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Behavioral and Socioemotional Outcomes at Third Grade of the Legacy for Children™ Randomized Control Trial to Promote Healthy Development of Children Living in Poverty

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Behavioral and Socioemotional Outcomes at Third Grade of the Legacy for Children™ Randomized Control Trial to Promote Healthy Development of Children Living in Poverty

By

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Bachelor of Arts in Psychology, Certificate in Global Health & Health Policy
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2015

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An abstract of
A thesis submitted to the Faculty of the
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Abstract

Behavioral and Socioemotional Outcomes at Third Grade of the Legacy for Children™ Randomized Control Trial to Promote Healthy Development of Children Living in Poverty

By Caroline M. Barry

Background: Approximately 20% of children in the United States live in poverty, and racial and ethnic minority groups are at especially high risk. The intersections of disadvantage due to race, ethnicity, and poverty compound the challenges that children face as they grow and develop. Although growing up in poverty is linked with heightened risk of impaired development, parents can play a pivotal role in mitigating these effects. To leverage the influence of parental self-efficacy and social support on child development, the Centers for Disease Control and Prevention (CDC) developed Legacy for Children™ (*Legacy*). *Legacy* is a public health approach that promotes positive parenting by supporting healthy mother-child relationships, building maternal self-efficacy, and fostering social support networks in order to improve child developmental outcomes among families living in poverty.

Objective and Methods: The purpose of this study is to analyze behavioral and socioemotional outcome data from *Legacy* children at third grade. Results on behavioral, emotional, and social development outcomes from the intervention and control groups are compared at both sites of the randomized control trial: Miami and Los Angeles. Univariate and bivariate statistics provide descriptive data from each site and test for associations by group assignment. Multiple linear regressions and multivariable logistic regressions provide beta estimates and odds ratios controlling for baseline demographic variables.

Results: Children of *Legacy* mothers in Los Angeles were at lower risk for externalizing behaviors and poor adaptive skills than children whose mothers did not receive the intervention. There were no outcome differences by group assignment in Miami.

Conclusions: Group-based positive parenting interventions such as *Legacy* may have a sustained impact on children's behavioral and socioemotional development several years after intervention completion. Long-term, tailored efforts are likely needed in order to maximize benefits for families and children living in poverty.

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INTRODUCTION

Approximately 1 in 5 children in the United States lives in poverty (Koball & Jiang, 2018). This fraction is slightly higher (21%) for those under 5 years of age. Forty-one percent of children live in families that are low-income, i.e., with household incomes at or below 200% of the federal poverty level. These rates are higher among racial and ethnic minorities, with children from Black and Hispanic families more than twice as likely as their white counterparts to live in poverty (Koball & Jiang, 2018). The intersections of disadvantage due to race, ethnicity, and poverty compound the challenges these children face as they grow and develop. Given the high prevalence of people affected, it is unsurprising that the consequences of early childhood poverty pose a significant public health problem.

Data indicate that childhood poverty is associated with a range of adverse outcomes related to economic prosperity (Duncan, Ziol-Guest, & Kalil, 2010; McLaughlin & Rank, 2018; Holzer, Whitmore Schanzenbach, Duncan, & Ludwig, 2008), learning and academic achievement (Engle & Black, 2008; Lazar et al., 1982), cognition (Ayoub et al., 2009; Farah et al., 2006; Lazar et al., 1982; Walker et al., 2011), health and wellbeing (Daelmans et al., 2017; Halfon & Hochstein, 2002), and socioemotional and behavioral development (Bolger, Patterson, Thompson, & Kupersmidt, 1995; Grant et al., 2003; Werthamer-Larsson, Kellam, & Wheeler, 1991; Zilanawala & Pilkauskas, 2012). Children who grow up in poverty are more likely to live in poverty as adults (Duncan et al., 2010). Income-related disparities school achievement (Black, Hess, & Berenson-Howard, 2000) and performance on intellectual and language tests emerge within the first few years of life (Fernald, Marchman, & Weisleder, 2013). Growing up in a household

facing economic hardship also increases the risk of chronic stress and poorer overall physical health (Duncan et al., 2010; Evans & Kim, 2013). Problems with emotion regulation (Raver, Blair, & Garrett-Peters, 2015), social relationships (Bolger et al., 1995), and behavior (Bolger et al., 1995; Grant et al., 2003; Werthamer-Larsson et al., 1991; Zilanawala & Pilkauskas, 2012) have also been identified for youth who experienced childhood poverty.

To begin to address these issues, the Centers for Disease Control and Prevention (CDC) developed Legacy for Children™ (*Legacy*), an evidence-based public health approach to improve child outcomes among families living in poverty (Perou et al., 2012). Informed by elements of public health and developmental psychology, *Legacy* is a group-based intervention to promote positive parenting among mothers facing economic hardship. The guiding principle behind *Legacy* is that "all mothers can successfully parent, regardless of life circumstances, if given the opportunity to improve their parenting knowledge and their parenting behaviors while also acknowledging that it takes time and is a dynamic process" (Perou et al., 2012). According to the model, by enhancing parental self-efficacy, a mother can evaluate and achieve behaviors to positively impact her child's development. In addition to enhancing self-efficacy, the group environment allows mothers to foster a sense of community as they provide and receive peer support to fellow parents. Finally, the *Legacy* philosophy emphasizes that there are numerous ways to build positive mother-child relationships that have lasting effects for healthy child development.

From 2001 through 2009, *Legacy* was implemented and evaluated as a set of randomized controlled trials (RCTs) at two intervention sites: Los Angeles (UCLA) and

Miami (Perou et al., 2012). *Legacy*'s theoretical foundation and study aims were informed by review of early intervention research as well as input from public health experts and developmental psychologists. Study aims included:

a. To document the implementation process and evaluate intervention fidelity.
b. To determine and compare the relationships between self-efficacy, sense of community, and mother-child interaction in the intervention versus comparison groups.
c. To reassess the intervention's goals as they relate to developmental outcomes (related to cognition, language, socioemotional development, and behavior) of children whose mothers are in the intervention versus comparison groups.
d. To analyze mothers' responses to the intervention and how specific components influenced intervention quality.
e. To analyze the costs and benefits of the program implementation (Perou et al., 2012).

Results on child cognitive outcomes (Perou et al., 2019) and socioemotional and behavioral development (Kaminski et al., 2013) through child age 5 indicate that *Legacy* may have a positive impact on mothers and children living in poverty. Further, to support these outcomes, a process evaluation using qualitative data from participating mothers revealed positive perceptions of the program and application of learned parenting skills (Hartwig, Robinson, Comeau, Claussen, & Perou, 2017).

These findings are promising and speak to *Legacy*'s effectiveness in several domains; however, both sites have collected additional data on child socioemotional and behavioral outcomes since the preliminary report published in 2013 by Kaminski and

colleagues. Using updated, age-appropriate measures, the current study reports on child socioemotional and behavioral outcomes at third grade, stratified by site. Measures included in the present analyses used self-report, maternal report, and child performance tasks to assess facets of child socioemotional and behavioral development, such as attention, internalizing and externalizing problems, behavioral symptoms, depressive symptoms, emotion regulation, anger management, empathy, and socialization among peers. In order to evaluate *Legacy*'s effectiveness as a public health approach to prevent problems in these areas, results from treatment versus comparison groups are reported.

Theoretical Framework

The theoretical framework is a crucial component of research, as it provides the foundation for a study or intervention design. It structures, supports, and anchors the study's rationale, purpose, and significance (Osanloo & Grant, 2016). For *Legacy*, in conjunction with a robust evidence base on poverty and child outcomes, Albert Bandura's Social Cognitive Theory (Bandura, 1977, 1986) provides a framework for the study design and intervention development.

Social Cognitive Theory is a modified version of Social Learning Theory, which posits that human learning happens in a social context through active and shared interactions between the individual, environment, and behavior (Bandura, 1977, 1986). A key concept central to Social Cognitive Theory is self-efficacy. Bandura defines self-efficacy as a person's beliefs about their ability to perform behaviors and make adjustments to achieve desired objectives (Bandura, 1997). In other words, high self-efficacy reflects a strong belief in one's power to effect change through actions. According to Bandura, the four main pathways for increasing self-efficacy include:

mastery experience, social modeling, improved well-being, and verbal persuasion. Mastery experience refers to a growing personal history of success through persistent effort. Social modeling refers to repeatedly observing successes of others going through similar circumstances. Improved well-being refers to strengthened mental, emotional, and physical health. Lastly, verbal persuasion refers to a person having others convince them of their own ability to succeed (Bandura, 1999). In line with Social Cognitive Theory, as each of these increases, so too does a person's self-efficacy.

Legacy operates by boosting maternal self-efficacy. Maternal self-efficacy specifically refers to a mother's perceived ability to assess her own behaviors and modify them in a way that positively impacts her child's development (Bandura, 1977; Brody, Flor, & Gibson, 1999). The *Legacy* intervention philosophy promotes the idea that if mothers are provided with an opportunity to learn parenting skills, develop confidence in their parenting skills, and improve parenting behaviors in an environment with continued support from peers, then they will be able to positively influence their child's development. In addition to social support, the group setting allows for sharing stories of mastery experience, social modeling, and verbal persuasion among participating mothers (Perou et al., 2012).

In the development of public health programs such as *Legacy*, theoretical application has its strengths and limitations. A strength of Social Cognitive Theory in this context is its flexibility among many levels of the social-ecological model in describing human behavior change (LaMorte, 2018). However, its limitations include a focus on learning processes without regard for biology, hormones, emotions, motivation, and other factors pertinent to human behavior change. Social Cognitive Theory's broadness also

makes it difficult to operationalize in its entirety (LaMorte, 2018), which is why the present study focuses specifically on the concept of self-efficacy as a mechanism of change in intervention design. While theory can provide the foundation for research design and intervention, one theory alone cannot always capture the full scope of a complex human experience such as poverty. For this reason, the present study also incorporates existing knowledge from the evidence base on poverty and early child development.

LITERATURE REVIEW

The literature reflects a need for improved understanding of child development and effective interventions to prevent adverse outcomes, especially among vulnerable populations. To begin to address this need, the *Legacy* program was designed to work with families living in disadvantaged communities to promote healthy child development in the following domains: cognitive, language, socioemotional, and behavioral (Perou et al., 2012). Cognitive development consists of a child's growing processes for thinking, reasoning, remembering, and language (i.e., listening, recognition, understanding, speech production) (Neaum, 2010). Socioemotional development refers to a child's burgeoning capacity to a) understand, express, manage, and regulate emotions, b) foster satisfying, supportive relationships with peers and adults, and c) explore their own environment (Cohen, Onunaku, Clothier, & Poppe, 2005). Behavioral development consists of activity regulation and attention control (Rothbart, Posner, & Kieras, 2006).

Impact of Early Childhood Poverty

Addressing health disparities in early childhood is critical to supporting positive outcomes through adulthood (Robinson et al., 2017). Early childhood poverty is a

significant public health issue with impact at the individual, social, and economic levels and across the lifespan (Ayoub et al., 2009; Bolger, Patterson, Thompson, & Kupersmidt, 1995; Daelmans et al., 2017; Duncan, Ziol-Guest, & Kalil, 2010; Engle & Black, 2008; Farah et al., 2006; Grant et al., 2003; Halfon & Hochstein, 2002; McLaughlin & Rank, 2018; Holzer et al., 2008; Lazar et al., 1982; Walker et al., 2011; Werthamer-Larsson, Kellam, & Wheeler, 1991; Zilanawala & Pilkauskas, 2012). Downstream effects of poverty on child development include adverse outcomes related to economic impact (Duncan et al., 2010; McLaughlin & Rank, 2018), future learning and school achievement (Engle & Black, 2008; Lazar et al., 1982), health and wellbeing (Daelmans et al., 2017; Halfon & Hochstein, 2002), cognition (Ayoub et al., 2009; Farah et al., 2006; Lazar et al., 1982; Walker et al., 2011), and socioemotional and behavioral outcomes (Bolger et al., 1995; Grant et al., 2003; Werthamer-Larsson et al., 1991; Zilanawala & Pilkauskas, 2012).

Economically, the impact of childhood poverty is sizeable. In the United States alone, over 14 million children currently live in poverty (Koball & Jiang, 2018), and associated annual costs to the national economy are estimated above $1 trillion (McLaughlin & Rank, 2018). These costs of childhood poverty equate to approximately 5.4% of gross domestic product (GDP) and theoretically function by reducing economic productivity and the value of health while increasing crime and the cost of healthcare (McLaughlin & Rank, 2018; Holzer et al., 2008). Financial consequences of poverty affect the individual level as well. Compared to those raised in families with incomes at least double the federal poverty line by age 6, those raised in poverty during their early

years work significantly fewer hours, earn less than half as much, and receive significantly more food stamps as adults (Duncan et al., 2010).

Beyond economic arguments for poverty reduction, however, are arguments in favor of healthy human life, especially considering the effects of childhood poverty on a host of developmental outcomes. For one, alongside childhood poverty, health and wellbeing suffers. Research shows an association between disadvantage during early years and poor overall health, higher BMIs, higher levels of psychological distress (Duncan, Ziol-Guest, & Kalil, 2010), and chronic stress (Evans & Kim, 2013). Children raised in low-income households are at heightened risk for compromised immune function and infectious, respiratory, metabolic, and cardiovascular diseases (Cohen, Janicki-Deverts, Chen, & Matthews, 2010; Galobardes, Lynch, & Smith, 2008), although maternal nurturance can buffer against these downstream effects (Miller et al., 2011). The robust poverty-morbidity link is likely due to lack of early intervention and elevated risk of illness and accidents (Aber, Bennett, Conley, & Li, 1997; Wise & Meyers, 1988).

In addition to downstream impact on physical health, childhood poverty is associated with delays in cognitive development (Ayoub et al., 2009; Fernald, Marchman, & Weisleder, 2013; Hackman & Farah, 2009; Lazar et al., 1982; Walker et al., 2011). Historically, cognition has been a critical outcome of early childhood interventions for those living in poverty, with particular attention given to intellectual performance (Lazar et al., 1982). The disparities emerge within the first few years of life. As a function of socioeconomic status, longitudinal findings reveal significant disparities in language processing and vocabulary by the age of 18 months (Fernald et al., 2013). Poverty from ages 1 through 3 years has been linked with significant decline in cognitive

skills when compared to national norms, though children enrolled in Early Head Start programs performed better than their unenrolled counterparts (Ayoub et al., 2009). More broadly, reviews report consistent associations between childhood socioeconomic status and neurocognitive performance, including language and executive function (Hackman & Farah, 2009; Walker et al., 2011).

Relatedly, the association between poverty and low academic achievement has been well established (Brooks-Gunn & Duncan, 1997; Engle & Black, 2008; Hair, Hanson, Wolfe, & Pollak, 2015). The early emergence of school-related disparities can have lasting consequences. Growing up in a low-income family negatively predicts academic performance from 2 years of age through high school (Black, Hess, & Berenson-Howard, 2000) as well as educational attainment through early adulthood (Entwisle, Alexander, & Olson, 2005). School readiness upon kindergarten entry is a critical predictor of future academic success, including performance on achievement tests, grade retention, dropout, among others (Zigler, Gilliam, & Jones, 2006). Further, the timing of exposure and intervention is critical. Poverty during early childhood is linked with less time in school than poverty during later years, suggesting early childhood is a prime time for intervention to improve outcomes (Brooks-Gunn & Duncan, 1997; Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001).

Early childhood poverty also affects socioemotional and behavioral development, the focus of the present study. Socioemotional development encompasses a child's feelings and associated self-management and regulation, as well as the ability to empathize and interact effectively to build satisfying relationships with others (Thompson, 1993). Chronic poverty during childhood is linked with difficulty regulating

emotions and managing negative feelings, which could be explained in part by chaos at home and related parenting behaviors (Raver, Blair, & Garrett-Peters, 2015). For children, lower household income is linked with more depressive symptoms (Tracy, Zimmerman, Galea, McCauley, & Stoep, 2008) and lower self-esteem (Bolger et al., 1995). Children living in poverty are also more likely to experience peer rejection, less popularity, and more conflict in their peer relationships than children living without economic hardship (Bolger et al., 1995).

Behavioral development refers to a child's growing capacity to control their attention and activity (Rothbart et al., 2006), and its links with poverty are well-established (Bolger et al., 1995; Grant et al., 2003; Werthamer-Larsson et al., 1991; Zilanawala & Pilkauskas, 2012). Children raised in families facing material hardship display more externalizing and internalizing behaviors, including aggression, social withdrawal, anxious behaviors, and depressive behaviors (Zilanawala & Pilkauskas, 2012). Across 46 studies of children in poverty, the average effect sizes were 0.17 and 0.22 for externalizing and internalizing symptoms respectively (Grant et al., 2003).

Child behavioral development is related to aspects of the school environment as well. Not only are children raised in poverty more likely to attend schools with few resources (Moore, Redd, Burkhauser, Mbwana, & Collins, 2009), but childhood poverty is linked with conduct problems in the classroom (Bolger et al., 1995). Additionally, low achievement and poor behavior in the classroom are predictive of aggressive and shy behavior problems among students (Werthamer-Larsson et al., 1991),

Role of Parenting

The connection between childhood poverty and a range of adverse outcomes is robust; however, there is compelling evidence that positive parenting can buffer these effects (Miller et al., 2011). Poverty's link with child academic and socioemotional outcomes is partially explained by increasing risk factors and decreasing protective factors within the parent-child relationship (Engle & Black, 2008). Further, the relationship between current poverty and children's poor mental health is explained by negative parenting practices (Grant et al., 2003), such as mothers' diminished emotional responsiveness and frequent use of physical punishment (McLeod & Shanahan, 1993). Low-income families are more likely to use harsh, controlling parenting practices (Steinberg, Elmen, & Mounts, 1989), which are associated with parents' stress and poor emotional health (Dodge, Pettit, & Bates, 1994; Yoshikawa, Aber, & Beardslee, 2012).

Parenting interventions. Because developmental disparities emerge early, the most effective prevention efforts for children living in poverty are those that intervene early to promote learning and parent-child interactions (Walker et al., 2011). Early interventions work to promote positive development and prevent negative outcomes before they arise; from a public health perspective, prevention approaches have the potential to be more cost-effective and have sustained positive outcomes over time (García, Heckman, Leaf, & Prados, 2016). Specifically, prevention programs that target parenting skills can improve child outcomes in the face of adversity, as parents learn ways to foster safe and nurturing environments for their child's growth and development (Britto et al., 2017; Morris et al., 2017; Perrin, Leslie, & Boat, 2016).

A number of interventions that target parenting have shown at least short-term improvement in child cognitive, language, socioemotional, and behavioral outcomes

(Olds, Sadler, & Kitzman, 2007; Sandler, Ingram, Wolchik, Tein, & Winslow, 2015). In a meta-analysis of 77 evaluations of parent training programs to improve child behavior and adjustment, Kaminski and colleagues found that specific intervention components predicted larger effect sizes on parenting behaviors and children's externalizing behavior. Key intervention components included: enhancing positive parent-child interactions, increasing emotional communication skills, emphasizing the value of time out and consistent parenting practices, and devoting time during training sessions to practicing new skills with their children. Promoting cognitive, academic, or social skills development in children was also associated with positive outcomes (Kaminski, Valle, Filene, & Boyle, 2008).

Social support for parents. In addition to parent skills training, research points to the importance of social support for families living in poverty and its association with health and child behavior (Lee, Halpern, Hertz-Picciotto, Martin, & Suchindran, 2006). Poverty can lead to social isolation (Balaji et al., 2007), social relationships with high stress (Balaji et al., 2007; Bradley & Corwyn, 2002; McConnell, Breitkreuz, & Savage, 2011), reduced encounters and time spent with neighbors due to limited availability of safe areas in the community, and a diminished sense of community due to these factors (Griggs & Walker, 2008). However, increased social support can serve as a protective factor against harsh, chaotic, stressful environments to boost parents' mental and physical health, emotion regulation and coping behaviors, and self-efficacy (Leahy-Warren, McCarthy, & Corcoran, 2012; Lee et al., 2006; McConnell et al., 2011; Thoits, 2011). Higher perceived social support is also linked to positive parenting and fewer child

behavior concerns, and social support moderates the association between parenting stress due to financial hardship and positive parent-child interactions (McConnell et al., 2011).

Parental self-efficacy. Parental self-efficacy is defined as the extent to which parents believe they are able to successfully accomplish their responsibilities in the parenting role and have a positive influence on their children's behavior and development. Parental self-efficacy has been linked with a host of adaptive parenting skills, maternal stress and mental health, and reduced problem behaviors in children (Coleman & Karraker, 1998). Self-efficacy has been found to predict maternal discipline style and child conduct problems (Sanders & Woolley, 2005). For low-income families, the relationship between nurturing parenting and children's mental health is moderated by parental self-efficacy. One way in which poverty can affect child development is through compromising parental self-efficacy (Coleman & Karraker, 1998; Elder, 1995). Parental self-efficacy is a key determinant and focal point of the *Legacy* intervention.

Legacy for Children™ (*Legacy*)

Intervention Development

Given the strong association between childhood poverty and adverse outcomes, the potential for intervention impact at the parent level, and knowledge of key factors that influence parenting, the Centers for Disease Control and Prevention (CDC) developed the *Legacy* model. Legacy for Children™ (*Legacy*) is a public health approach that focuses on positive parenting to improve child developmental outcomes among families living in poverty. *Legacy* promotes positive parenting by supporting healthy mother-child relationships, building maternal self-efficacy, and fostering social support networks. The following description is based on the *Legacy* study protocol, Legacy for Children™: A

pair of randomized controlled trials of a public health model to improve developmental outcomes among children in poverty (Perou et al., 2012).

The *Legacy* philosophy is grounded in the evidence that parents influence children's development, social support can reduce parenting stress, and reduced parenting stress can lead to better management of child behavior, with strong effects for families living under stressful conditions such as poverty. According to Perou and colleagues (2012), those behind the program's development, *Legacy*'s five model assumptions include:

a. Mothers can have a significant positive influence on their children's short-term and long-term development.
b. The quality of the mother-child relationship is more important than any particular experience mothers provide to their children.
c. An important factor in parenting is the mothers' commitment and sense of responsibility for making deliberate and thoughtful choices in furthering their children's development.
d. Mothers can develop and sustain positive parenting best when they experience social support, such as that from other mothers who share a sense of parental responsibility.
e. There are multiple pathways to positive mother-child relationships (para. 11).

Legacy takes a group-based approach to create a sense of community among mothers and group leaders in order to positively impact parenting. This group-based model may be more cost-effective than alternative individual-based options for reducing behavior problems and developmental risk (Corso, Visser, Ingels, & Perou, 2015).

Specifically, *Legacy* aims to promote parental self-efficacy among mothers. *Legacy* promotes the idea that "mothers can effectively parent regardless of life circumstances, if given the opportunity to improve their parenting knowledge and behaviors while also acknowledging that it takes time and is a dynamic process" (Perou et al., 2012). *Legacy* posits if mothers have social support from a group and the opportunity to develop a sense of belonging with a community, they can more successfully change their parenting behaviors and maintain these changes to support healthy child development.

Legacy's five primary goals are derived from its philosophy and model assumptions. As outlined by Perou et al. (2012), intervention goals include:

a. To promote mothers' responsibility, investment, and devotion to parenthood.
b. To promote mothers' responsiveness and sensitivity in relationships with their child.
c. To support mothers in guiding their child's emotional and behavioral regulation.
d. To promote mothers' sense of community.
e. To promote mothers' positive influence of their child's cognitive and language development (para 12).

Curricula development. CDC selected the University of Miami (UM) and the University of California, Los Angeles (UCLA) for *Legacy* curriculum development and implementation through a competitive award process. Each site developed its own curriculum based on the *Legacy* philosophy, model assumptions, and goals. Hereafter, sites are referred to by city name (Los Angeles, Miami), and their curricula by institution (UCLA, UM).

Sites were free to design their own curriculum format as long as they met the five model elements and included three core activity types: 1) mother and mother-child group sessions, 2) one-on-one sessions, and 3) community activities. Mother-only sessions focused on community building within the group and in-depth coverage of key information. Mother-child sessions provided opportunities to practice and apply learned skills. One-on-one sessions allowed group leaders and mothers to meet individually to reinforce key concepts and address unique concerns; one-on-one time initially took place via home visits but was later delivered by setting aside individual meetings at group sessions. Finally, community activities were special occasions for fostering group cohesion and building a sense of community; activities were planned in part by the mothers and included birthday celebrations, trips to the park, library, restaurants, or other local events. Site staff developed their curricula to provide informational, emotional, and skills-based support to build parental self-efficacy and foster a sense of community among mothers (Hartwig, Robinson, Comeau, Claussen, & Perou, 2017; Perou et al., 2012).

At both sites, the core intervention component consisted of weekly group sessions with mothers, facilitated by a group leader with expertise in child development. Community activities supplemented these sessions. Mothers received transportation and child care or their cost equivalents, meals or snacks, and small incentives at both sites. Beyond the underlying framework and basic accommodations, the sites differed in their curriculum format, structure, initiation time, length, incentives, education, and staff training. Curriculum differences are described in Figure 1 and in more detail elsewhere (Perou et al., 2012).

Legacy Findings: Past & Present

Previous findings from *Legacy* are promising. Results on cognitive outcomes indicated that children of mothers who participated in *Legacy* at the LA site had significantly higher IQ (equivalent to 4 IQ points) and achievement scores at 2 and 6 years post-intervention, and IQ group differences not only persisted, but widened over time (Perou et al., 2019). Despite no cognitive or language group differences at Miami, the LA findings provide evidence of *Legacy*'s effectiveness in preventing cognitive delays among children living in poverty. Critically, the mixed outcomes across sites might be a consequence of demographic and risk factor disparities. To best understand root causes of these outcome disparities, additional research is needed.

Additionally, results on socioemotional and behavioral outcomes indicated overall benefit from the program through child age 5 years, though affected factors differed by site (Kaminski et al., 2013). Outcomes were assessed using the following parent-report measures: the Brief Infant-Toddler Social and Emotional Assessment (BITSEA), the Devereux Early Childhood Assessment (DECA), and the Strengths and Difficulties Questionnaire (SDQ). The BITSEA was used to assess attention, compliance, empathy, imitation or play, mastery motivation, and social relatedness, as well as problem behaviors on subscales for oppositional, inattentive, and hyperactive behaviors. The DECA assessed socioemotional competence using subscales for attachment, initiative, and self-control, as well as problem behaviors. Finally, the SDQ was used to screen for conduct problems, emotional concerns, hyperactivity, peer issues, and prosocial behaviors. Each of these measures were age-appropriate for the younger sample (child ages 1-5 years old). Results showed that in Miami, children of mothers in the program

were at lower risk for behavioral concerns (i.e., attention, aggression, and social withdrawal) at 2 years of age and lower risk for socioemotional problems (i.e., difficulty expressing emotions, difficulty with adult-child relationships) at 6 years of age. In Los Angeles, *Legacy* children were at lower risk for hyperactive behavior at 5 years of age. These findings were promising for the effectiveness of *Legacy* in reducing behavioral and socioemotional problems through age 5 years and the potential for longer-term impacts. However, a primary limitation of the study at these earlier time points was its reliance on parents' reports for all child outcomes (Kaminski et al., 2013). As *Legacy* children have grown up, self-report and performance measures were added to supplement parent reports and bolster the validity of outcome assessments.

To support some of these reported findings and better understand the mechanisms through which *Legacy* operates, Hartwig and colleagues conducted a qualitative study of participating mothers' perceptions of parenting. Following the intervention, focus group discussions with mothers from both sites revealed mother's description of understanding and use of positive parenting practices learned through *Legacy*. Mothers described showing commitment, striving to be sensitive and responsive to their child's needs, guiding child behavior and emotions, and helping their child learn (Hartwig et al., 2017). These discussions also revealed reported improvements in mother's self-efficacy (Hartwig et al., 2017), a guiding construct behind the *Legacy* program (Perou et al., 2012).

Past findings lead to the present study, which serves as a follow-up to the report on socioemotional and behavioral outcomes by Kaminski and colleagues (2013). The

current objective is to compare children's socioemotional and behavioral outcomes by mothers' group assignment (*Legacy* intervention or care as usual) at third grade.

STUDENT CONTRIBUTION

The Principal Investigator (PI) of this study conducted secondary data analysis on socioemotional and behavioral outcomes of children whose mothers participated in the Legacy for Children™ pair of randomized controlled trials (Clinical-Trials.gov #: NCT00164697) at in Los Angeles, California (LA) and Miami, Florida (Miami). The PI is a current Master of Public Health (MPH) candidate at Rollins School of Public Health, Emory University. She also works as a graduate student researcher on the Child Development Studies (CDS) team at the Centers for Disease Control and Prevention (CDC).

The PI's contributions to this project included: deciding which outcome measures to analyze, devising an analytic plan, analyzing the data, reporting results, development of tables and figures, and writing the manuscript presented in Chapter 4. Given the focus on socioemotional and behavioral outcomes, analyses focused on relevant, appropriate measures for which enough complete data were available. Behavioral measures included the Behavior Assessment System for Children, 2nd edition (BASC-2) (Reynolds & Kamphaus, 2004) and Continuous Performance Task (CPT) (Beck, Bransome, Mirsky, Rosvold, & Sarason, 1956; Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991). Emotional measures included the Child Depression Inventory (CDI) (Allgaier et al., 2012; Kovacs, 1992, 2003), Emotion Regulation Checklist (ERC) (Shields & Cicchetti, 1997; 1998), and Children's Emotion Management Scale: Anger (CEMS:A) (Zeman, Shipman, & Penza-Clyve, 2001). Social measures included the Children's Empathy

Questionnaire (CEQ) (Funk, Fox, Chan, & Curtiss, 2008) and a scale for Peer Social Support, Bullying, & Victimization (PSSB) (Ladd, Kochenderfer, & Coleman, 1996). Measures and scoring are described in Figure 2.

The PI's analytic plan and corresponding tables followed a logical progression from univariate analyses of demographic data, stratified by site, to t-tests for mean comparisons and finally, logistic regressions. Logistic regressions were performed using dichotomized cutoff scores for each measure in order to assess and report risk reduction on a broader level, in line with the aim of *Legacy* as a public health intervention. Further, the intended journal for first submission of this manuscript is the *American Journal of Public Health* (AJPH). AJPH published the CDS team's behavioral and socioemotional outcomes through 5 years of age, which reported odds ratios using dichotomized cutoff scores also.

Ethical Considerations

This study is a secondary data analysis of deidentified child socioemotional and behavioral outcomes data from a pair of randomized controlled trials (RCTs) in LA and Miami. The data set did not have identifiers or a key to link data back to identifiable information. Those responsible for deidentification were not members of the study team. According to a review of study materials, the Institutional Review Board (IRB) at Emory University determined that this study was exempt from IRB review as it did not meet the definition of "human subjects research" per university policies and procedures and federal rules (see Appendix A for IRB determination letter). The full protocol was approved and monitored by IRBs at the CDC, RTI International, UCLA, and University of Miami. All participating mothers provided informed consent. Mothers and children

received transportation to the assessment visit, and mothers received $100 at each assessment visit for their time and effort. The average assessment time was 2.5 hours.

Although the current study was exempt from IRB review, the PI took deliberate measures to ensure adherence to ethical principles during analysis and reporting. First, the PI completed CITI certification in Social & Behavioral Research. Additionally, in accordance with CDC guidelines, the PI signed a confidentiality agreement prior to accessing the data set. Finally, three PhD-level researchers, as well as experts from the Child Development Studies team at CDC, provided guidance and feedback regarding the use of appropriate analytic methods and accurate reporting of findings.

Legacy Intervention

The present study is a secondary analysis of Legacy for Children™ (*Legacy*) data collected at 3rd-4th grade (hereafter named the "third grade" timepoint), with a focus on children's socioemotional and behavioral outcomes. Data come from 364 mother-child dyads who participated in the *Legacy* randomized controlled trial (RCT) between 2001 and 2009 at LA and Miami sites. The CONSORT (CONsolidated Standards of Reporting Trials) flowchart (previously published elsewhere, see Perou et al., 2019) provides complete information on eligibility and retention through the current assessment timepoint.

Mothers were eligible for inclusion in the *Legacy* RCT if they were 1) at least 18 years of age, 2) resided within the intervention catchment area, 3) were able to speak and understand English, 4) intended to raise their child speaking English as their primary language, 5) received prenatal care, and 6) had income less than 200% of the poverty level as indicated by receipt of Medicaid, food stamps, or qualification for Temporary

Assistance for Needy Families (TANF). Due to intervention design, mothers were excluded if they were 1) expecting a multiple birth or 2) had existing substance abuse or mental health issues. The randomization ratio into intervention and comparison groups was 3:2 to protect against group-based attrition.

The two intervention sites created their own curricula and implementations based on the *Legacy* philosophy, goals, and core intervention components (see Chapter 2 for program overview). Site-specific community and demographic factors, in addition to pilot-testing, influenced curriculum development at each site. At UCLA, mothers participated in *Legacy* from the start of their third trimester of pregnancy through their child's third year of age (five prenatal sessions followed by nine blocks of 10 weekly group sessions). Weekly group sessions were approximately 150 minutes long and alternated between 1) mother-only time (to discuss milestones and options for parenting behavior, and to emphasize the importance of a mother's role in healthy child development) and 2) mother-child interaction time (to apply learned skills and strengthen positive parenting in a safe, supportive environment). The maximum number of sessions mothers could attend at UCLA was 101. *Legacy* at UCLA began with 12 groups of mothers recruited during pregnancy from Women, Infants and Children clinics, but due to attrition, groups merged to yield 7 groups at intervention close.

At University of Miami, mothers participated in *Legacy* from child age of approximately 6 weeks through 5 years. Weekly group sessions were approximately 90 minutes long and each session consisted of mother-only time, mother-child interaction time, and community building time. The maximum number of sessions mothers could attend at Miami was 250. *Legacy* at University of Miami began with 12 groups of

mothers recruited from two hospitals within three days of childbirth, but due to attrition, groups merged to yield 5 groups at intervention close.

Measures

Mothers' baseline assessments occurred prenatally at UCLA and within 6 weeks of childbirth at University of Miami. Reassessments occurred at both sites when the children were 6, 12, 24, 36, 48, and 60 months old, and again when they reached third or fourth grade. At the most recent time point (referred to as "third grade" assessment), the median child age was 9 years old at both sites (UCLA = 111 months; University of Miami = 113 months). Assessors were blinded to participant randomization. Efforts were taken to maximize retention over the course of the study, including transportation, child care, contact via phone and mail, and disbursement of $100 for mothers' participation at each assessment visit. At third grade, 63% (188/300) and 56% (176/315) of children completed at least one socioemotional or behavioral assessment at UCLA and University of Miami respectively. Accommodations were made to administer assessments in Spanish or Haitian-Creole for a subset of children at earlier time points; however, by third grade, all assessments were administered in English. Details on language accommodations are reported elsewhere (Perou et al., 2019). For the present analyses, measures of child behavioral, emotional, and social developmental outcomes are described below and detailed in Figure 2.

Behavioral Outcome Measures

CDC assessed child behavioral functioning and attention-related problems using two measures. The Behavior Assessment System for Children, 2nd edition parent rating scale (BASC-2) was completed by mother-report (Reynolds & Kamphaus, 2004). BASC-

2 is a valid, reliable 160-item assessment of multidimensional behavioral functioning for children ages 6 through 11 years. Subscales capture clinical features (Aggression, Anxiety, Attention Problems, Atypicality, Conduct Problems, Depression, Hyperactivity, Somatization, Withdrawal) and adaptive features (Activities of Daily Living, Adaptability, Functional Communication, Social Skills). Composite scales capture Attention Problems, Internalizing Problems, Externalizing Problems, Behavioral Symptoms Index, and Adaptive Skills. BASC-2 uses a 4-point Likert scale to rate each item according to frequency of the child's behavior (1=never, 2=sometimes, 3=often, 4=almost always). Example items include "acts without thinking" (Hyperactivity), "has a short attention span" (Attention Problems), and "shares toys or possessions with other children" (Adaptability). For this version of BASC-2, Cronbach's alpha is 0.85 (range 0.73-0.88), and test-retest reliability is 0.84 (range 0.65-0.87) (Reynolds & Kamphaus 2004). Internal consistency for the BASC-2 in this study was 0.91. Children are considered "at-risk" with T-scores ≥60 on clinical scales and ≤40 on adaptive scales. Dichotomous outcomes were created based on these cutoffs.

The second measure for behavioral and attention-related problems was the Continuous Performance Task (CPT). CPT is a computer program that assesses child performance directly by prompting them to press a button when shown a target stimulus (the letter X). The child must resist responding when shown other stimuli (other letters). Each letter is shown one-at-a-time for 250 ms, for a total of 360 trials. The test takes 14 minutes to complete. Scoring is based on detectability (i.e., responding when appropriate, a reflection of attentional capacity), hit reaction time (HRT) (i.e., speed and reaction time consistency), omissions (i.e., failing to respond when necessary, a reflection of

distractibility), commissions (i.e., responding when unprompted, a reflection of impulsivity), and perseverations (i.e., reaction times less than 100 ms, which indicate slow or repeated responses to previous stimuli or random or anticipatory responses, given normal expectations for human processing and reaction time). T-scores ≥60 for all variables indicate elevated risk for attention problems (Beck et al., 1956; Mirsky et al., 1991).

Emotional Outcome Measures

CDC administered the Child Depression Inventory-Short (CDI-S) to assess child depressive symptoms (Kovacs, 1992). This self-report measure was adapted from the original CDI, appropriate for youth from 7 to 17 years of age. CDI-S was developed by removing items with lower inter-item correlations from the original version. CDI-S has 10 items, each to evaluate a symptom of depression. Every item presents a set of 3 sentences of varying symptom severity from which the child is prompted to select the sentence that best describes their feelings over the previous two weeks (e.g., "I am sad once in a while," "I am sad many times," or "I am sad all the time") (Kovacs, 1992). Individual items relate to the following: 'negative body image', 'crying spells', 'feeling unloved', 'irritability', 'lack of friends', 'loneliness', 'pessimism', 'sadness', 'self-deprecation', and 'self-hatred' (Kovacs, 2003). Scores can range from 0 to 20, where higher scores reflect more depressive symptoms. Screens are considered positive if scores are ≥3 (Allgaier et al., 2012). A dichotomous outcome was created to capture those positive screens (i.e., meet clinical criteria for depressive symptoms). A meta-analysis of the short form's internal consistency across previous studies reported a Cronbach's alpha

point estimate of 0.77 (95% CI: 0.74, 0.80) (Sun & Wang, 2015); however, in this study, internal consistency for the CDI-S was 0.58.

Each mother also completed the Emotion Regulation Checklist (ERC), an assessment of their child's emotional expression and self-awareness, empathy, flexibility, anger regulation, and mood changes (Shields & Cicchetti, 1997; 1998). ERC is validated for assessment of children ages 6 through 12 years and has three subscales (Emotion Regulation, Lability/Negativity, Inappropriate Affect) with 24 items for which respondents rate their child using a 4-point Likert scale (1=never, 2=sometimes, 3=often, 4=almost always). Sample items from the Emotion Regulation (ER) subscale include "Can say when he/she is feeling sad, angry or mad, fearful or afraid" and "Is empathetic toward others; shows concern when others are upset/distressed." ER scores can range from 5 to 20, with higher scores indicating better emotion regulation. Sample (reverse-coded) items from the Lability/Negativity (LN) subscale include "Transitions well from one activity to another" and "Can recover quickly from episodes of upset or distress." LN scores can range from 4 to 16, with lower scores indicating better regulation. Sample items from the Inappropriate Affect (IA) subscale include "Responds negatively to neutral or friendly overtures by peers" and "Displays negative emotions when attempting to engage others in play." IA scores can range from 4 to 16, with lower scores indicating more appropriate affect. For the ERC subscales, internal consistency ranges from 0.83 (ER) to 0.96 (LN) with an overall Cronbach's alpha of 0.89 (Shields & Cicchetti, 1998). Internal consistency for the ERC in this study was 0.71.

The Children's Emotion Management Scale: Anger (CEMS:A) was used to capture mothers' ratings of their child's behavior when they are feeling mad. CEMS:A

uses a 3-point Likert scale (1=hardly ever, 2=sometimes, 3=often) to rate items such as "My child holds his/her anger in" and "My child gets mad inside but doesn't show it" (Zeman, Shipman, & Penza-Clyve, 2001). CEMS:A has three subscales (Inhibition, Dysregulation, and Emotion Coping). Subscale scores can range from 4 to 12, with higher scores indicating more inhibition, more dysregulation, and better coping, respectively. Although no previous report of reliability for the parent version could be located, developers reported Cronbach's alphas for the three subscales of the CEMS:A self-report, ranging from 0.62 to 0.77 (Zeman, Shipman, & Penza-Clyve, 2001). Internal consistency for the CEMS:A in this study was 0.57.

Social Outcome Measures

The Children's Empathy Questionnaire (CEQ) was administered to children to assess self-reported empathy towards others. CEQ is an 11-item reduced version of a measure originally designed to assess empathic attitudes in youth (Funk et al., 2008). Sample items include "When I'm mean to someone, I usually feel bad about it later" and "When I see someone who's happy, I get happy too." Respondents rate each item using a 3-point Likert scale (1=no, 2=maybe, 3=yes) to best describe their feelings. Possible scores range from 11 to 33, with higher scores indicating higher empathy. Internal consistency for the CEQ in this study was 0.72.

To report social behaviors at school, children completed a scale for Peer Social Support and Bullying (PSSB) with 18 items from three questionnaires by Ladd, Kochenderfer, & Coleman (1996). Child respondents rated each item using a 5-point Likert scale (1=never, 2=hardly ever, 3=sometimes, 4=most of the time, 5=always) to best describe their social experiences at school. PSSB has three subscales: Social Support

from Peers (SS), Perceived Victimization (PV), and Engagement in Bullying Behaviors (BB). Sample items (and associated subscales) include “Are there kids in your class who ask you to play with them?” (SS), “Does anyone in your class pick on you at school?” (PV), and “Do you pick on other kids in your class at school?” (BB). Mean scores range from 1 to 5, where higher scores on SS reflect higher social support, and lower scores on PV and BB reflect less victimization and bullying, respectively. Subscales have Cronbach’s alphas of 0.92 (SS), 0.81 (PV), and 0.78 (BB). Internal consistency for the PSSB in this study was 0.58.

Statistical Analyses

The PI ran statistical analyses using SPSS, Version 26.0 (IBM Corp., 2019). First, univariate analyses were performed for overall and site-specific demographic data, as well as descriptive statistics for outcome assessments. Assessment scores were then recoded to dichotomous outcomes according to recommended cutoffs, and frequency analyses were completed. Next, site-stratified (UCLA, University of Miami) bivariate analyses were performed to compare outcomes between groups. Raw outcome scores by group status (intervention vs. comparison) were compared with *t*-tests for continuous measures and chi-square tests for measures with clinical cut-offs using a conservative intent-to-treat approach (i.e., data was analyzed according to participants’ original randomization).

Then, regressions were run to predict outcomes based on intervention group while controlling for key demographic variables. Multiple linear regressions were performed to predict outcomes on measures with continuous scores (Emotion Regulation Checklist, Children’s Emotion Management Scale: Anger, Children’s Empathy Questionnaire, and

Peer Social Support and Bullying) based on group status. Multivariable logistic regressions were performed to predict adverse outcomes beyond the respective clinical cutoff points of the BASC-2, CPT, and CDI-S based on group status, reflecting the odds of meeting criteria for behavioral or socioemotional problems in intervention versus comparison groups. Covariates included information collected at baseline: mother's age at the time of child's birth, education, race/ethnicity, and child's gender. Results of logistic regressions are reported as odds ratios.

JOURNAL ARTICLE

Behavioral and Socioemotional Outcomes of the Legacy for Children™ Randomized Control Trial to Promote Healthy Development of Children Living in Poverty at Third Grade, Two to Six Years Post-Intervention

Abstract

Objective: To assess the longer-term impact on behavioral and socioemotional development of Legacy for Children™, a public health approach to improve child developmental outcomes among families living in poverty.

Methods: Mothers who were recruited prenatally or at the time of childbirth participated in *Legacy* randomized controlled trials between 2001 and 2009 in Miami, FL or Los Angeles, CA. Of the initial 574 mother-child dyads, 364 of them completed at least one behavioral or socioemotional outcome measure at the third-grade follow-up. Intent-to-treat analyses compared *Legacy* and comparison groups on behavioral and socioemotional outcomes.

Results: Children of *Legacy* mothers in Los Angeles were at lower risk for externalizing behaviors and poor adaptive skills than children whose mothers did not receive the intervention. There were no outcome differences by group assignment in Miami.

Conclusions: Group-based positive parenting interventions such as *Legacy* may have a sustained impact on children's behavioral and socioemotional development several years after intervention completion. Long-term, tailored efforts are likely needed in order to maximize benefits for families and children living in poverty.

Approximately 1 in 5 children in the United States lives in poverty.[1] Forty-one percent of children live in families that are low-income, i.e., at or below 200% of the federal poverty level. Data indicate that childhood poverty is associated with a range of adverse outcomes related to economic prosperity,[2-4] learning and academic achievement,[5,6] cognition,[6-9] health and wellbeing,[10,11] and socioemotional and behavioral development.[12-15] Given the high prevalence of individuals affected and the long-term health impacts, the consequences of early childhood poverty pose a significant public health problem.

Growing up in a household facing economic hardship increases the risk of chronic stress and poorer overall physical health.[2,16] Problems with emotion regulation,[17] social relationships,[12] and behavior[12-15] have also been identified for those who experienced childhood poverty. Children raised in families facing material hardship have been found to show more externalizing and internalizing behaviors, including hyperactivity, aggression, social withdrawal, anxious behaviors, and depressive behaviors.[18] Chronic exposure to cumulative stress such as poverty adversely impacts self-regulation processes essential to coping and adapting to life's demands.[16]

To begin to address these issues, the Centers for Disease Control and Prevention (CDC) developed Legacy for Children™ (*Legacy*), an evidence-based public health approach to improve child outcomes among families living in poverty.[19] Informed by public health and developmental psychology, *Legacy* is a group-based intervention to promote positive parenting among mothers facing economic hardship. The *Legacy* model is based on three mechanisms of change: promoting maternal self-efficacy, supporting

sensitive parent-child relationships, and facilitating a sense of community among mothers.[19]

From 2001 through 2009, *Legacy* was implemented and evaluated as a set of randomized controlled trials (RCTs) at two intervention sites: Los Angeles (LA) and Miami.[19] Results on child cognitive outcomes[20] and socioemotional and behavioral development[21] through child age 5 indicate that *Legacy* may have a positive impact on mothers and children living in poverty. Further, to support these outcomes, a qualitative evaluation revealed mothers' positive perceptions of the program and the application of learned parenting skills.[22]

These findings are promising and speak to *Legacy*'s effectiveness in several domains. Both sites have collected additional data on child socioemotional and behavioral outcomes since the preliminary report on parent-reported measures published by Kaminski and colleagues in 2013. Using updated, age-appropriate measures, the current study extends the child socioemotional and behavioral outcomes by examining third grade data by site, 2-6 years post-intervention (depending on the curriculum). Measures included in the present analyses used self-report, maternal report, and child performance tasks to assess facets of child socioemotional and behavioral development. In order to evaluate *Legacy*'s effectiveness as a public health approach to prevent problems in these areas, results from treatment versus comparison groups are reported.

METHODS

Data come from 364 mother-child dyads who completed at least one behavioral or socioemotional measure as part of the *Legacy* randomized controlled trial (RCT) between 2001 and 2009 at LA and Miami sites. Figure 1 is the CONSORT (CONsolidated

Standards of Reporting Trials) flowchart (previously published in *Journal of Developmental & Behavioral Pediatrics*, 2019)[20], which provides complete information on eligibility and retention through the current assessment timepoint.

Intervention

Mothers were eligible for inclusion in the *Legacy* RCT if they were 1) at least 18 years of age, 2) resided within the intervention catchment area, 3) were able to speak and understand English, 4) intended to raise their child speaking English as their primary language, 5) received prenatal care, and 6) had income less than 200% of the poverty level as indicated by receipt of Medicaid, food stamps, or qualification for Temporary Assistance for Needy Families (TANF). Due to intervention design, mothers were excluded if they were 1) expecting a multiple birth or 2) had existing substance abuse or mental health issues. The randomization ratio into intervention and comparison groups was 3:2 to protect against group-based attrition.[19]

The two intervention sites created their own curricula and implementations based on the *Legacy* philosophy, goals, and core intervention components.[19] Site-specific community and demographic factors, in addition to pilot-testing, influenced curriculum development at each site. For the University of California, Los Angeles (UCLA) curriculum, mothers participated in *Legacy* from the start of their third trimester of pregnancy through their child's third year of age (five prenatal sessions followed by nine blocks of 10 weekly group sessions). Weekly group sessions were approximately 150 minutes long and alternated between 1) mother-only time (to discuss milestones and options for parenting behavior, and to emphasize the importance of a mother's role in healthy child development) and 2) mother-child interaction time (to apply learned skills

and strengthen positive parenting in a safe, supportive environment). The maximum number of sessions mothers could attend at UCLA was 101. *Legacy* at UCLA began with 12 groups of mothers recruited during pregnancy from Women, Infants and Children clinics, but due to attrition, groups merged to yield 7 groups at intervention close.[19] Additional information on the curriculum design, implementation, and approach can be found elsewhere.[19]

For the University of Miami curriculum, mothers participated in *Legacy* from child age of approximately 6 weeks through 5 years. Weekly group sessions were 90 minutes long and each session consisted of mother-only time, mother-child interaction time, and community building time. The maximum number of sessions mothers could attend in Miami was 250. *Legacy* at University of Miami began with 12 groups of mothers recruited from two hospitals within three days of childbirth, but due to attrition, groups merged to yield 5 groups at intervention close.[19]

Measures of Children's Behavioral and Socioemotional Outcomes

Mothers' baseline assessments occurred prenatally in LA and within 6 weeks of childbirth in Miami. Reassessments occurred at both sites when the children were 6, 12, 24, 36, 48, and 60 months old, and again when they reached third or fourth grade. At the most recent time point (hereafter called "third grade"), the median child age was 9 years old at both sites (UCLA = 111 months; University of Miami = 113 months). Assessors were blinded to participant randomization. Efforts were taken to maximize retention over the course of the study, including transportation, child care, contact via phone and mail, and disbursement of $100 for mothers' participation at each assessment visit. At third grade, 63% (188/300) and 56% (176/315) of children completed at least one

socioemotional or behavioral assessment in LA and in Miami respectively. Accommodations were made to administer assessments in Spanish or Haitian-Creole for a subset of children at earlier time points; however, by third grade, all assessments were administered in English. Details on language accommodations are reported elsewhere.[20] For the present analyses, measures of child behavioral, emotional, and social developmental outcomes are described below.

Behavioral Outcome Measures

We assessed child behavioral functioning and attention-related problems using two measures. The Behavior Assessment System for Children, 2nd edition parent rating scale (BASC-2) was completed by mother-report.[23] BASC-2 is a valid, reliable 160-item assessment of multidimensional behavioral functioning for children ages 6 through 11 years.[23] Example items include "acts without thinking" (Externalizing Problems: Hyperactivity subscale) and "shares toys or possessions with other children" (Adaptive Skills: Adaptability subscale). Internal consistency for the BASC-2 in this study was 0.91. Children are considered "at-risk" with T-scores ≥60 on clinical scales and ≤40 on adaptive scales. Dichotomous outcomes were created based on these cutoffs.

Continuous Performance Task (CPT) is a computer program that assesses child performance directly by prompting them to press a button when shown a target stimulus (the letter X). The child must resist responding when shown other stimuli (other letters). Scoring is based on detectability (i.e., responding when appropriate, a reflection of attentional capacity), hit reaction time (HRT) (i.e., speed and reaction time consistency), omissions (i.e., failing to respond when necessary, a reflection of distractibility), commissions (i.e., responding when unprompted, a reflection of impulsivity), and

perseverations (i.e., reaction times less than 100 ms, which indicate slow or repeated responses to previous stimuli or random or anticipatory responses, given normal expectations for human processing and reaction time). T-scores ≥60 for all variables indicate elevated risk for attention problems.[24]

Emotional Outcome Measures

Children responded to the Child Depression Inventory-Short (CDI-S) to assess child depressive symptoms, appropriate for youth from 7 to 17 years of age.[25] CDI-S has 10 items. Every item presents a set of 3 sentences of varying symptom severity from which the child is prompted to select the option that best describes their feelings over the previous two weeks (e.g., "I am sad once in a while," "I am sad many times," or "I am sad all the time").[25] Screens are considered positive if scores are ≥3.[26] A dichotomous outcome was created to capture those positive screens (i.e., meet clinical criteria for depressive symptoms). A meta-analysis of the short form's internal consistency across previous studies reported a Cronbach's alpha point estimate of 0.77;[27] however, in this study, internal consistency for the CDI-S was 0.58.

Each mother also completed the Emotion Regulation Checklist (ERC), an assessment of their child's emotional expression and self-awareness, empathy, flexibility, anger regulation, and mood changes.[28,29] ERC is validated for assessment of children ages 6 through 12 years and has three subscales (Emotion Regulation, Lability/Negativity, Inappropriate Affect) with 24 items for which respondents rate their child using a 4-point Likert scale (1=never, 2=sometimes, 3=often, 4=almost always).[28,29] Internal consistency for the ERC in this study was 0.71.

Mothers rated their child's behavior when they are feeling mad using the Children's Emotion Management Scale: Anger (CEMS:A). CEMS:A has three subscales (Inhibition, Dysregulation, and Emotion Coping).[30] Subscale scores can range from 4 to 12, with higher scores indicating more inhibition, more dysregulation, and better coping, respectively.[30] Internal consistency for the CEMS:A in this study was 0.57.

Social Outcome Measures

Children reported on empathy towards others using the Children's Empathy Questionnaire (CEQ). CEQ is an 11-item reduced version of a measure originally designed to assess empathic attitudes in youth.[31] Possible scores range from 11 to 33, with higher scores indicating higher empathy. Internal consistency for the CEQ in this study was 0.72.

To report social behaviors at school, children completed a scale for Peer Social Support and Bullying (PSSB) with 18 items from three questionnaires.[32] Child respondents rated each item using a 5-point Likert scale (1=never, 2=hardly ever, 3=sometimes, 4=most of the time, 5=always) to best describe their social experiences at school. Mean scores range from 1 to 5, where higher scores on SS reflect higher social support, and lower scores on PV and BB reflect less victimization and bullying, respectively.[32] Internal consistency for the PSSB in this study was 0.58.

Statistical Analyses

Statistical analyses were performed using SPSS, Version 26.0.[33] First, univariate analyses were conducted for overall and site-specific demographic data, as well as descriptive statistics for outcome assessments. Assessment scores were then recoded to dichotomous outcomes according to recommended cutoffs, and frequency analyses were

completed. Next, site-stratified (LA, Miami) bivariate analyses were performed to compare outcomes between groups. Raw outcome scores by group status (intervention vs. comparison) were compared with *t*-tests for continuous measures and chi-square tests for measures with clinical cut-offs using a conservative intent-to-treat approach (i.e., data was analyzed according to participants' original randomization).

Then, regressions were run to predict outcomes based on intervention group while controlling for key demographic variables. Multiple linear regressions were performed to predict outcomes on measures with continuous scores (Emotion Regulation Checklist, Children's Emotion Management Scale: Anger, Children's Empathy Questionnaire, and Peer Social Support and Bullying) based on group status. Multivariable logistic regressions were performed to predict socioemotional and behavioral functioning using clinical cutoff points of the BASC-2, CPT, and CDI-S based on group status, reflecting the odds of meeting criteria for behavioral or socioemotional problems in intervention versus comparison groups. Results are presented for unadjusted and adjusted analyses; covariates were based on information collected at baseline: mother's age at the time of child's birth, education, race/ethnicity, and child gender.

RESULTS

Demographics

Demographic data were collected at baseline and are reported in Table 1, stratified by site, for the sample of mothers with children who had at least one behavioral or socioemotional outcome at third grade. Full sample baseline demographic data have been reported previously.[19] There were no significant differences between intervention and comparison groups at baseline and third grade for demographic variables (child's

gender, maternal age at birth, race/ethnicity, education, income level, language primarily spoken at home, and employment status). There were no statistically significant differences in demographic variables between mothers who completed at least one socioemotional or behavioral measure and those who completed none. Additionally, there were no statistically significant differences in demographic variables between mothers who completed all socioemotional and behavioral measures and those with incomplete data, except for mothers with college degrees. Mothers with college degrees were more likely to complete all measures in Miami but less likely to complete all measures in LA.

The third-grade sample was representative of the larger baseline sample. Mothers were young at the time of their child's birth (mean age was 23.3 years [SD = 4.6] in Miami and 25.1 years [SD = 5.5] in LA), and many reported very low income (58.7% and 48.7% of mothers in Miami and LA respectively reported incomes less than $20,000 at baseline). The majority of mothers were women of color. In Miami, 71.8% of the sample was non-Hispanic black and 18.1% was Haitian. In LA, the sample was approximately split between Hispanic and non-Hispanic black mothers. The majority of mothers' highest level of education was high school or GED (63.6% in Miami and 59.2% in LA) and were not working (78.1% in Miami and 69.5% in LA) at baseline. English was the primary language spoken at home for 66.3% of mothers in Miami and 49.4% of mothers in LA. Mean maternal IQ was 80.1 (SD = 13.9) and 82.8 (SD = 12.9) in Miami and LA, respectively.

Bivariate Analyses

In LA, a lower frequency of *Legacy* mothers than comparison mothers reported externalizing problems, χ_2 (1, n = 169) = 5.93, p = 0.02, and risk for adaptive skills

problems, χ_2 (1, n = 169) = 7.00, p = 0.01, in their children. Additionally, in LA, there was a marginally statistically significant association between assigned group and elevated risk for behavioral symptoms, χ_2 (1, n = 169) = 3.62, p = 0.06. In Miami, however, chi-square tests revealed no significant group differences.

There were no statistically significant differences in means on any of the continuous outcomes in Miami (Emotion Regulation Checklist, Children's Emotion Management Scale: Anger, Children's Empathy Questionnaire, and Peer Social Support and Bullying).

Regression Analyses

Logistic regressions were performed to obtain odds ratios for each outcome measure with clinical cutoffs (BASC-2, Continuous Performance Task, and Child Depression Inventory-S) based on group assignment (Table 3). Although not predictive of scores in Miami, children of *Legacy* mothers reported significantly better outcome scores on two composite measures of the BASC-2 in LA: Externalizing and Adaptive Skills. The unadjusted odds (95% CI) of meeting clinical criteria for concern for Externalizing and Adaptive Skills were 3.36 (1.40-8.09) and 5.76 (2.15-15.47) times higher respectively among children whose mothers were assigned to the comparison group than among children whose mothers were assigned to *Legacy*. When adjusting for demographic variables (mother's age at the time of child's birth, education, race/ethnicity, and child's gender), the odds (95% CI) of meeting clinical criteria for concern on Behavioral Symptoms Index were 2.61 (1.14-5.98) times higher among comparison group children than among *Legacy* children. There was no observed

association between group assignment and scores on the Continuous Performance Task or Child Depression Inventory-S at either site.

Linear regressions were performed to model outcome scores on continuous measures without clinical cutoffs (Emotion Regulation Checklist, Children's Emotion Management Scale: Anger, Children's Empathy Questionnaire, and Peer Social Support and Bullying) based on group assignment and adjusting for the same demographics previously mentioned (Table 2). Unadjusted beta coefficients for these outcomes were non-significant across sites. However, when adjusting for demographics, assignment to the intervention significantly predicted several outcomes at one site.. In LA, *Legacy* children's scores on the Lability/Negativity subscale of the Emotion Regulation Checklist were decreased by 0.42 units compared to the other group when accounting for demographic covariates [$F(4, 157) = 4.58$, $p < 0.001$] and explained 14% of the variance in outcome scores around the mean. *Legacy* children's scores on the ERC's Emotion Regulation subscale were increased by 0.21 units compared to the other group with adjustment for demographics [$F(4, 157) = 4.57$, $p < 0.001$] and explained 4% of the variance in outcome scores around the mean. Also in LA, group assignment predicted scores on one subscale of the Peer Social Support and Bullying measure: Engagement in Bullying. *Legacy* children's scores for engagement in bullying were decreased by 0.05 units, with a significant overall model [$F(4, 168) = 2.11$, adjusted $R^2 = 0.04$, $p = 0.045$]. *Legacy* had no observed effect on Miami's scores for these measures or on either site's scores on the Children's Emotion Management Scale or Children's Empathy Questionnaire.

DISCUSSION

The purpose of this study was to assess behavioral and socioemotional outcomes of children whose mothers participated in *Legacy*, a public health approach to promote positive parenting among mothers of young children living in poverty. *Legacy* was tested as a randomized control trial at two sites: Miami and LA. Behavioral and socioemotional outcomes through child age 5 years have previously been reported: *Legacy* children in Miami were at lower risk for behavioral problems at 2 years and socioemotional problems at 4 years, and *Legacy* children in LA at lower risk for hyperactivity at 5 years.[21] Additionally, *Legacy* children in Miami were at lower risk for behavioral problems between 2 to 5 years of age. To examine these impacts 2-6 years post-intervention, the current study presents follow-up analyses on child outcome data several years later, at third grade.[21]

Overall, the results showed that the observed effects of *Legacy* were partially sustained through third grade, indicating that the intervention may be effective in reducing behavioral and emotion regulation problems over the long-term, 4 to 6 years post-intervention. Children of mothers assigned to *Legacy* in LA had different outcomes from those in the comparison group on the BASC-2 (Externalizing, Adaptive Skills) without adjustments. Reduced externalizing symptomology among *Legacy* children in LA aligns with their improved cognitive performance at third grade[20] and their reduced risk for hyperactive behavior at 5 years of age.[21]

When adjusting for demographics, *Legacy* children outperformed the comparison group on the previous measures as well as the Emotional Regulation Checklist (Lability/Negativity, Emotion Regulation) and Peer Social Support and Bullying

(Engagement in Bullying). Despite improved behavioral outcomes among *Legacy* children in LA, there were no observed differences between groups in Miami.

Outcome differences by site may be attributable to site differences in risk factor profiles and potential for intervention impact. For instance, mean BASC-2 composite scores were lower among both groups in Miami, whereas these scores were higher among the comparison group in LA; thus, it is possible that *Legacy* has greater potential for mitigating adverse outcomes at higher levels of concern, but the effect is diminished at lower levels of concern.

Site differences might be responsible for differences in observed effects across Miami and LA and why previous effects in Miami were not sustained through third grade. Both sites recruited low-income mothers and adhered to the *Legacy* model elements and core components of the intervention. However, mothers in Miami were less resourced than those in LA. Miami mothers reported younger age at the time of child's birth as well as lower levels of education and income. Miami mothers with college degrees were less likely than their counterparts to complete all measures at third grade assessment, which might reflect a lack of time or less camaraderie and social support given their smaller representation at this site. More Miami mothers also reported not working, and while this could have a positive (more time available for child-rearing) or negative impact on parenting, in most cases in Miami, not working is likely an indicator of financial insecurity given their low household incomes. Low income, via material hardship, predicts parental stress and reduced positive parenting behavior, each of which is linked to developmental outcomes in children.[34] While *Legacy* may facilitate motivation change in mothers, the intervention cannot change fundamental financial

situations or parents' time and availability. This might partially explain site and outcome differences.

In light of these findings, it is important to acknowledge the limitations of the study design and methods. First, despite adhering to core components and guiding principles, the *Legacy* interventions were different in Miami and LA. Curricula between sites differed in length, age range, and implementation approach, among others. It is possible that confounders were unobserved given the assessment methods. Thus, it cannot be determined whether these factors are related to or responsible for outcome differences; however, future examination will be conducted to explore how *Legacy* operates optimally and for whom in order to inform targeting and tailoring of programs to best serve families in poverty.

Other limitations include attrition over time and limited generalizability. By third grade, 37% and 44% of the original participants in LA and Miami respectively were missing; despite using conservative, intent-to-treat methods, analyses did not account for intervention participation or dropout, and examination into potential dose-response analyses is ongoing. Also, the generalizability of findings extends only to those who completed at least one third-grade assessment. Further, although 34% of mothers in Miami and 51% of mothers in LA reported primarily speaking a language other than English at home, generalizability is limited to families with mothers who are comfortable speaking English. Development of *Legacy* for Spanish-speakers is currently underway.

Despite these limitations, the *Legacy* approach has many strengths. *Legacy* capitalizes on rigorous design and implementation to improve developmental outcomes for children born into poverty. The intervention itself is a comprehensive approach with a

theory-integrated focus on fostering self-efficacy--as well as strengthened sense of community and parent-child relationships--among mothers facing adversity, informed by public health and developmental psychology. *Legacy* study design as a randomized control trial allows for causal inference while controlling for potential confounding variables. The implementation process has consisted of continuous quality improvement, monitoring with established tools, and assessments of fidelity. Further, the program was intended to be broadly disseminated if effective. Factors were accounted for that would facilitate dissemination and implementation in community-based settings, with plans for longitudinal cost analyses, mixed-methods evaluations, and an adaptive model to meet the unique needs of different communities. Finally, as children have grown older, assessment has become less reliant upon solely parent-report measures of child outcomes. *Legacy* uses child performance measures and child self-report to corroborate parent-reported findings.

PUBLIC HEALTH IMPLICATIONS

Although behavioral, socioemotional, and cognitive outcomes at third grade have been published,[20] a range of other outcomes are being analyzed. Physical health and health behaviors that have been assessed include height and weight, alcohol and tobacco use, emergency room visits, physical activity, nutrition, and oral health. Language, communication, school grades, and retention are being assessed with teacher reports, and school records will provide information on attendance, test scores, referrals, and retention. Having teachers and schools provide these data will offer more tangible, real-world data on the potential longer-term impact of *Legacy* on these children as they grow and develop.

Additionally, CDC is working with other federal organizations to improve *Legacy* by evaluating implementation and dissemination factors among diverse communities. CDC conducted two qualitative studies with *Legacy* mothers to identify specific barriers and facilitators.[22,35] Efforts are underway to adapt and evaluate program content and curricula to meet the needs of Spanish-speaking families.[35] Further, preliminary findings have shown that *Legacy* boosts mothers' engagement in clinical and early educational settings.[36] These results will be helpful in strengthening the program moving forward.

Early intervention has been shown to have the greatest impact, especially since disparities in developmental outcomes due to socioeconomic disadvantage emerge early and spread farther with time,[37,38] and integrated services through settings they are already accessing may be the best option for families and children due to convenience and sustainability. A public health intervention for families from diverse communities may be well-suited to integration within existing care systems already utilized by the target population.[39] In fact, CDC has initiated dissemination in community settings via primary care and Early Head Start with the hopes that housing *Legacy* within existing, utilized systems will foster sustained protection against adverse developmental outcomes for families in need.[36]

In conclusion, the findings from this study add to the growing body of literature on *Legacy* as a public health approach that may have sustained impact on behavior and emotion regulation features of child development through third grade. However, the program's promise in the short-term for mitigating deleterious effects does appear to fade with time. Sustained efforts are likely needed in order to maximize benefits for families and children living in poverty

References

1. Koball H, Jiang Y. *Basic Facts about Low-Income Children: Children under 18 Years, 2016. New York: National Center for Children in Poverty.* Columbia University Mailman School of Public Health;2018.
2. Duncan GJ, Ziol-Guest KM, Kalil A. Early-Childhood Poverty and Adult Attainment, Behavior, and Health. *Child development.* 2010;81(1):306-325.
3. Holzer HJ, Whitmore Schanzenbach D, Duncan GJ, Ludwig J. The economic costs of childhood poverty in the United States. *Journal of Children and Poverty.* 2008;14(1):41-61.
4. McLaughlin M, Rank MR. Estimating the Economic Cost of Childhood Poverty in the United States. *Social Work Research.* 2018;42(2):73-83.
5. Engle PL, Black MM. The effect of poverty on child development and educational outcomes. *Annals of the New York Academy of Sciences.* 2008;1136(1):243-256.
6. Lazar I, Darlington R, Murray H, Royce J, Snipper A, Ramey CTJMotsfricd. Lasting effects of early education: A report from the Consortium for Longitudinal Studies. *Monographs of the Society for Research in Child Development.* 1982;47:i-151.
7. Ayoub C, O'Connor E, Rappolt-Schlictmann G, Vallotton C, Raikes H, Chazan-Cohen RJECRQ. Cognitive skill performance among young children living in poverty: Risk, change, and the promotive effects of Early Head Start. 2009;24(3):289-305.

8. Farah MJ, Shera DM, Savage JH, et al. Childhood poverty: Specific associations with neurocognitive development. *Brain Res.* 2006;1110(1):166-174.

9. Walker SP, Wachs TD, Grantham-McGregor S, et al. Inequality in early childhood: risk and protective factors for early child development. *The Lancet.* 2011;378(9799):1325-1338.

10. Daelmans B, Darmstadt GL, Lombardi J, et al. Early childhood development: The foundation of sustainable development. *The Lancet.* 2017;389(10064):9-11.

11. Halfon N, Hochstein M. Life course health development: An integrated framework for developing health, policy, and research. *Milbank Quarterly.* 2002;80(3):433-479.

12. Bolger KE, Patterson CJ, Thompson WW, Kupersmidt JBJCd. Psychosocial adjustment among children experiencing persistent and intermittent family economic hardship. 1995;66(4):1107-1129.

13. Grant KE, Compas BE, Stuhlmacher AF, Thurm AE, McMahon SD, Halpert JAJPb. Stressors and child and adolescent psychopathology: moving from markers to mechanisms of risk. *Psychol Bull.* 2003;129(3):447.

14. Werthamer-Larsson L, Kellam S, Wheeler LJAjocp. Effect of first-grade classroom environment on shy behavior, aggressive behavior, and concentration problems. *American Journal of Community Psychology.* 1991;19(4):585-602.

15. Zilanawala A, Pilkauskas NVJ. Material hardship and child socioemotional behaviors: Differences by types of hardship, timing, and duration. *Children and Youth Services Review.* 2012;34(4):814-825.

16. Evans GW, Kim P. Childhood poverty, chronic stress, self-regulation, and coping. *Child Dev Perspect.* 2013;7(1):43-48.

17. Raver CC, Blair C, Garrett-Peters P. Poverty, household chaos, and interparental aggression predict children's ability to recognize and modulate negative emotions. *Developmental Psychopathology.* 2015;27(3):695-708.

18. Zilanawala A, Pilkauskas NVJC, Review YS. Material hardship and child socioemotional behaviors: Differences by types of hardship, timing, and duration. *Children and Youth Services Review.* 2012;34(4):814-825.

19. Perou R, Elliott MN, Visser SN, et al. Legacy for Children™: A pair of randomized controlled trials of a public health model to improve developmental outcomes among children in poverty. *BMC Public Health.* 2012;12:691.

20. Perou R, Robinson LR, Danielson ML, et al. The Legacy for Children™ Randomized Control Trial: Effects on Cognition Through Third Grade for Young Children Experiencing Poverty. *Journal of Developmental Behavioral Pediatrics.* 2019;40(4):275-284.

21. Kaminski JW, Perou R, Visser SN, et al. Behavioral and socioemotional outcomes through age 5 years of the Legacy for Children public health approach to improving developmental outcomes among children born into poverty. *American journal of public health.* 2013;103(6):1058-1066.

22. Hartwig SA, Robinson LR, Comeau D, Claussen AH, Perou R. Maternal perceptions of parenting following an evidence-based parenting program: A qualitative study of Legacy for Children™. *Infant Mental Health Journal.* 2017;38(4):499-513.

23. Reynolds C, Kamphaus R. BASC-2 Behavior Assessment for Children Manual. In: Circle Pines, MN: American Guidance Service; 2004.

24. Beck LH, Bransome ED, Jr., Mirsky AF, Rosvold HE, Sarason I. A continuous performance test of brain damage. *Journal of consulting psychology.* 1956;20(5):343-350.

25. Kovacs M. *Children's depression inventory: Manual.* Multi-Health Systems North Tonawanda, NY; 1992.

26. Allgaier AK, Fruhe B, Pietsch K, Saravo B, Baethmann M, Schulte-Korne G. Is the Children's Depression Inventory Short version a valid screening tool in pediatric care? A comparison to its full-length version. *J Psychosom Res.* 2012;73(5):369-374.

27. Sun S, Wang S. The Children's Depression Inventory in Worldwide Child Development Research: A Reliability Generalization Study. *Journal of Child and Family Studies.* 2015;24(8):2352-2363.

28. Shields A, Cicchetti D. Emotion regulation among school-age children: The development and validation of a new criterion Q-sort scale. *Developmental Psychology.* 1997;33(6):906.

29. Shields A, Cicchetti D. Reactive Aggression Among Maltreated Children: The Contributions of Attention and Emotion Dysregulation. *Journal of Clinical Child Psychology.* 1998;27(4):381-395.

30. Zeman J, Shipman K, Penza-Clyve S, . Development and initial validation of the Children's Sadness Management Scale. *Journal of Nonverbal Behavior.* 2001;25(187):187–205.

31. Funk J, Fox C, Chan M, Curtiss K. The development of the Children's Empathic Attitudes Questionnaire using classical and Rasch analyses. *Journal of Applied Developmental Psychology.* 2008;29(3):187-196.

32. Ladd GW, Kochenderfer BJ, Coleman CC. Friendship quality as a predictor of young children's early school adjustment. *Child development.* 1996;67(3):1103-1118.

33. *IBM SPSS Statistics for Macintosh* [computer program]. Version 26.0. Armonk, NY: IBM Corp.; 2019.

34. Gershoff ET, Aber JL, Raver CC, Lennon MC. Income is not enough: incorporating material hardship into models of income associations with parenting and child development. *Child development.* 2007;78(1):70-95.

35. Beasley LO, Silovsky JF, Espeleta HC, et al. A qualitative study of cultural congruency of Legacy for Children for Spanish-speaking mothers. *Child Youth Serv Rev.* 2017;79:299-308.

36. Robinson LR, Hartwig SA, Smith DC, et al. Supporting Early Social and Emotional Relationships Through a Public Health Parenting Program: The Legacy for Children™ Intervention. In: Morris AS, Williamson AC, eds. *Building Early Social and Emotional Relationships with Infants and Toddlers: Integrating Research and Practice.* Cham: Springer International Publishing; 2018:183-211.

37. Robinson LR, Hartwig SA, Smith DC, et al. Supporting early social and emotional relationships through a public health parenting program: The Legacy for Children™ intervention. In: Morris AS, Williamson AC, eds. *Building early*

social and emotional relationships with infants and toddlers. Switzerland: Springer; 2019:183-211.

38. Robinson LR, Thompson R, Dworkin P, McAbe MA, Peacock G, Thorpe PG. CDC Grand Rounds Report: Early Childhood Health Disparities. *MMWR Morbidity and mortality weekly report.* 2017.

39. Morris AS, Robinson LR, Hays-Grudo J, Claussen AH, Hartwig SA, Treat AE. Targeting parenting in early childhood: A public health approach to improve outcomes for children living in poverty. *Child Development.* 2017;88:388–397.

Table 1. Demographics of *Legacy* mothers with children who have at least one behavioral or socioemotional outcome at third grade (n=364)

	Miami (n=188)			Los Angeles (n=176)		
	n or M	% or SD	Difference by Group (*p*)	n or M	% or SD	Difference by Group (*p*)
Intervention group			--			--
Intervention	111	59.0		106	60.2	
Comparison	77	41.0		70	39.8	
Child's gender			0.54			0.08†
Boy	93	49.5		88	50.3	
Girl	95	50.5		87	49.7	
Maternal age at birth	23.3	4.6	0.65	25.1	5.5	0.71
Maternal IQ	80.1	13.9	0.83	82.8	12.9	0.37
Race/ethnicity			0.95			0.14
Hispanic	14	7.4		80	45.5	
Non-Hispanic Black	135	71.8		83	47.2	
Haitian	34	18.1		0	0.0	
White/other	5	2.6		13	7.4	
Education			0.41			0.50
Less than high school diploma	45	24.1		40	23.0	
High school diploma or GED	119	63.6		103	59.2	
Vocational/technical school or Associate's degree	21	11.2		24	13.8	
College degree or higher	2	1.10		7	4.0	
Income level			0.27			0.32
<$20,000	101	58.7		77	48.7	
$20,000—$29,999	34	19.8		43	27.2	
$30,000—$39,999	20	11.6		18	11.4	
$40,000—$49,999	12	7.0		10	6.3	
$50,000+	5	2.9		10	6.3	
Language primarily spoken at home			1.00			0.56
English	124	66.3		86	49.4	
Other language	63	33.7		88	50.6	
Employment status			0.58			0.54
Full-time	24	12.8		16	9.2	
Part-time	17	9.1		37	21.3	
Not working	146	78.1		121	69.5	

Notes: †Denotes marginal statistical significance at the 0.10 level. Demographics were assessed as baseline, with the exception of maternal IQ, which was assessed at child age 6 months using the Kaufman Brief Intelligence Test.

Table 2. Logistic regression models predicting third-grade adverse behavioral and socioemotional outcomes with clinical cutoffs based on group assignment to *Legacy* intervention

	Miami				Los Angeles			
	OR	95% CI	aOR	95% CI	OR	95% CI	aOR	95% CI
BASC-2								
Externalizing	0.88	0.36-2.12	0.83	0.33-2.09	**0.38***	**0.17-0.84**	**0.30***	**0.12-0.72**
Internalizing	1.26	0.52-3.03	1.29	0.53-3.17	0.81	0.36-1.87	0.79	0.33-1.85
Behavioral Symptoms Index	0.77	0.33-1.78	0.74	0.31-1.75	0.49	0.23-1.03	**0.38***	**0.17-0.88**
Lack of Adaptive Skills	0.82	0.39-1.72	0.78	0.36-1.68	**0.35***	**0.16-0.78**	**0.17***	**0.07-0.47**
Continuous Performance Task								
ADHD Confidence Index	1.51	0.73-3.12	1.66	0.78-3.52	1.05	0.54-2.05	0.92	0.45-1.88
Child Depression Inventory-S	1.63	0.90-2.96	1.60	0.86-2.99	0.86	0.47-1.60	0.92	0.48-1.75

Notes: *Denotes statistical significance at the 0.05 level. †Denotes marginal statistical significance at the 0.10 level. Adjusted regression models accounted for baseline demographics: mother's age at birth, education, race/ethnicity, and child's gender. A sensitivity analysis was also conducted using mother's IQ as a covariate instead of education.

Table 3. Linear regression models predicting third-grade behavioral and socioemotional outcomes based on assignment to Legacy for Children™ intervention

	Miami						Los Angeles					
	Unadjusted beta (SE)	*p*	Adj. beta	F	Adj. R^2	*p*	Unadjusted beta (SE)	*p*	Adj. beta	F	Adj. R^2	*p*
Emotion Regulation Checklist												
Lability/Negativity	-0.56 (0.32)	0.09	-0.67	1.48	0.02	0.18	-0.27 (0.33)	0.43	-0.42	4.58	0.14	**<0.001***
Inappropriate Affect	0.17 (0.25)	0.50	0.11	0.60	-0.02	0.76	-0.25 (0.27)	0.36	-0.32	1.66	0.03	0.12
Emotion Regulation	0.36 (0.39)	0.37	0.54	1.98	0.04	0.06†	-0.05 (0.41)	0.90	0.21	4.57	0.15	**<0.001***
Children's Emotion Management Scale: Anger												
Inhibition	-0.27 (0.31)	0.39	-0.21	1.75	0.03	0.099†	0.02 (0.32)	0.96	-0.09	0.11	-0.04	0.998
Dysregulation	-0.14 (0.26)	0.60	-0.17	1.14	0.01	0.34	0.21 (0.23)	0.37	0.15	1.21	0.01	0.30
Coping	-0.27 (0.30)	0.36	-0.22	1.76	0.03	0.097†	0.49 (0.30)	0.10†	0.42	0.87	-0.01	0.53
Children's Empathy Questionnaire	-0.47 (0.58)	0.41	-0.42	0.71	-0.01	0.67	1.30 (0.67)	0.05†	1.35	0.62	-0.02	0.74
Peer Social Support and Bullying												
Social Support from Peers	-0.09 (0.11)	0.43	-0.08	1.28	0.01	0.26	0.10 (0.12)	0.39	0.11	1.91	0.04	0.07†
Perceived Victimization	0.04 (0.14)	0.75	0.03	0.59	-0.02	0.77	-0.01 (0.14)	0.95	-0.03	0.65	-0.01	0.71
Engagement in Bullying	0.05 (0.09)	0.55	0.05	0.30	-0.03	0.96	-0.05 (0.06)	0.40	-0.05	2.11	0.04	**0.045***

Notes: Adj. = adjusted. *Denotes statistical significance at the 0.05 level. †Denotes marginal statistical significance at the 0.10 level. Analysis for Emotion Regulation Checklist is based on 1998 scoring criteria (Shields & Cicchetti, 1998). T-scores are reported for CEQ. Adjusted regression models accounted for baseline demographics: mother's age at birth, education, race/ethnicity, and child's gender. A sensitivity analysis was also conducted using mother's IQ as a covariate instead of education.

PUBLIC HEALTH IMPLICATIONS

Contextualizing Findings

The purpose of this study was to assess behavioral and socioemotional outcomes of children whose mothers participated in *Legacy*, a public health approach to promote positive parenting among mothers of young children living in poverty. *Legacy* was tested as a randomized control trial at two sites: Miami and LA. Behavioral and socioemotional outcomes through child age 5 years have previously been reported with promising results and optimism for longer-term effects, with *Legacy* children in Miami at lower risk for behavioral problems at 2 years and socioemotional problems at 4 years, and *Legacy* children in LA at lower risk for hyperactivity at 5 years (Kaminski et al., 2013). Additionally, *Legacy* children at Miami were at lower risk for behavioral problems between 2 to 5 years of age. The current study presents follow-up analyses on child outcome data several years later, at third grade (Kaminski et al., 2013).

Overall, the results showed that the observed effects of *Legacy* were partially sustained until third grade, indicating that the intervention may be effective in reducing certain behavioral problems over the long-term, 2 to 6 years post-intervention. Children of mothers assigned to *Legacy* in LA had different outcomes from those in the comparison group on the BASC-2 (Externalizing, Adaptive Skills) without adjustments and Emotional Regulation Checklist (Lability/Negativity, Emotion Regulation) and Peer Social Support and Bullying (Engagement in Bullying) with adjustments. According to regressions, *Legacy* children had improved behavioral outcomes compared to their counterparts in the comparison group at LA; however, there were no observed differences between groups at Miami. Outcome differences by site may be attributable to site

differences in risk factor profiles and potential for intervention impact. For instance, mean BASC-2 composite scores were lower among both groups at Miami, whereas these scores were higher among the comparison group at LA; thus, it is possible that *Legacy* has greater potential for mitigating adverse outcomes at higher levels of concern, but the effect is diminished at lower levels of concern. Reduced externalizing symptomology at LA also aligns with the improved cognitive performance of *Legacy* children at third grade (Perou et al., 2019).

Site differences might be responsible for differences in observed effects across Miami and LA. Both sites recruited low-income mothers and adhered to the *Legacy* model elements and core components of the intervention. However, mothers at Miami were less resourced than those at LA. Miami mothers reported younger age at the time of child's birth as well as lower levels of education and income. Miami mothers with college degrees were less likely than their counterparts to complete all measures at third grade assessment, which might reflect a lack of time or less camaraderie and social support given their smaller representation at this site. More Miami mothers also reported not working, and while this could have a positive (more time available for child-rearing) or negative impact on parenting, in most cases at Miami, not working is likely an indicator of financial insecurity given their low household incomes. Low income, via material hardship, predicts parental stress and reduced positive parenting behavior, each of which is linked to developmental outcomes in children (Gershoff, Aber, Raver, & Lennon, 2007). While *Legacy* may facilitate motivation change in mothers, the intervention cannot change fundamental financial situations or parents' time and availability. This might partially explain site and outcome differences.

Limitations & Strengths

In light of these findings, it is important to acknowledge the limitations of the study design and methods. First, although *Legacy* was conceived with theoretical underpinnings from public health and developmental psychology, its primary construct informed by behavioral science theory was self-efficacy. Parental self-efficacy has been assessed as part of process evaluation, but these findings have not yet been reported, so further research is needed to understand whether and how *Legacy* operates via this theoretical mechanism. Other potential mediators being evaluated at the parent level include commitment, satisfaction, emotional well-being, sense of community, support, and connectedness, positive mother-child interaction, and positive parenting practices. These potential mediators, including self-efficacy, are individual-level constructs, and perhaps the Social Ecological framework, which accounts for influence at the interpersonal, organizational, community, and policy levels, would have broadened the scope of *Legacy*'s functional reach to sustain longer term outcomes (Bronfenbrenner, 1999).

Additionally, despite adhering to core components and guiding principles, the *Legacy* interventions were different at Miami and LA (Figure 1). Curricula between sites differed in length, age range, and implementation approach, among others. It is possible that confounders were unobserved given the assessment methods. Thus, it cannot be determined whether these factors are related to or responsible for outcome differences; however, future examination will be conducted to explore how *Legacy* operates optimally and for whom in order to inform targeting and tailoring of programs to best serve families in poverty.

Other limitations include attrition over time and limited generalizability. By third grade, 37% and 44% of the original participants at LA and Miami respectively were missing; despite using conservative, intent-to-treat methods, analyses did not account for intervention participation or dropout, and examination into potential dose-response analyses is ongoing. Also, the generalizability of findings extends only to those who completed at least one third-grade assessment. Further, although 34% of mothers at Miami and 51% of mothers at LA reported primarily speaking a language other than English at home, generalizability is limited to families with mothers who are comfortable speaking English. Development of *Legacy* for Spanish-speakers is currently underway.

Despite these limitations, the *Legacy* approach has many strengths. *Legacy* capitalizes on rigorous design and implementation to improve developmental outcomes for children born into poverty. The intervention itself is a comprehensive approach with a theory-integrated focus on fostering self-efficacy--as well as strengthened sense of community and parent-child relationships--among mothers facing adversity, informed by public health and developmental psychology. *Legacy* study design as a randomized control trial allows for causal inference while controlling for potential confounding variables. The implementation process has consisted of continuous quality improvement, monitoring with established tools, and assessments of fidelity. Further, the program was intended to be broadly disseminated if effective. Factors were accounted for that would facilitate dissemination and implementation in community-based settings, with plans for longitudinal cost analyses, mixed-methods evaluations, and an adaptive model to meet the unique needs of different communities. Finally, as children have grown older, assessment has become less reliant upon solely parent-report measures of child outcomes.

Legacy uses child performance measures and child self-report to corroborate parent-reported findings.

Implications, Future Directions, & Conclusions

Although behavioral, socioemotional, and cognitive outcomes at third grade have been published (Perou et al., 2019), a range of other outcomes are being analyzed. Physical health and health behaviors that have been assessed include height and weight, alcohol and tobacco use, emergency room visits, physical activity, nutrition, and oral health. Language, communication, school grades, and retention are being assessed with teacher reports, and school records will provide information on attendance, test scores, referrals, and retention. Having teachers and schools provide these data will offer more tangible, real-world data on the potential longer-term impact of *Legacy* on these children as they grow and develop.

Additionally, CDC is working with other federal organizations to improve *Legacy* by evaluating implementation and dissemination factors among diverse communities. CDC conducted two qualitative studies with *Legacy* mothers to identify specific barriers and facilitators (Beasley et al., 2017; Hartwig et al., 2017). Efforts are underway to adapt and evaluate program content and curricula to meet the needs of Spanish-speaking families (Beasley et al., 2017). Further, preliminary findings have shown that *Legacy* boosts mothers' engagement in clinical and early educational settings (Robinson et al., 2018). These results will be helpful in strengthening the program moving forward.

Early intervention has been shown to have the greatest impact, especially since disparities in developmental outcomes due to socioeconomic disadvantage emerge early and spread farther with time (Robinson et al., 2017; 2019), and integrated services

through settings they are already accessing may be the best option for families and children due to convenience and sustainability. A public health intervention for families from diverse communities may be well-suited to integration within existing care systems already utilized by the target population (Morris et al., 2017). In fact, CDC has initiated dissemination in community settings via primary care and Early Head Start with the hopes that housing *Legacy* within existing, utilized systems will foster sustained protection against adverse developmental outcomes for families in need (Robinson et al., 2018).

In conclusion, the findings from this study add to the growing body of literature on *Legacy* as a public health approach that may have sustained impact on behavior and emotion regulation features of child development through third grade. However, the program's promise in the short-term for mitigating deleterious effects does appear to fade with time. Sustained efforts are likely needed in order to maximize benefits for families and children living in poverty.

References

Aber, J. L., Bennett, N. G., Conley, D. C., & Li, J. (1997). The effects of poverty on child health and development. *Annu Rev Public Health, 18*, 463-483. doi:10.1146/annurev.publhealth.18.1.463

Allgaier, A. K., Fruhe, B., Pietsch, K., Saravo, B., Baethmann, M., & Schulte-Korne, G. (2012). Is the Children's Depression Inventory Short version a valid screening tool in pediatric care? A comparison to its full-length version. *J Psychosom Res, 73*(5), 369-374. doi:10.1016/j.jpsychores.2012.08.016

Ayoub, C., O'Connor, E., Rappolt-Schlictmann, G., Vallotton, C., Raikes, H., & Chazan-Cohen, R. (2009). Cognitive skill performance among young children living in poverty: Risk, change, and the promotive effects of Early Head Start. *Early Childhood Research Quarterly, 24*(3), 289-305. doi:10.1016/j.ecresq.2009.04.001

Balaji, A. B., Claussen, A. H., Smith, D. C., Visser, S. N., Morales, M. J., & Perou, R. (2007). Social support networks and maternal mental health and well-being. *J Womens Health (Larchmt), 16*(10), 1386-1396. doi:10.1089/jwh.2007.CDC10

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215. doi:10.1037/0033-295X.84.2.191

Bandura, A. (1986). *Social Foundations of Thought and Action: A Social-Cognitive View*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY, US: Freeman.

Bandura, A. (1999). Social cognitive theory of personality. *Handbook of personality, 2*, 154-196.

Beasley, L. O., Silovsky, J. F., Espeleta, H. C., Robinson, L. R., Hartwig, S. A., Morris, A., & Esparza, I. (2017). A qualitative study of cultural congruency of Legacy for Children™ for Spanish-speaking mothers. *Child Youth Serv Rev, 79*, 299-308. doi:10.1016/j.childyouth.2017.06.022

Beck, L. H., Bransome, E. D., Jr., Mirsky, A. F., Rosvold, H. E., & Sarason, I. (1956). A continuous performance test of brain damage. *J Consult Psychol, 20*(5), 343-350. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/13367264

Black, M. M., Hess, C. R., & Berenson-Howard, J. (2000). Toddlers from low-income families have below normal mental, motor, and behavior scores on the Revised Bayley Scales. *Applied Developmental Psychology, 21*(6), 655-666. doi:10.1016/S0193-3973(00)00059-9

Bolger, K. E., Patterson, C. J., Thompson, W. W., & Kupersmidt, J. B. (1995). Psychosocial adjustment among children experiencing persistent and intermittent family economic hardship. *Child Development, 66*(4), 1107-1129. doi:10.2307/1131802

Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology, 53*(1), 371-399. doi:10.1146/annurev.psych.53.100901.135233

Britto, P. R., Lye, S. J., Proulx, K., Yousafzai, A. K., Matthews, S. G., Vaivada, T., . . . Early Childhood Development Interventions Review Group, f. t. L. E. C. D. S. S. C. (2017). Nurturing care: promoting early childhood development. *Lancet, 389*(10064), 91-102. doi:10.1016/S0140-6736(16)31390-3

Brody, G. H., Flor, D. L., & Gibson, N. M. (1999). Linking maternal efficacy beliefs, developmental goals, parenting practices, and child competence in rural single-parent African American families. *Child Development, 70*(5), 1197-1208.

Bronfenbrenner, U. (1999). Environments in developmental perspective: Theoretical and operational models. In S. L. Friedman & T. D. Wachs (Eds.), *Measuring environment across the life span: Emerging methods and concepts* (p. 3–28). American Psychological Association. https://doi.org/10.1037/10317-001

Brooks-Gunn, J., & Duncan, G. J. (1997). The effects of poverty on children. *The Future of Children, 7*(2), 55-71. doi:10.2307/1602387

Campbell, F. A., Pungello, E. P., Miller-Johnson, S., Burchinal, M., & Ramey, C. T. (2001). The development of cognitive and academic abilities: growth curves from an early childhood educational experiment. *Dev Psychol, 37*(2), 231-242. doi:10.1037/0012-1649.37.2.231

Cohen, J., Onunaku, N., Clothier, S., & Poppe, J. (2005). *Helping Young Children Succeed: Strategies to Promote Early Childhood Social and Emotional Development*. Retrieved from https://www.zerotothree.org/resources/136-helping-young-children-succeed-strategies-to-promote-early-childhood-social-and-emotional-development

Cohen, S., Janicki-Deverts, D., Chen, E., & Matthews, K. A. (2010). Childhood socioeconomic status and adult health. *Annals of the New York Academy of Sciences, 1186*(1), 37-55.

Coleman, P. K., & Karraker, K. H. (1998). Self-efficacy and parenting quality: Findings and future applications. *Developmental Review, 18,* 47-85. doi:10.1006/drev.1997.0448

Corso, P. S., Visser, S. N., Ingels, J. B., & Perou, R. (2015). Cost-effectiveness of Legacy for Children™ for reducing behavioral problems and risk for ADHD among children living in poverty. *J Child Adolesc Behav, 3*(240). doi:10.4172/2375-4494.1000240

Daelmans, B., Darmstadt, G. L., Lombardi, J., Black, M. M., Britto, P. R., Lye, S., . . . Lancet Early Childhood Development Series Steering, C. (2017). Early childhood development: the foundation of sustainable development. *Lancet, 389*(10064), 9-11. doi:10.1016/S0140-6736(16)31659-2

Dodge, K. A., Pettit, G. S., & Bates, J. E. (1994). Socialization mediators of the relation between socioeconomic status and child conduct problems. *Child Development, 65*(2 Spec No), 649-665. doi:10.2307/1131407

Duncan, G. J., Ziol-Guest, K. M., & Kalil, A. (2010). Early-childhood poverty and adult attainment, behavior, and health. *Child Dev, 81*(1), 306-325. doi:10.1111/j.1467-8624.2009.01396.x

Elder, G. H. (1995). Life trajectories in changing societies. In *Self-efficacy in changing societies.* (pp. 46-68). New York, NY, US: Cambridge University Press.

Engle, P. L., & Black, M. M. (2008). The effect of poverty on child development and educational outcomes. *Annals of the New York Academy of Sciences, 1136*(1), 243-256. doi:10.1196/annals.1425.023

Entwisle, D. R., Alexander, K. L., & Olson, L. S. (2005). First Grade and Educational Attainment by Age 22: A New Story. *American Journal of Sociology, 110*(5), 1458-1502. doi:10.1086/428444

Evans, G. W., & Kim, P. (2013). Childhood poverty, chronic stress, self-regulation, and coping. *Child Development Perspectives, 7*(1), 43-48. doi:10.1111/cdep.12013

Farah, M. J., Shera, D. M., Savage, J. H., Betancourt, L., Giannetta, J. M., Brodsky, N. L., . . . Hurt, H. (2006). Childhood poverty: specific associations with neurocognitive development. *Brain Research, 1110*(1), 166-174. doi:S0006-8993(06)01937-8 [pii] 10.1016/j.brainres.2006.06.072 [doi]

Fernald, A., Marchman, V. A., & Weisleder, A. (2013). SES differences in language processing skill and vocabulary are evident at 18 months. *Dev Sci, 16*(2), 234-248. doi:10.1111/desc.12019

Funk, J., Fox, C., Chan, M., & Curtiss, K. (2008). The development of the Children's Empathic Attitudes Questionnaire using classical and Rasch analyses. *Journal of Applied Developmental Psychology, 29*(3), 187-196. doi:10.1016/j.appdev.2008.02.005

Galobardes, B., Lynch, J. W., & Smith, G. D. (2008). Is the association between childhood socioeconomic circumstances and cause-specific mortality established? Update of a systematic review. *Journal of Epidemiology & Community Health, 62*(5), 387-390.

García, J. L., Heckman, J. J., Leaf, D. E., & Prados, M. J. (2016). *The life-cycle benefits of an influential early childhood program*. National Bureau of Economic

Research. Cambridge, MA. Retrieved from https://www.nber.org/papers/w22993.pdf

Gershoff, E. T., Aber, J. L., Raver, C. C., & Lennon, M. C. (2007). Income is not enough: incorporating material hardship into models of income associations with parenting and child development. *Child Dev, 78*(1), 70-95. doi:10.1111/j.1467-8624.2007.00986.x

Grant, K. E., Compas, B. E., Stuhlmacher, A. F., Thurm, A. E., McMahon, S. D., & Halpert, J. A. (2003). Stressors and child and adolescent psychopathology: moving from markers to mechanisms of risk. *Psychol Bull, 129*(3), 447-466. doi:10.1037/0033-2909.129.3.447

Griggs, J., & Walker, R. (2008). *The costs of child poverty for individuals and society: a literature review*. Retrieved from https://www.jrf.org.uk/sites/default/files/jrf/migrated/files/2301-child-poverty-costs.pdf

Hackman, D. A., & Farah, M. J. (2009). Socioeconomic status and the developing brain. *Trends in Cognitive Science, 13*(2), 65-73. doi:10.1016/j.tics.2008.11.003

Hair, N. L., Hanson, J. L., Wolfe, B. L., & Pollak, S. D. (2015). Association of Child Poverty, Brain Development, and Academic Achievement. *JAMA Pediatr, 169*(9), 822-829. doi:10.1001/jamapediatrics.2015.1475

Halfon, N., & Hochstein, M. (2002). Life course health development: an integrated framework for developing health, policy, and research. *Milbank Q, 80*(3), 433-479, iii. doi:10.1111/1468-0009.00019

Hartwig, S. A., Robinson, L. R., Comeau, D. L., Claussen, A. H., & Perou, R. (2017). Maternal Perceptions of Parenting Following an Evidence-Based Parenting Program: A Qualitative Study of Legacy for Children(Tm). *Infant Ment Health J, 38*(4), 499-513. doi:10.1002/imhj.21657

Holzer, H. J., Whitmore Schanzenbach, D., Duncan, G. J., & Ludwig, J. (2008). The economic costs of childhood poverty in the United States. *Journal of Children and Poverty, 14*(1), 41-61. doi:10.1080/10796120701871280

IBM Corp. Released 2019. IBM SPSS Statistics for Macintosh, Version 26.0. Armonk, NY: IBM Corp.

Kaminski, J. W., Perou, R., Visser, S., Scott, K., Beckwith, L., Howard, J., . . . Danielson, M. (2013). Behavioral and socioemotional outcomes through age 5 of the Legacy for Children™ public health approach to improving developmental outcomes among children born into poverty. *American Journal of Public Health, 103*(6), 1058-1066. doi:10.2105/AJPH.2012.300996

Kaminski, J. W., Valle, L. A., Filene, J. H., & Boyle, C. L. (2008). A meta-analytic review of components associated with parent training program effectiveness. *Journal of Abnormal Child Psychology, 36*(4), 567-589. doi:10.1007/s10802-007-9201-9

Koball, H., & Jiang, Y. (2018). *Basic Facts About Low-Income Children, Children Under 18 Years, 2016*. Retrieved from New York, NY: http://www.nccp.org/publications/pdf/text_1194.pdf

Kovacs, M. (1992). *Children's Depression Inventory*. North Tonawanda, NY: Multi-Health Systems, Inc.

Kovacs, M. (2003). *Children's Depression Inventory (CDI): Technical manual update*. North Tonawanda, NY: Multi-Health Systems.

Ladd, G. W., Kochenderfer, B. J., & Coleman, C. C. (1996). Friendship quality as a predictor of young children's early school adjustment. *Child Dev, 67*(3), 1103-1118. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/8706512

LaMorte, W. W. (2018). Behavioral Change Models: The Social Cognitive Theory. Retrieved from http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories5.html

Lazar, I., Darlington, R., Murray, H., Royce, J., Snipper, A., & Ramey, C. T. (1982). Lasting effects of early education: A report from the Consortium for Longitudinal Studies. *Monographs of the Society for Research in Child Development, 47*(2/3), i-151. doi:10.2307/1165938

Leahy-Warren, P., McCarthy, G., & Corcoran, P. (2012). First-time mothers: social support, maternal parental self-efficacy and postnatal depression. *J Clin Nurs, 21*(3-4), 388-397. doi:10.1111/j.1365-2702.2011.03701.x

Lee, L. C., Halpern, C. T., Hertz-Picciotto, I., Martin, S. L., & Suchindran, C. M. (2006). Child care and social support modify the association between maternal depressive symptoms and early childhood behaviour problems: a US national study. *J Epidemiol Community Health, 60*(4), 305-310. doi:10.1136/jech.2005.040956

McConnell, D., Breitkreuz, R., & Savage, A. (2011). From financial hardship to child difficulties: main and moderating effects of perceived social support. *Child Care Health Dev, 37*(5), 679-691. doi:10.1111/j.1365-2214.2010.01185.x

McLaughlin, M., & Rank, M. R. (2018). Estimating the Economic Cost of Childhood Poverty in the United States. Social Work Research, 42(2), 73–83. https://doi.org/10.1093/swr/svy007

McLeod, J. D., & Shanahan, M. J. (1993). Poverty, parenting, and children's mental health. *American Sociological Review, 58*(3), 351-366. doi:10.2307/2095905

Miller, G. E., Lachman, M. E., Chen, E., Gruenewald, T. L., Karlamangla, A. S., & Seeman, T. E. (2011). Pathways to resilience: Maternal nurturance as a buffer against the effects of childhood poverty on metabolic syndrome at midlife. *Psychological Science, 22*(12), 1591-1599.

Mirsky, A. F., Anthony, B. J., Duncan, C. C., Ahearn, M. B., & Kellam, S. G. (1991). Analysis of the elements of attention: a neuropsychological approach. *Neuropsychol Rev, 2*(2), 109-145. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/1844706

Moore, K. A., Redd, Z., Burkhauser, M., Mbwana, K., & Collins, A. (2009). *Children in poverty: Trends, consequences, and policy options*. Retrieved from Washington, D.C.: https://www.childtrends.org/wp-content/uploads/2013/11/2009-11ChildreninPoverty.pdf

Morris, A. S., Robinson, L. R., Hays-Grudo, J., Claussen, A. H., Hartwig, S. A., & Treat, A. E. (2017). Targeting Parenting in Early Childhood: A Public Health Approach to Improve Outcomes for Children Living in Poverty. *Child Dev, 88*(2), 388-397. doi:10.1111/cdev.12743

Neaum, S. (2010). *Child Development for Early Childhood Studies*: SAGE.

Olds, D. L., Sadler, L., & Kitzman, H. (2007). Programs for parents of infants and toddlers: recent evidence from randomized trials. *Journal of Child Psychology and Psychiatry, 48*(3-4), 355-391. doi:10.1111/j.1469-7610.2006.01702.x

Osanloo, A., & Grant, C. (2016). Understanding, selecting, and integrating a theoretical framework in dissertation research: Creating the blueprint for your "house". *Administrative issues journal: connecting education, practice, and research, 4*(2), 7. doi:10.5929/2014.4.2.9

Perou, R., Elliott, M. N., Visser, S. N., Claussen, A. H., Scott, K. G., Beckwith, L. H., . . . Smith, D. C. (2012). Legacy for Children™: A pair of randomized controlled trials of a public health model to improve developmental outcomes among children in poverty. *BMC Public Health, 12*(1), 691. doi:10.1186/1471-2458-12-691

Perou, R., Robinson, L. R., Danielson, M. L., Claussen, A. H., Visser, S. N., Scott, K. G., . . . Smith, D. C. (2019). The Legacy for Children Randomized Control Trial: Effects on Cognition Through Third Grade for Young Children Experiencing Poverty. *J Dev Behav Pediatr, 40*(4), 275-284. doi:10.1097/DBP.0000000000000656

Perrin, E. C., Leslie, L. K., & Boat, T. (2016). Parenting as Primary Prevention. *JAMA Pediatr, 170*(7), 637-638. doi:10.1001/jamapediatrics.2016.0225

Raver, C. C., Blair, C., & Garrett-Peters, P. (2015). Poverty, household chaos, and interparental aggression predict children's ability to recognize and modulate negative emotions. *Dev Psychopathol, 27*(3), 695-708. doi:10.1017/S0954579414000935

Reynolds, C. R., & Kamphaus, R. W. (2004). *BASC-2 behavioral assessment system for children manual* (2 ed.). Circle Pines, MN: AGS Publishing.

Robinson, L. R., Bitsko, R. H., Thompson, R. A., Dworkin, P. H., McCabe, M. A., Peacock, G., & Thorpe, P. G. (2017). *CDC Grand Rounds: Addressing Health Disparities in Early Childhood*. *66*(29), 32.

Robinson, L. R., Hartwig, S. A., Smith, D. C., Lee, A. H., Forbes, L. W., Perou, R., … Fitzmorris, D. (2018). Supporting Early Social and Emotional Relationships Through a Public Health Parenting Program: The Legacy for Children™ Intervention. In A. S. Morris & A. C. Williamson (Eds.), *Building Early Social and Emotional Relationships with Infants and Toddlers: Integrating Research and Practice* (pp. 183–211). https://doi.org/10.1007/978-3-030-03110-7_8

Rothbart, M. K., Posner, M. I., & Kieras, J. (2006). Temperament, Attention, and the Development of Self-Regulation. In *Blackwell handbook of early childhood development.* (pp. 338-357). Malden: Blackwell Publishing.

Sanders, M. R., & Woolley, M. L. (2005). The relationship between maternal self-efficacy and parenting practices: Implications for parent training. *Child: Care, Health and Development, 31*(1), 65-73. doi:10.1111/j.1365-2214.2005.00487.x

Sandler, I., Ingram, A., Wolchik, S., Tein, J.-Y., & Winslow, E. (2015). Long-term effects of parenting-focused preventive interventions to promote resilience of children and adolescents. *Child Development Perspectives*. doi:10.1111/cdep.12126

Shields, A., & Cicchetti, D. (1997). Emotion regulation among school-age children: The development and validation of a new criterion Q-sort scale. *Developmental Psychology, 33*(6), 906-916. doi:10.1037/0012-1649.33.6.906

Shields A, Cicchetti D. Reactive Aggression Among Maltreated Children: The Contributions of Attention and Emotion Dysregulation. *Journal of Clinical Child Psychology.* 1998;27(4):381-395.

Steinberg, L., Elmen, J. D., & Mounts, N. S. (1989). Authoritative parenting, psychosocial maturity, and academic success among adolescents. *Child Dev, 60*(6), 1424-1436. doi:10.2307/1130932

Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *J Health Soc Behav, 52*(2), 145-161. doi:10.1177/0022146510395592

Thompson, R. A. (1993). Socioemotional development: Enduring issues and new challenges. *Developmental Review, 13*(4), 372-402.

Tracy, M., Zimmerman, F. J., Galea, S., McCauley, E., & Stoep, A. V. (2008). What explains the relation between family poverty and childhood depressive symptoms? *J Psychiatr Res, 42*(14), 1163-1175. doi:10.1016/j.jpsychires.2008.01.011

Walker, S. P., Wachs, T. D., Grantham-McGregor, S., Black, M. M., Nelson, C. A., Huffman, S. L., . . . Richter, L. (2011). Inequality in early childhood: risk and protective factors for early child development. *Lancet, 378*(9799), 1325-1338. doi:10.1016/S0140-6736(11)60555-2

Werthamer-Larsson, L., Kellam, S., & Wheeler, L. (1991). Effect of first-grade classroom environment on shy behavior, aggressive behavior, and concentration problems. *Am J Community Psychol, 19*(4), 585-602. doi:10.1007/BF00937993

Wise, P. H., & Meyers, A. (1988). Poverty and child health. *Pediatr Clin North Am, 35*(6), 1169-1186. doi:10.1016/S0031-3955(16)36577-4

Yoshikawa, H., Aber, J. L., & Beardslee, W. R. (2012). The effects of poverty on the mental, emotional, and behavioral health of children and youth: implications for prevention. *American Psychologist, 67*(4), 272. doi:10.1037/a0028015

Zeman, J., Shipman, K., & Penza-Clyve, S. (2001). Development and initial validation of the Children's Sadness Management Scale. *Journal of Nonverbal Behavior, 25*, 187-205. doi:10.1023/A:1010623226626

Zigler, E., Gilliam, W. S., & Jones, S. M. (2006). *A Vision for Universal Preschool Education*. New York: Cambridge University Press.

Zilanawala, A., & Pilkauskas, N. V. (2012). Material Hardship and Child Socioemotional Behaviors: Differences by Types of Hardship, Timing, and Duration. *Child Youth Serv Rev, 34*(4), 814-825. doi:10.1016/j.childyouth.2012.01.008

Appendix A: IRB Determination Letter

EMORY UNIVERSITY | Institutional Review Board

May 31, 2019

Caroline Barry
Emory University
Rollins School of Public Health

RE: Determination: No IRB Review Required
Title: *Legacy for Children Follow-Up Study at 3rd Grade*
PI: Caroline Barry

Dear Ms. Barry,

Based on our review of the materials you provided, we have determined that it does not require IRB review because it does not meet the definition of research with human subjects as set forth in Emory policies and procedures and federal rules, if applicable. Specifically, in this project, you will conduct a secondary data analysis study on de-identified data. The dataset you will be provided with will not have any identifiers attached and you will not be provided with a key linking the data back to identifiable information. Those responsible for removing identifiers from the dataset are not members of the study team.

Please note that this determination does not mean that you cannot publish the results. This determination could be affected by substantive changes in the study design or identifiability of data. If the project changes in any substantive way, please contact our office for clarification.

Thank you for consulting the IRB.

Sincerely,

Emilie Scheffer
Research Protocol Analyst
Emory University Institutional Review Board

Appendix B:

Figure 1. Legacy for Children™ curriculum components at each site

	University of California at Los Angeles	*University of Miami*
Guiding Principles	A curriculum designed to elicit thoughts, feelings, self-reflection, and perspectives from mothers instead of instructing prescriptively. Content based on three principles: 1. Training of parenting skills can be effective 2. Interventions should occur when mothers feel uncertain but motivated to learn necessary skills 3. Time-limiting interventions can help to promote parent learning and minimize burnout	A "reality-based parenting" approach that imparts developmentally appropriate knowledge and skills through interactive lessons. Content addressed four key factors of parent identity: 1. Parenting as both a duty and an opportunity 2. Parents as nurturers 3. Parents as influencers of their child's development 4. Parents as guides of their child's socialization
Timeline	Begins when the mother is approximately 7 months pregnant; ends when the child turns 3 years old	Begins when the child is approximately 2-3 months old; ends when the child turns 5 years old
Duration	~150 minutes/session	~90 minutes/session
Structure	● 5 prenatal sessions followed by 9 postnatal blocks (3 blocks per year) of 10 weekly group sessions, with breaks of 4-6 weeks in between blocks ● One-on-one time with the intervention specialist during a home visit over breaks ● Family Unity Network (FUN) Club event after each mother-only session (60 minutes)	● 34-36 weekly group sessions per year ● Each session consists of the three core components: mother-only time, mother-child time, and community building activities; time devoted to each is flexible and dependent upon group needs ● One-on-one time with the intervention specialist generally occurred during mother-child time when appropriate
Content	Alternates between mother-child and mother-only sessions each week	Addresses the three core components at each weekly session

All information reported here is derived from Perou et al., 2012 and Robinson et al., 2019.

Appendix C:

Figure 2. Assessment measures and scoring

Domain	Assessment Measure	Type	Scoring	Internal Reliability	Subscales/Items
Behavior	Behavior Assessment System for Children, 2nd Edition (BASC-2)[1]	Mother report	Elevated risk = T-scores ≥60 on clinical scales and ≤40 on adaptive scales	α = 0.91	Clinical: Aggression, Anxiety, Attention Problems, Atypicality, Conduct Problems, Depression, Hyperactivity, Somatization, Withdrawal Adaptive: Activities of Daily Living, Adaptability, Functional Communication, Social Skills Composite: Attention Problems, Internalizing Problems, Externalizing Problems, Behavioral Symptoms Index, and Adaptive Skills
	Continuous Performance Task (CPT)[2]	Child performance	Elevated risk = T-scores ≥60 on all variables		Detectability, Omissions, Commissions, Perseverations, Hit Reaction Time (HRT)
Emotion	Child Depression Inventory-Short (CDI-S)[3]	Child self-report	Elevated risk ≥3[4]	α = 0.58	Depression construct items for: "negative body image", "crying spells", "feeling unloved", "irritability", "lack of friends", "loneliness", "pessimism", "sadness", "self-deprecation", and "self-hatred"[5]
	Emotion Regulation Checklist (ERC)[6]	Mother report		α = 0.71	Emotion Regulation, Lability/Negativity, Inappropriate Affect
	Children's Emotion Management Scale: Anger (CEMS:A)[7]	Child self-report		α = 0.57	Inhibition, Dysregulation, Coping
Social Features	Children's Empathy Questionnaire (CEQ)[8]	Child self-report		α = 0.72	
	Peer Social Support and Bullying (PSSB)[9]	Child self-report		α = 0.58	Social Support from Peers (SS), Perceived Victimization (PV), Engagement in Bullying Behaviors (BB)

[1] Reynolds & Kamphaus, 2004; [2] Beck, Bransome, Mirsky, Rosvold, & Sarason, 1956; [3] Kovacs, 1992; [4] Allgaier et al., 2012; [5] Kovacs, 2003; [6] Shields & Cicchetti, 1997; 1998; [7] Zeman, Shipman, & Penza-Clyve, 2001; [8] Funk et al., 2008; [9] Ladd, Kochenderfer, & Coleman, 1996

Appendix D:

Table 4. Independent *t*-tests: Socioemotional outcomes of Legacy for Children™ and comparison children at third grade (n=361)

	Miami			Los Angeles		
	Intervention Mean (SE)	Comparison Mean (SE)	*p*	Intervention Mean (SE)	Comparison Mean (SE)	*p*
Emotion Regulation Checklist						
Lability/Negativity	8.70 (0.21)	9.26 (0.24)	0.09†	8.89 (0.22)	9.15 (0.25)	0.43
Inappropriate Affect	6.48 (0.16)	6.31 (0.19)	0.50	6.15 (0.17)	6.40 (0.21)	0.36
Emotion Regulation	16.09 (0.24)	15.73 (0.32)	0.37	16.63 (0.27)	16.69 (0.28)	0.90
Children's Emotion Management Scale: Anger						
Inhibition	8.13 (0.20)	8.40 (0.24)	0.39	8.23 (0.19)	8.21 (0.27)	0.96
Dysregulation	5.05 (0.16)	5.18 (0.21)	0.60	4.59 (0.16)	4.38 (0.16)	0.37
Coping	8.80 (0.19)	9.08 (0.23)	0.36	9.23 (0.18)	8.74 (0.25)	0.10
Children's Empathy Questionnaire	26.67 (0.38)	27.14 (0.42)	0.41	27.33 (0.41)	26.03 (0.53)	0.05†
Peer Social Support and Bullying						
Social Support from Peers	4.01 (0.07)	4.10 (0.09)	0.43	4.01 (0.07)	3.91 (0.10)	0.42
Perceived Victimization	1.92 (0.09)	1.87 (0.10)	0.75	1.83 (0.08)	1.84 (0.12)	0.95
Engagement in Bullying	1.33 (0.06)	1.28 (0.07)	0.55	1.15 (0.04)	1.21 (0.05)	0.40

Notes: *Denotes statistical significance at the 0.05 level. †Denotes marginal statistical significance at the 0.10 level. Analysis for Emotion Regulation Checklist is based on 1998 scoring criteria (Shields & Cicchetti, 1998). T-scores are reported for CEQ.

Appendix E:

Table 5. Chi-square tests: Behavioral and emotional development outcomes of Legacy for Children™ and comparison children at third grade (n=357)

	Miami				Los Angeles			
	Int.	Comp.	χ^2	*p*	Int.	Comp.	χ^2	*p*
BASC-2 (T-scores)								
Externalizing								
+	13	10	0.09	0.77	12	18	5.93	**0.02***
-	92	62	--	--	89	50	--	--
Internalizing								
+	16	9	0.26	0.61	15	12	0.24	0.63
-	89	63	--	--	86	56	--	--
Behavioral Symptoms Index								
+	14	12	0.38	0.54	16	19	3.62	0.06†
-	91	60	--	--	85	49	--	--
Lack of Adaptive Skills								
+	20	16	0.27	0.61	12	19	7.00	**0.01***
-	85	56	--	--	89	49	--	--
Continuous Performance Task								
ADHD Confidence Index								
+	28	14	1.26	0.26	34	23	0.02	0.88
-	78	59	--	--	70	45	--	--
Child Depression Inventory-S								
+	67	38	2.64	0.10	58	40	0.22	0.64
-	41	38	--	--	47	28	--	--

Notes: *Denotes statistical significance at the 0.05 level. †Denotes marginal statistical significance at the 0.10 level. +Denotes elevated risk. -Denotes not at elevated risk. T-scores reported for BASC-2 and CDI-S.