Better Brains, Better Futures:

Evidence-Based Policies for Supporting Children's Early Brain Development

BY
DANIEL ENGSTER, HOBBY SCHOOL OF PUBLIC AFFAIRS, UNIVERSITY OF HOUSTON
QUIANTA MOORE, BAKER INSTITUTE FOR PUBLIC POLICY, RICE UNIVERSITY

HOBBY SCHOOL OF PUBLIC AFFAIRS
UNIVERSITY of HOUSTON

RICE UNIVERSITY'S BAKER INSTITUTE FOR PUBLIC POLICY

This report is based on the Early Childhood Development and Policy Symposium held at the University of Houston on October 18, 2018. We would like to thank the speakers who presented at this Symposium for their valuable insights, including Flavio Cunha, Shay Everitt, Patrick Gill, Kim Griffin, Ellie Johnson, Leslie Wang, Cynthia Osborne, Deborah Phillips, and Stephanie Rubin as well as Representative Garnet Coleman, Representative Sarah Davis, Senator Larry Taylor, and Representative Armando Walle.

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Executive Summary

Children's brains develop at an extraordinary rate during the first few years of their lives, particularly from birth to age four. In normal conditions, a baby's brain will double in size during the first year of life and grow to 90 percent of its adult size by age five. The brain development that occurs during these early years provides the foundation, or hardware, for all future development. Children who grow up in healthy and supportive environments tend to develop more neural connections and demonstrate higher cognitive and socio-emotional intelligence later in life than those who grow up in lacking supportive environments.

Because of the importance of brain development in early childhood, economists have identified investments in early childhood development as one of the most cost-effective public expenditures. High quality early childhood policies can promote healthy brain development and avoid costly learning delays and health problems later in life. In the long-term, these policies have been tied to the creation of a capable and productive labor force. Every dollar invested in programs supporting early childhood development generates a return on investment of as little as $3 to as much as $17 per dollar invested.

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Researchers have identified several early childhood development programs that are especially important for stimulating brain development: home visiting programs, parenting education classes, quality child care, and preschool or pre-Kindergarten classes. Broader programs that mitigate poverty and food insecurity and promote safe housing and access to health care are also important in reducing the stressors that ultimately affect the parent-child relationship and subsequent brain development of young children, but are not addressed by this report.

Texas home visiting programs provide parents with information and resources so that they can provide the best care for their children. Texas supports a variety of home visiting programs that have proven successful in improving school readiness, decreasing child maltreatment, and

achieving other positive outcomes. The report offers a number of recommendations for improving the reach and effectiveness of these programs including:

- Increase funding for home visiting programs and expand services;
- Expand Family Connects;
- Train home visitors on how to screen for and address maternal depression.

Quality child care and preschool (or pre-Kindergarten) classes provide safe and stimulating care for children during the workday and are associated with increased school readiness and long-term socio-emotional and health benefits. Texas currently administers its subsidized child care program through the Texas Workforce Commission and funds half-day preschool through local school districts. The report offers a number of recommendations for improving the quality and effectiveness of child care and preschool in Texas including:

- Designate one agency to administer, fund, and manage programs that support early childhood education;
- Increase participation of child care providers in Texas Rising Star quality rating program and further incentivize quality care;
- Reallocate funds to the High Quality Pre- Kindergarten Grant Program.

Given the valuable insights that the science of early childhood brain development has provided to our understanding of not only child, but also adult outcomes, the report further suggests that individuals who work with families with young children, including employees of the Texas Workforce Commission and Department of Family Protective Services as well as home visitors, parenting educators, child care workers, and preschool teachers, should be encouraged to take a course on early childhood brain development.

I. Why Early Childhood Development Matters*

The strength and competitiveness of a state depends, in part, on the intellect and capacity of the next generation. Approximately seven million children live in Texas, which is 9.5% of the total children in the United States. The capacity of these children to be leaders in our future economy is heavily dependent on what happens to them during childhood, which is often driven by state and local policy. Thus, Texas state policy has a significant impact on the future of Texas.

Science demonstrates that the foundation of a person's ability to be innovative, creative, analytical and intellectual is established in the brain during the first few years of life. The brain controls every aspect of human life, from breathing to learning, behaving, adapting and thinking. Because the brain controls all aspects of human life, impaired brain function compromises physical, mental, and emotional health and overall productivity in society. Therefore, investments in early childhood to support healthy brains help to reduce Texas' costs in remediation, health care, mental health services, and increased rates of incarceration.

Policies that support healthy brain development in young children must address the root causes of suboptimal brain development, which requires a basic understanding of how brains develop. Brains develop in the first few years of life in a hierarchal fashion, with simple circuits developing first, and then more complex circuits building upon the simple ones. Neurons are the most important cells in the brain and connections between neurons, called neuronal synapses, are formed at the rate of more than a million new connections per second. These neuronal synapses are critical for healthy brain development. The rate of forming connections is fastest during the first few years of a child's life, and 90% of a person's brain is formed by age five. That means that the brain architecture needed to do well in school, control behavior, and have healthy socio-emotional health is already established by the time a child enters kindergarten. Children who have grown up in stressful or unstimulating environments during their first four or five years may have difficulty catching up with peers because the very architecture of their brains will be compromised. They will have fewer neural connections and, in extreme cases, markedly smaller brains.[1]

* This section of this paper was adapted from a brief written by Drs. Quianta Moore, Claire Bocchini, and Jean Raphael, titled, "Development of an evidence-based early childhood development strategy". Full brief can be found here https://www.bakerinstitute.org/research/development-evidence-based-early-childhood-development-strategy/

A combination of genes and early childhood experiences affect the nature and quality of how the brain architecture is built during the first few years of life. Moreover, there is a critical window of time from birth to age three when the rate of neuronal connections and modifications make the brain most susceptible to significant and irreversible modifications.[2] Thus, negative childhood experiences during this critical window can have life-long consequences. During this critical window of brain development, many external factors can influence, both positively and negatively, brain development. Each of these factors influence brain development by either stimulating neuronal connections or not stimulating them in which case they are eliminated.[3] Therefore, the environment in which a child grows during the first few years of life can either promote copious, strong neuronal connections or a dearth of neuronal connections.

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Below we discuss some of the environmental factors that influence brain development in early childhood prenatally to age four. While we recognize the most critical window ranges from prenatal to age three, we also acknowledge that the brain is still developing at age four, albeit at a much slower rate, and there are programs targeting children at age four that have shown positive outcomes. Moreover, as children typically depend on adults, and adults create the environment in which children live, we discuss the factors through the lens of a two-generation framework of maternal and relational pathways.

Maternal Depression

Approximately 38% of women in the U.S. have suffered from prenatal depression and there are many more women who may be at risk for it.[4] Additionally, prenatal depression may be underdiagnosed because symptoms of depression are attributed to physical and hormonal changes typical of pregnancy.[5]

Scientists postulate that depression causes abnormal programming effects in the hypothalamic-pituitary-adrenal (HPA) axis, which controls maternal stress hormones, leading to abnormally elevated stress hormones in depression. Fetal exposure to stress hormones can hinder a child's learning, memory consolidation and executive function later in life. Exposure to hormones in utero can also increase a child's inability to concentrate or pay attention.[6] Thus, prenatal depression can have life-long impacts.

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Prenatal depression also contributes to preterm delivery and lower birth weight.[7] Preterm delivery is, in turn, the leading cause of infant morbidity and mortality in the U.S., and a source of higher healthcare costs.[8] Additionally, premature children face a higher risk of developing cognitive and behavioral problems.[9] Thus, policies to increase the diagnosis and treatment of prenatal depression will prevent the adverse impact depression has on fetal brain development and ultimately reduce healthcare costs.

Postpartum depression is prevalent in Texas and can also affect the brain development of infants. It is estimated that 69,000 Texas women experience postpartum depression each year. Moreover, mood disorders account for 60% of the 100,000 women of childbearing age who were hospitalized with a mental health disorder in 2012. [10]

As discussed above, young children's brains need stimulating environments to thrive. Maternal depression hinders the mother from interacting with her child in a positive, responsive manner. Emotions such as sadness, fatigue, loneliness, lack of motivation and lability, all impede the mother from creating a stimulating environment, and maternal depression has even been associated with deprivation of the child's basic needs such as, food and nutrition. This leads to poor growth and has been associated with adverse behavior outcomes in children.[11] Moreover, children of mothers with postpartum depression have been shown to have language and cognitive delays.[12] Children living in poverty have a higher risk of experiencing the negative consequences of caregiver depression than children who do not.

Overall, maternal depression can negatively impact children's brain development in the first few years of life thus, policies to diagnose, treat and mitigate risk factors for maternal depression will

result in healthier brain development in children and reduce healthcare costs and behavioral and academic challenges.

Maternal Stress

Stress encompasses a diverse range of acute or chronic exposures.[13] There are many factors that contribute to maternal stress, such as poverty, food insecurity, neighborhood violence, and intimate partner violence. As with depression, maternal stress may lead to HPA axis alterations, which causes an abnormal increase in stress hormones. Exposure to elevated levels of stress hormones in utero, can cause over-arousal in the infant, which can have short and long-term impacts on cognitive development.[14] High prenatal stress, as with depression, also leads to low birth weight infants and preterm delivery, which puts the child at risk for developmental delay.[15]

Numerous studies have assessed the impact of maternal stress on neurodevelopmental and psychological outcomes. Infants of prenatally stressed mothers have been observed to have less positive interaction with their mothers, be highly reactive, show worse regulation of attention, and have worse language abilities.[16] Maternal stress has also been associated with sleep disorders, difficult temperament, poor cognitive performance, and increased fearfulness in infants and toddlers. Prenatal stress has also negatively impacted preschool children, as these have been found to have lower attention, hyperactivity, and behavioral and emotional problems.[17] Thus, children who were exposed to prenatal stress hormones are more likely to enter kindergarten with behavioral and learning challenges.

Maternal Physical Health

Adequate nutrition is critical to normal brain development during pregnancy and up to age two years old.[18] An essential mineral to brain development is, for example, iron. Iron deficiency during pregnancy and infancy have significant impacts on brain development. Fetal iron deficiency changes brain architecture, chemistry, and development.[19] Infants with iron deficiency anemia test lower in cognitive, motor, social-emotional, and neurophysiologic development. These differences persist even after treatment with iron.

Adequate maternal vitamin D levels is associated with improved neuropsychological development in children, including language, motor, and psychomotor outcomes.[20] Sufficient fatty acid intake, especially docosahexaenoic acid (DHA), is also important to brain development because fatty

acids serve a major role in the growth and function of brain tissue.[21] Long-term studies suggest positive effects from increasing DHA nutrition on mental and motor skill development in early childhood.[22] Reduced DHA is associated with impaired cognitive and behavioral performance.[23]

Two important points should be underlined about maternal-child nutrition: under-nutrition negatively affects brain development and the window of opportunity to correct it closes after age two.[24] It is therefore very important to ensure adequate nutrition for pregnant women and young children.

The Caregiver-Child Relationship

The interactions that infants and toddlers have with their caregivers has the largest impact on the number and quality of the neuronal connections that are made during the critical window of brain development. Stimulating environments promote the development of strong neuronal connections, and the absence of such environments causes the termination of the neuronal connections that are critical for cognition, intelligence, and overall functioning in society.

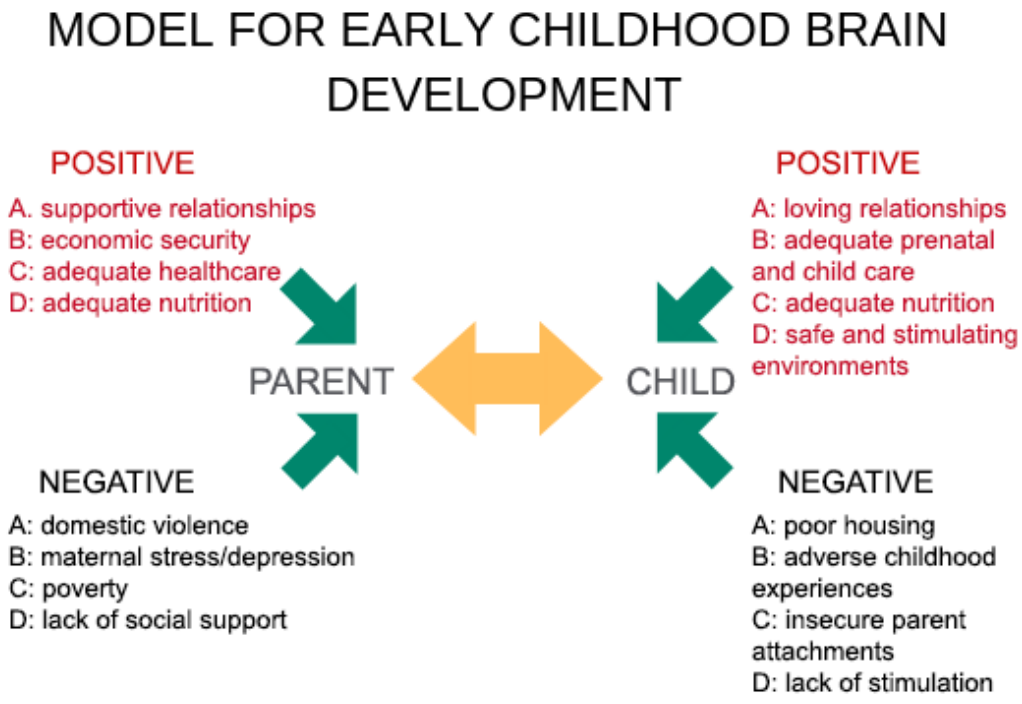
The parent-child or caregiver-child relationship is one of the most important experiences for brain development and cognitive outcomes in young children.[25] This relationship is vital for optimal brain development because of the dependency of neuronal connections on stimulating human interaction. Parental response to their child's verbal or nonverbal cues, frequently called "serve and return", influences whether neural connections are strengthened or eliminated.[26] An example of a positive serve and return scenario is a caregiver or parent's attentive response to a young child's cries through eye contact, acknowledging the child, and meeting the child's need. This type of positive interaction fosters neural connections that are important for communication and social skills.

Pleasurable neurochemicals are released in the child's brain when he or she engages in serve and return with a caring adult. These supportive relationships produce positive neurochemicals in the child's brain that can protect him or her from the negative effects of adverse childhood experiences such as, poverty or violence and toxic stress.[27] While the parent-child relationship continues to be important in developing optimal neuronal modifications throughout life, the significance of these relationships on the brain's architecture declines over time.

In the absence of supportive relationships, the child's "serves" to the adult caregiver go unreturned, and neuronal connections will be lost, resulting in impaired brain development. Impaired brain development increases the likelihood of poor outcomes in cognition, language, learning, and physical and mental health. In extreme scenarios when children are neglected or abused (i.e. physical, sexual, or emotional abuse) in the first years of life, their brains experience excessive termination of several important synapses in the brain. This results in permanent damage to the developing brain, and these children have been shown to have a smaller head size, less gray and white matter volume, abnormal brain structure, brain hypo-activation, increased incidence of mental illness, and a lower IQ. Unfortunately, these abnormalities cannot be fully reversed despite adoption into families with loving, responsive caregiver relationships.[28]

Impaired brain development increases the likelihood of poor outcomes in cognition, language, learning, and physical and mental health.

Figure 1



Even in less extreme home environments where children are not abused or neglected, the parent-child relationship can be affected by external factors that decrease the number of serve and return

interactions between parent and child (Figure 1). Poverty and the associated circumstances of poverty such as lack of social support, working multiple low wage jobs, inadequate housing, and neighborhood violence can put so much pressure on caregivers that they are unable to adequately engage in serve and return on a consistent basis. This puts children living in poverty at a greater risk of suboptimal brain development than children living in wealthier homes. The 30 million word gap described by Betty Hart and Todd Risley between children living in poverty and those in higher-income homes is not surprising considering the impact of poverty on the capacity of caregivers to engage in serve and return.[29] Policies that support financial security and safe and affordable housing will help at-risk children have healthy brain development and help to lessen the gap between children living in poverty and those who do not.

II. Economic Costs and Benefits of Early Childhood Development Policies

Investments in children's early brain development are beneficial both to the children themselves and society as a whole. High quality programs that support children's development tend to pay for themselves over time and even generate positive returns on investment. Children who receive high quality care during their early years are more likely to have higher levels of educational achievement and attainment, higher employment and earnings, and better health.[30] They are also less likely to need remedial education, to be involved in the criminal justice system, or to need social assistance as adults. Economists point to these investments as crucial in upcoming years for supporting a capable and productive labor force.[31]

Over the last decade, prominent economists such as the Noble Prize winner James Heckman, have demonstrated the fiscal benefits of investing in early childhood development.[32] Highlighting the importance of capitalizing on the sensitive periods of children's brain development, they argue that investments in early childhood development are smart expenditures of public dollars. If children's brains are not stimulated during the critical window of development, it can be very costly to make up this missed opportunity later. Although remedial programs in elementary or middle school can partially compensate for underdeveloped cognitive or socio-emotional abilities, however, these programs are usually more expensive and less effective than investments in the first few years of life.[33] Children who fall behind early are more likely to generate higher welfare and criminal justice costs for society as adults. From an economic perspective, it makes good sense to invest in early childhood development. The dollars spent on the early years save money over time and help society to avoid higher crime, medical, and other costs.

Research on specific early childhood development programs has found significant short- and long-term benefits and cost savings. The Nurse-Family Partnership home visiting program, for example, has been estimated to reduce pregnancy complications by 31 percent, preterm births by 15 percent, infant deaths by 45 percent, child injuries by 33 percent, child maltreatment by 31 percent, youth violent crime by 45 percent, and Medicaid spending by 8 percent (among other benefits).[34] The cost savings associated with these outcomes is significant. According to RAND economists, the Nurse-Family Partnership generates on average $3 in total benefits to society for each $1 spent and nearly $6 for each $1 spent serving higher risk families.[35]

Nurse-Family Partnership Home Visiting Program (estimates)	
Reduced pregnancy complications	31%
Reduced preterm births	15%
Reduced infant deaths	45%
Reduced child injuries	33%
Reduced child maltreatment	31%
Reduced youth violent crime	45%
Reduced Medicaid spending	8%

The Triple P - Positive Parenting Program has shown similar savings. By reducing substantiated cases of child maltreatment and child out-of-home placements, the Triple P can cover its startup costs in the first year of operation and then generate positive returns in subsequent years.[36]

Similar returns on investment have been found for quality child care and preschool programs. High quality child care programs have been estimated to return anywhere from $7 to $12 for each dollar invested from savings on special education, criminal justice, and social assistance over the lifetimes of the enrolled children.[37] Additional cost savings can be generated through higher female employment. In Quebec, for example, a new universal child care program was estimated to cover forty percent of the program costs in the first year just from the increased tax revenues due to higher female employment.[38] High quality universal preschool for three- and four-year-olds has likewise been calculated to have the potential to pay for itself within nine years and result in significant cost savings for governments in subsequent years.[39]

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Not all studies have found significant benefits or cost savings from early childhood development programs.[40] Lower quality programs often produce limited benefits and cost savings. Additionally, a continuity of high quality care also appears to be important for maintaining early gains. Many of the benefits of home visiting programs for children may fade out over time if children graduate from good home care to poor child care and low performing schools. Similarly, children who show

initial positive gains from high quality child care and preschool may lose this early advantage if they do not attend high quality elementary schools.

The mixed research results for early childhood development programs highlight the importance of continuing program evaluations and innovations. While research has made clear that high quality home visiting, parenting education, child care, and preschool programs can all support important benefits for children and generate significant cost savings, it is equally clear that not all programs are equally beneficial and cost effective. Pilot programs and evaluations are important for determining which components of programs contribute most to their success and why some programs succeed in one context but not another.

The remainder of this report focuses on home visiting, parent education, child care, and preschool programs. All these programs can contribute in significant ways to children's healthy brain development and social functioning. Other broader social programs are also necessary for supporting children's healthy growth. Children's healthy brain development depends on economic security, decent housing, access to health care, and a safe neighborhood and clean environment.[41] How exactly society should address these broader conditions is nonetheless very complex and admits to various different approaches. We therefore do not discuss policies for addressing these broader issues here. It does bear noting, however, that high quality child care and preschool programs can increase parents' economic self-sufficiency by freeing them up to work full-time during the day.[42] Some home visiting programs such as the Nurse-Family Partnership also aim to promote economic self-sufficiency. Thus, the programs discussed here can contribute to financial stability and better housing and other opportunities for families. Other measures are, however, also necessary.

III. Texas Home Visiting and Parenting Education Programs

Parents are the single most important influence on children during their critical first three years of life. How much parents speak and read to their children, for example, can directly impact language and reading competency later in life. State programs that empower parents to provide supportive and stimulating care to children during these early years can therefore be very important for maximizing their children's brain development and providing them a solid foundation for their future development.

One important state administered program that can positively impact brain development and health outcomes is home visiting. Home visiting programs provide parents or expecting parents with periodic in-home visits from early childhood and health professionals. Depending on the program, home visitors may provide health screenings, developmental assessments, information about parenting and child development, or referrals to community services. Some home visiting programs begin during pregnancy and continue until the child reaches age two, while others begin around age two or three and continue through kindergarten. In Texas, these programs are voluntary but most have eligibility requirements. All programs aim to help families reduce Adverse Childhood Experiences (ACES) that lead to adverse health, emotional, and economic outcomes and to increase positive caregiving practices that encourage cognitive, emotional, and physical health.

Texas Home Visiting supports three programs with federal, state, and private funding: 1) Home Instruction for Parents of Preschool Youngsters (HIPPY); 2) Parents as Teachers (PAT); and 3) Nurse-Family Partnership (NFP). The state also oversees Family Connects, a new home visiting program that currently operates in four counties, and Healthy Outcomes through Prevention and Early Support (Project HOPES), which provides comprehensive and community-based child abuse prevention programs for families with young children including home visiting. Other home visiting programs operating in Texas include Early Head Start (Home-based), Healthy Start, Healthy Families America, and AVANCE.

The three main Texas Home Visiting programs are all evidence-based, meaning they have demonstrated significant positive short- and long-term outcomes in at least one rigorous

randomized controlled research trial and meet other quality requirements.[43] Each program has different target populations, purposes, and approaches.

Home Instruction for the Parents of Preschool Youngsters (HIPPY) focuses on increasing children's school readiness by empowering parents with the knowledge and skills they need to successfully teach their children. The program serves children ages three to five years old and includes 30 one-hour weekly home visits and group meetings.

Parents as Teachers (PAT) aims to provide general parenting education, increase children's school readiness, identify development delays and health issues, and prevent child abuse and neglect. It serves a broad range of families, including pregnant women and families with children from birth through age five years. The program includes at least 10-12 home visits annually and 20-24 for higher risk families.

Nurse-Family Partnership (NFP) emphasizes maternal and child health. Its goals include improving pregnancy outcomes, enhancing child health and development, promoting parental economic self-sufficiency, increasing father involvement, and reducing domestic violence. The program is open to low-income, first-time mothers who are not more than 28 weeks pregnant. Nurses conduct a strengths and risk assessment and complete one-hour home visits as needed until the child is age two. It is the only program of the three used in Texas that requires the home visitor to have a bachelor's degree in nursing. The other models employ paraprofessionals or former program recipients to deliver the home visits.[44]

Family Connects is a new, voluntary, evidence-based home visiting program currently offered in four Texas counties: Bastrop, Bexar, Travis, and Victoria. The program is different from other home visiting models in a couple of ways: it is open to all interested families with newborns, regardless of their circumstances, and consists of a single home visit roughly three weeks after the baby's birth to share information about healthy practices, assess family health and other needs, and provide connections to community resources. In some cases, follow-up visits may be scheduled.

The diversity of home visiting programs in Texas is generally considered a good thing, since it allows communities to match the specific needs of their families to specific programs.[45] It is nonetheless important to align the strengths of different home visiting programs with community

goals. Too often, Cynthia Osborne writes, administrators assume that home visiting programs are more or less all the same and all address roughly the same problems.[46] Different programs serve different groups and have different goals, however, so it is important for communities to be clear about their goals and to choose the appropriate program for meeting them.

Texas Senate Bill 426, which established the Texas Home Visiting Program, identifies ten goals for Home Visiting programs. These goals build on the performance measures mandated by the Maternal, Infant, and Early Childhood Home Visiting Program for programs receiving federal funding.

Texas Senate Bill 426, which established the Texas Home Visiting Program, identifies 10 goals for Home Visiting programs:

1) Improved maternal/child health
2) Improved cognitive development of children
3) Increased school readiness of children
4) Reduced child abuse and neglect
5) Improved child safety
6) Improved social-emotional development of children
7) Improved parenting skills and nurturing and bonding
8) Improved family economic self-sufficiency
9) Reduced parental involvement with the criminal justice system
10) Increased father involvement and support

Research has found positive outcomes on one or more of these measures for all three of the Texas Home Visiting Programs. Most high-quality studies of home visiting programs nonetheless report null effects, and even when effects are positive, the impacts are usually modest.[47] This does not mean the programs are not working or not cost effective. As detailed in Section 2, even modest benefits can yield large economic returns. Moreover, the value of saving a child's life or increasing children's bonds with their parents is difficult to put a price on. Yet, it is important for states and communities to be realistic about what home visiting programs can do on their own and to ensure programs are being implemented as designed.

Table 1 provides a summary of the effectiveness of Texas's three main Home Visiting Programs. A favorable listing indicates that at least one rigorous research study has found positive results

for the program in that area. Assessments do not exist for all programs in all areas. Family Connects, which is just being implemented in Texas, has not yet been assessed, but it builds on a program in Durham, North Carolina which was found to promote improved parenting, improved maternal mental health, higher quality home environment, and less infant emergency medical care.[48]

Table 1[49]

Outcome	Home Instruction for Parents (HIPPY)	Parents as Teachers (PAT)	Nurse-Family Partnership (NFP)
Improved maternal/child health	Not measured	No effect	**Favorable**
Improved child development and increased school readiness	**Favorable**	**Favorable**	**Favorable**
Reduced child abuse and neglect	Not measured	**Favorable**	**Favorable**
Improved parenting skills and nurturing and bonding	**Favorable**	**Favorable**	**Favorable**
Improved family economic self-sufficiency	Not measured	**Favorable**	**Favorable**
Reduced parental involvement with the criminal justice system	Not measured	Not measured	**Favorable**
Increased father involvement and support	Not measured	Not measured	**Favorable**

Because different home visiting programs have different goals and approaches, it is hard to draw general conclusions about them as a whole. Researchers who have studied diverse programs nonetheless have identified a couple of important characteristics of successful programs. First,

home visiting programs are generally more effective when they focus on the most vulnerable subgroups in a population (e.g., parents living in poverty, with psychological difficulties or children with disabilities).[50] Secondly, larger positive effects are usually found when nurses and/or other professionals deliver home visiting services to families instead of paraprofessionals.[51]

Recommendations

1) *Continue to support a diverse portfolio of high-quality home visiting programs in Texas.*
   Communities where multiple home visiting models exist are more likely to be successful at meeting the diverse needs of families.[52] It therefore makes sense to continue supporting multiple programs rather than supporting just one.

2) *Continue to evaluate short- and long-term outcomes of programs and attempt to identify when and why programs are most effective.*
   It is important to evaluate program outcomes on a regular basis to ensure home visiting programs are achieving their goals. Just as important, however, is to understand when, why, and how programs succeed. One reason research findings on home visiting are mixed is because positive results from one home visiting model are often difficult to replicate in a different geographic or demographic context.[53] In order to understand why programs work, it is important to evaluate not just if they achieve an outcome but also how and why. This means studying the particular elements of programs in order to identify what is driving their success. As Osborne writes, "Without this peek inside the black box, communities do not know which elements of the model to faithfully replicate and which elements they could alter to fit their circumstances."[54]

3) *Ensure home visiting programs adhere as much as possible to model design.*
   Low adherence to model fidelity may be another reason for the mixed research results on home visiting programs.[55] Several studies of home-visiting programs have found that the planned curriculum and visit activities did not always follow the program model.[56] Client attrition from programs is also a problem.[57] If programs are to be successful, they need to remain faithful to their design and retain clients to the best of their abilities.

4) *Increase funding for home visiting programs and expand services.*

Although home visiting programs are not a magic bullet for curing all that ails children or families, they are still considered by experts to be "the most promising early childhood intervention we have."[58] Despite the state of Texas's generous support for home visiting programs, all state, federal, and private programs combined serve less than two percent of Texas families with children zero-three years old and only about 3.5 percent of families with at least two risk factors, including poverty, low parental education, having a teenage mother or father, preterm birth, poor maternal health, and parental underemployment or unemployment.[59] Given that the population of children under six in Texas is expected to increase by 8% in the next ten years and almost 33% over the next 30 years, expanded funding and services will be necessary just to keep pace with population growth.[60]

Home visiting programs can be expensive, but by helping to ensure children's early healthy development, they offset costly problems down the road including healthcare, social welfare, mental health, and criminal justice costs. Just as importantly, by assisting families with young children to get off to the right start, they help to ensure that children will have the greatest opportunity to become productive and responsible citizens and successful parents themselves.

5) *Expand Family Connects program.*

Ideally, every mother during pregnancy and at birth would receive one home visit devoted to parenting education, screening for potential risk factors, and connecting with necessary resources. Mothers with identified risks would then receive additional home visits commensurate with their needs.[61] The Family Connects program represents an important step toward the realization of this ideal, but currently has limited reach. Expanding the program in communities that are ready to support it represents an important step toward addressing the needs of all Texas children and families. Universal screening is important because, even though poverty, low parental education, unemployment, and the like are common predictors of family distress, research shows that many families without these markers can also benefit from greater support.[62] Family Connects can help to direct support to the families who most need it.

6) *Restore funding for Early Childhood Intervention (ECI).*

One group of families with especially pressing needs are those who have children with developmental delays, disabilities, or serious medical diagnoses. In Texas, the Early

Childhood Intervention program serves these families through home visits – though the program is usually treated apart from other home visiting program. The program has suffered budget cuts in recent years which has limited its ability to serve this population.[63] Increased funding for this program would represent valuable support for a home visiting program that serves some of Texas's most vulnerable children.

7) *Fund parenting education pilot programs.*

Since home visiting tends to be expensive, it is useful to consider ways to reach larger numbers of parents at lower costs and direct resources where they are most needed. Evidence-based parenting education programs offer one means to do this. Evidence-based parenting programs generally provide group classes to lower risk families and more individualized services to those at higher risk. Because they are able to serve more clients with fewer professionals, they have been identified as one of the most cost effective public policy solutions for improving child welfare.[64] The Positive Parenting Program (Triple P), for example, has been found to improve parenting skills, child development, maternal mental health, and the home environment.[65] In a randomized, controlled trial of Triple P in South Carolina, researchers further found that Triple P significantly reduced substantiated child maltreatment, child out-of-home placements, and child maltreatment injuries in counties where it was implemented.[66]

The Positive Parenting Program is currently operating on a small scale in several Texas communities. Evaluations of a Houston Pilot Program and the Dallas program have found positive results for parenting skills, positive parenting practices, overall parenting efficacy, and reductions in children's behavior problems.[67] Other outcomes have not been assessed. Lawmakers might consider building on the lessons learned from the Houston and Dallas programs to support a large scale pilot of the Triple P or other parenting education programs which offer cost-effective ways to reach larger numbers of parents and assess those in need of more individualized attention.

8) *Train all providers of home services to young children and parents in the science of early brain development.*

Understanding how the brain develops and the role that early life experiences play in shaping brain architecture are important for effectively serving parents and children. Even relatively short, continuing education courses in the current science of brain development

can provide keen insights to home visitors and their managers. The Palix Foundation also offers a free online Brain Story Certification course (19 modules that take about 30 hours total) that includes interviews with leading experts in neurobiology and mental health who explain the latest research on brain development. The course is designed for professionals seeking a deeper understanding of brain development and its importance for lifelong health, and is available for free at https://www.albertafamilywellness.org/training.

9) *Train home visitors on how to screen for and address maternal depression[68].*

As noted in Section 1, mental health problems, such as maternal depression, are common among women in the U.S., especially among low-income women exposed to stressful life events, low social support, child care stress, marital difficulties, and poverty.[69] One in six new mothers in Texas, for example, experience perinatal depression.[70] Children of depressed mothers are at heightened risk for a range of negative outcomes including abuse, neglect, accidental injury, developmental delays, cognitive impairments, and attachment insecurity.[71]

Home visitors are in a unique position to address maternal depression and other mental health problems. Unfortunately, they may overlook or ignore these conditions because they may not recognize them, know how to treat them, or know where they should refer clients.[72] Systematic screening and referral at time of home visitation enrollment can help identify women in need of support for depression or other mental health issues. Programs might also train home visitors on how to treat maternal depression and when they should make referrals to mental health professionals.[73]

IV. Early Childhood Education Opportunities: Preschool and Quality Childcare

Ensuring children have access to a safe, stimulating environment during the first few years of life is essential to securing a bright future for them. Rigorous studies over the last fifty years have demonstrated that quality, affordable early childhood education (ECE) reduces the likelihood that children will need special education services or be held back, and increases the likelihood of high school graduation and college attendance.[74] These effects last into adulthood, as these individuals are more likely to be healthy, earn more, and avoid contact with the criminal justice system.[75] Thus, the benefits of ECE can reduce state costs, saving taxpayers up to $17.00 per dollar invested in early education, and ensure a competitive future for Texas.[76]

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Poverty puts children at a greater risk of not receiving the necessary stimulation to support optimal brain development and this translates into not being ready for kindergarten. Because the root cause of lack of kindergarten readiness is embedded in brain development, children who start behind often stay behind.[77] Thus, in many states, public funds are used to support access to early learning opportunities, such as quality childcare and preschool. In Texas, state funds are used to support access to preschool for qualified three and four year olds. Federal dollars are used to support access to childcare programs. However, many states, including Texas, do not provide access for every child who could benefit from preschool or quality childcare. Additionally, not all early childhood education programs have the same long-term impact because the quality of programs differ. Thus, there are two key issues, cost and quality, which must be considered when developing policies in Texas to support access to ECE opportunities. Additionally, opportunities to support parents in interacting with their children is a critical component of supporting brain development, yet is often an unrecognized component of effective preschool and childcare programs.

Preschool

A. Cost

Currently, the State of Texas funds half-day public preschool for children ages three and four. Preschool is tuition-free for children from low-income, dual-language, foster, or military families. Children who do not meet these criteria can still attend preschool, but are required to pay tuition to their local school districts. State funds are allocated to fund public preschool through the Foundation School Program (FSP) and Pre-kindergarten Expansion Grants. Public preschool is administered by public school districts, and school districts can either provide preschool services directly or contract with a community organization to provide services. As of June 2007, 80% of school districts in Texas offer either full-day or half day preschool programs, which serves 46% of four year olds in the state.[78] The Texas Education Agency (TEA) defines a half-day program as a minimum of three hours and a full-day program as a minimum of seven hours a day.[79] FSP funds are allocated to school districts based on district level average daily attendance (ADA) aggregates. However, because Texas only funds half-day preschool, each half-day student counts as half of a student for the purpose of calculating the ADA.[80] Thus, school districts do not receive the same level of funding for preschool as they do K-12 programs, and as such school districts need to seek outside funding sources to meet the needs of their district. Additionally, the school districts that offer full-day preschool are able to do so through supplemental funds obtained from other sources.

B. Quality

The quality of preschool (Pre-K) programs correlates with achieving intended benefits from the investment. Texas has minimal requirements for defining quality of preschool programs. Criteria used by other states include, licensing requirements for the facility and teacher(s), length of school, nutrition, health, curriculum, parent engagement, and program assessment. In a review of preschool programs across the country, most had stringent education, licensure, and credential requirements for the lead classroom teacher and more flexible expectations of the assistant teacher. The maximum class size typically fell between 18 and 20 and the teacher/student ratio ranged between 1:8 and 1:10. Length of the school day varied between half and full. Individual programs defined "half" and "full" school days differently. For example, Oklahoma Free Pre-K and Pennsylvania Pre-K Counts offer full or half day options. Meanwhile, Tennessee Voluntary Pre-K is "full-day," defining it as five and a half hours and NYC Pre-K for All is also "full-day," but

defines it as 6 hours and 20 minutes. Florida Voluntary Pre-K has half-day options both over the summer and during the school year.

In 2015, the Texas Legislature, at the urging of Governor Abbott, passed House Bill (HB) 4 to create the High Quality Pre-Kindergarten Grant Program.[81] To qualify for the grant, districts must have demonstrated the ability to meet enhanced quality standards related to curriculum, teacher qualifications, academic performance, and family engagement. The grants were flexible enough that districts could use the funds to expand to a full-day program, reduce class sizes and staff-to-student ratios, or otherwise improve the quality of its preschool program. In an effort to identify optimal teacher-student rations, HB 4 also required all districts with a preschool program to report preschool class sizes and staff-to-student ratios for each preschool classroom. Unfortunately, in the 2017 legislative session funding for this grant program was cut. Thus, unless the Texas legislature prioritizes quality preschool, Texas will likely continue to receive low marks for quality from the National Institute for Early Education Research, and not yield all of the benefits (and savings) from its preschool program.[82]

C. Parental engagement

In a review of sixteen preschool programs across the nation, parental engagement or home visiting was found to be a component in twelve of the programs. For instance, the Oklahoma preschool program engages parents during home visits, parenting support/training, parent involvement activities and parent conferences.[83] ParentCorps and HIPPY are two specific home visit interventions that were paired with pre-K programs. ParentCorps demonstrated its efficacy through a pilot program at select urban schools.[84] It was associated with higher kindergarten achievement test scores, teacher-rated academic performance, and child behavior issues in school for students and improved effective parenting practices for family members.[85] HIPPY was also evaluated through a pilot intervention. Like ParentCorps, HIPPY's effects were observed both at school and at home. At school, children demonstrated increased kindergarten readiness, higher attendance rates, promotion to first grade, and higher math achievement as third-graders.[86] Parents reported improved self-efficacy and there were greater enrichment and more educational activities at home.[87] In Washington, DC, universal preschool with home visits not only improved school attendance, but also was correlated with increased maternal labor force participation.[88] Preschool programs with home visits also appeared to track outcomes for longer. For example, Michigan Great Start Readiness Program reported increased likelihood of graduating from high school on time and academic performance on state examinations at the end

of high school.[89] In the Oklahoma program, which includes home visits, middle schoolers performed better in mathematics assessments, were more likely to have taken advanced coursework, and were less likely to have been held back a grade since kindergarten.[90]

Both preschool programs with and without home visiting demonstrated clear gains in literacy and math skills. However, those without home visits appeared to measure a more narrow set of outcomes that focused on standardized literacy, math performance and kindergarten readiness. For example, the preschool program in San Antonio, which does not include home visits, reported outcomes of improved kindergarten readiness and closing the gap between a nationally representative sample of children and at-risk children in San Antonio.[91] On the other hand, programs like the Michigan Great Start Readiness Program, which does include home visits, reported similar academic and school readiness outcomes in their students, but also observed socio-emotional gains, such as increased creativity and demonstration of taking initiative.[92]

Studies have repeatedly demonstrated the benefits of preschool and the return on investment in societal gains. However, some studies have demonstrated a loss in academic gains by 3rd grade.[93] This loss in academic gains has been misinterpreted to mean that preschool has no effect and should not be prioritized in state funding decisions. This misinterpretation is due to the lack of understanding of the importance of brain development and the types of outcomes that should be invested in. While preparing at-risk children for kindergarten is important, and academic outcomes are a way to measure whether children are learning, academic outcomes do not measure the aspects of brain development that are critical for life-long success. Academic outcomes can be influenced by the quality of education children receive after they leave preschool, and thus are impacted by factors other than a child's brain development and ability to learn. On the other hand, outcomes such as social skills, behavior regulation and executive function have not been shown to wane over time.[94] In fact, these outcomes are better indicators of brain development and are also critical to functioning as a productive member of society in adulthood.

Childcare

A. Cost

Texas receives federal funds to pay for subsidized childcare for low-income families through the Child Care and Development Block Grant (CCDBG). The CCDBG allots hundreds of millions of dollars to states in order to increase access to and the quality and supply of childcare for low-income working parents.[95] Though many other states administer the CCDBG funds through health or educational agencies, Texas administers the funds through the Texas Workforce Commission.[96] Thus, childcare is seen as a function of enabling low-income parents to work, as opposed to an early childhood educational opportunity. This perspective has influenced the lack of prioritization of ensuring quality learning environments in child care centers receiving TWC subsidies, which disproportionately affects low income families. The average cost of child care is over $8,700 per infant and $6,700 for a four-year old.[97] That means that without subsidies from TWC, a single mother with one infant who is at 100% of the FPL would be using 54% of her income to pay for childcare.[98] Moreover, since only 13% of the childcare providers who accept TWC funds are designated as "quality" by the state's quality rating system, low-income parents have limited access to quality providers within the available childcare providers who accept TWC and cannot afford to pay for childcare outside of the TWC subsidies.[99] Thus, low-income families have limited access to early childhood educational opportunities for their children.

While parents may have an opportunity to have someone watch their child while they go to work, their child does not receive the necessary stimulation to ensure that he or she will have optimal brain development and have the chance to break the generational cycle of poverty. Additionally, even families with median incomes spend 15% of their earnings on childcare, compared to the 7% of earnings for childcare that is considered affordable.[100]. Lack of access to a quality child care center means that hundreds of thousands of Texas' children lack stimulating learning environments, which negatively impacts their ability to perform well in school and ultimately puts these children on a trajectory for being less prepared for the labor force and earning lower wages as adults resulting in continued cycles of poverty in Texas.

> The lack of affordability and lack of access to quality learning environments for at-risk families demonstrates a clear need for additional subsidies for low-income families and families above the poverty line.

B. Quality

The Texas Department of Family and Protective Services (DFPS) enforces the minimal Child Care Licensing requirements for childcare providers and includes standards for director and staff qualifications, curriculum, nutrition, and overall health and safety. These standards, while ensuring the health and safety of children, are not associated with learning or developmental outcomes of the children in these childcare facilities. The state quality rating system, Texas Rising Star (TRS), which operates out of TWC is more closely related to developmental outcomes. TRS has a two, three and four-star rating system, which is based on the cumulative points given to each category. There are five categories: 1) director and staff qualifications and training; 2) caregiver-child interactions; 3) curriculum; 4) nutrition and indoor/outdoor activities; and 5) parent involvement and education.[101] If a provider meets all of the required measures for a two-star designation, then the points-based system is used to determine whether the provider scores at a three-star or four-star level.[102] The category for caregiver-child interactions is the most germane to brain development and includes group size/staff ratios, warm and responsive style of the providers, language facilitation and support, play-based interactions and guidance and support for children's regulation. However, participation in TRS is optional, and only a small percentage of childcare providers go through the necessary steps to become TRS rated. TWC has tried to incentivize participation in TRS by giving childcare providers a higher reimbursement based on their rating (four-star receives highest reimbursement, and two-star lowest), but that has not significantly increased participation in TRS so far in part because higher reimbursement levels have not been sufficiently high.

C. Parental engagement

TRS supports parent engagement in childcare centers, but as mentioned above only a small number of childcare providers participate in TRS. Additionally, DFPS supports parent engagement through its Prevention and Early Intervention Division. Parental engagement and support are important components of any program because parents often spend the most time with their child and are the biggest influence on their child's brain development and subsequent outcomes. Thus, gains made in early childhood education programs are sustained and reinforced when parents understand and apply responsive parenting at home. Notably, some of the risk factors for suboptimal brain development, such as maternal depression and stress, are decreased when parents receive parental support.[103] If programs and quality ratings are designed with brain development in mind, then parental engagement and support would be a core component of early

childhood educational opportunities and there would be a central agency responsible for funding and monitoring ECE programs.

Recommendations

1) *Encourage every state employee whose job duties intersect with families with young children, including those who work for TWC and DFPS, to take a course on early childhood brain development.*

   If policy makers and those who administer state programs had a better understanding of the brain science, then decision and programs would be developed with the intended outcome of improving brain development of young children and Texas would realize the outcomes and cost-savings from the programs it supports. An example of this can be found in Alberta, Canada where the Palix Foundation funded the Brain Story Certification Course. This course was taken by policymakers in Alberta and is now mandatory for all agencies receiving government funds. As noted in Section 3, an online version of this course is available for free.

2) *Designate one agency to administer, fund, and manage programs that support early childhood education in order to increase efficiency, maximize outcomes, and ensure the prioritization of program components that support brain development.*

   Currently three different organizations, TEA, TWC, and DFPS, administer programs that are designed to improve the outcomes of children and support families. However, children and families do not exist in silos. The same family may come in contact with all three state agencies, and there are missed opportunities to have shared language and messaging, as well as capture data and savings when the agencies function independent of one another.

3) *Increase participation of child care providers in TRS by removing barriers to TRS enrollment such as cost and administrative burdens, providing additional funds to support additional staff and training, and ensuring reimbursement rates incentivize quality care.*

   The fact that low income families are essentially forced to send their children to low-quality child care providers, while their wealthier counterparts can afford to send their children to high quality childcare providers, increases the disparities between the rich and the poor

and contributes to generational inequality. Raising the quality of the childcare providers who participate in TWC should be of highest priority to close this income gap for future generations and ensure that children growing up in poverty have an equal chance to succeed as those who do not.

4) *Reallocate funds to the High Quality Pre-Kindergarten Grant Program*

The loss of funding to support high quality preschool in Texas was a huge setup for children in the state. Reallocating funds to support this program would help to ensure that vulnerable children receive the intended benefits from preschool and that Texas maximizes its return on investment. The quality of the preschool program is directly tied to the outcomes achieved by the program, and thus, without this additional funding, Texas' children and taxpayers not likely to receive maximum benefit.

5) *Integrate TWC child care data and Head Start data with TEA data on students enrolled in Texas public education.*

In 2006, the 79th Texas Legislature authorized the creation of three Education Research Centers (ERCs) to house Texas educational data and facilitate research that benefits all levels of education in Texas. The ERCs were to provide access to high quality, student-level data from the Texas Education Agency (TEA), the Texas Higher Education Coordinating Board (THECB), the Texas Workforce Commission (TWC), and other sources of educational information for the state of Texas.[104] The ERC currently includes data on children in public Pre-K through higher education (P-16) but does not include data on children who receive public child care subsidies or who attend Head Start programs. These data limitations hinder researchers from assessing the long-term benefits of early childhood development programs and identifying reforms to improve their benefits and cost-effectiveness. The integration of data on all early childhood programs would facilitated effective programming and cost-effective policy-making.

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