal care helps to ensure babies' healthy development, but it is not enough. Infants and toddlers need regular well baby care. They need regular check-ups and a full complement of immunizations. Their growth and development need to be monitored at regular intervals. Children who visit the doctor regularly get sick less often than children who do not.[74]

Well baby visits also provide teachable moments–especially for first-time parents. Doctors, physician's assistants, nurses and nurse practitioners can provide a great deal of information and advice, health and safety tips, and referrals to community services. In the process, they can help parents become more confident, competent mothers and fathers. Health professionals can also spot serious problems, or address minor ones before they become major. Recognizing that all families need consistent access to medical care, preventive services and parenting advice, many pediatric and family practices are including professionals trained in child development on their staffs.

These preventive services make tremendous sense, but some families cannot take advantage of them. Nearly one in five of Florida's children has no health insurance. Most are seen by health professionals only when a stomach ache or fever is serious enough to warrant a visit to the emergency room.

Breast-feeding. The January 1998 issue of *Pediatrics* featured the results of an 18-year study of the long-term benefits of breast-feeding. The study found that breast-feeding is associated with "small but detectable" increases in cognitive ability and educational achievement. The study, which followed one hundred New Zealand children, found that in relation to a comparison group, babies who were breast-fed for eight months or more scored higher on IQ tests; demonstrated increased reading comprehension, mathematical ability and overall scholastic ability; received higher teacher ratings in reading and math; and achieved higher scores on high school exit examinations.[75]

Many parents appreciate the advantages of breast-feeding, including the fact that breast-fed babies benefit from their mothers' stronger immune systems. But many find it difficult to continue nursing their babies once they go back to work. And today, nationwide, more than half of all mothers with babies under the age of one work outside of the home. Although 55 percent of working mothers breast-feed their infants, those who work outside the home tend to stop sooner than those who are not employed. Only 10 percent of working mothers continue nursing for six months after birth, compared to 24 percent of non-employed mothers.[76] Some employers have launched programs that enable nursing mothers to feed their babies at on-site, child-care centers or to express and store breast milk during the work day in "lactation rooms."

Building Early Language Skills. Many aspects of an infant's surroundings affect brain development and intellectual growth, including the linguistic environment. New research shows that children pay close attention to the language they hear beginning in the first months of life. By six months they already show a preference for the sounds associated with their native language; they tune in to native sounds and tune out other languages. By the time children reach their first birthday, their brains are already starting to map the sound structure of their native language.[77]

Early language learning is bolstered by the special ways that adults speak to babies and young children, commonly known as "parentese." When adults talk to children they tend to speak more rhythmically and more slowly; they exaggerate phonetic shifts; they use simpler grammar and vocabulary. Through these everyday exchanges, children learn not only about language, but about emotional contact and social relationships.

Just as language processes in infancy are influenced by social exchanges with parents and caregivers, so is later language development and competence. One study found that when mothers spoke to their infants regularly, their children learned almost 300 more words by age two than did those children whose mothers rarely spoke to them. Even more striking, the study found that simply being exposed to language was not enough; for those infants whose mothers rarely spoke to them, but who frequently listened to television or to adults talking among themselves, there was little benefit by the age of two.[78]

Research suggests that regular parent-child interchanges during the first year not only provide valuable learning opportunities, but lay the foundation for later achievement. One recent study of parent-child interaction found that compared with other children, those whose parents talked to and interacted with them more had a stronger grasp of the conceptual possibilities of language and were better problem solvers when they reached elementary school.[79] Reading aloud to children has also been shown to contribute significantly to school readiness.[80]

Reducing Risks for Children of Teen Mothers. When children have children, both mothers and babies are at risk–physically, developmentally, emotionally, academically and financially. Research shows that teenagers who are not faring well in school and have lower educational aspirations are more likely to have sex during adolescence than those who are doing better in school and have higher hopes for the future. A key strategy for reducing early childbearing is to give young people the services, the motivation and the sense of hope needed to postpone parenthood; young people need other ways to gain status and assert their adulthood. In this sense, education reform and economic development are keys to lowering the rate of teen parenthood.[81]

But once teen mothers have given birth, how can they be helped to take good care of their children and postpone subsequent pregnancies until their twenties? Studies have shown that early intervention programs for young mothers that begin during pregnancy can achieve these goals while reducing the incidence of abuse.

For example, the Prenatal/Early Infancy Project provided home visits by nurses to 400 families in Elmira, New York, beginning during pregnancy and continuing until the children's fourth birthdays. About 85 percent of program participants were low-income, unmarried teenagers who were pregnant with their first child. The program was found to reduce the rate of verified cases of neglect and abuse by 80 percent, lower the rate of second pregnancies by 42 percent, and increase the number of years that the mothers participated in the work force by 83 percent. Follow-up studies also indicated that the program more than paid for itself; 80 percent of the cost savings came from reduced welfare costs and food-stamp expenditures. Most importantly, the effects of participation in the Prenatal/Early Infancy Project were found to be long-term. Fifteen years later, the researchers found that in relation to a comparison group, program participants had less reliance on welfare, fewer subsequent children, fewer arrests and significantly lower rates of child abuse.[82]

Prevention Throughout Early Childhood

A child's first birthday is a poignant event. The developmental leaps of a child's first year are nothing short of spectacular. But the milestones that lie ahead are equally important. Children's needs change dramatically during the toddler and early childhood years. With mobility comes the need for greater vigilance to prevent accidents and injuries-both at home and in child-care settings. With rapid cognitive growth and the emergence of new language skills, children need different kinds of stimulation. As children's experiences with and in the world become more complex, they must be adequately equipped to handle the stress that is inevitable in daily life. And as children develop, parents must ensure that the child care and early education arrangements they make are safe, stimulating and supportive.

Preventing Accidents. Preventable injuries account for 92 percent of deaths of young children in Florida.[83] This fact is all the more tragic because most of these injuries are preventable with safety measures such as “child-proof”

households, seat belts in cars, bicycle helmets, and child-proof fences and gates around swimming pools. Community-based prevention approaches such as the National 4-H Council's Communities for Child Safety-appear to be helpful. A national campaign known as Healthy Child Care America has promoted preventive safety measures in child care settings.

Preventing Cognitive Delays and Mental Retardation. Parents are their children's first and most important teachers. Virtually all parents want to succeed in this role, but those with little education are clearly at a disadvantage. Statistics bear this out. Parents' education level is one of the best predictors of children's school success. Moreover, children, regardless of race, who are born to mothers with less than 12 years of education are four times more likely to have developmental delays so severe that they are considered to have mental retardation. For this reason family literacy programs, which emphasize adult education for parents along with preschool education for children, are a particularly important way to prevent developmental delays and school failure.[84]

These programs, like other parent education programs, can broaden parents' knowledge, provide positive academic and social experiences that can help them support their children's achievement, and give them the tools they will need in coming years to help their children with homework. But just as important, they can help parents understand the kinds of day-to-day interaction and stimulation that foster young children's cognitive growth and lead to school success: holding and soothing; talking and reading; singing and playing; and exploring new places and ideas. These interactions may seem "natural," but parents who are perpetually rushed and under stress may not give young children all of the intellectual stimulation and emotional support they need to enter kindergarten "ready to learn." For example, according to Starting Points, a 1994 Carnegie Corporation of New York report on meeting the needs of young children, only half of the nation's infants and toddlers are regularly read to by their parents.[85]

Finally, parent-education programs can raise parents awareness that children can be overstimulated or overexposed to harmful stimulation, including both real-life and media-generated violence. Several neuroscientists have theorized that the combination of too little healthy stimulation and too much harmful stimulation prevents the formation of vital brain connections and hinders children's ability to manage stress and process information.[86]

Preventing Child Maltreatment. In 1994 there were more than 168,000 reported cases of child maltreatment in Florida. This figure reflects both abuse and neglect–and both can jeopardize brain development. Nationwide, 45 percent of the 2.7 million children who were reported to be abused in 1990 were cited as victims of neglect.[87] In an overview of child neglect, the research team of Martha Farrell Erickson and Byron Egeland found that the impact of emotional neglect (which they also characterize as "psychologically unavailable parenting") was more profound than either physical neglect or any other type of maltreatment. Recent research suggests that parents are more likely to subject their children to neglect when they lack understanding of their children's behavior and the importance of the parent-child relationship; when they experience a high level of stress in their daily lives; when they are socially isolated or lack adequate support; and when they themselves have histories of neglect or inadequate care. Moreover, numerous studies of child abuse have found that children who have been maltreated, including those who have been neglected, tend to have insecure or anxious attachments with their primary caregivers. Family support programs that address these issues, including home visitation programs, can help to prevent abuse and neglect. Since neglect takes many forms and neglectful parents have an array of underlying problems, prevention programs are most effective when they are flexible and can tailor their strategies and services to the needs of diverse families.[88]

Reducing Stress. A number of recent studies have focused on the impact of stress and trauma on the brains of young children. The findings are consistent: young children who have experienced prolonged stress and/or trauma are at risk for long-lasting neurological vulnerabilities which can put them at risk for drug abuse, teen pregnancy and a range of psychiatric problems later in life.[89]

According to psychiatrist Bruce Perry, "The experience of the traumatized child is fear, threat, unpredictability, frustration, chaos, hunger, and pain. Therefore, the traumatized child's template for brain organization is the stress response."[90] This means that traumatized children live in a persistent state of fear and react to stressors, both mild and severe, with similar behaviors.

The stress response occurs at several levels. At the physiological level, adrenalin surges, the heart pounds, blood pressure soars and muscles prepare for "fight or flight." At the hormonal level, the stress response spurs release of cortisol, a steroid hormone which helps the body respond to danger. Everyone produces cortisol, especially during certain times of the day, but severe trauma and stress can lead to abnormal, harmful cortisol cycles.

Recent research has also provided important clues about how to buffer children from the stress of life's unavoidable ups and downs. Dr. Megan Gunnar of the University of Minnesota has found that secure early attachment appears to have an "immunizing" effect, buffering children to some degree against the harmful effects of stress.[91] Studies by Bruce Perry and others have shown that early intervention can effectively short-circuit the stress response by preventing the reactions to the trauma from becoming a generalized state of being.[92] And researchers now believe that babies can learn to regulate their stress responses and older children can learn to reset their stress responses through loving experiences with nurturing caregivers.

IV. Recommendations: Invest UpFront

Support Responsible Parenthood

- Invest in preconception education, health care and counseling, including voluntary family planning.
- Improve parents' access to information and resources.
- Ensure access to high-quality, preventive mental health services for families, especially those designed to prevent child abuse or neglect.
- Expand access to family-support and home-visitation programs such as Healthy Families Florida.

Invest in Preventive Health Care

- Make health information and counseling available to all women of childbearing age.
- Ensure adequate prenatal care.
- Promote the benefits of folic acid supplements during pregnancy.
- Promote breast-feeding.
- Ensure adequate access to health care and coverage (with an emphasis on regular well baby care and immunizations).
- Ensure that mental health services are available to children under age 5 through both Medicaid and private insurance.
- Offer smoking cessation and drug and alcohol treatment programs geared to prospective or expectant parents.
- Ensure that prospective and new parents have access to critical information on child health and safety.

Support Community Mobilization Efforts

- Spread information about effective programs.
- Ensure effective coordination of existing programs.
- Support efforts by employers to implement family-friendly policies.
- Engage employers, faith communities, community-based organizations and other partners in prevention efforts.

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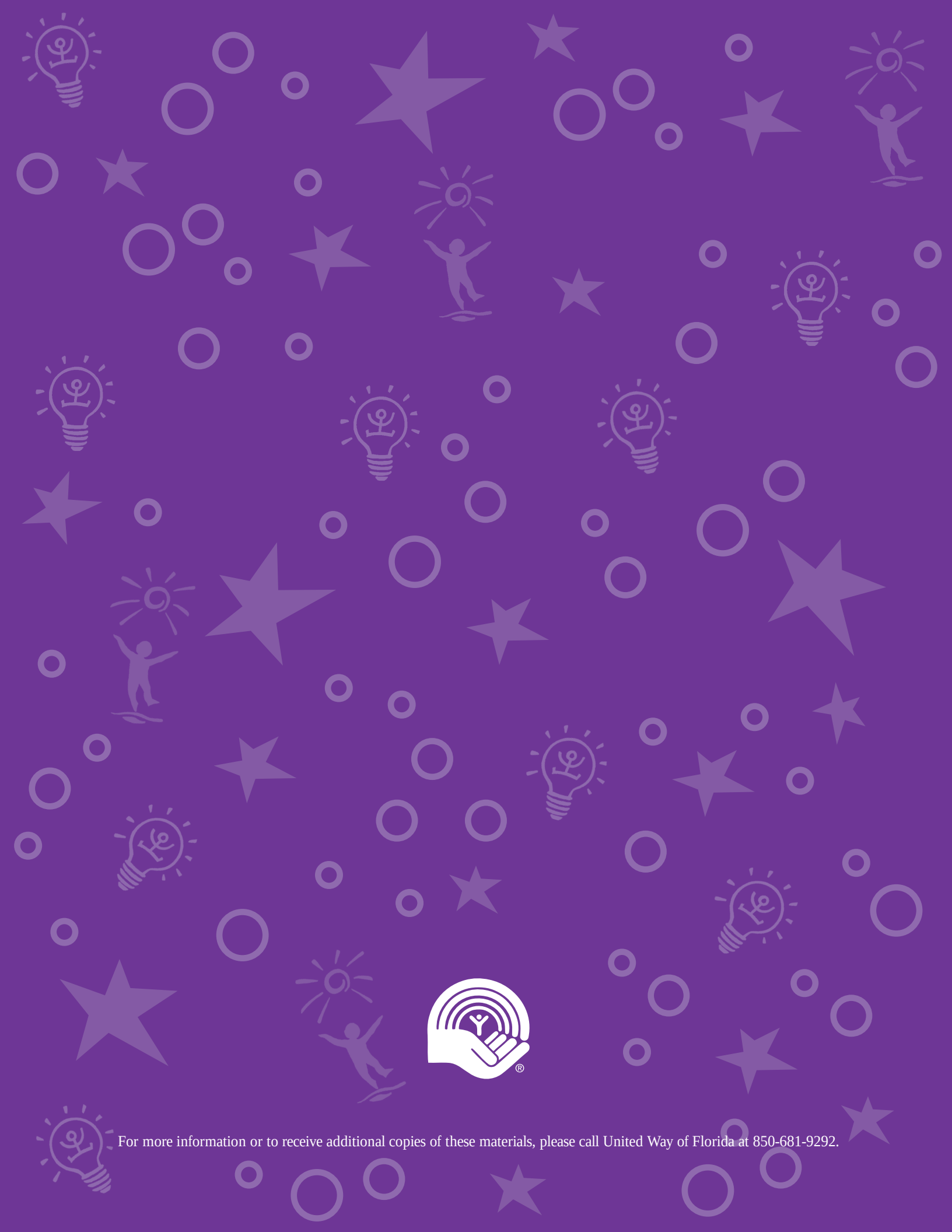

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