

The Massachusetts Healthy Families Evaluation-2: Early Childhood (MHFE-2EC):

Follow-up Study of a Randomized, Controlled Trial of a
Statewide Home Visiting Program for Young Parents

**Final Report to Massachusetts Department of Public Health,
Children's Trust of Massachusetts**



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HRSA Disclaimer

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Commonly Used Acronyms and Abbreviations

DCF	Department of Children and Families	MHFE-1	Massachusetts Healthy Families Evaluation – Phase 1
DESE	Department of Elementary and Secondary Education	MHFE-2	Massachusetts Healthy Families Evaluation – Phase 2
DPH	Department of Public Health	MHFE-2EC	Massachusetts Healthy Families Evaluation – Phase 2: Early Childhood
DTA	Department of Transitional Assistance	PDS	Participant Data System
FY	Fiscal Year	RCT	Randomized Controlled Trial
GED	General Educational Development	RIO	Referral and Information Only (Control Group)
GIS	Geographic Information Systems	T1, T2, T3, T4, T5	Time 1, Time 2, Time 3, Time 4, Time 5 (data collection points)
HFA	Healthy Families America	TC	Target Child
HFM	Healthy Families Massachusetts	TIER	Tufts Interdisciplinary Evaluation Research
HRSA	Health Resources and Services Administration		
HVS	Home Visiting Services (Intervention Group)		
ITT	Intent to Treat		

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Executive Summary

The Massachusetts Healthy Families Evaluation Phase 2: Early Childhood (MHFE-2EC) is a longitudinal follow-up evaluation of Healthy Families Massachusetts (HFM), a statewide, universal home visiting program for adolescent mothers. The evaluation utilized the randomized controlled trial (RCT) designⁱ of the Massachusetts Healthy Families Evaluation (MHFE-2), in which eligible mothers who were pregnant or parenting their firstborn child were randomly assigned to receive HFM services or to receive referrals and information only. MHFE-2 evaluated early impacts of HFM, within the first two years of program enrollment, and included detailed information about program quality and utilization and participants' experiences with the program. The findings from MHFE-2EC extend the evaluation to a period of several years beyond service delivery, as families transitioned from infancy and toddlerhood into the early childhood years, and focuses primarily on young mothers' and their firstborn children's outcomes.

Following a brief summary of study design and methods, this Executive Summary highlights major findings related to program impacts for the full sample and within particular subgroups,ⁱⁱ as well as how earlier program effects impact later outcomes indirectly. The summary concludes with a presentation of implications and opportunities for: (a) HFM specifically, (b) the home visiting field more generally, and (c) other services that intersect with home visiting programs. We close with a brief discussion of areas for future research and exploration. This document is meant primarily for a policy and program audience; readers with a greater interest in technical detail are invited to read the full report.¹



Healthy Families Massachusetts (HFM)

HFM is a statewide, comprehensive, voluntary, newborn home visiting program for all first-time parents under the age of 21. An affiliate of Healthy Families America (HFA), HFM provides parenting support, information, and services to parents via home visits, goal-setting activities, group-based activities, secondary contacts (e.g., phone calls, voice mails, drop-in visits), and referral services. The program's stated goals are to:

- prevent child abuse and neglect by supporting positive, effective parenting;
- achieve optimal health, growth, and development in infancy and early childhood;
- promote educational attainment, job, and life skills among parents;
- prevent repeat pregnancies during the teen years; and
- promote parental health and well-being.

Although there are Healthy Families affiliates in 40 states, HFM remains the only statewide implementation of the HFA model that specifically targets adolescent parents. Since its inception in 1997, HFM has provided services to more than 35,000 young families.

The Massachusetts Healthy Families Evaluation (MHFE-2: Early Childhood)

Framed by Jacobs's Five-Tiered Approach to evaluation,² a developmental model that moves evaluation activities from a primary focus on descriptive and process-oriented information in the earlier tiers to an emphasis on program effects in the latter ones, MHFE-2 followed a sample of approximately 700 mothers and their children from over three waves of data collection from 2008 through 2012. Participants were recruited through the combined efforts of HFM local and state personnel and researchers at Tufts University. Eligibility requirements for participating in MHFE-2 included being a consenting female of at least 16 years of age, having not received any HFM services in the past (i.e., no transfers or reenrollments), being an English or Spanish speaker, and being cognitively able to provide informed consent. It employed a RCT design to assess program impacts,

ⁱA randomized controlled trial is a study in which people are assigned, by chance, to groups receiving different treatments. One of the treatments is the control group, which receives either a placebo, no treatment, or a standard treatment. Assigning people at random creates similar groups of people that can then be compared objectively to determine the effectiveness of the treatment being tested.

ⁱⁱSubgroups refer to groups of mothers as defined by a particular experience or characteristic at program enrollment. The subgroups examined in this evaluation were created based on mothers' report of depressive symptoms and family support at program enrollment, along with state agency data on mothers' childhood history of maltreatment.

collecting and analyzing data from two comparable samples of families: one that was offered HFM home visiting services and one that was not. Eligible women who consented to the study were randomly assigned to either the treatment group (Home Visiting Services; HVS) or the control group (Referral and Information Only; RIO). In total, 704 participants enrolled in the original study, of whom 433 (62%) were assigned to the HVS group, and 271 (38%) to the RIO group. Employing a mixed-methodsⁱⁱⁱ approach, the evaluation sought to answer several research questions regarding program operations and participant engagement, as well as whether participation in HFM yielded positive effects in the five HFM goal areas. Data were collected via telephone surveys; in-home assessments, observations, and qualitative interview; analysis of HFM program data; and several state agencies.

The MHFE-2EC study extends the RCT design of MHFE-2 to two additional time points: a fourth wave of data collection that occurred approximately 60 months post-enrollment when firstborn children were in preschool (Time 4), and a fifth wave occurring one year later, at 72 months post-enrollment when children were in early elementary school (Time 5). For the follow-up early childhood study, 490 and 445 participants enrolled in T4 and T5, respectively, 70% and 65% of the original sample. MHFE-2EC employed the same mixed-methods approach as did MHFE-2, with the addition of an extensive child protocol that included standardized child assessments, research-based measures of child executive functioning, and a child narrative completion task.

We used an intent to treat (ITT)^{iv} approach for determining program effects. Once mothers were assigned to the HVS (Healthy Families) group or the RIO (non-program, control) group, their assignment held—regardless of whether, for the HVS group, the mothers actually received home visiting services. Indeed, for the MHFE-2EC sample, approximately 13% of HVS mothers never received a home visit. ITT is a conservative approach to measuring program effects.

Methodological highlights of MHFE-2EC:

- A randomized controlled trial (RCT) longitudinal design
- Five waves of data, spanning six years, on a sample of young families in Massachusetts
- Multiple data collection methods with separate mother and child protocols, program, and state agency data
- Mixed analytic approaches: qualitative and quantitative
- Intent to treat (ITT) analytic approach to detecting program impacts

Characteristics of the MHFE-2/MHFE-2EC Sample

Figure ES1 provides a description of key demographic characteristics of participants at enrollment.

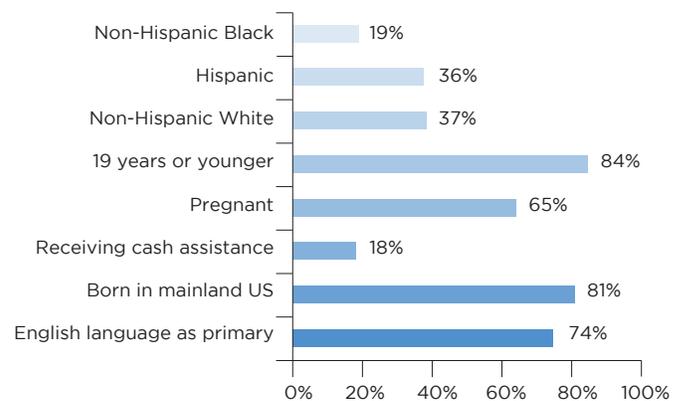


Figure ES1. Demographics of Participants at Enrollment (original cohort)

The MHFE-2EC sample comprised first-time mothers under 21 years of age at the time of birth; the average age of mothers at enrollment was 18.7, and as shown in Figure ES1, the overwhelming majority was 19 years of age or younger. Adolescent parents are simultaneously managing the difficult transitions to both adulthood and parenthood in the context of challenging life circumstances, which may demand different and additional approaches to programming.

ⁱⁱⁱ A mixed-methods approach refers to the use of both quantitative and qualitative methodology. Traditional quantitative measures include surveys with Likert scales, while qualitative measures include ethnographic interviews and observations.

^{iv} Intent to Treat (ITT) analytic approach includes all participants assigned to each treatment condition, regardless of participants' compliance or engagement with the treatment assigned to them.

A brief snapshot of these challenging circumstances, at program enrollment, includes:

- High rates of residential instability (average of two moves in past year);
- More than one half had childhood history of substantiated maltreatment;
- More than one third were clinically depressed;
- High incidence of lifetime trauma (average of three traumatic events);
- Approximately 3.5 acts of intimate partner violence in relationships (both as victim and as perpetrator).

We demonstrate in this report that many of these early factors continue to impact the lives of both mothers and their children several years beyond childbirth and enrollment in the Healthy Families Massachusetts evaluation. Based on our previous evaluation, we know that HFM leads to reductions in parenting stress and risky behaviors, and increases in educational attainment for young mothers (see Figure ES2).¹

Goal 1: Child Maltreatment	<ul style="list-style-type: none"> • HVS mothers less likely to report parenting stress
Goal 2: Child Health and Development	<ul style="list-style-type: none"> • No program effects
Goal 3: Education, Job, & Life Skills	<ul style="list-style-type: none"> • HVS mothers more likely to complete 1 year of college
Goal 4: Repeat Teen Pregnancies/births	<ul style="list-style-type: none"> • HVS mothers more likely use condoms
Goal 5: Parental Health & Well-being	<ul style="list-style-type: none"> • HVS mothers were less likely to: <ul style="list-style-type: none"> • Engage in risky behaviors (3+) • Use marijuana • Perpetrate Intimate Partner Violence (IPV)

Figure ES2. Main program effects from MHFE-2 evaluation

MHFE-2EC examines whether these favorable program impacts were sustained over time for the full sample of young mothers at T4 and T5, as well as within subgroups, including young mothers who were depressed at enrollment, those who experienced childhood maltreatment, and those with high or low levels of family support. We also examine links between program dosage (i.e., number of home visits received) and T4 and T5 outcomes for the HVS program group. Finally, we examine whether and how the previous program effects on T3 parenting stress and college attendance were associated with further effects at T4 and T5.

Key Findings: Program Impacts

To assess the longer-term impacts of HFM on young mothers' and their firstborn children's outcomes, we examined a variety of measures and indicators aligned with the HFM goal areas. Here we summarize program effects for the full sample, as well as within subgroups based on maternal depression and family support at enrollment and mothers' history of childhood maltreatment. Results indicate that participation in HFM continues to play a role in families' lives, several years after program engagement, in areas relevant to: (a) young adult parents' own health and development, (b) parenting school-age children, and (c) developmental tasks in early childhood. We highlight key findings below.

Does participation in HFM yield positive effects in the program goal areas?

HFM has five stated program goals. For this evaluation, we developed an additional goal, focused on advocacy and service use, covering an area of potential program impact within the early childhood period. Below we present program main effects, seen in bold, and highlight notable subgroup findings.

Goal 1: Prevent child abuse and neglect by supporting positive, effective parenting.

No overall program effects were found for outcomes in this goal area (including rates of maltreatment, parenting stress, parental discipline, and observed mother-child synchrony) for the full sample. Two favorable program effects were demonstrated among subgroups of mothers with higher psychosocial risks. Among the subgroup of mothers who had low family support at the time of program enrollment, HVS mothers reported less parental stress than RIO mothers when their children were preschool age. The early social support that HFM provides reduced the perception of stress, and conceivably enhanced mechanisms related to coping with stress several years later. Among mothers who were depressed at program enrollment (39% of the sample), HVS mothers were less likely to use corporal punishment than were RIO mothers. Likely, the curricular guidance HFM provides around disciplinary strategies is sustained over time for mothers who were depressed at enrollment. As HVS mothers receive support or referrals around their own mental health, they may be more able to absorb and implement information directly related to parenting. Yet, for mothers with a childhood history of substantiated maltreatment (55% of sample), HVS mother-child dyads at preschool age exhibited less synchrony in their interactions than did RIO mother-child dyads, suggesting there is still work to be done to effectively work with mothers who enter the program with a history of maltreatment in their own childhoods.



Goal 2: Promote optimal health, growth, and development in infancy and early childhood.

For this early childhood period, we examined developmental predictors of school success: school readiness, vocabulary, and executive functioning skills such as working memory, cognitive flexibility, and behavioral control. **Children in the HVS group demonstrated better working memory in preschool than did children in the RIO group.** No program effects were found for child outcomes related to receptive vocabulary, school readiness, emotion regulation, or general health, for the full sample. Interestingly, HVS mothers reported engaging in fewer literacy activities with their school-age children than did RIO mothers. Further exploration of this finding indicates that this program effect was strongest among mothers with high family support at enrollment, and that HVS mothers had greater involvement and contact with school teachers, suggesting that the additional support in their lives—within their families or through their children’s schools—enabled them to engage in these behaviors less frequently themselves.

Several subgroup findings merit attention. For mothers without a history of childhood maltreatment, HVS children displayed higher receptive vocabulary in preschool than did RIO children. Similarly, when mothers had high family support at program enrollment, HVS school-age children exhibited better emotion regulation than RIO school-age children.

Conversely, the program did not overcome the obstacles presented by subgroups of mothers entering the program with higher risk (e.g., history of childhood maltreatment, low family support). Among the subgroup of mothers who experienced maltreatment as children and who reported low family support at enrollment, children of HVS mothers were more emotionally dysregulated than children of RIO mothers, both as reported by their mothers, and independently. Children of young parents are at greater risk for physiological and emotional dysregulation,³ due to multiple factors that often accompany early parenthood, such as a history of maternal childhood maltreatment or low economic resources. It may be that the HFM program plays a role in helping mothers to recognize and report this regulation more clearly; at the same time, addressing these personal and environmental challenges to positive development remains challenging.

Goal 3: Encourage educational attainment, job, and life skills among parents.

Mothers in HVS were less likely than RIO mothers to report experiencing homelessness since the birth of their child (28% vs. 41% for HVS and RIO, respectively). No program effects were found on education, employment, or perception of adequate resources for the full sample. The finding that HFM families experienced less homelessness is a significant one, given the adverse consequences of homelessness for children, including greater risk of health, emotional, behavioral, and developmental problems.^{4,5,6,7,8} The prevention of early homelessness, therefore, provides a long-term protective effect for a host of child outcomes that may be observable in future years.

For the subgroup of mothers that were not clinically depressed at program enrollment, HVS mothers were more likely than RIO mothers to graduate from college (7.6% HVS vs. 0.9% RIO), and for those that did not experience childhood maltreatment, HVS mothers were more likely to complete a training program (33.6% HVS vs 18.4% RIO). For this goal area, then, the absence of psychosocial risk factors during program enrollment enabled program mothers to make greater gains than control mothers in educational attainment and economic self-sufficiency several years after program engagement.

The subgroup findings on college graduation and job training extend earlier findings that HFM mothers were more likely than RIO mothers to finish one year of college, for the entire sample. While the overall college

^v Our evaluation purposefully examined births within two years (rapid repeat birth) as our indicator, though the HFM program goal focuses on preventing repeat teen pregnancies. At this time period, with mothers in their mid-twenties, examining spacing between births was a more relevant measure, as a short inter-pregnancy interval is seen as risk factors for any mothers, regardless of age.^{11, 12}

completion rate in this sample is small (5%), initially non-depressed HVS mothers were about 7 times more likely to do so than initially non-depressed RIO mothers. Similarly, job-training completion was 28.3% for the whole sample, but non-maltreated HVS mothers were 83% more likely to have completed a job training program than non-maltreated RIO mothers. Over the life course, it has been demonstrated that early childbearing has negative consequences for long-term educational attainment and economic stability; teen mothers have been shown to complete less schooling, have less prestigious occupations and lower lifetime earnings than non-teen mothers, and are likely to receive public assistance when compared to older mothers.^{9,10} **Given this context, the program effects on housing stability, educational attainment, and job training are particularly noteworthy, and suggest the real economic benefits of home visiting for young mothers.**

Goal 4: Prevent repeat pregnancies during the teen years.

No program effects were found for the full sample on outcomes in this goal area, which we measured at this time period as the rate of rapid repeat birth (within two years of first birth),^v and number of births. Within the program group, however, HFM mothers who received more visits had fewer births within two years of their first child. This suggests that for this goal area, the level of engagement with the home visitor or program can influence a mother's decision around family planning. From a program delivery aspect it is critical to remember that HFM emphasizes supporting a mother with her choices, which at times may be at odds with this particular goal of preventing rapid repeat birth. Some mothers intentionally gave birth to a second child within this two year time frame. In this case, perhaps the home visitors' efforts would be better directed toward ensuring that mothers had the necessary resources and supports to accommodate and maintain their growing families.

Goal 5: Promote parental health and well-being.

Compared to mothers in RIO, mothers in HVS reported fewer depressive symptoms during the preschool period, and reported that they were less likely to engage in substance use (e.g., binge drinking, marijuana use, and/or cocaine use in the past month) during the kindergarten period. These findings were strongest for the subgroup of mothers who were clinically depressed at enrollment. No program effects for the full sample were found on diagnoses or treatment of physical or mental health conditions, personal mastery, or intimate partner violence (IPV), yet there were some effects for certain subgroups of mothers. A reduction in partner-perpetrated IPV was seen for the subgroup of mothers who did not have a history of childhood maltreatment as well as mothers who were clinically depressed at the time of program enrollment.

It is not surprising that the HFM program has the strongest impact in the goal area of mothers' health and well-being, as mothers are the direct recipients of all services provided. What is unexpected is the success that HFM has had with subgroup of mothers who were clinically depressed at the time of program enrollment. These findings suggest that HFM program practices aimed at supporting mothers with depression are successfully decreasing depression over time, either by direct support provided by home visitors or by referrals made for mental health services. In addition, HFM assists mothers in reducing health risk behaviors related to both physical safety and mental health.

Goal 6: Encourage advocacy and use of early childhood systems of care.

MHFE-2EC included a number of assessments examining how young mothers navigate and advocate within early childhood systems of care such as health and elementary education. **Compared to RIO mothers, HVS mothers reported going to the Emergency Room less often during the preschool period (66% HVS vs. 78% RIO).** Yet, for the subgroups of mothers with low family support initially, or who had experienced maltreatment in childhood, HVS mothers were more likely to take their children to the ER, compared to RIO mothers.

During the kindergarten period, compared to RIO mothers, HVS mothers reported that they were more likely to take action in a situation calling for self-advocacy (63% HVS vs. 50%). For the subgroup of mothers who were clinically depressed, HVS mothers were more likely than RIO mothers to take action regarding a problem related to their child's education in the kindergarten period (61.2% HVS vs. 38% RIO). Another positive program impact was found for the subgroup of mothers who had low family support at program enrollment: HVS mothers had better relationships with their teachers or child care providers in the kindergarten period than did RIO mothers.

Although this area of advocacy and positive navigation of early childhood systems of care is not a stated goal of the HFM program, HFM's influence in early childhood is evident in mothers' use of health care services as well as in self-advocacy. For mothers who are depressed at program enrollment, HFM appears to empower them to later advocate for their school-age children. For mothers with low family support, HFM may fill a void, and transform mothers' experiences and ideas about helping relationships, supporting later positive engagement with their child's teachers. These findings demonstrate the potential of HFM for providing transformative experiences for mothers who enroll with multiple risks.

Indirect HFM Program Effects

To better understand the long-term effects of HFM on mothers' outcomes, we examined whether HFM impacted mothers' adjustment in early childhood indirectly via earlier program effects on mothers' parenting distress and college attendance.^{1,13} We found support for both of these models. Notably, in the parental distress model, HFM participation was indirectly associated with maternal mental health during the preschool period and maternal wellness practices during kindergarten, via reductions in parental distress at Time 3 (two years after program enrollment, when children were approximately 2 years of age). Second, in the college attendance model, HFM participation was indirectly associated with maternal economic health outcomes (i.e., less dependence on public assistance and higher employment) during the preschool period, via the greater likelihood of college attendance reported at Time 3.

These analyses demonstrate how short-term effects of HFM, observed during or shortly after enrollment, have subsequent effects in the future. Thus, for some outcomes, home visiting effects are seen early on, for others in the longer term, and for yet others, indirectly through the early effects. This "suite" of program influences—for the full sample and for important subgroups—demonstrates that home visiting affects young mothers and their children in many areas, through several "paths." Moreover, the influences of HFM extend beyond the period of program enrollment, and even into different periods of the family life cycle. This report adds to the evidence base documenting the effectiveness of HFM specifically, and home visiting broadly, as a model of prevention and intervention for young mothers with varying levels of risk. The findings highlight how the universality of the HFM program, aimed toward a specific developmental period with high risk, can successfully modulate its services to meet critical and relevant needs for both the parents and children it serves.

Key Findings: Is Program Dosage Associated with Outcomes?

Mothers who participated in Time 4 received 26 visits (median = 16) over 16.1 months, on average. There was substantial variation in program take-up, with about 14% of the program group receiving no home visits at all, and about 46% receiving 18 or more home visits, the recommended dosage. Given this variation, it is important to examine the association between the

number of home visits HVS mothers received and their longer-term outcomes. Of course, these analyses are only correlational, falling outside of the RCT design, but provide useful documentation of how HFM is operating as a complement to the assessment of program effects.

An examination of the associations between dosage (i.e., the number of home visits HVS mothers received) and program outcomes at T4 (preschool age) and T5 (kindergarten age) revealed mixed results. Similar to what was reported previously, higher HFM dosage was associated with both maternal strengths and vulnerabilities.

Within the home visiting group, MHFE-2EC HVS mothers who received more home visits:

- reported less parenting distress during preschool,
- were more likely to perceive their kindergarten-age child as difficult,
- were more likely to use nonviolent discipline with their preschool-age child,
- were less likely to do literacy activities at home with their school-age child, and
- were less likely to have a repeat birth within two years of first birth.

Given both the favorable and unfavorable findings, it is likely that young mothers who engage with HFM have different profiles, including both high functioning young mothers with few obstacles who can easily fit home visits into their busy lives, as well mothers who are struggling and greatly need the home visitor's help. Similarly, mothers who leave the program early may do so because they are doing well and do not need additional services, or because their needs are so great that they cannot effectively or consistently engage in a home visiting program. These variations in maternal characteristics, coupled with the correlational nature of the analysis, complicate the interpretation of program dosage on young mothers' outcomes; nonetheless, recognition of this variability has implications for how HFM might conceptualize service delivery to maximize program effectiveness.

Implications and Opportunities

Implications of this evaluation are discussed in more detail in the final chapters of the report. Here, we very briefly summarize some observations/recommendations related to HFM program operations, and its relation to other organizations and agencies.



Recommendations for Program Practices

- Target most relevant program goals.** Our findings demonstrate that while HFM continues to successfully impact change in all six program areas, it is not reasonable to expect goal attainment in all goal areas for every family. It is important to understand that certain maternal and family characteristics at program enrollment play a substantial role in determining for whom the program works and in what ways; program staff can use this knowledge to best support each participant in moving toward whichever goals are most achievable for that family.
 - Restructure early visits to include guidance on referral connection and housing.** Acknowledging that there will likely be a portion of mothers who engage with the program “lightly,” programs should ensure that the content of the first few visits offer appropriate referral information and guidance about making connections to the services that mothers or home visitors feel are priorities. In light of the high incidence of homelessness in the MHFE-2EC sample, specific guidance on steps to ensure housing, or options if housing falls through, is warranted.
 - Continue flexible service modalities in order to extend program duration.** HFM has already incorporated technology into its outreach practices. A logical extension would be a service modality in which phone or video calls serve as the primary means of communication, with level of service varying according to family need. For example, a family may engage with weekly home visiting enthusiastically for a certain amount of time, but change to monthly visits, then monthly or bi-weekly phone or Skype calls, with an occasional periodic in-person home visit. This type of flexibility could increase duration of time in the program in a more time- and cost-
- efficient manner for both clients and home visitors. It would also allow for a continued relationship with a particular home visitor if a family or home visitor changed location. These types of strategies align with the more universal or “light touch” approaches that recently have been emphasized in the home visiting field.¹⁴
- Increase training/resources for staff on maltreatment and trauma.** When clients enter the program with their own histories of maltreatment during childhood, HFM program staff face particular challenges effecting positive change in parenting and self-care behaviors; this was evident in our evaluation. Ascertaining this history allows HFM to best support clients and staff working with these clients. The likelihood that at least one in two participants have experienced maltreatment is a sobering, but not insurmountable, statistic. Several evidence-based interventions demonstrate positive program impacts on parenting behaviors in vulnerable parents, many of which involve filming mothers and children, and providing for video feedback. One suggestion that may enhance goal attainment among vulnerable parents is to incorporate concentrated training opportunities in these intervention techniques for interested staff as part of a career ladder/professional development track. While it might not be possible for all staff to receive this training, providing specialized training opportunities for one or two individuals at each program site may allow for more intensive services for the families who could benefit most. This also may serve a dual purpose of investment in staff which could decrease staff turnover.
 - Use positive impacts on depressed mothers as a model for addressing risk.** The extent of HFM’s positive impact on mothers who were clinically depressed at program enrollment was unexpected. Among these mothers, positive impacts were seen in 4 of 6 goal areas—in parenting behavior, college graduation rates, decreased health risk behaviors, and in maternal advocacy. Going forward, the program can look to their implementation strategies regarding depression as a model for how to address other areas of risk, such as working with mothers with a childhood history of maltreatment. In the future this evaluation will further investigate the mechanisms for these positive impacts (e.g., number of referrals made, types of support provided, program utilization profiles of participants) to help the program better understand what program efforts can be applied to mothers with other or additional challenges.

- Consider ways to bolster HFM impact on children.** The evidence of program impacts on children's functioning, at least those aspects that we studied (e.g., executive function, emotion dysregulation, school readiness) was relatively sparse. There are several things to consider as we interpret our findings. First, it may be that the program exerts most of its influence on the mothers, particularly in areas of mental health, personal functioning, and basic needs such as housing. Expecting strong impacts on children's functioning years after the end of program services (especially for those families in which program participation was minimal) may be unrealistic. Impacts on child maltreatment, particularly neglect which characterizes the vast majority of maltreatment cases in this sample, are complex, and are complicated by a host of environmental and other external factors that are outside the purview of HFM services. Second, in the absence of 1) a specific identified child development goal (e.g., literacy) and curriculum that becomes a particular focus of the program and 2) the child as a direct recipient of program services, impacts on child functioning may be more elusive. Finally, the fact that some of the methods that we employed to assess children's development have little history of use with a sample such as this one, may also contribute to the lack of evidence of strong impacts on children's functioning.
- Ensure "in-house" expertise on parent-child interaction.** Invest in evidence-based approaches to support training on parent-child-interaction interventions for more vulnerable parents. HFM training and supervision policies already adhere to high program standards, but additional training for supervisors and some staff on new methods could empower the program as a whole to work with these families with confidence.
- Continue to strengthen cross-agency collaborations.** The power of an effective referral, for example, for mental health, housing, or financial assistance, often depends on the relationships between individuals at various agencies, at local, state, or federal levels. While HFM endeavors to model and guide parents in effective advocacy strategies, we know that program staff spend a great deal of effort connecting clients to services and service providers that will complement HFM services. Investing in shared knowledge of agency personnel, fostering relationships between HFM and other agency staff, and promoting rapport on an upper management level will ensure that critical referrals are completed.

Implications for HFM within Communities and across Sectors

While the intent of this longitudinal evaluation focused on HFM program impacts for the overall sample, what proved most illustrative of HFM's success and challenges lay in the subgroup analyses. Although a universal approach may have merit, it is clear that HFM is not a 'one size fits all' program, and that certain participant characteristics require different, extra, or concentrated efforts from HFM. Given these substantial challenges, we offer the following thoughts:

Conclusion

Results from this longitudinal evaluation demonstrate that the positive impact of the HFM program extends well beyond the time of program engagement for many young families. As these families transition into the new roles and relationships associated with early childhood, HFM provides the necessary support and modeling to foster positive personal and parenting trajectories. HFM is conceptualized as a prevention program; results from this report demonstrate that it also is an intervention program, particularly for mothers who come into the program with clinical depression. The evidence of positive long-term program impacts, both direct and indirect, for mothers with a range of life circumstances and risks at enrollment, highlights the wisdom of the flexibility within the HFM model.

INTRODUCTION

For almost 20 years, researchers at Tufts University have been engaged in an ongoing, developmentally oriented evaluation of the Healthy Families Massachusetts (HFM) home visiting program. HFM is an ambitious voluntary newborn home visiting program for all first-time parents ages 21 and under. Since its inception in 1998, HFM has worked with approximately 35,000 families to meet five goals: (1) prevent child abuse and neglect by supporting positive, effective parenting; (2) achieve optimal health, growth, and development in infancy and early childhood; (3) promote educational attainment, job, and life skills among parents; (4) prevent repeat pregnancies during the teen years; and (5) promote parental health and well-being.

Two evaluations of the HFM program, rooted in Jacobs's Five-Tiered Approach to evaluation,² were undertaken to provide a comprehensive understanding of program operation and effects. The Five-Tiered Approach (FTA) is a developmental model that moves evaluation activities primarily focused on descriptive and process-oriented information to program effects (see Appendix 1). The first phase of the evaluation (MHFE-1),¹⁵ completed in 2005, used a mixed-methods approach to describe program staff, services, and clients; examine program implementation compared to model standards; and provide feedback to HFM for program improvement. It also assessed the extent to which HFM was meeting the abovementioned goals using outcome data and a nonexperimental design. The second phase of the evaluation (MHFE-2),¹ completed in 2012, employed a randomized controlled trial (RCT) design with a new cohort of participants, with dual goals of documenting program operations and program effects through mothers' first two years of parenting. The primary advantage of MHFE-2 was the use of an experimental design, which made it possible to attribute changes in participant outcomes to the work of HFM. Extensive details on program operations and program effects for families during infancy and toddlerhood are described in the recent MHFE-2 evaluation report. A brief summary of positive program effects, by goal area, showed that, compared to mothers in the control group, HFM mothers:

1. experienced less parenting stress;
2. were more likely to complete one year of college;
3. were more likely to use condoms;
4. were less likely to engage in risky health behaviors, use marijuana, and perpetrate intimate partner violence.

In the present report, we document findings from the longitudinal follow-up study of the MHFE-2 sample. Beginning in 2011, MHFE-2 Early Childhood (MHFE-2EC) was conducted to investigate long-term program effects during the early childhood years (when children were approximately five and six years old); a time in which families were no longer receiving home visiting services. Throughout this study, we continued to examine program effects on the five stated HFM goals. An additional benefit of this longitudinal study was the opportunity to focus directly on children's functioning in areas such as school readiness, executive functioning, and emotion regulation.

In line with HFM stated goals, we asked whether positive effects of HFM could be observed in the early childhood years in the following areas:

1. incidence of child abuse and neglect
2. child health and development
3. maternal educational achievement and employment
4. prevalence of rapid repeat births
5. maternal well-being.

In addition to extending the research questions of MHFE-2 into early childhood, a further goal of MHFE-2EC was to explore whether and how receipt of HFM increased participants' knowledge and ability to navigate early childhood systems. Engagement with early childhood resources and contexts may further amplify program effects. Thus, the follow-up study explored parents' early education and school decisions, and investigated parents' advocacy abilities and use of community resources. Specifically, the following research questions were investigated:

1. Are HFM parents better able to identify, access, and remain appropriately engaged with community resources?
2. Are HFM parents better equipped to advocate for their children and themselves?

While the primary aim of MHFE-2EC was to examine longer-term program effects on mothers' and children's outcomes, there were several secondary aims. In addition to examination of program effects, we examined whether outcomes varied by degree of HFM participation for the program group. Next, we looked at whether program effects were more apparent for certain subgroups of mothers who varied on salient characteristics (i.e., whether mothers had experienced substantiated childhood maltreatment, whether they were clinically depressed at program enrollment, and the extent of family support at program enrollment). Third, we also explored whether earlier program effects on mothers' parenting stress and college attendance mediated longer-term

program effects measured in MHFE-2EC. Lastly, we used longitudinal modeling to examine whether HFM impacted mothers' depressive symptomatology over time.

In sum, the longitudinal follow-up study was designed to examine parent, family, and child outcomes within the context of parenting, family, and community characteristics and with consideration of the ways in which families utilize early childhood services and resources within their communities.

In the chapters that follow, we summarize the findings from MHFE-2EC. Chapters 1 and 2 provide an overview of HFM, the evaluation design, and the analytic approaches used for this report. Chapter 3 describes participant characteristics. Chapters 4 through 8 present the findings on participant outcomes. Specifically, Chapter 4 reviews overall program impacts, Chapter 5 examines links between program utilization and outcomes, Chapter 6 looks at subgroup or moderation analyses, Chapter 7 presents mediation models exploring whether earlier program effects drive later program effects, and Chapter 8 examines trends in maternal depression over time.

CHAPTER 1. EVALUATION DESIGN

In 1998, the Massachusetts Children's Trust implemented Healthy Families Massachusetts (HFM), a newborn home visiting program designed to promote positive child and family development among young families across the state. The current report summarizes a longitudinal follow-up study of the randomized-control trial Massachusetts Healthy Family Evaluation Phase-2 (MHFE-2).¹ The longitudinal study followed MHFE-2 families into early childhood and is known as Massachusetts Healthy Family Evaluation Phase-2: Early Childhood (MHFE-2EC). MHFE-2EC began in 2011. Using a randomized controlled trial design, data were collected and analyzed from two comparable samples of families - one that was offered HFM home visiting services and one that was not.

This chapter provides the structure of MHFE-2-EC's research design. First, an overview of Healthy Families Massachusetts (HFM) is provided. Second, the Five-Tiered Approach to evaluation^{2,16,17} which is used to inform the evaluation design and analyses conducted for this follow-up is briefly described. Finally, MHFE-2EC's data collection procedures, subsamples, retention rates, and data sources are described in detail.

1.1. Healthy Families Massachusetts (HFM)

HFM is a comprehensive, voluntary, newborn home visiting program for all first-time parents ages 21 and under in the state of Massachusetts. Affiliated with the Healthy Families America (HFA) home visiting program, HFM

provides parenting support, information, and services to young parents, beginning prenatally or until the child turns one year of age, and continuing until the child's third birthday. HFM program services include home visits, goal-setting activities, group-based activities, secondary contacts (such as through phone calls between home visitors and participants), and linkages and referrals to other resources. Since its inception, HFM has provided services to approximately 35,000 families.

The program's stated goals are to:

1. Prevent child abuse and neglect by supporting positive, effective parenting;
2. Achieve optimal health, growth, and development in infancy and early childhood;
3. Promote increased educational attainment, job, and life skills among parents;
4. Reduce repeat teen pregnancies;
5. Promote optimal parental health and wellness.

1.2. The Five-Tiered Approach to Evaluation

MHFE-2EC is rooted in Jacobs's Five-Tiered Approach to evaluation, a developmental model that moves evaluation activities primarily focused on descriptive and process-oriented information to program effects (see Appendix 1).^{2,16,17} To summarize: Activities at Tier One produce needs assessments, activities at Tiers Two and Three are directed at program processes, and activities at Tiers Four and Five focus on outcome evaluation with the primary difference between these two being the use of experimental design in Tier Five. MHFE-2EC is firmly situated in Tier Five. The MHFE-2 report includes a more detailed look at how the Five-Tiered approach was used to frame the study.¹

1.3. Study Design

Participants were randomly assigned to either Home Visiting services (HVS, program group) or Referral and Information Only (RIO, control group) at the time of study enrollment. Participants assigned to HVS could receive HFM home visiting services and those assigned to RIO could not, but were given child development information and referred to other services. Follow-up study evaluation activities, subsamples, and attrition rates are described in the following sections. The MHFE-2 report includes further details on all aspects of the initial study design.¹

1.3.1. Data Collection Timeframe and Sample Retention

In total, HFM recruited 837 participants for the study, of whom 517 (62%) were assigned to HVS, and 320 (38%) to RIO (See Figure 1.1 for a flowchart illustrating MHFE-2 and MHFE-2EC sample recruitment and retention procedures). Once participants were randomly assigned by HFM, the Tufts evaluation team assumed responsibility for recruitment and data collection activities.

The Tufts evaluation team recruited participants in two phases. First, each mother was asked to complete a half-hour interview on the phone, and sign a release allowing Tufts to access her agency (administrative) data. Participants had the option to do either or both activities. Given that participants were randomly assigned into HVS or RIO, this is the sample for which the causal effectiveness of the program can be established. For this reason, mothers who provided at least one source of data (via the phone interview or agency data release) were included in this sample, which we refer to as the *Impact Study sample*. Of the 837 mothers recruited for the study, 704 enrolled in the Impact Study sample. Of this group, 690 mothers (98%) agreed to release their agency data.

Second, Impact Study participants were offered the option of participating in an additional 2-2.5 hour in-depth, in-person interview. Participants who consented to this research visit were considered to be part of the *Integrative Study subsample*. Data collected during the in-person interview were used to clarify findings that emerged from the impact study analysis; however, due to self-selection into this sub-sample, the assumption of random assignment no longer holds.

MHFE-2/MHFE-2EC interviews were conducted at five time points: Time 1 (T1) interviews were completed about one month after enrollment, Time 2 (T2) interviews were completed about 12 months after enrollment, Time 3 (T3)

interviews were completed about 24 months after enrollment, Time 4 (T4) interviews were completed approximately 60 months after enrollment, and Time 5 (T5) interviews were completed about 74 months after enrollment.

T1 data collection proceeded from February 2008 to February 2010; T2 data collection proceeded from April 2009 to April 2011; and T3 data collection began in March 2010 and lasted until August 2012. T4 data collection began in December 2012 and concluded in June 2014; Time 5 (T5) data collection began in July 2014 and concluded in December 2015.

Sixteen percent ($n = 133$) of the initial 837 recruits did not participate in the evaluation—they are referred to as excluded in the flowchart—because they asked to be withdrawn or were deemed ineligible by Tufts ($n = 91$),^{iv} or were never located by the Tufts team ($n = 42$).

As seen in Figure 1, phone interviews were completed by 684 mothers at T1 (97%), 564 at T2 (80%), and 594 at T3 (84%). The in-person interview was completed by 473 mothers at T1 (69%), 401 at T2 (71%), and 409 at T3 (69%). Of the 473 participants who elected to complete the in-person interview at T1, most (79%, $n = 373$) also completed it at T2 and T3.

Outreach and recruitment for MHFE-2EC began in 2012 and followed these guidelines: (a) sample recruitment was from the 684 mothers who completed T1 phone interviews, and (b) families were recruited according to mothers' firstborn child's age (target child, TC), with the goal of engaging families prior to children entering kindergarten for T4, and then to engage families when children were enrolled in kindergarten for T5. At T4, 490 participants completed phone interviews (72% of the T1 sample) of whom 289 (59%) were HVS and 201 (41%) were RIO. At T5, 445 participants completed phone interviews (65% of T1 sample), 263 (59%) were HVS and 182 (41%) were RIO. A high percentage of families completed the in-person interviews at T4 and T5, 88% and 91%, respectively (see Figure 1.1).

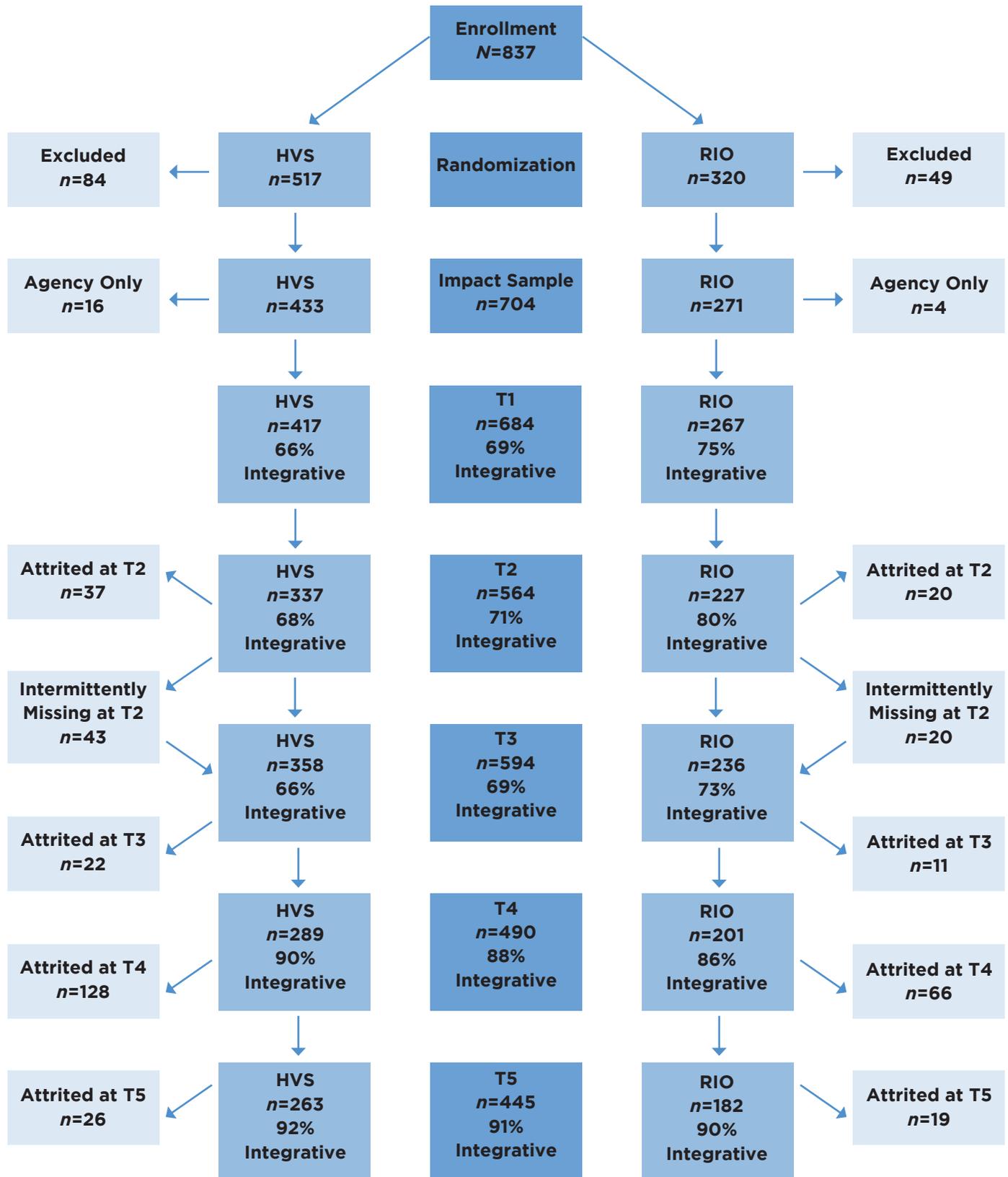
i Participating agencies include the Department of Children and Families (DCF); the Department of Elementary and Secondary Education (DESE); the Department of Public Health (DPH); and the Department of Transitional Services (DTA).

ii A small subsample of participants (see Figure 1.1) only released their agency data and did not complete the telephone interview. These participants are referred to as "Agency Only."

iii This represents the average timing of data collection. We allowed 18 months from enrollment to collect T1 data (the majority of data were collected by 4 months); a window of 18 months between T1 and T2, and 18 months between T2 and T3. In total, we allowed no more than 3 years to lapse between T1 and T3 (average time between T1 and T3 was 24.84 months for the phone interviews and 24.72 for the in-person interviews). On average, there were 11.9 months between the T1 and T2 phone interviews, 12.1 months between the T1 and T2 in-person interviews, 12.4 months between the T2 and T3 phone interviews, and 11.98 months between the T2 and T3 in-person interviews. For MHFE-2EC, on average there were 32.45 months between the T3 and T4 phone interviews, 33.99 months between the T3 and T4 in-person interviews, 14.98 months between the T4 and T5 phone interviews, and 15.16 months between the T4 and T5 in-person interviews.

iv Participants could be deemed ineligible by Tufts if they were enrolled into the study but did not meet HFM program-specific eligibility requirements (e.g., due to loss of their pregnancy through miscarriage or termination) or, if they did not meet MHFE-2 evaluation eligibility, as detailed earlier. All these participants were withdrawn from the study.

Figure 1.1. MHFE-2 and MHFE-2EC Sample Recruitment and Retention



1.3.2. Data Sources

Data were collected from a variety of sources, including phone and in-person interviews, standardized assessments, observational measures, public agency administrative data, the HFM management information system (called the Participant Data System; PDS), and population-level data (i.e., 2010 U.S. Census). These data allowed us to accomplish a variety of analytic tasks, such as assessing program impacts, contextualizing the nature of HFM program operations and mothers' experiences in the HFM program, and unpacking the complex ecologies of first-time teenage mothers and their community contexts. Each of these data sources is described below in more detail.

Phone Interview

Semi-structured interviews were conducted by phone at each of the five data collection time points. These interviews generated data that helped characterize MHFE participants and their contexts, and included demographics (e.g., age, ethnic background, relationship status); current family resources and involvement of the baby's father; current residential and financial circumstances; and maternal well-being (e.g., social connection, depression). Information about participants' use of public and social services other than HFM was elicited to contextualize the impact of HFM services relative to the array of other services that mothers in both the HVS and RIO groups may have received.

In-Depth, In-Person Interview

In addition to participating in the phone interview, the majority of mothers participated in an in-person interview in their homes. The in-person interview included a semi-structured interview, the administration of written questionnaires, observations of mother-child interactions, and for MHFE-2EC, an additional child protocol. During these in-person visits, qualitative and quantitative methods were used to collect in-depth information about social relationships and support networks (e.g., family/friend, father of baby, neighborhood/community); parenting behaviors; recent histories of intimate partner violence; and personal functioning/well-being (e.g., adverse childhood experiences, health risk behaviors). Observations of mother-child interaction (e.g., dyadic synchrony), as well as a child protocol that included standardized assessments of receptive vocabulary and school readiness, measures of executive functioning, and an attachment-based narrative completion task were included.



Public Agency Administrative Data

State public agency data were utilized to answer the primary research questions about the effectiveness of HFM in achieving the outcomes specified in its five goals. Participating agencies included the Departments of Children and Families (DCF), Elementary and Secondary Education (DESE), Public Health (DPH), and Transitional Assistance (DTA). These data were collected for all MHFE-2 and MHFE-2EC participants who granted TIER researchers permission to access their administrative data. Through Memoranda of Understanding established between the Children's Trust and each of these agencies, data transfers from the agencies to MHFE-2 began in 2010. MHFE-2EC data transfers cover a period of time between January 2007 and December 2016 for T4 participants and between January 2007 and December 2020 for T5 participants.

HFM Participant Data

The Participant Data System (PDS) is the web-based management information system administered and maintained by the Children's Trust. Data entered by home visitors and supervisors provided background information about participants (e.g., pregnancy and birth information), detail about service planning and utilization (e.g., referral, enrollment, and service levels; the frequency and content of home visits and other HFM services; Individual Family Service Plans [IFSP's] goal setting and attainment), child and mother assessments and status reports, and discharge records.

Population-Level Census Data

Geographic Information Systems (GIS) was used to characterize the communities in which participants lived. Data were derived from spatially assigning participants to a community and then accessing spatially organized public databases (e.g., MassGIS, U.S. Census) that characterized the communities in which participants lived.

1.4. Chapter Summary

Healthy Families Massachusetts (HFM) is a newborn home visiting program for all first-time parents ages 21 and under in the state of Massachusetts. It provides services such as home visits, goal-setting activities, group-based activities, secondary contacts (e.g., phone calls between home visitors and participants), and linkages and referrals to other resources. The program has five stated goals, which address the positive health and development of participating families.

The Massachusetts Healthy Families Evaluation Phase 2: Early Childhood (MHFE-2EC) is a longitudinal follow-up evaluation of HFM. Utilizing a randomized controlled trial (RCT) design and rooted in the Five-Tiered Approach to evaluation, MHFE-2EC examines the longer-term impacts of HFM on mothers' and children's outcomes through the preschool and early school-age years.

CHAPTER 2. ANALYTIC APPROACH

The original MHFE-2 report was organized by the Five-Tiered Approach to evaluation (See Section 1.2). The primary outcome analyses for this report are situated in Tier Five activities, all examining whether HFM was successful at achieving its long-term goals. To this end, we used several analytic approaches. First, overall program impacts were examined using an intent to treat (ITT) approach. The randomized controlled trial design, implemented as part of Tier Five, allows us to establish whether those outcomes can be attributed to the program. Breaking away from the RCT design, we also examined whether outcomes might vary depending on program utilization for the home visiting group only. Next, we continued with more detailed examinations to explore whether effects might differ among several key subgroups (i.e., moderation). Then, mediation models were run to explore possible mechanisms or pathways through which the program affects longer-term outcomes. Finally, we used growth curve analyses to determine if there was a program impact on mothers' depression symptoms over time.

The details of each analytic approach are described below.

2.1. Main Effects using Intent to Treat (ITT) Approach

Keeping in line with previous analyses,^{1,13} ITT program effects were estimated, comparing T4 and T5 outcomes between the HVS program group and the RIO control group based on random assignment status, regardless of whether young mothers in the HVS group took up the home visiting program and received home visits. Indeed, 14% of HVS mothers did not receive any home visits, suggesting that the ITT estimates are a lower-bound estimate of program effects, but perhaps more closely reflect the reality of implementing the intervention at the population level, where non-uptake is expected.

ITT analyses were conducted in Stata 14.0, in which each outcome was regressed on the program status indicator variable (1 = HVS, 0 = RIO). Ordinary least squares (OLS) regression was used with continuous outcomes and logistic regression for binary outcomes. All models included a standard list of control variables to improve precision of the estimates of program effects, including maternal age at target child's (TC) birth (in years), maternal race/ethnicity (non-Hispanic White [omitted], non-Hispanic Black, Hispanic, non-Hispanic other), TC's age at the T4 or T5 phone interview (in years), and TC's sex (1 = female, 0 = male). All main effects analyses utilized Stata's survey data commands in order to incorporate Inverse Probability Weights (IPW) to reweight the data to be representative of the original T1 sample and adjust for attrition over time (see Appendix 2), and robust standard errors to adjust for clustering of mothers within HFM catchment areas where participants were recruited.

Both weighted and unweighted program effects were estimated and findings were comparable; thus only the weighted estimates are presented in this report.



2.2. Variation by Program Utilization

A set of regression models explored associations between the total number of HFM home visits mothers in the HVS group received and T4 and T5 outcomes. Models were run comparably to the main effects models, subsetting to the HVS group. As these models assume linear associations between the number of home visits and outcomes, several non-linear models were tested, including piecewise regression and generalized additive models (GAM). Both of these techniques allow for exploration of thresholds, whereby the association between the number of home visits and outcomes is only apparent (or is larger) after a certain number of home visits. These models did not reveal significant threshold effects and are not summarized in this report. We also examined other measures of HFM utilization, notably HFM enrollment duration and mothers' fidelity to the program. Given high correlations between both duration and fidelity and the number of home visits ($r = .93$ and $r = .79$, respectively), and the similarity of the findings, only associations between number of home visits and outcomes are described in this report. Finally, given the slight positive skew of number of home visits (i.e., 28% of mothers received fewer than five home visits, and 14% did not receive any), we computed a square root transformation. Findings were comparable to those using the untransformed version, and thus we only present findings using untransformed number of home visits.

2.3. Differential Effects by Subgroups

HFM program effects may vary for different subgroups of young mothers. As such, interaction terms between the program status indicator variable and select T1 (baseline) variables were incorporated into main effects analyses (each moderator examined in a separate regression model).

Based on program effects on mothers' psychological vulnerability identified in MHFE-2,¹¹⁸ mothers' self-reported depressive symptomatology and her childhood history of substantiated maltreatment based on Department of Children and Families (DCF) records were each examined as moderators of HFM program effects. We assessed depression using the Center for Epidemiological Studies Depression Scale (CES-D).¹⁹ To assess mothers' history of maltreatment, DCF records were available for 78% ($n = 382$) of the MHFE-2EC sample who was born in Massachusetts, detailing whether mothers were listed as victims of substantiated reports of physical abuse, neglect, or sexual abuse in Massachusetts during their childhoods. Mothers without DCF records were more likely to be Puerto Rican or foreign-born Latina young women and

were more likely to report residential mobility in the year prior to enrollment. They were also less likely to have received social services (e.g., welfare, food stamps, housing assistance) since pregnancy.

Mothers' perception of the dependability of their families, assessed at T1, was examined as a moderator of home visiting program effects. Home visiting may be particularly valuable for mothers with low levels of social support, or conversely, it may be that home visiting is most effective when experienced as a supplement to existing family support. Mothers were asked to rate the extent to which they could depend on seven different family members (e.g., spouse/partner, parents, siblings, etc.) for help or assistance. This measure of social support was administered as part of the in-home interview completed by 69% of mothers at T1, reflecting 67% ($n = 330$) of the MHFE-2EC sample. Comparing the baseline demographic and background characteristics of this subsample to the remaining mothers who participated at T4 revealed that mothers who participated in the T1 in-home interview were less likely to have been employed and more likely to have been born in Puerto Rico and to have experienced maltreatment during childhood than mothers in the T4 sample who were excluded from this analysis.

Significant interaction terms between home visiting program group and depressive symptomatology and childhood maltreatment were interpreted by examining the marginal effect of the home visiting program within each subgroup (i.e., HVS vs. RIO differences within each subgroup). For family dependability, a continuous score, interactions were graphed and program effects were tested for various values of family dependability (increments of 0.5 of a point).

2.4. Pathway Analyses: Long-Term Program Impacts on Mothers' Adjustment

To better understand the long-term effects of HFM on mothers' outcomes, we examined whether program participation type (HVS vs. RIO) impacted mothers' adjustment at T4 and T5 indirectly via earlier program effects at T3.^{1,13} Two separate models were examined. First, we examined if the association between HFM program participation was indirectly associated with mothers' T4 mental health (i.e., depressive symptoms, attachment, and locus of control) and both their T5 wellness practices and risk engagement through the program effect on T3 parental distress. Second, we examined if the association with HFM program participation was indirectly linked with mothers' T4 economic dependence (i.e., employment, cash assistance, and food stamps) and their T5 physical health through college attendance (i.e., complet-

ing one year of college) at T3. Analyses were conducted in Mplus 7.4.²⁰ First, a set of analyses was conducted to determine whether the observed mental health and economic indicators could appropriately represent theoretical constructs of poor mental health and economic dependence. Second, structural equation modeling was used to test the mediation models. Mediation was tested using the percentile bootstrap method and was concluded significant when the 95% confidence limits of the specific indirect effect did not include zero.²¹ To handle missing data, parameters were estimated using full information maximum likelihood (FIML).²²

2.5. Trajectory Analyses on Depressive Symptomatology

A series of multi-level regression models explored the individual growth trajectories of mothers' reports of depression across all time points (T1-T5). For this phenomenon of interest, we fit three series of models: first we tested the overall trajectory for the full evaluation sample, allowing both HFM program and the control group to inform the average trajectory. We then tested whether the experience of becoming a parent shifted the trajectory in a meaningful way to examine the impact of childbirth on depressive symptomatology. Finally, we tested the impact of HFM on their initial depression scores and any fluctuation over time (for both pre- and postpartum periods) between program and control groups.

CHAPTER 3. PARTICIPANT CHARACTERISTICS

3.1. Program Group Equivalency in MHFE-2EC

To ensure that the HVS and RIO groups are equivalent and that random assignment still holds within the MHFE-2EC sample, mothers in the two program groups were compared on the T1 background and demographic characteristics and state administrative data. Overall, few differences emerged between HVS and RIO mothers at T4 and T5. In comparison to HVS mothers, RIO mothers were more likely to have been born in the U.S. and less likely to have been born in Puerto Rico. The differences that emerged between HVS and RIO mothers in MHFE-2EC were similar to those observed at baseline (see Table 3.1).

3.2. MHFE-2EC Retention and Attrition

A total of 684 mothers ($n = 417$ HVS, $n = 267$ RIO) participated in MHFE-2 at Time 1 (T1). Of this original sample, 72% ($n = 490$) participated in MHFE-2EC (T4). HVS



mothers were retained at a slightly lower rate than RIO mothers (HVS = 69%, RIO = 75%) at T4. Not surprisingly, participation in MHFE-2EC was strongly associated with MHFE-2 participation: Mothers who participated at T4 were more likely to have participated in all three previous data collection points and less likely to have left the study after T1 or have had intermittent participation in MHFE-2 than mothers who were lost to attrition.

Mothers who participated in MHFE-2EC were compared with mothers who did not participate, on T1 background and demographic characteristics, as well as state administrative data from the Massachusetts Departments of Transitional Services (DTA), Children and Families (DCF), and Public Health (DPH), for the overall sample and within program (HVS vs. RIO) groups (see Table 3.2).

With respect to the overall sample, few differences were found between mothers who were retained and those who were not. Mothers who participated at T4 were more likely to be English-speaking and less likely to be Spanish-speaking or bilingual than mothers lost to attrition. Mothers who participated were more likely to have been engaged or married to the fathers of their babies at T1, more likely to be living with an adult relative and less likely to have dropped out of high school at T1 than mothers lost to attrition.

Similar to the overall sample, HVS mothers who participated at T4 were more likely to be English-speaking and less likely to be Spanish-speaking than HVS mothers lost to attrition. HVS mothers who participated at T4 were more likely to have lived with an adult relative, and less likely to have been single at T1 and to have received food stamps prior to study enrollment than HVS mothers lost to attrition.

RIO mothers who participated at T4 were more likely than other RIO mothers to have been parenting (vs. pregnant) at study enrollment and to have received cash assistance before study enrollment. They were also less likely to have been born in Puerto Rico and more likely to be U.S.-born than mothers lost to attrition.

Finally, specifically within HVS mothers, we examined whether there were differences in HFM utilization according to MHFE-2EC retention status, including the total number of home visits received and the duration of enrollment. HVS mothers who participated at T4 received a greater number of home visits ($M = 26.4$, $SD = 28.0$) and were enrolled in HFM longer ($M = 1.3$ years, $SD = 1.1$) than HVS mothers lost to attrition ($M = 19.7$ home visits, $SD = 22.0$; $M = 1.0$ years, $SD = 1.0$).

Approximately one year after T4, 445 of the 490 T4 mothers participated in T5 (91% retention). Across the whole sample, the 45 mothers who attrited from T4 to T5 were less likely to be Hispanic than mothers who remained in the study at T5 (20% vs. 36%, respectively). This pattern was also true for RIO mothers (10% vs. 32%, respectively). Mothers who left the study after T4 were more likely than mothers retained at T5 to have received cash assistance (35% vs. 19%, respectively), as well as food stamps (28% vs. 16%, respectively) before enrollment. With respect to HVS moms specifically, mothers who left the study after T4 were less likely than mothers who participated in T5 to have lived with an adult at T1 (58% vs. 78%, respectively) and to have had a firstborn female child (23% vs. 49%, respectively). Among RIO mothers, those who left the study after T4 were less likely to have dropped out of high school than those who remained at T5 (15% vs. 41%, respectively).

Overall, there were relatively few differences between MHFE-2EC participants and the original MHFE-2 sample of young mothers. Findings suggest that more English-speaking, non-Hispanic Black mothers were retained, as well as mothers who were in relationships with the fathers of their babies, lived with adult relatives, and were in school or had already graduated at enrollment. Mothers who participated in MHFE-2EC were more likely to receive welfare and/or food stamps, but patterns varied somewhat by program status.

Based on these findings, inverse probability weights (IPW) were created to adjust for any biases due to sample attrition over time in the assessment of HFM program effects at T4 and T5, respectively. The creation of the weights is described in more detail in Appendix 2, and the use of the weights is described further in the analytic strategy (Chapter 2).

3.3. MHFE-2EC Sample Description

Descriptive statistics for the MHFE-2EC sample are presented in Table 3.3. On average, MHFE-2EC mothers were 23.6 years old ($SD = 1.3$) at T4, and 24.9 years old ($SD = 1.3$) at T5. Mothers were of diverse ethnic backgrounds;



37% were Non-Hispanic White, 34% were Hispanic, 21% were Black, and 7% were non-Hispanic other. Most mothers were born in the U.S. (83%), with 69% born in Massachusetts specifically.

At T4 and T5, approximately 22% of mothers remained in romantic relationships with their baby's father. More than a third (37%) of mothers were single at T4, this proportion declined to 30% at T5. Slightly less than a third (31%) of mothers lived with an adult relative at T4; at T5 25% of mothers lived with an adult relative.

By T4 and T5, 83% and 85% of mothers, respectively, had completed high school or a GED, 2.3% were in the process of completion and 14% and 13%, respectively, had dropped out. At T5, 45% of mothers reported four or more adverse childhood experiences (ACEs).

On average, mothers were 18.8 years old ($SD = 1.3$) when they gave birth, and 35% were parenting at the time of study enrollment. At T4, mothers' firstborn children were 4.8 years old ($SD = 0.5$) at T4, and 6.1 years ($SD = 0.5$) at T5. On average, 53% of children were male. Data from DCF indicated that by T5, 38% of children experienced at least one substantiated child maltreatment report since birth, and 2% of children were no longer in their mothers' custody.

3.4. HFM Program Utilization

The MHFE-2 report included a detailed examination of HFM participation among mothers assigned to the program group.¹ On average, mothers received 24 home visits (median = 14 visits, range = 0-118) over the course of their enrollment in HFM, and approximately 14% of the program group did not receive any home visits. Among the MHFE-2EC sample, program utilization was comparable: on average, mothers in the T4 sample received 26 visits (median = 16 visits, range = 0-118) and mothers in the T5 sample received 27 visits (median = 16 visits, range = 0-118), with 13.5% and 11.8% receiving no visits, respectively.

Table 3.1. Background and Demographic Characteristics at Baseline by Home Visiting Program Group for Time 4, Time 5, and Original Sample (Equivalency Testing)

	Original Sample			Time 4 Sample			Time 5 Sample		
	HVS (n=417)	RIO (n=267)	Overall (n=684)	HVS (n=289)	RIO (n=201)	Overall (n=490)	HVS (n=263)	RIO (n=182)	Overall (n=445)
Background and demographic characteristics									
Maternal age at study enrollment (years)	18.60 (1.32)	18.65 (1.25)	18.62 (1.29)	18.63 (1.35)	18.65 (1.26)	18.64 (1.31)	18.61 (1.35)	18.62 (1.25)	18.61 (1.31)
Race/ethnicity									
White, non-Hispanic	34.3%	41.6%	37.1%	34.6%	40.8%	37.1%	33.5%	39.6%	36.0%
Black, non-Hispanic	20.4%	18.0%	19.4%	22.1%	19.9%	21.2%	22.1%	19.2%	20.9%
Hispanic	38.4%	30.0%	35.1%*	37.4%	29.9%	34.3%	38.4%	32.4%	36.0%
Other, non-Hispanic	7.0%	10.5%	8.3%	5.9%	9.5%	7.3%	6.1%	8.8%	7.2%
Preferred language									
English	73.2%	76.2%	74.4%	77.1%	78.5%	77.7%	76.8%	77.9%	77.3%
Spanish	5.6%	3.4%	4.7%	3.9%	2.5%	3.3%	4.2%	3.3%	3.9%
English and Other	20.4%	20.0%	20.3%	18.0%	18.5%	18.2%	18.1%	18.2%	18.2%
Other	0.7%	0.4%	0.6%	1.1%	0.5%	0.8%	0.8%	0.6%	0.7%
Place of birth									
United States	77.9%	87.3%	81.6%*	77.9%	89.6%	82.7%*	77.9%	89.6%	82.7%*
Puerto Rico	8.6%	3.4%	6.6%*	8.0%	2.0%	5.5%*	8.0%	2.2%	5.6%*
Outside of United States	13.4%	9.4%	11.8%	14.2%	8.5%	11.8%	14.1%	8.2%	11.7%
Born in Massachusetts	69.7%	68.2%	69.1%	68.4%	69.2%	68.7%	68.1%	70.3%	69.0%
Relationship status									
Single	28.7%	26.0%	27.6%	25.2%	26.5%	25.7%	25.3%	27.1%	26.0%
Dating target child's father	17.9%	17.7%	17.8%	19.1%	15.5%	17.6%	19.5%	14.9%	17.6%
Engaged/married to target child's father	47.3%	47.5%	47.4%	49.6%	50.5%	50.0%	49.0%	49.7%	49.3%
Dating someone else	6.1%	8.7%	7.1%	6.0%	7.5%	6.6%	6.2%	8.3%	7.1%
Lives with an adult relative	73.2%	72.8%	73.1%	76.4%	73.5%	75.2%	78.1%	72.9%	76.0%
High school/GED status									
Dropped out	24.1%	19.2%	22.2%	21.6%	17.0%	19.7%	21.3%	16.6%	19.4%
In progress	36.6%	37.7%	37.0%	38.2%	38.0%	38.1%	38.0%	40.9%	39.2%
Completed	39.3%	43.0%	40.7%	40.3%	45.0%	42.2%	40.7%	42.5%	41.5%
Currently employed	24.6%	24.5%	24.6%	26.1%	22.5%	24.6%	25.9%	21.0%	23.9%
Moved at least once in past year	54.9%	61.6%	57.5%	54.3%	60.6%	56.9%	53.3%	59.2%	55.7%
Below adequate basic family resources	19.5%	19.8%	19.6%	18.2%	19.6%	18.8%	17.7%	19.3%	18.3%
Depression symptoms above clinical cutoff	34.3%	42.8%	37.6%*	35.9%	44.2%	39.3%	36.7%	43.9%	39.6%
Parenting at study enrollment (vs. pregnant)	34.8%	34.8%	34.8%	34.6%	38.3%	36.1%	33.8%	37.4%	35.3%
Maternal age at first birth (years)	18.76 (1.29)	18.80 (1.23)	18.77 (1.27)	18.79 (1.30)	18.78 (1.23)	18.78 (1.27)	18.77 (1.30)	18.75 (1.23)	18.76 (1.27)
Target child's sex (male)	53.4%	53.4%	53.4%	53.3%	51.7%	52.7%	51.0%	53.3%	51.9%
State agency data									
US Census 2010 block median neighborhood income (\$1,000s)	47.46 (26.02)	48.74 (25.18)	47.96 (25.68)	48.67 (27.47)	48.73 (26.07)	48.70 (26.88)	48.42 (27.71)	48.29 (24.92)	48.37 (26.58)
Received DTA cash assistance before enrollment	20.7%	17.0%	19.3%	20.5%	19.9%	20.2%	19.1%	18.2%	18.7%
Received DTA food stamps before enrollment	17.2%	18.9%	17.9%	14.6%	20.4%	17.0%	13.4%	19.3%	15.8%
DCF substantiated child maltreatment report (mother)	55.7%	53.7%	54.9%	56.3%	54.4%	55.5%	56.6%	55.8%	56.3%
DCF substantiated child maltreatment report before study enrollment (target child) ¹	7.8%	14.4%	10.4%	9.0%	13.0%	10.7%	7.9%	14.9%	10.9%
DPH adequate prenatal care ¹	73.4%	77.5%	75.0%	73.9%	77.9%	75.6%	72.2%	74.1%	73.0%
DPH target child low birthweight ¹	8.8%	12.3%	10.2%	8.0%	13.0%	10.2%	7.6%	13.6%	10.1%
DPH target child premature birth ¹	7.2%	12.3%	9.2%	6.8%	13.0%	9.6%	5.1%	13.6%	8.7%

Note. Table presents *M* (*SD*) for continuous variables and % for categorical variables.

HVS = program group, home visiting services; RIO = control group, referral and information only; DTA = Department of Transitional Assistance; DCF = Department for Children and Families; DPH = Department of Public Health.

*Difference between HVS and RIO significant at $p < .05$ or less.

¹Analysis included only mothers who had given birth to the target child at the time of study enrollment.

Table 3.2. Comparison of Retained and Attrited Participants at Time 4

	HVS			RIO			Total		
	Retained (n=289)	Attrited (n=128)	Total (n=417)	Retained (n=201)	Attrited (n=66)	Total (n=267)	Retained (n=490)	Attrited (n=194)	Total (n=684)
Background and demographic characteristics									
Maternal age at study enrollment (years)	18.63 (1.35)	18.54 (1.26)	18.60 (1.32)	18.65 (1.26)	18.64 (1.25)	18.65 (1.25)	18.64 (1.31)	18.58 (1.25)	18.62 (1.29)
Race/ethnicity									
White, non-Hispanic	34.6%	33.6%	34.3%	40.8%	43.9%	41.6%	37.1%	37.1%	37.1%
Black, non-Hispanic	22.1%	16.4%	20.4%	19.9%	12.1%	18.0%	21.2%	14.9%	19.4%
Hispanic	37.4%	40.6%	38.4%	29.9%	30.3%	30.0%	34.3%	37.1%	35.1%
Other, non-Hispanic	5.9%	9.4%	7.0%	9.5%	13.6%	10.5%	7.3%	10.8%	8.3%
Preferred language									
English	77.1%	64.6%	73.2%*	78.5%	69.2%	76.2%	77.7%	66.1%	74.4%*
Spanish	3.9%	9.4%	5.6%*	2.5%	6.2%	3.4%	3.3%	8.3%	4.7%*
English and Other	18.0%	26.0%	20.4%	18.5%	24.6%	20.0%	18.2%	25.5%	20.3%*
Other	1.1%	0.0%	0.7%	0.5%	0.0%	0.4%	0.8%	0.0%	0.6%
Place of birth									
United States	77.9%	78.1%	77.9%	89.6%	80.3%	87.3%*	82.7%	78.9%	81.6%
Puerto Rico	8.0%	10.2%	8.6%	2.0%	7.6%	3.4%*	5.5%	9.3%	6.6%
Outside of United States	14.2%	11.7%	13.4%	8.5%	12.1%	9.4%	11.8%	11.9%	11.8%
Born in Massachusetts	68.4%	72.7%	69.7%	69.2%	65.2%	68.2%	68.7%	70.1%	69.1%
Relationship status									
Single	25.2%	36.5%	28.7%*	26.5%	24.6%	26.0%	25.7%	32.5%	27.6%
Dating target child's father	19.1%	15.1%	17.9%	15.5%	24.6%	17.7%	17.6%	18.3%	17.8%
Engaged/married to target child's father	49.6%	42.1%	47.3%	50.5%	38.5%	47.5%	50.0%	40.8%	47.4%*
Dating someone else	6.0%	6.3%	6.1%	7.5%	12.3%	8.7%	6.6%	8.4%	7.1%
Lives with an adult relative	76.4%	66.1%	73.2%*	73.5%	70.8%	72.8%	75.2%	67.7%	73.1%*
High school/GED status									
Dropped out	21.6%	29.9%	24.1%	17.0%	26.2%	19.2%	19.7%	28.6%	22.2%*
In progress	38.2%	33.1%	36.6%	38.0%	36.9%	37.7%	38.1%	34.4%	37.0%
Completed	40.3%	37.0%	39.3%	45.0%	36.9%	43.0%	42.2%	37.0%	40.7%
Currently employed	26.1%	21.4%	24.6%	22.5%	30.8%	24.5%	24.6%	24.6%	24.6%
Moved at least once in past year	54.3%	56.3%	54.9%	60.6%	64.6%	61.6%	56.9%	59.2%	57.5%
Below adequate basic family resources	18.2%	22.3%	19.5%	19.6%	20.3%	19.8%	18.8%	21.7%	19.6%
Depression symptoms above clinical cutoff	35.9%	30.6%	34.3%	44.2%	38.5%	42.8%	39.3%	33.3%	37.6%
Parenting at study enrollment (vs. pregnant)	34.6%	35.2%	34.8%	38.3%	24.2%	34.8%*	36.1%	31.4%	34.8%
Maternal age at first birth (years)	18.79 (1.30)	18.69 (1.27)	18.76 (1.29)	18.78 (1.23)	18.84 (1.22)	18.80 (1.23)	18.78 (1.27)	18.74 (1.25)	18.77 (1.27)
Target child's sex (male)	53.3%	53.6%	53.4%	51.7%	58.7%	53.4%	52.7%	55.3%	53.4%
State agency data									
US Census 2010 block median neighborhood income (\$1,000s)	48.67 (27.47)	44.71 (22.24)	47.46 (26.02)	48.73 (26.07)	48.78 (22.43)	48.74 (25.18)	48.70 (26.88)	46.09 (22.33)	47.96 (25.68)
Received DTA cash assistance before enrollment	20.5%	21.2%	20.7%	19.9%	7.9%	17.0%*	20.2%	16.6%	19.3%
Received DTA food stamps before enrollment	14.6%	23.7%	17.2%*	20.4%	14.3%	18.9%	17.0%	20.4%	17.9%
DCF substantiated child maltreatment report (mother)	56.3%	54.3%	55.7%	54.4%	51.1%	53.7%	55.5%	53.2%	54.9%
DCF substantiated child maltreatment report before study enrollment (target child) ¹	9.0%	4.9%	7.8%	13.0%	23.1%	14.4%	10.7%	9.3%	10.4%
DPH adequate prenatal care ¹	73.9%	72.2%	73.4%	77.9%	75.0%	77.5%	75.6%	72.9%	75.0%
DPH target child low birthweight ¹	8.0%	10.8%	8.8%	13.0%	8.3%	12.3%	10.2%	10.2%	10.2%
DPH target child premature birth ¹	6.8%	8.1%	7.2%	13.0%	8.3%	12.3%	9.6%	8.2%	9.2%

Note. Table presents *M* (*SD*) for continuous variables and % for categorical variables.

HVS = program group, home visiting services; RIO = control group, referral and information only; DTA = Department of Transitional Assistance; DCF = Department for Children and Families; DPH = Department of Public Health.

*Difference between retained and attrited significant at *p* < .05 or less.

¹Analysis included only mothers who had given birth to the target child at the time of study enrollment.

Table 3.3. Background and Demographic Characteristics by Home Visiting Program Group at Time 4 and Time 5

	Time 4			Time 5		
	HVS (n=289)	RIO (n=201)	Overall (n=490)	HVS (n=263)	RIO (n=182)	Overall (n=445)
Maternal age (years)	23.57 (1.35)	23.61 (1.28)	23.59 (1.32)	24.86 (1.37)	24.85 (1.30)	24.86 (1.34)
Race/ethnicity						
White, non-Hispanic	34.6%	40.8%	37.1%	33.5%	39.6%	36.0%
Black, non-Hispanic	22.1%	19.9%	21.2%	22.1%	19.2%	20.9%
Hispanic	37.4%	29.9%	34.3%	38.4%	32.4%	36.0%
Other, non-Hispanic	5.9%	9.5%	7.3%	6.1%	8.8%	7.2%
Place of birth						
United States	77.9%	89.6%	82.7%*	77.9%	89.6%	82.7%*
Puerto Rico	8.0%	2.0%	5.5%*	8.0%	2.2%	5.6%*
Outside of United States	14.2%	8.5%	11.8%	14.1%	8.2%	11.7%
Born in Massachusetts	68.4%	69.2%	68.7%	68.1%	70.3%	69.0%
Relationship status						
Single	33.8%	41.5%	37.0%	29.5%	30.0%	29.7%
Dating target child's father	2.8%	1.5%	2.3%	3.1%	1.7%	2.5%
Engaged/married to target child's father	20.5%	20.5%	20.5%	19.9%	17.8%	19.1%
Dating someone else	42.9%	36.0%	40.0%	47.2%	50.6%	48.6%
Lives with an adult relative	30.0%	32.2%	30.9%	26.4%	23.8%	25.3%
High school/GED status						
Dropped out	14.4%	14.4%	14.4%	13.0%	12.2%	12.6%
In progress	2.2%	2.5%	2.3%	1.9%	2.8%	2.3%
Completed	83.4%	83.2%	83.4%	85.1%	85.1%	85.1%
Adverse childhood experiences (ACEs, 4 or more)	--	--	--	47.2%	42.6%	45.4%
Parenting at study enrollment (vs. pregnant)	34.6%	38.3%	36.1%	33.8%	37.4%	35.3%
Maternal age at first birth (years)	18.79 (1.30)	18.78 (1.23)	18.78 (1.27)	18.77 (1.30)	18.75 (1.23)	18.76 (1.27)
Target child age (years)	4.80 (0.45)	4.83 (0.46)	4.81 (0.45)	6.09 (0.54)	6.10 (0.55)	6.09 (0.54)
Target child sex (male)	53.3%	51.7%	52.7%	51.0%	53.3%	51.9%
Substantiated child maltreatment report since birth (target child)	--	--	--	37.5%	39.5%	38.4%
Permanent custody loss of target child	--	--	--	1.9%	2.3%	2.1%

Note. Table presents *M (SD)* for continuous variables and % for categorical variables. Time non-invariant variables are assessed at Time 4 and Time 5, respectively.
HVS = program group, home visiting services; RIO = control group, referral and information only.
*Difference between HVS and RIO significant at $p < .05$ or less.

CHAPTER 4. OVERALL HFM PROGRAM IMPACT

A primary objective of the longitudinal follow-up study was to determine longer-term HFM program effects when target children were of preschool (T4) and Kindergarten (T5) age. We investigated whether HFM was effective in achieving the six aforementioned goals: (1) to prevent child abuse and neglect by supporting positive, effective parenting; (2) to achieve optimal health, growth, and development in infancy and early childhood; (3) to encourage educational attainment, job, and life skills among parents; (4) to prevent repeat pregnancies during the teen years; (5) to promote parental health and well-being; and (6) to increase mothers' knowledge and ability to navigate early childhood systems, at later time points. Accordingly, analyses were conducted to explore overall program effects, specifically whether the intervention group (HVS) was significantly different from the control group (RIO) on a variety of indicators within the goal areas.

In the following sections, for each HFM goal, first we present descriptive information on the outcome variables used to determine program effects. Descriptive analyses focus on the full evaluation sample. Following descriptive information, overall program impacts are described. An intent to treat (ITT) approach was used in analyses investigating program effects, such that mothers randomly assigned to the treatment group were considered to be part of the HFM group whether or not they actually received any home visiting services (refer back to chapter 2 for details).

Favorable program main effects were observed in four of the six goal areas (child outcomes, maternal health and well-being, economic outcomes, and the navigation of early childhood systems), and included findings related to the development of children's executive function, maternal depression, substance use, mother's use of emergency medical services, and housing. Below we describe each of these findings in more detail.



4.1. Goal 1: Prevent Child Abuse and Neglect by Supporting Positive, Effective Parenting

The primary indicators used for Goal 1 analyses were *administrative reports of child maltreatment, mother-reported discipline behaviors, mothers' reports of parenting stress and observed mother-child dyadic synchrony* (see Appendix 3, which provides detailed information about the measures used in this study). Table 4.1 displays descriptive statistics for Goal 1 outcomes.

Table 4.1. Descriptive Information for Goal 1 Outcomes: Prevent Child Abuse and Neglect by Supporting Positive, Effective Parenting

	T4				T5			
	%	Mean (SD)	Range	N	%	Mean (SD)	Range	N
Department of Children and Families (DCF) Data^a								
Presence of Substantiated Maltreatment Report	--			--	28.5			471
Presence of Maltreatment Report(s) (Regardless of Substantiation)	--			--	45.0			471
Parenting Stress Index (PSI)								
Parental Distress		26.54 (8.93)	12-58	407		25.80 (9.23)	12-54	375
Parent-Child Dysfunctional Interaction		18.02 (5.93)	12-42	412		18.07 (6.50)	12-49	375
Difficult Child		25.65 (8.24)	12-56	412		24.52 (8.22)	12-53	369
Mother-Child Dyadic Synchrony		2.99 (0.96)	0-5	345		--	--	--
Conflict Tactics Scale—Parent-Child (CTSPC)								
Non-Violent Discipline (Chronicity)		52.36 (28.11)	0-100	406		52.89 (27.90)	1-100	375
Corporal Punishment (Prevalence)	46.8			406	36.9			379

^aThis analysis examined reports since HFM enrollment ended through August 2016.

Administrative data on child maltreatment from Department of Children and Families (DCF) revealed high rates of child maltreatment since the program end date. Forty-five percent of all children had some recorded form of a maltreatment report (i.e., any report filed with DCF regardless of substantiation), and approximately 29% of children had a substantiated maltreatment report on file.

Mothers reported moderate levels of the use of non-violent discipline at T4 and T5 ($M = 52.36$ at T4, $M = 52.89$ at T5; range = 0-100). Nearly half (49%) of mothers reported that they used corporal punishment at least once in the past year at T4, which declined to 37% at T5. These figures were lower than mothers' self-reported use of corporal punishment at T3 (61%).¹³

Mothers reported relatively high levels of parenting stress, specifically on the parental distress ($M = 26.54$ at T4, $M = 25.80$ at T5) and difficult child ($M = 25.65$ at T4, $M = 24.52$ at T5) subscales. For both subscales, scores higher than 35 are considered to be in the clinical range. Thus, mothers tended to experience moderately high levels of stress related to parenting competence, restrictions on a parent's life, conflict with the child's other parent, social support, depression, and difficulties dealing with children. Conversely, mothers tended to score low on the dysfunctional interaction subscale ($M = 18.02$ at T4, $M = 18.07$ at T5; scores higher than 30 are considered to be in the clinical range), suggesting that mothers generally felt satisfied with their interactions with their children and believed that their children were meeting their expectations.

On average, mothers and children demonstrated typical levels of coordination and balance within parent-child interactions as indicated by scores on the dyadic synchrony measure ($M = 2.99$; range of 0-5) assessed at T4.

There were no main program effects on Goal 1 outcomes at either T4 or T5 (see Table 4.2).

Table 4.2. HFM Impacts in Goal 1: Prevent Child Abuse and Neglect by Supporting Positive, Effective Parenting

	T4			T5		
	B (SE)	OR	95% CI	B (SE)	OR	95% CI
Department of Children and Families (DCF) Data^a						
Presence of Substantiated Maltreatment Report		--	--		1.24	0.79, 1.97
Presence of Maltreatment Report(s) (Regardless of Substantiation)		--	--		1.15	0.76, 1.74
Parenting Stress Index (PSI)						
Parental Distress	-1.78 (0.95)		-3.78, 0.21	-1.18 (0.80)		-2.88, 0.52
Parent-Child Dysfunctional Interaction	-0.46 (0.53)		-1.57, 0.64	-0.72 (0.64)		-2.08, 0.64
Difficult Child	-0.27 (0.75)		-1.86, 1.32	-0.70 (0.97)		-2.74, 1.33
Mother-Child Dyadic Synchrony	-0.08 (0.14)		-0.38, 0.21	--		--
Conflict Tactics Scale—Parent-Child (CTSPC)						
Non-Violent Discipline (Chronicity)	-1.04 (2.25)		-5.79, 3.71	-1.82 (2.91)		-7.96, 4.32
Corporal Punishment (Prevalence)		0.98	0.53, 1.81		0.77	0.51, 1.16
Note. We present unstandardized regression coefficients (<i>B</i>) and standard errors (<i>SE</i>) with 95% confidence intervals (<i>CI</i>) for continuous outcomes and Odds Ratios (<i>OR</i>) with 95% confidence intervals (<i>CI</i>) for binary outcomes.						
^a This analysis examined reports since HFM enrollment ended through August 2016						

4.2. Goal 2: Achieve Optimal Health, Growth, and Development in Infancy and Early Childhood

Indicators used to assess children’s health, growth, and development included *maternal reports of children’s general health and diagnosed health conditions* (e.g., asthma, autism, diabetes); *maternal and observed reports* (Story Stem) *of emotional dysregulation*; *mothers’ perceptions of the home literacy environment*; and *children’s school readiness* (Bracken School Readiness Assessment); receptive vocabulary skills (Receptive One-Word Picture Vocabulary Test); and executive function, including *working memory* (Corsi Block Task); *short-term auditory memory, sequencing, and working memory abilities* (Digit Span); *behavioral regulation including inhibitory control, attention, and working memory* (Head-Toes-Knees-Shoulders); *cognitive flexibility* (Dimensional Change Card Sort).

See Table 4.3 for a description of Goal 2 outcomes.

Table 4.3. Descriptive Information for Goal 2 Outcomes: Achieve Optimal Health, Growth, and Development in Infancy and Early Childhood

	T4				T5			
	%	Mean (SD)	Range	N	%	Mean (SD)	Range	N
Child's General Health		4.40 (0.87)	1-5	483		4.37 (0.80)	2-5	421
Number of Diagnosed Health Conditions (Past Year)		--	--	--		0.60 (0.91)	0-6	419
Emotional Dysregulation								
Emotional Regulation Checklist (ERC)		1.78 (0.53)	1-3.6	478		1.79 (0.55)	1-3.7	421
Story Stem Task		--	--	--	55.9			329
Bracken School Readiness Assessment								
Composite Standard Score		92.50 (16.17)	12-129	343		94.17 (16.16)	40-133	342
Descriptive Classification—Delayed	34.4			343	26.3			342
Receptive One-Word Picture Vocabulary Test (ROW-PVT)		105.60 (10.31)	62-134	366		--	--	--
Executive Functioning								
Working Memory (Corsi Block Task)		0.16 (0.12)	0-0.5	356		0.25 (0.14)	0-0.6	342
Working Memory (Digit Span)		0.29 (0.11)	0-0.6	345		0.33 (0.11)	0-0.6	341
Behavioral Regulation/Inhibitory Control (Head-Toes-Knees-Shoulders)		17.36 (18.52)	0-60	323		34.23 (18.39)	0-60	340
Cognitive Flexibility (Dimensional Change Card Sort)		2.73 (2.71)	0-6	366		4.47 (2.34)	0-6	341
Home Literacy Environment Questionnaire (HLEQ): Parent's Involvement in Literacy-Related Activities		3.80 (1.00)	1-6	376		3.84 (1.04)	0.2-6	372

Mothers indicated that their children were in good health ($M = 4.40$ at T4, $M = 4.37$ at T5; range = 1-5 with higher scores indicating better overall health). Mothers also indicated that children's dysregulation (i.e., child's propensity for mood swings, angry reactivity, emotion intensity) was relatively moderate ($M = 1.78$ at T4, $M = 1.79$ at T5; range = 1-4), but 55.9% of children exhibited dysregulation during an observed task.

Children scored moderately high, on average, on tests of school readiness and receptive vocabulary skills, but scored moderately low on tests assessing behavioral regulation (i.e., inhibitory control, attention, working memory), and working memory at T4. Furthermore, at T4, children demonstrated relatively average abilities on tests of short-term auditory memory, sequencing, and working memory abilities as well as cognitive flexibility. At T5, children's working memory, behavioral regulation, and cognitive flexibility improved. Results showed that mothers had moderate involvement in their children's literacy related activities ($M = 3.80$ at T4, $M = 3.84$ at T5; range = 1-6). See Table 4.3 for details.

When considering the program's impact on children's health, growth, and development, we found a significant program effect on children's working memory at T4 (see Table 4.4): Children of mothers in HFM scored higher on the forward version of the Corsi Block Task, attaining higher proportion scores during the task. The proportion score represents levels completed out of a total number of levels, adjusting for consistency of performance within each level. Higher scores reflect better working memory ($M = 0.17$ HVS, $M = 0.15$ RIO; Cohen's $d = .19$). However, at T5, HVS mothers reported less involvement in literacy-related activities relative to RIO mothers ($M = 3.80$ HVS, $M = 3.97$ RIO; Cohen's $d = -.17$), although the effect size was rather small.

Table 4.4. HFM Impacts in Goal 2: Achieve Optimal Health, Growth, and Development in Infancy and Early Childhood

	T4			T5		
	B (SE)	OR	95% CI	B (SE)	OR	95% CI
Child's General Health	0.08 (0.07)		-0.07, 0.23	0.06 (0.08)		-0.11, 0.24
Number of Diagnosed Health Conditions (Past Year)	--		--	-0.00 (0.15)		-0.31, 0.31
Emotional Dysregulation						
Emotional Regulation Checklist (ERC)	0.00 (0.05)		-0.11, 0.11	0.06 (0.06)		-0.06, 0.19
Story Stem Task	--		--		1.02	0.56, 1.86
Bracken School Readiness Assessment						
Composite Standard Score	-1.13 (1.61)		-4.52, 2.26	-0.11 (1.22)		-2.68, 2.46
Descriptive Classification—Delayed or Not		0.98	0.58, 1.65		1.16	0.64, 2.08
Receptive One-Word Picture Vocabulary Test (ROW-PVT)	1.83 (1.16)		-0.62, 4.28	--		--
Executive Functioning						
Working Memory (Corsi Block Task)	0.02 (0.01)*		0.00, 0.04	0.01 (0.01)		-0.02, 0.03
Working Memory (Digit Span)	-0.00 (0.01)		-0.02, 0.02	-0.01 (0.01)		-0.03, 0.01
Behavioral Regulation/Inhibitory Control (Head-Toes-Knees-Shoulders)	2.58 (2.39)		-2.46, 7.62	0.52 (1.56)		-2.76, 3.81
Cognitive Flexibility (Dimensional Change Card Sort)	-0.22 (0.28)		-0.81, 0.37	0.17 (0.25)		-0.35, 0.69
Home Literacy Environment Questionnaire (HLEQ): Parent's Involvement in Litera- cy-Related Activities	-0.19 (0.11)		-0.43, 0.04	-0.17 (0.08)*		-0.34, -0.01
Note. * $p < .05$; We present unstandardized regression coefficients (<i>B</i>) and standard errors (<i>SE</i>) with 95% confidence intervals (<i>CI</i>) for continuous outcomes and Odds Ratios (<i>OR</i>) with 95% confidence intervals (<i>CI</i>) for binary outcomes						

4.3. Goal 3: Encourage Educational Attainment, Job, and Life Skills Among Parents

Several outcome measures were used to assess mothers' Educational Attainment, Job, and Life Skills development: *residential mobility, homelessness, sufficiency of resources, self-reported college attainment, completion of training programs, and employment*. See Table 4.5 for a description of Goal 3 outcomes.

Table 4.5. Descriptive Information for Goal 3 Outcomes: Encourage Educational Attainment, Job, and Life Skills Among Parents

	T4				T5			
	%	Mean (SD)	Range	N	%	Mean (SD)	Range	N
Residential Mobility (Past Year)	41.6			485	39.1			442
Homelessness (Since Enrollment)	--			--	33.0			443
Basic Resources (FRS)		88.23 (12.91)	23.1-100	482		90.16 (11.98)	15.4-100	439
Mother Graduated from College (AA or BA)	--			--	5.2			443
Mother Completed Training Program	--			--	28.3			441
Mother is Employed	57.2			488	58.2			443

By T5, 5.2% of mothers had graduated from college with either an associate or bachelor's degree, and more than a quarter (28.3%) had completed a training program. More than half of mothers were employed (57.2% at T4, 58.2% at T5).

When reporting about access to basic resources, mothers tended to report that their needs were being met ($M = 88.23$ at T4, $M = 90.16$ at T5, out of a possible 100), suggesting that mothers generally have access to basic resources such as food for two meals a day, a house or apartment, and enough clothes for their family. Mothers had lived in an average of 1.6 residences in the past year at T4 and 1.5 at T5, with approximately 42% of mothers moving at least once in the past year at T4 and 39% at T5. By T5, a third of mothers had experienced at least one bout of homelessness since their child was born, cumulatively for about 14 months, on average.

The program did not have a direct effect on mothers' educational attainment, job, or life skills at T4 (see Table 4.6), but HVS mothers were significantly less likely to experience homelessness since the time of HFM enrollment (28.3% HVS, 40.9% RIO).

Table 4.6. HFM Impacts in Goal 3: Encourage Educational Attainment, Job, and Life Skills Among Parents

	T4			T5		
	B (SE)	OR	95% CI	B (SE)	OR	95% CI
Residential Mobility (Past Year)		1.00	0.62, 1.60		1.15	0.74, 1.79
Homelessness (Since Enrollment)		--	--		0.56*	0.33, 0.96
Basic Resources (FRS)	-0.39 (1.10)		-2.72, 1.93	-0.39 (0.81)		-2.10, 1.32
Mother Graduated from College (AA or BA)		--	--		2.32	0.73, 7.39
Mother Completed Training Program		--	--		1.49	0.88, 2.55
Mother's Employment Status		0.96	0.60, 1.51		1.26	0.86, 1.85

Note. * $p < .05$; We present unstandardized regression coefficients (B) and standard errors (SE) with 95% confidence intervals (CI) for continuous outcomes and Odds Ratios (OR) with 95% confidence intervals (CI) for binary outcomes.

4.4. Goal 4: Prevent Repeat Pregnancies During the Teen Years

In analyses related to Goal 4, we used rapid repeat births as the outcome variable. See Table 4.7 for descriptive statistics related to these outcomes.

Table 4.7. Descriptive Information for Goal 4 Outcomes: Prevent Repeat Pregnancies During the Teen Years

	%	Mean (SD)	Range	N
Repeat Birth Within Two Years of First Child's Birth	15.7			485

Approximately 16% of mothers in the T4 sample reported a repeat birth within two years of their first child's birth. On average, mothers had between one and two living biological children ($M = 1.52$; range = 1-4) at T4.

There were no program effects found on rapid repeat births (see Table 4.8).

Table 4.8. HFM Impacts in Goal 4: Prevent Repeat Pregnancies During the Teen Years

	OR	95% CI
Repeat Birth Within Two Years of First Child's Birth	1.07	0.59, 1.96
Note. We present Odds Ratio (OR) with 95% confidence interval (CI).		

4.5. Goal 5: Promote Parental Health and Well-Being

Indicators used to assess mothers' health and well-being included maternal depression, personal mastery, substance use (i.e., binge drinking, marijuana and cocaine use), *illnesses and chronic conditions* (e.g., diabetes, high blood pressure, asthma), *mental health disorders* (e.g., depression anxiety disorder, substance abuse), and *intimate partner violence* (see Table 4.9).

Table 4.9. Descriptive Information for Goal 5 Outcomes: Promote Parental Health and Well-Being

	T4			T5		
	Mean (SD)	Range	N	Mean (SD)	Range	N
Maternal Depression (CES-D)	11.95 (10.50)	0-46	488	11.36 (10.53)	0-60	441
Personal Mastery (PMS)	3.19 (0.59)	1.2-4	486	3.17 (0.60)	0.7-4	443
Substance Use (Past Month; YRBS)	--	--	--	0.18 (0.45)	0-4	395
Number of Treated Illnesses/Chronic Conditions (Past Year)	--	--	--	0.67 (1.00)	0-5	441
Number of Diagnosed Mental Health Disorders (Past Year)	--	--	--	0.41 (0.77)	0-4	442
Conflict Tactics Scale—Partner (CTS2S)						
Partner-Perpetrated Intimate Partner Violence	0.90 (1.26)	0-7	346	0.98 (1.22)	0-7	340
Self-Perpetrated Intimate Partner Violence	0.96 (1.10)	0-6	345	0.95 (1.02)	0-7	339

MHFE-2EC mothers' average depression scores were below the clinical cutoff (a score of 16 or higher is considered "at risk" for clinical levels of depression) on the Center for Epidemiological Studies Depression Scale (CES-D), ($M = 11.95$ at T4, $M = 11.36$ at T5; range = 0-60). Mothers reported moderately high levels of mastery on the Pearlin Mastery Scale suggesting that mothers felt fairly in control of factors that may significantly impact their lives ($M = 3.19$ at T4, $M = 3.17$ at T5; range = 0-4).

In terms of health conditions at T5, mothers reported little substance use in the past month ($M = 0.18$, where 0 = no days of use, 1 = 1-2 days of use) and less than one treated illness ($M = 0.67$) and diagnosed mental health disorder ($M = 0.41$) in the past year.

Finally, when asked about intimate partner violence (IPV) and the number of psychological or physical attacks in the past year, mothers indicated an average of about one partner-perpetrated act ($M = 0.90$ at T4, $M = 0.98$ at T5, range = 0-7) and mother-perpetrated act ($M = 0.96$ at T4, $M = 0.95$ at T5, range = 0-7) at each study time point.

As seen in Table 4.10, analyses investigating overall program impacts revealed that HFM had a direct effect on T4 maternal depression and T5 substance use. Mothers in the treatment group reported fewer depressive symptoms in the past week compared to the control group ($M = 11.01$ HVS, $M = 13.18$ RIO; Cohen's $d = -.21$). On average, HVS mothers spent fewer days binge drinking or using marijuana or cocaine in the past month relative to RIO mothers ($M = 0.14$ HVS, $M = 0.24$ RIO; Cohen's $d = -.23$).

Table 4.10. HFM Impacts in Goal 5: Promote Parental Health and Well-Being

	T4		T5	
	B (SE)	95% CI	B (SE)	95% CI
Maternal Depression (CES-D)	-2.17 (0.66)**	-3.56, -0.77	-0.25 (0.97)	-2.30, 1.80
Personal Mastery (PMS)	0.07 (0.05)	-0.03, 0.16	0.01 (0.04)	-0.07, 0.09
Substance Use (Past Month)	--	--	-0.10 (0.05)*	-0.20, -0.00
Number of Treated Illnesses/Chronic Conditions (Past Year)	--	--	-0.12 (0.13)	-0.39, 0.15
Number of Diagnosed Mental Health Disorders (Past Year)	--	--	-0.05 (0.09)	-0.23, 0.14
Conflict Tactics Scale—Partner (CTS2S)				
Partner-Perpetrated Intimate Partner Violence	0.00 (0.10)	-0.20, 0.20	-0.18 (0.13)	-0.44, 0.09
Self-Perpetrated Intimate Partner Violence	-0.03 (0.07)	-0.18, 0.11	-0.07 (0.07)	-0.21, 0.07
Note. ** $p < .01$; * $p < .05$; We present unstandardized regression coefficients (B) and standard errors (SE) with 95% confidence intervals (CI).				

4.6. Goal 6: Increase Mothers' Knowledge and Ability to Navigate Early Childhood Systems

The outcome measures used for Goal 6 analyses were *mothers' perceptions about parent-caregiver relationships, mothers' involvement at child's school, mothers' advocacy at home and in educational settings, awareness of neighborhood resources, and use of emergency rooms or urgent care clinics*. See Table 4.11 for a description of Goal 6 outcomes.

Table 4.11. Descriptive Information for Goal 6 Outcomes: Increase Mothers' Knowledge and Ability to Navigate Early Childhood Systems

	T4				T5			
	%	Mean (SD)	Range	N	%	Mean (SD)	Range	N
Parent-Caregiver Relationship Scale (PCRS)		4.53 (0.69)	1-5	359		4.55 (0.74)	1-5	362
Parent Teacher Involvement (PTI)		--	--	--		2.22 (0.45)	0.6-4	328
Advocacy								
Self-Advocacy (Household)	--			--	57.8			400
Maternal Advocacy (Educational Setting)	--			--	53.9			384
Awareness of Resources	76.3			408	--			--
ER Visits for Child (Any Since TC Birth)	77.9			479	--			--
ER Visits for Mother (Any Since TC Birth)	71.3			485	--			--
ER/Urgent Care Visits for Child (Any in Past Year)	--			--	47.3			412
ER/Urgent Care Visits for Mother (Any in Past Year)	--			--	52.3			430

When asked about the quality of their relationship with their child's caregiver, mothers tended to have a favorable perception of their relationships ($M = 4.53$ at T4, $M = 4.55$ at T5; range = 1-5). Mothers reported average involvement with children's Kindergarten teachers at T5 ($M = 2.22$; range 0-4). More than half of mothers reported advocating for themselves (58%) and for their children in educational settings (54%). And, approximately 76% of mothers indicated that they were aware of most (4-7) resources in their neighborhood at T4.

In terms of visits to the ER, about three quarters of mothers and children had visited the ER at T4 since TC was born, and about half of mothers and their children had made a visit to the ER or urgent care at T5 (past year).

Mothers in the home visiting group were more likely than mothers in the control group to report self-advocacy (e.g., taking action towards resolving a problem) in household settings (63%, 50%, respectively; $OR = 1.74$, $p < .05$). HFM had a significant impact on the prevalence of mothers' visits to the emergency room at T4. On average, 78% of RIO mothers visited the emergency room at least once since the birth of their first child compared to 67% of HVS mothers ($OR = 0.53$, $p < .01$; see Table 4.12).

Table 4.12. HFM Impacts in Goal 6: Increase Mothers' Knowledge and Ability to Navigate Early Childhood Systems

	T4			T5		
	B (SE)	OR	95% CI	B (SE)	OR	95% CI
Parent-Caregiver Relationship Scale (PCRS)	-0.08 (0.06)		-0.21, 0.05	-0.01 (0.06)		-0.13, 0.10
Parent Teacher Involvement (PTI)	--		--	-0.09 (0.07)		-0.24, 0.07
Advocacy						
Self-Advocacy (Household)		--	--		1.74*	1.15, 2.63
Maternal Advocacy (Educational Setting)		--	--		1.54	0.98, 2.43
Awareness of Resources		1.10	0.57, 2.12		--	--
ER Visits for Child (Any Since TC Birth)		0.56	0.28, 1.10		--	--
ER Visits for Mother (Any Since TC Birth)		0.53**	0.34, 0.83		--	--
ER/Urgent Care Visits for Child (Any in Past Year)					1.37	0.99, 1.89
ER/Urgent Care Visits for Mother (Any in Past Year)					1.01	0.63, 1.62
Note. ** $p < .01$; * $p < .05$; We present unstandardized regression coefficients (<i>B</i>) and standard errors (<i>SE</i>) with 95% confidence intervals (CI) for continuous outcomes and Odds Ratios (<i>OR</i>) with 95% confidence intervals (CI) for binary outcomes.						

4.7. Summary

Overall, findings from the analyses of main program effects suggest that HFM had an impact on families in four HFM goal areas. When compared to the control group (RIO):

- Children of mothers in the HFM program group (HVS) displayed higher working memory (Goal 2);
- At T5, mothers in the HFM program group (HVS) were less likely to report involvement in literacy activities at home (Goal 2) relative to mothers in the control group;
- Mothers in the HFM program group (HVS) were less likely to be homeless without a place to live since HFM enrollment (Goal 3);
- Mothers in the HFM program group (HVS) reported fewer depressive symptoms and less substance use (Goal 5);
- Mothers in the HFM program group (HVS) were more likely to self-advocate in the household (Goal 6);
- Mothers in the HFM program group (HVS) were less likely to visit the emergency room (Goal 6).

CHAPTER 5. LINKS BETWEEN UTILIZATION AND OUTCOMES

The following chapter considers how patterns of HFM program utilization were related to overall program effects and the achievement of the six stated program goals. Specifically, analyses investigated whether the number of home visits that mothers received was related to outcomes. Within the T4 sample, mothers received between 0-118 home visits ($M = 26.39$, median = 16) across approximately 16 months, on average. Analyses were only conducted on the HVS group and therefore cannot be interpreted as causal.

Results indicated that the number of home visits that HVS mothers received was associated with parenting stress (Goal 1), disciplinary practices (Goal 1), children's dysregulation (Goal 2), home learning environment (Goal 2), repeat births (Goal 4), and partner-perpetrated intimate partner violence (Goal 5). Notably, each home visit mothers attended was related to a tenth of a point increase in their use of non-violent discipline, and a fifth of a point decrease in parental distress scores, both at T4. At T5, however, number of home visits was positively related to difficult child scores on the PSI (0.03 of a point increase) and negatively associated with mothers' participation in home literacy activities; the latter finding was very small (0.01 of a point). Results showed that children of mothers who received a higher number of home visits showed higher levels of dysregulation, although the differences were quite small. In the area of repeat births, mothers who received more home visits were significantly less likely to have reported a repeat birth within two years of their first child's birth ($OR = 0.98$, $p < .01$), such that 23% of mothers who received no home visits had another baby within two years of the target child; this statistic was only 16% for mothers who received the "average" number of home visits (i.e., 26). Finally, the number of home visits that mothers received was related to more partner-perpetrated intimate partner violence, specifically, for each additional home visit, mothers reported .01 more acts in the past year, which is quite small. Results are presented in Table 5.1.

Table 5.1. Associations Between Number of Home Visits and Maternal and Child Outcomes

	T4			T5		
	B (SE)	OR	95% CI	B (SE)	OR	95% CI
Goal 1: Prevent Child Abuse and Neglect by Supporting Positive, Effective Parenting						
Parenting Stress Index (PSI): Parental Distress	-0.05 (0.02)*		-0.09, -0.01			
Parenting Stress Index (PSI): Difficult Child				0.03 (0.01)*		0.00, 0.05
Conflict Tactics Scale—Parent-Child (CTSPC): Non-Violent Discipline (Chronicity)	0.12 (0.04)*		0.02, 0.21			
Goal 2: Achieve Optimal Health, Growth, and Development in Infancy and Early Childhood						
Regulation of Negative Emotion (ERC)	0.00 (0.00)*		0.00, 0.00			
Home Literacy Environment Questionnaire (HLEQ): Parent's Involvement in Literacy-Related Activities				-0.00 (0.00)**		-0.01, -0.00
Goal 4: Prevent Repeat Pregnancies During the Teen Years						
Repeat Birth Within Two Years of First Child's Birth		0.98**	0.97, 0.99			
Goal 5: Promote Parental Health and Well-Being						
Intimate Partner Violence (Partner Perpetrated, CTC2S)	0.01 (0.00)*		0.00, 0.01			
Note. ** $p < .01$; * $p < .05$; We present unstandardized regression coefficients (B) and standard errors (SE) with 95% confidence intervals (CI) for continuous outcomes and Odds Ratios (OR) with 95% confidence intervals (CI) for binary outcomes.						

Overall, then, we found some small associations between number of HFM home visits mothers received and their outcomes. As reported in the previous report,¹ mothers who received fewer home visits were more likely to enroll postpartum, and were less likely to live with an older relative or guardian, less residentially and financially stable, and less likely to be depressed at enrollment. We see here a pattern in which mothers' low utilization seems to signal both strengths and vulnerabilities. Results from analyses of the associations between utilization and maternal outcomes, likewise, support this strength/vulnerability phenomenon, with fewer visits being associated with both favorable and unfavorable outcomes.

CHAPTER 6. UNDERSTANDING DIFFERENTIAL GOAL ACHIEVEMENT BY SUBGROUPS

The extensive analyses undertaken in our prior report, as well as subsequent secondary analyses, demonstrated that the effect of HFM on young mothers often differs according to maternal experiences and characteristics. Given the diversity of the HFM population, it is reasonable to expect that the program, may be most effective in some areas for the most vulnerable mothers, and in other areas most effective for mothers who are less vulnerable or whose lives are more stable. The baseline characteristics that have emerged to consistently impact outcomes over time are centered around psychological vulnerability and family support. For these analyses, we chose the following three indicators to represent these salient experiences: (1) maternal depression at program enrollment, (2) maternal history of childhood maltreatment, and (3) maternal perceptions of family support at program enrollment. (See Appendix 3 for a further description of the moderator variables.)

6.1. Psychological Vulnerability

Given variation in home visiting program effects according to mothers' risk and psychological vulnerability,^{1,18} T1 maternal depression and mothers' history maltreatment were examined as moderators of HFM program effects on mothers' T4 and T5 outcomes. Previous analyses suggested sizable reduction in the likelihood of repeat birth among vulnerable mothers in the HVS relative to the RIO group,¹⁸ as well as some favorable program effects in mothers' risky behavior, but the findings were not entirely consistent.¹ More than a third of the sample (39.3%) scored above the clinical cutoff (scores of 16 or higher) on the CES-D at T1, and 55.5% of the sample had substantiated reports of childhood maltreatment.

As seen in Table 6.1, findings indicated that the main effect on depression at T4 was strongest for mothers with clinically significant levels of depression at T1 ($M = 13.50$ HVS, $M = 17.88$ RIO; Cohen's $d = -.38$). Thus, although the program group overall showed lower levels of depression compared to the control group, the effect was strongest for mothers who experienced depression during pregnancy or postpartum and who enrolled in HFM at this time. At T5, several program effects were found among mothers with clinically significant levels of depression at T1. Notably, HVS mothers were less likely to report using corporal punishment in the past year (37.2% HVS, 52.7% RIO), reported fewer acts of partner-perpetrated intimate partner violence in the past year ($M = 0.79$ HVS, $M = 1.21$ RIO; Cohen's $d = -.35$), reported less frequent substance use in the past month ($M = 0.13$ HVS, $M = 0.31$ RIO; Cohen's $d = -.36$), and were more likely to report advocacy in educational settings (61.2% HVS, 38.0% RIO). This penultimate finding adds nuance to the main effect on substance use. Finally, one program effect emerged for mothers who reported low depression at T1: HVS mothers were more likely to have obtained a college degree by T5 than RIO mothers (7.6% HVS, 0.9% RIO). These results suggest that in regard to parental health and well-being, HFM may be most beneficial for mothers who experienced depression during pregnancy or postpartum mothers.

Next, we examined program effects for mothers based on whether they had a substantiated maltreatment report filed with DCF during their own childhoods (see Table 6.2). The most favorable program effects were found among mothers without a history of childhood maltreatment: HVS mothers were 83% more likely to have completed a training program at T5 relative to controls (33.6% HVS, 18.4% RIO) and reported less IPV ($M = 0.76$ HVS, $M = 1.41$ RIO; Cohen's $d = -.54$ for partner-perpetrated, $M = 0.75$ HVS, $M = 1.12$ RIO for self-perpetrated; Cohen's $d = -.43$). Further, among this group of mothers, children of HFM mothers exhibited superior receptive vocabulary ($M = 108.32$ HVS, $M = 104.44$ RIO; Cohen's $d = .41$) and inhibitory control ($M = 23.04$ HVS, $M = 17.38$ RIO; Cohen's $d = .31$) relative to children of control mothers at T4. On the other hand, mothers with a history of maltreatment had lower dyadic synchrony scores at T4 in the program group relative to controls ($M = 2.70$ HVS, $M = 3.14$ RIO; Cohen's $d = -.46$), and reported more self-perpetrated IPV at T5 ($M = 1.12$ HVS, $M = 0.88$ RIO; Cohen's $d = .45$). Mothers in the home visiting group who had childhood maltreatment reports also were more likely to report taking their child to the ER or urgent care in the past year (57.4% HVS, 37.7% RIO) and had children with higher emotional dysregulation scores ($M = 1.94$ HVS, $M = 1.69$ RIO; Cohen's $d = .46$), both at T5.

Table 6.1. HFM Marginal Impacts within Depression Subgroups

	T4						T5					
	Below Clinical Cutoff			Above Clinical Cutoff			Below Clinical Cutoff			Above Clinical Cutoff		
	HVS	RIO	95% CI	HVS	RIO	95% CI	HVS	RIO	95% CI	HVS	RIO	95% CI
Goal 1: Prevent Child Abuse and Neglect by Supporting Positive, Effective Parenting												
Conflict Tactics Scale—Parent-Child (CTSPC): Corporal Punishment (Prevalence)	--	--	--	--	--	--	--	--	--	37.2%	52.7%*	-29.4, -1.6
Goal 3: Encourage Educational Attainment, Job, and Life Skills Among Parents												
Mother Graduated from College (AA or BA)	--	--	--	--	--	--	7.6%	0.9% ***	2.7, 10.7	--	--	--
Goal 5: Promote Parental Health and Well-Being												
Maternal Depression (CES-D)	--	--	--	13.50 (1.10)	17.88 (1.21) **	-7.45, -1.31	--	--	--	--	--	--
Intimate Partner Violence (Partner Perpetrated, CTS2S)	--	--	--	--	--	--	--	--	--	0.79 (0.08)	1.21 (0.12) ***	-0.60, -0.24
Substance Use (Past Month)	--	--	--	--	--	--	--	--	--	0.13 (0.06)	0.31 (0.06) **	-0.30, -0.07
Goal 6: Increase Mothers' Knowledge and Ability to Navigate Early Childhood Systems												
Maternal Advocacy (Educational Setting)	--	--	--	--	--	--	--	--	--	61.2%	38.0% **	8.5, 37.8
Note. *** $p < .001$; ** $p < .01$; * $p < .05$; Table presents means and standard errors (in parentheses) for continuous outcomes and percentages for binary outcomes for the HVS and RIO groups, respectively, with 95% confidence intervals (95% CI) of the difference between HVS and RIO groups within each depression subgroup. All means and percentages are adjusted for maternal age at target child's birth, target child's age, and target child's sex.												

Table 6.2. HFM Marginal Impacts within Childhood Maltreatment Subgroups

	T4						T5					
	No Childhood Maltreatment Reports			Childhood Maltreatment Reports			No Childhood Maltreatment Reports			Childhood Maltreatment Reports		
	HVS	RIO	95% CI	HVS	RIO	95% CI	HVS	RIO	95% CI	HVS	RIO	95% CI
Goal 1: Prevent Child Abuse and Neglect by Supporting Positive, Effective Parenting												
Dyadic Synchrony	--	--	--	2.70 (0.10)	3.14 (0.15)*	-0.79, -0.09	--	--	--	--	--	--
Goal 2: Achieve Optimal Health, Growth, and Development in Infancy and Early Childhood												
Regulation of Negative Emotion (ERC)	--	--	--	--	--	--	--	--	--	1.94 (0.05)	1.69 (0.09) **	0.08, 0.42
Receptive One-Word Picture Vocabulary Test (ROW-PVT)	108.32 (0.81)	104.44 (1.14) *	0.84, 6.91	--	--	--	--	--	--	--	--	--
HTKS: Total score	23.04 (0.99)	17.38 (1.93) *	0.63, 10.69	--	--	--	--	--	--	--	--	--
Goal 3: Encourage Educational Attainment, Job, and Life Skills Among Parents												
--	--	--	--	--	--	--	33.6%	18.4% *	1.8 28.8			
Goal 5: Promote Parental Health and Well-Being												
Intimate Partner Violence (Partner Perpetrated, CTS2S)	--	--	--	--	--	--	0.76 (0.06)	1.41 (0.22) *	-1.21, -0.11	--	--	--
Intimate Partner Violence (Mother Perpetrated, CTS2S)	--	--	--	--	--	--	0.75 (0.06)	1.12 (0.11) *	-0.68, -0.06	1.12 (0.12)	0.88 (0.10) *	0.02, 0.48
Goal 6: Increase Mothers' Knowledge and Ability to Navigate Early Childhood Systems												
ER/Urgent Care Visits for Child (Any in Past Year)	--	--	--	--	--					57.4%	37.7%	9.9, 29.5
Note. *** $p < .001$; ** $p < .01$; * $p < .05$; Table presents means and standard errors (in parentheses) for continuous outcomes and percentages for binary outcomes for the HVS and RIO groups, respectively, with 95% confidence intervals (95% CI) of the difference between HVS and RIO groups within each maltreatment subgroup. All means and percentages are adjusted for maternal age at target child's birth, target child's age, and target child's sex.												

6.2. Mothers' Family Support

Mothers' perception of the dependability of their families, assessed at T1, was examined as a moderator of home visiting program effects. Home visiting may be particularly valuable for mothers with low levels of social support, or conversely, it may be that home visiting is most effective when experienced as a supplement to existing family support. Mothers were asked to rate the extent to which they could depend on seven different family members (e.g., spouse/partner, parents, siblings, etc.) for help or assistance on a 5-point Likert scale ranging from 0 = "Not at all" to 4 = "All of the time", and a mean score was computed ($M = 2.1, SD = 0.8$ for the T4 sample).

HFM program effects varied according to T1 ratings of family support for several outcomes: parenting stress and home learning environment at T4 and emotional dysregulation, parent-caregiver relationship, and use of ER for child at T5. Among mothers with low levels of family dependability (i.e., scores of 2 or lower), mothers in the HVS group had significantly lower parenting stress (in 2 of the 3 subscales: parent-child dysfunctional interaction, difficult child) than RIO mothers. These findings are displayed in Figures 6.1 and 6.2.

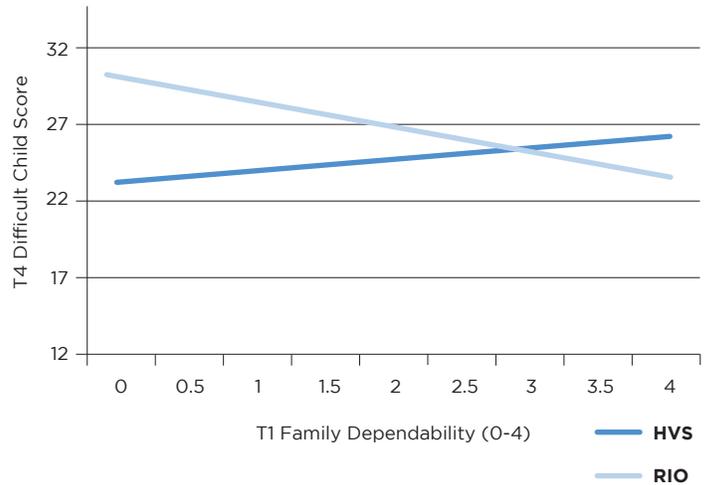


Figure 6.2. Interaction between HFM and T1 Family Support on T4 Parenting Stress (Difficult Child)

HVS mothers reported lower involvement in literacy activities than RIO mothers at higher levels of family dependability, but the differences were slight (score above 2; see Figure 6.3).

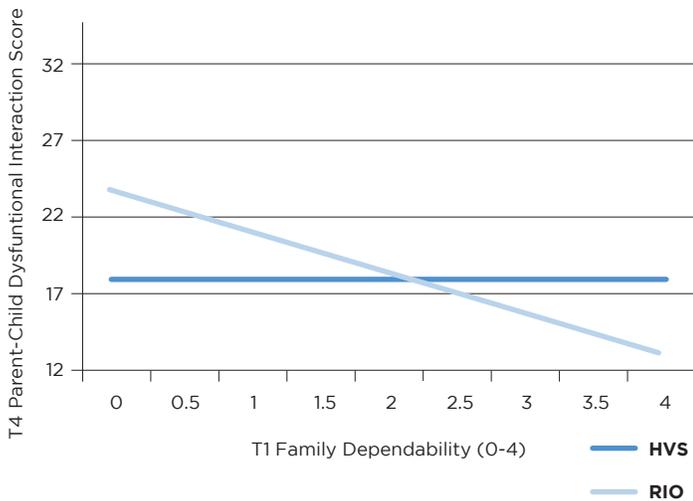


Figure 6.1. Interaction Between HFM and T1 Family Support on T4 Parenting Stress (Parent-Child Dysfunctional Interaction)

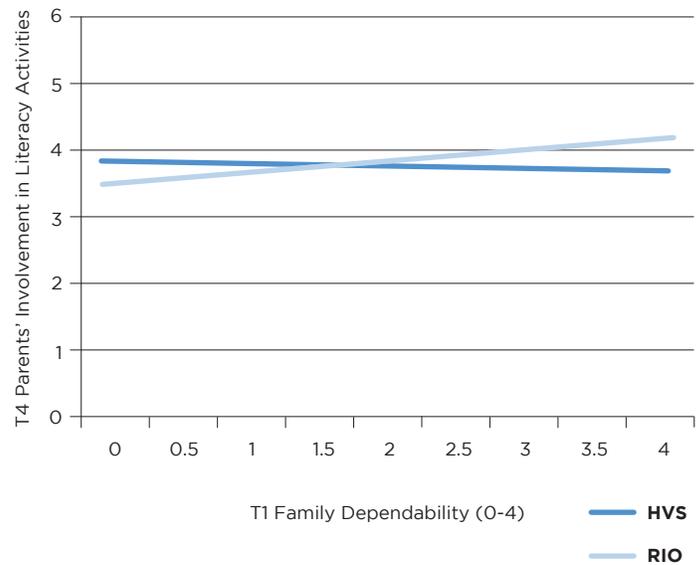


Figure 6.3. Interaction between HFM and T1 Family Support on T4 Home Learning Environment (Parents' Involvement in Literacy)

Children of HVS mothers exhibited more dysregulation during an observed task than children of RIO mothers at low levels of family support, but less dysregulation when family dependability was high (see Figure 6.4).

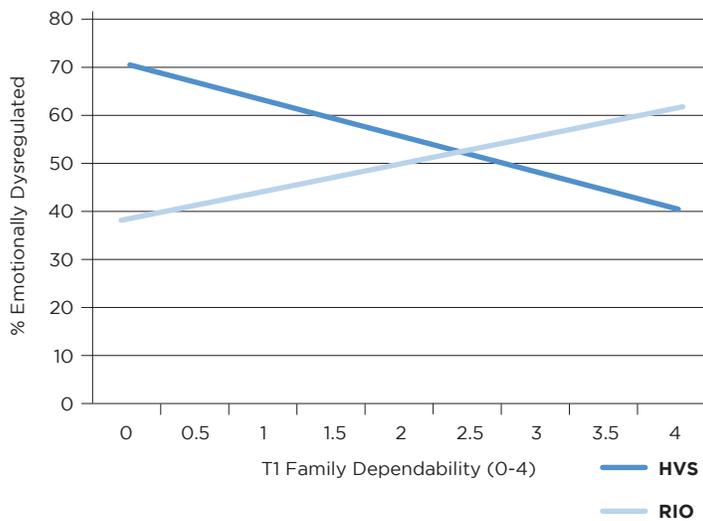


Figure 6.4. Interaction between HFM and T1 Family Support on T5 Emotional Dysregulation (Story Stem)

HVS mothers reported more confident and collaborative relationships with their child’s caregivers than RIO mothers at lower levels of family dependability (scores lower than 1.5; see Figure 6.5).

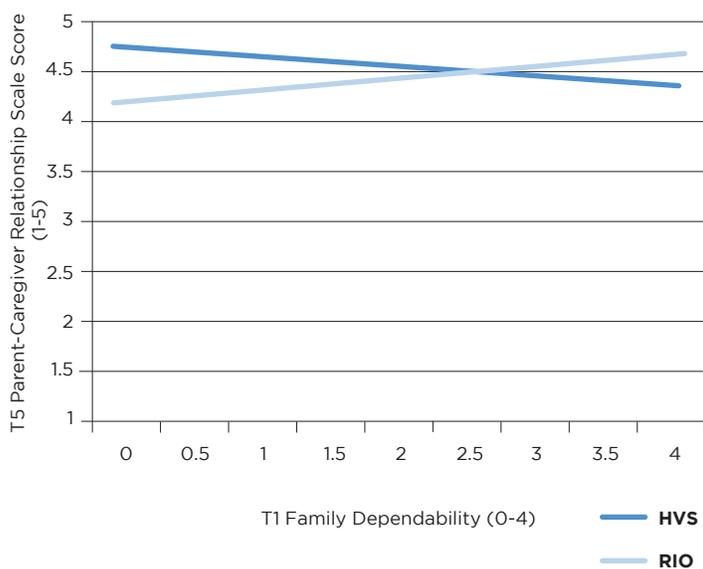


Figure 6.5. Interaction between HFM and T1 Family Support on T5 Parent-Caregiver Relationship

As seen in Figure 6.6, HVS mothers were significantly more likely than RIO mothers to use the ER or urgent care clinics for their children in instances where family dependability was low.

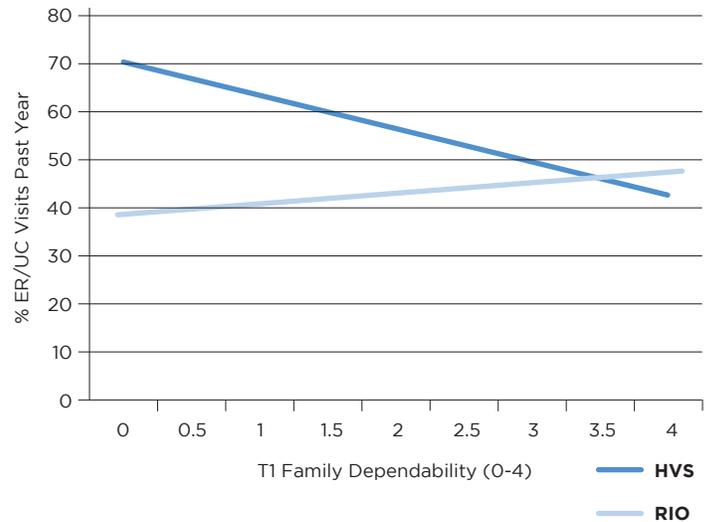


Figure 6.6. Interaction between HFM and T1 Family Support on T5 Child's Use of ER or Urgent Care in Past Year

Overall, the findings suggest that home visiting reduces parenting stress and promotes parents’ ability to establish relationships with their children’s caregivers in the context of low levels of family support. Further, HVS mothers who reported low levels of family support at T1 were considerably more likely to make use of the ER or urgent care clinics than RIO mothers. On the other hand, HVS mothers with higher levels of family support were less likely to report engaging in literacy activities at home with their children, perhaps because they had other family members to provide this type of stimulation. The whole of these findings suggests that in the context of low family dependability, HFM helps mothers provide less stressful home environments, and seek out support and guidance from service providers. Home visiting may compensate when young mothers’ families are not dependable, but in the context of high family dependability, home visitors may focus their efforts on other goal areas.

CHAPTER 7. UNDERSTANDING PATHWAYS TO PROGRAM IMPACTS

Two mediation models were assessed to better understand the process between HFM program participation and long-term outcomes of interest measured at T4 and T5. Prior positive program impacts found at T3,¹ notably reductions in parental distress and increased college attendance, were further tested to assess whether these earlier HFM program effects led to further impacts at T4 and T5. We tested two models of mediation: the first examining whether reductions in parenting stress led to mothers' favorable mental health and wellness, and the second examining whether increased college attendance led to mothers' economic self-sufficiency several years later.

7.1. Model 1: Parental Distress as a Mediator

The first model examined whether the association between HFM program participation was indirectly associated with mothers' T4 mental health, which included their depressive symptoms, attachment, and locus of control

and both their T5 wellness practices and risk engagement through the program effect on T3 parental distress (see Figure 7.1). Given the previously reported reduction in HVS mothers' parental distress at T3 (path a , Figure 7.1), we further examined whether T3 parental distress was associated with T4 poor mental health (path d), T5 wellness practices (path g^1), and T5 risk engagement (path g^2). Moreover, we examined whether T4 poor mental health was associated with T5 wellness practices (path e^1) and risk engagement (path e^2). We hypothesized that: (a) HVS participation would be positively associated with lower levels of T3 parental distress, and in turn, lower levels of T3 parental distress would be negatively associated with T4 poor mental health (paths a and d); (b) T4 poor mental health would be negatively associated with T5 wellness practices (path e^1) and positively associated with T5 risk engagement (path e^2); and (c) HVS participation would be positively associated with lower levels of T3 parental distress, and in turn, lower levels of T3 parental distress would be positively associated with T5 wellness practices (paths a and g^1) and negatively associated with T5 risk engagement (paths a and g^2).

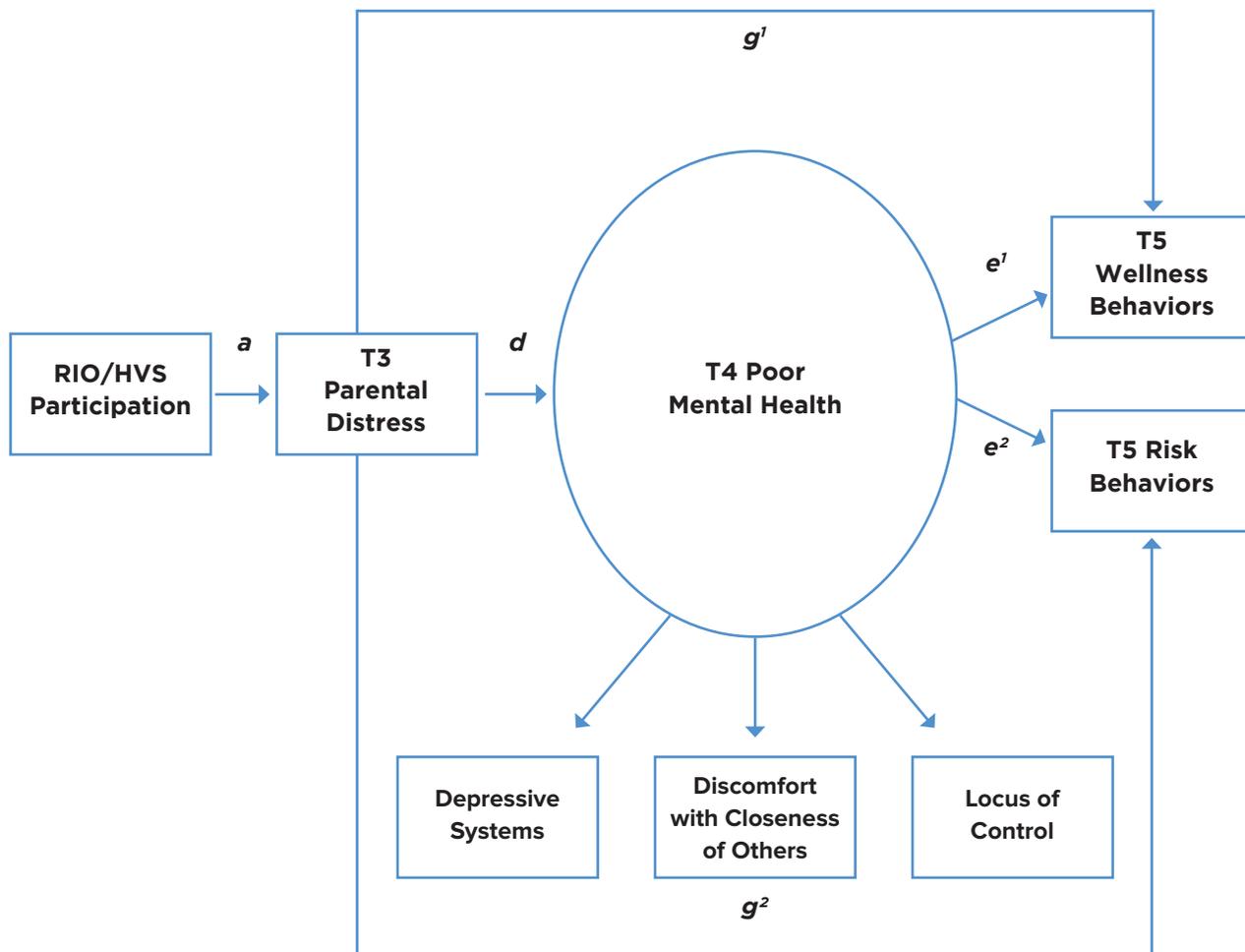


Figure 7.1. Theoretical Model: Long-Term Program Effects on Mothers' Wellness and Risk Behaviors through Parental Distress and Poor Mental Health

7.2. Model 2: College Attendance as a Mediator

Second, we were interested in whether the association between HFM program participation was indirectly associated with mothers' T4 economic dependence, including employment and receipt of cash assistance (Transitional Aid to Families with Dependent Children [TAFDC]) and food stamps (Supplemental Nutrition Assistance [SNAP]) and their T5 physical health through college attendance (i.e., completing one year of college) at T3 (see Figure 7.2). Because earlier program effects indicated that HVS mothers were more likely to complete one year of college at T3 (path *a*, Figure 7.2), we further examined whether the favorable effect on college completion at T3 was associated with T4 economic dependence (path

d) and T5 mental health diagnoses (path *g*), as well as whether T4 economic dependence was associated with T5 mental health diagnoses (path *e*). Specifically, we hypothesized that: (a) HVS mothers would be more likely to have completed at least one year of college at T3, and in turn, college completion at T3 would be negatively associated with T4 economic dependence (paths *a* and *d*); (b) T4 economic dependence would be positively associated with number of mental health diagnoses at T5 (path *e*); and (c) HVS mothers would be more likely to have completed at least one year of college at T3, and in turn, T3 college completion would be negatively associated with number of mental health diagnoses at T5 (paths *a* and *g*).

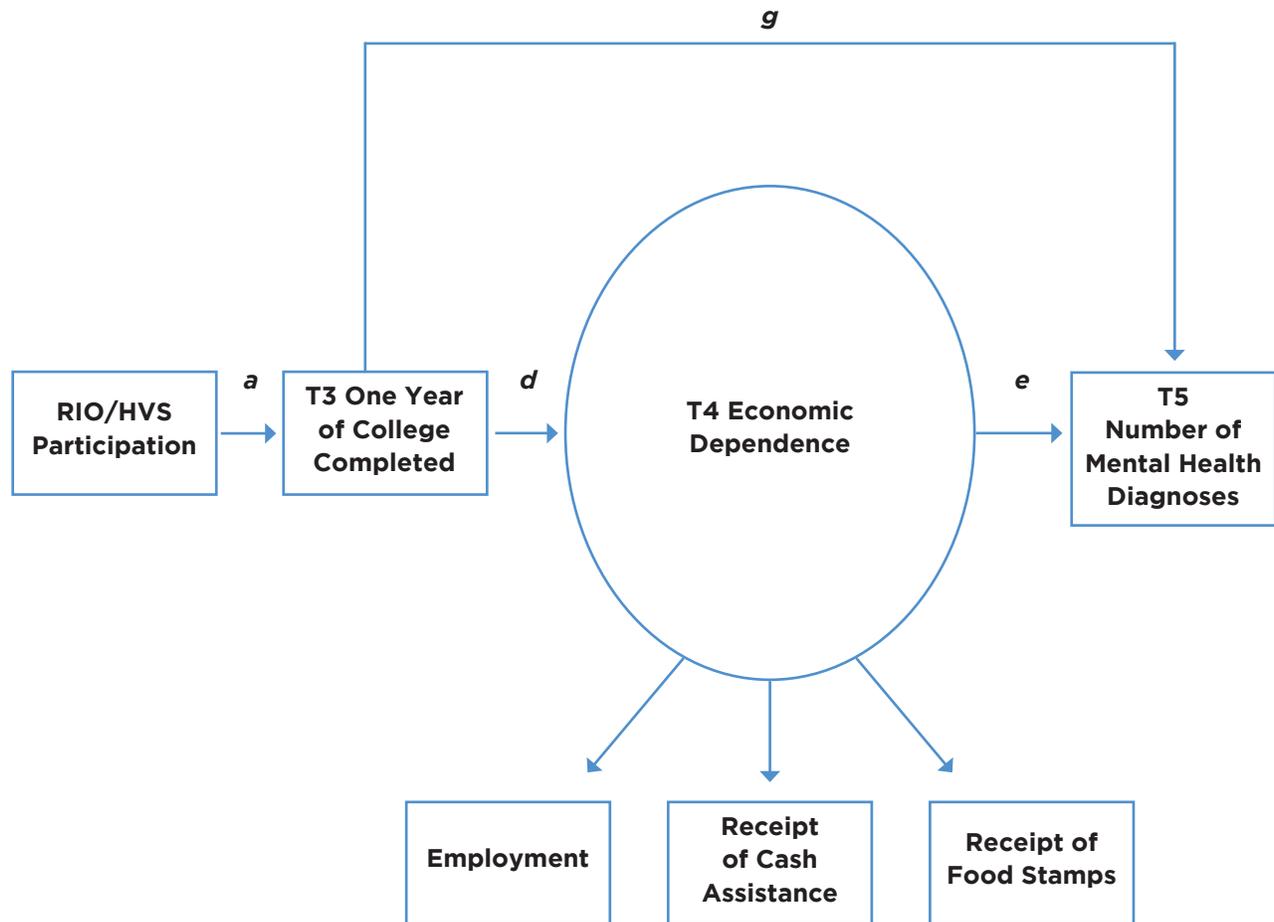


Figure 7.2. Theoretical Model: Long-Term Program Effects on Mothers' Economic Dependence and Mental Health Diagnoses through College Attendance

7.3. Methodology

7.3.1. Sample

We selected mothers with complete data at T3 who had data on at least one T4 or T5 outcome. Our analytic sample for model 1 included 331 mothers (57% HVS) and for model 2 included 325 mothers (57% HVS). Overall, mothers in the current sample were quite similar to those omitted with a few exceptions. Notably, mothers in the analytic sample were more likely than mothers omitted from the analysis to have had a substantiated childhood maltreatment report and have been born in Puerto Rico.

7.3.2. Analytic Plan

For each model, analyses were completed in two steps. Separate analyses were first conducted to determine whether the observed mental health and economic indicators could appropriately represent theoretical constructs of poor mental health and economic dependence. Once theoretical constructs were deemed appropriate^{xi}, a second set of analyses were separately conducted to test the mediation models^{xii}. See Appendix 3 for a further description of the variables included in the mediation analyses.

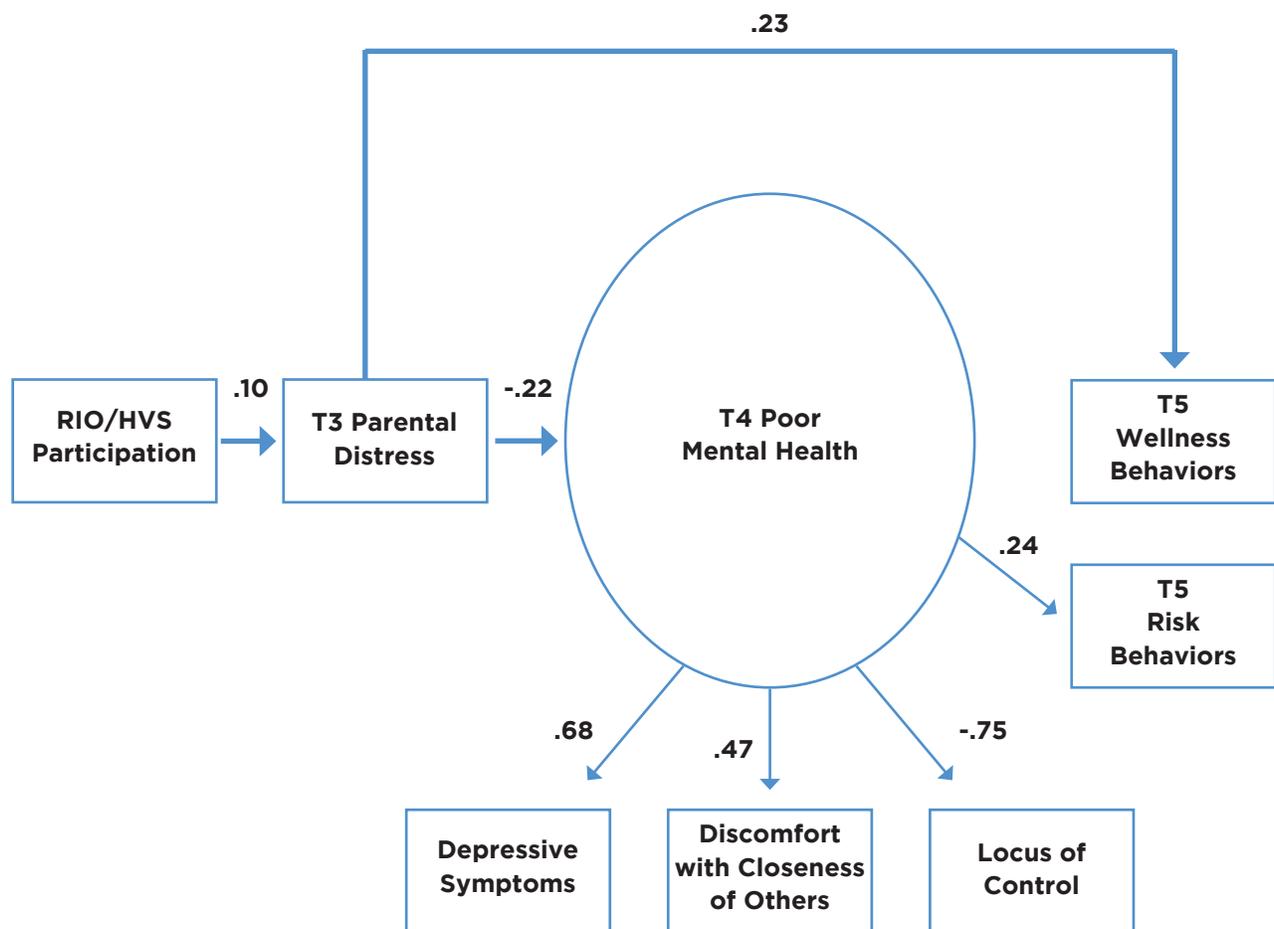


Figure 7.3. Mediation Model: Long-Term Program Effects on Mothers' Wellness and Risk Behaviors through Parental Distress and Poor Mental Health

Note. Standardized path coefficients are presented. All lines indicate significant paths where $p < .05$. $\chi^2 (49, N = 331) = 95.33$, $p < .01$; CFI = .91; RMSEA = .05; SRMR = .05. Bolded pathways indicate significant mediation. Analyses controlled for ethnicity and earlier time points of mediators and outcomes.

^{xi} Several fit indices were evaluated (comparative fit index [CFI], root mean square error of approximation [RMSEA], and standardized root mean square residual [SRMR]) to determine model fit. Good (acceptable) model fit is reflected by a CFI = .95 (.90), RMSEA = .05 (.08), and SRMR = .05 (.08).^{23,24}

^{xii} Mediation was tested using the percentile bootstrap method and was concluded significant when the 95% confidence limits of the specific indirect effect did not include zero. To handle missing data, parameters were estimated using full information maximum likelihood (FIML).^{21,22}

7.4. Model 1: Parental Distress Mediation Model

HFM participation was indirectly associated with maternal mental health at T4 and T5 wellness practices and risk engagement (see Figure 7.3): Relative to mothers in the control group, mothers assigned to the home visiting program group reported lower levels of parental distress at T3, and in turn, lower levels of parental distress were negatively associated with mothers' poor mental health at T4 and positively associated with mothers' wellness practices at T5. T3 parental distress significantly mediated the association between HFM and T4 poor mental health (95% CI [-.144, -.007]), as well as between HFM and T5 wellness practices (95% CI [.001, .021]). Moreover, mothers' T4 poor mental health was positively associated with their T5 risk engagement; however, T4 poor mental health did not emerge as a significant mediator between HFM and T5 risk engagement. No associations emerged between mothers' T3 parental distress and their T5 risk engagement nor between mothers' T4 poor mental health and their T5 wellness practices. No direct associations emerged between HFM and mothers' T4 poor mental health or their T5 wellness practices and risk engagement.

7.5. Model 2: College Mediation Model

HFM participation was indirectly associated with maternal economic health outcomes at T4 (see Figure 7.4): HVS mothers were more likely than RIO mothers to have completed one year of college at T3, and in turn, completing one year of college at T3 was negatively associated with economic dependence at T4. T3 college attainment significantly mediated the association between T1 program effects and T4 economic dependence (95% CI [-.313, -.004]). Moreover, mothers' T4 economic dependence was positively associated with their number of mental health diagnoses at T5; however, T4 economic dependence did not emerge as a link between HFM and number of T5 mental health diagnoses. No direct associations emerged between HFM and economic dependence nor between HFM and number of T5 mental health diagnoses.

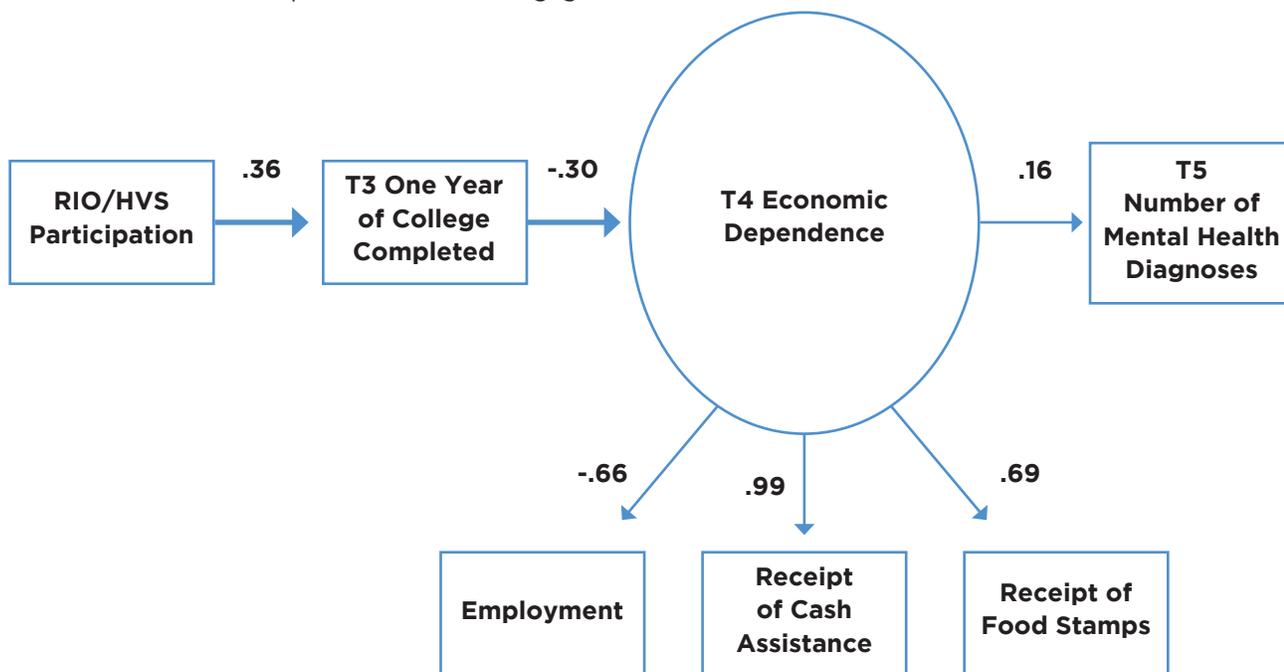


Figure 7.4. Mediation Model: Long-Term Program Effects on Mothers' Economic Dependence and Mental Health Diagnoses through College Attendance

Note. Standardized path coefficients are presented. All lines indicate significant paths where $p < .05$. Cambria Math $\chi^2 (32, N = 325) = 61.85$, $p < .01$; CFI = .89; RMSEA = .05. Bolded pathways indicate significant mediation. Analyses controlled for ethnicity and earlier time points of mediators and outcomes.

Overall, participation in the home visiting services program had favorable, indirect long-term effects on mothers' mental health and economic adjustment.

CHAPTER 8. TRAJECTORY ANALYSES ON MATERNAL DEPRESSIVE SYMPTOMATOLOGY

The present study includes five waves of data collected over 6 years, providing a unique opportunity to examine outcomes of interest for a sample of young mothers as they mature into adulthood. In this chapter, we examine mothers' depressive symptomatology over six points in time from pregnancy/early parenting to the time when their children are entering school to determine HFM program impacts on maternal depression over the first six years of parenting.

8.1. Analytic Approach

The main outcome of interest for the longitudinal analysis was mothers' depressive symptomatology using the Center of Epidemiological Studies Depression Scale (CES-D).¹⁹ CES-D was assessed at each time point (T1-T5).

Maternal age in years was the primary predictor variable in the growth trajectories. In order to provide a more meaningful intercept (i.e., 0-point), the variable is centered on the sample's minimum age (i.e. 16 years), so that the youngest mothers in the sample have a value of "0" for age. Whether mothers participated in HFM was the second primary predictor of interest. Here we used *post-enrollment years*, whereby the HFM program group was measured as 0 years of intervention up through their HFM enrollment date, after which years in HFM is represented by the difference between the date of the interview and date of enrollment; the control group was measured as 0 years of program for all interviews.

We controlled for four time-invariant characteristics of young mothers' early parenting experiences: (a) maternal age at birth (in years, centered at sample mean), (b) mothers' self-reported race/ethnicity (non-Hispanic White, Hispanic, non-Hispanic Black, non-Hispanic other), (c) whether the mother was pregnant or parenting at MHFE enrollment, and (d) whether the mother had reported having a subsequent child after the birth of the MHFE focal child. We also incorporated a time-varying variable, post-parenting years, years since becoming a parent, into the models.

We used a multi-level modeling (MLM) approach for individual change to explore maternal depression over time.²⁵ In this analysis time points (level-1) are clustered within mothers (level-2), yielding two levels of analysis. All MLM growth trajectories were estimated using the MIXED command in SPSS 21. For further details, see technical description in Appendix 4.

8.2. Findings

Approximately 43% of the variation in depressive symptomatology across time was attributable to differences among mothers in the sample, meaning that inter-individual differences explained a meaningful proportion of variance in depressive symptomatology. Overall, the unadjusted grand mean across mothers and across five time points was 12.84 ($SD = .31$) on the CES-D scale. After adjusting for the control variables, the overall mean is slightly higher ($M = 14.07$, $SD = 1.49$). On average maternal depressive symptomatology scores maintained a steady decrease as mothers aged, approximately a half a point (0.43) each year, and did not indicate any kind of unsteady change. Both the unadjusted grand mean and the rate of change are depicted in Figure 8.1.

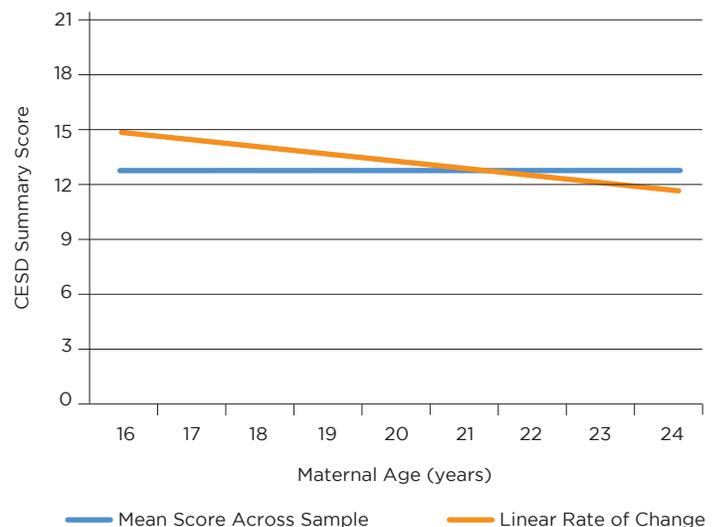


Figure 8.1. Average Maternal Depressive Symptomatology Scores and Rate of Change

Next, we fit a series of models to test whether maternal depressive symptomatology shifted in various ways after the birth of the focal child. Results indicated that there was a shift in the rate of change following the birth of the focal child, such that the steady rate of decrease in depressive symptomatology attenuated in the postpartum period. The steady decrease before birth flattened out postpartum. Additionally, results revealed that maternal age at first birth was positively associated with initial depressive symptomatology scores, such that for each year older a mother was at the birth of the focal child, on average that year difference was associated with a 5.26 increase in score depression scores at age 16.

Finally, we examined HFM program effects on the overall depression trajectories. Results indicated a protective effect of HFM Program on mothers' overall depressive symptomatology trajectories. On average, HFM mothers score nearly 1.6 points lower ($SD = 0.63$) on depressive symptomatology than control group mothers and this difference was steady in both the pre- and post-birth periods. The final model for HFM program impact is depicted in Figure 8.2, and results from the final models are displayed in Table 8.1.

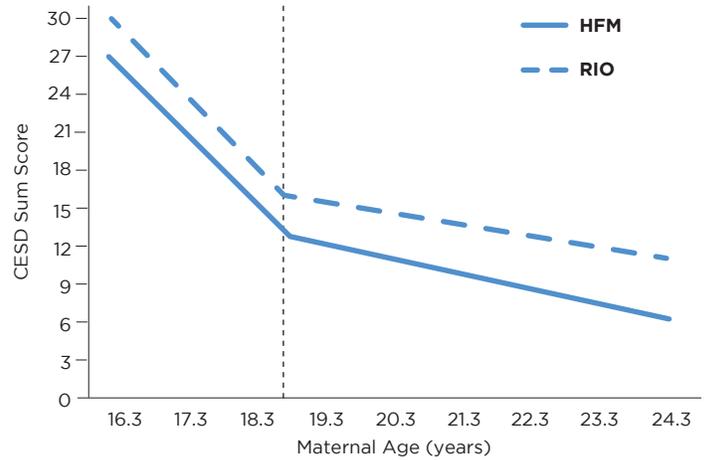


Figure 8.2. HFM Program Impact on Maternal Depressive Symptomatology, T1-T5

Table 8.1. Final Growth Trajectory Model Examining Depressive Symptomatology over Time

	Variable	Parameter	Unconditional Growth	Parenting Onset	HFM Program Impact
Fixed effects					
Initial status, π_{0i}	Intercept	γ_{00}	15.03***	25.32***	26.15***
	Age at first birth	γ_{01}		5.26***	5.17***
	Enrolled pregnant	γ_{02}		-0.32	-0.33
	Subsequent child	γ_{03}		0.34	0.35
	Race / NH White ^a	γ_{04}		1.25	1.10
	Race / Hispanic	γ_{05}		2.87*	2.87*
	Race/ NH Other	γ_{06}		4.47*	4.26*
Linear change, π_{1i}	Intercept	γ_{10}	-0.43***	-4.67**	-4.60**
	Age at first birth	γ_{11}		-0.10	-0.10
	Enrolled pregnant	γ_{12}		0.11	0.11
	Subsequent child	γ_{13}		0.14	0.14
	Race / NH White ^a	γ_{14}		-0.33	-0.33
	Race / Hispanic	γ_{15}		-0.40	-0.40
	Race/ NH Other	γ_{16}		-0.71*	-0.71*
Post Parenting, π_{2i}	Intercept	γ_{20}		4.52**	4.44**
HFM Program, π_{3i}	Intercept	γ_{30}			-1.58*
Variance Components					
Level-1:	Within-person	σ_{ϵ}^2	53.99***	53.77***	53.76***
Level-2:	Initial status	σ_0^2	77.58***	75.41***	74.31***
	Linear change				
	Variance	σ_1^2	1.12***	1.07***	1.08***
	Covariance	σ_{01}	-5.80***	-5.51***	-5.48***
Model fit					
	-2LL (#parameters)		19952.3 (6)	19848.8 (19)	19842.6 (20)
	AIC		19964.3	19886.8	19882.6
	BIC		19999.8	19999.2	20000.9
Note. * $p < .05$; ** $p < .01$; *** $p < .001$.					
^a Reference group is non-Hispanic Black.					

CHAPTER 9. DISCUSSION

This report describes key findings from the longitudinal follow-up of the evaluation of the Healthy Families Massachusetts (HFM) program, a statewide, universal, voluntary newborn home visiting program for young first-time parents living in Massachusetts. We build upon the results of the initial randomized controlled trial (RCT) program evaluation (MHFE-2) that followed families over the course of two years (typically the period from pregnancy to toddlerhood). This second phase of the Massachusetts Healthy Families Evaluation extends the timeline, following families into the early childhood years.

Findings of this report demonstrate that the HFM program supports positive life trajectories for young mothers and their children in several critical areas, such as maternal mental health and well-being, mothers' educational attainment, and housing stability. We also identified factors that present challenges to parents and providers over time. The chapter begins with a brief overview of salient features of the study design, followed by a discussion of findings related to long-term program impacts. Each section contextualizes and interprets key findings. We conclude with implications for HFM program and policy, implications for the wider home visiting and family support fields, and suggested topics for future research.

9.1. Notes on Study Methodology

We have summarized the evaluation methods used in the conduct of MHFE-2EC and the full set of findings in the report and do not reprise them here. Rather, this discussion is meant to highlight, integrate, and interpret key findings, and to identify key methodological contributions of the study, in the service of improving HFM, and home visiting programming more generally.

To begin, there are several features of this evaluation to take into account when interpreting and generalizing the findings: the unique HFM population and its developmental trajectory; the interdisciplinary, multi-methods design; and the conservative analytic approach. We also address the limitation of the RCT design, in spite of its popularity. Each of these is discussed in more detail below.

9.1.1. Developmental Trajectories of Adolescent Parents and Their Children

Of the Healthy Families affiliates across the U.S., HFM remains the only model to specifically target adolescent parents. Thus, the experience of transitioning to both parenthood and adulthood simultaneously, often while facing challenging life circumstances, is unique to the

young parents in HFM and this evaluation. This longitudinal follow-up study provides an opportunity to observe young parenting over time, as parents and children transition out of infancy and toddlerhood to the preschool years and into the elementary school context.

While research documents that, as a group, children of young parents demonstrate poorer long-term outcomes than children born to older parents,^{10,26} we also know that that there is heterogeneity in adaptation among both adolescent mothers and their children.^{18,27} We wanted to explore how these children fared further on in the developmental process; we did so when children were in the preschool and kindergarten years. During the preschool period, just over half of the families were connected to formal daycare/preschool settings; at kindergarten age, the majority of children were in a formal school environment. The shared experience of the school community, with new social structures and systems for both children and parents, may serve as an equalizer or normalizing component for families of adolescent parents. This follow-up allowed us to examine more closely whether the disadvantage of having a young parent that has been demonstrated in the research literature continues at the preschool and elementary school-age periods.

9.1.2. Interdisciplinary, Multimethod Approach

The original RCT evaluation was designed and managed by a well-established, interdisciplinary team of senior investigators, including team members who initiated the first cohort evaluation of HFM—MHFE-1—in 1998. That evaluation study design, informed by the fields of developmental science, cultural psychology, and child and family policy, employed multiple methodologies that are incorporated into this follow-up evaluation. Our protocols utilized many of the same standardized, validated measures, as well as project-developed surveys that were modified to reflect the new developmental stages that families were navigating. We continued to conduct observations of parent-child interactions and added new protocols focused directly on children's functioning. Lastly, our team continued to have access to comprehensive program, state agency, and census data, enabling us to gather relevant information about the mothers and children at multiple levels. This allowed for a host of secondary analyses that can be used to explain, interpret, and answer further questions about the mothers' experiences, and the family, program, and community contexts in which they parented.

9.1.3. Conservative Analytic Approach

This evaluation used a rigorous study design to isolate treatment effects: a randomized controlled trial (RCT). Due to the random assignment of women to receive HFM services in full (HVS) or to receive referrals and information only (RIO), we can assume that any differences in outcomes between the HVS and RIO groups are due to the impact of HFM rather than to existing differences between the women. From a program and policy perspective, this design imparts a critical level of confidence in our findings. Moreover, we adhered to a conservative analytic plan that is reflected in several analytic decisions and techniques used, including calculating inverse probability weights to account for sample attrition and examining the intent to treat (ITT) effects only.

9.1.4. Limitations to Longitudinal Design

Although it is a “gold standard” for providing evidence of program effectiveness, the longitudinal RCT method has its limitations. Among these are changing economic and political climates over the course of a multiyear RCT, as well as modifications to the program being evaluated. Both of these dynamic factors can challenge the generalizability of even the most careful and conservative evaluation plan. In 2008, when participants were first enrolling in the original RCT evaluation, the U.S. was at the precipice of economic crisis; the Great Recession was the context within which many mothers received program services. In 2011, as part of the Affordable Care Act, Massachusetts was one of the states to be awarded home visiting expansion funding. This new energy and interest in community-based services such as home visiting allowed HFM to implement program enhancements and expand its services; thus, the program that exists currently differs slightly from the iteration that was evaluated.

9.2. Discussion of HFM Program Impacts

HFM had impacts in several areas of critical importance for the health and development of young parents and their children. We found positive program main effects concentrated in four of six goal areas (see Figure 9.1), including increased executive functioning skills of preschool children (Goal 2), reduced rates of family homelessness (Goal 3), reduced health risks for mothers (Goal 5), reduced rates of maternal emergency room use (Goal 6), and increased maternal self-advocacy (Goal 6).

Goal 2: Promoting optimal child development

- Better executive functioning in preschool

Goal 3: Promoting educational attainment, job and life skills among parent

- Experienced less homelessness since birth of child

Goal 5: Promoting parenting health and well-being

- Lower depressive symptoms during preschool period
- Less likely to engage in substance use in past month in kindergarten period

Goal 6: Promoting navigation of early childhood systems

- Mothers less likely to use emergency room
- Mothers more likely to advocate for themselves

Figure 9.1. Positive HFM Program Main Effects

Particular subgroups of mothers enjoyed additional benefits from HFM participation, suggesting that the program could support both highly vulnerable mothers, and those with less risk. Lastly, pathway analyses demonstrated that some early program impacts continue to effect change in related domains at later time points.

Given the conservative analytic approach used by the evaluation, most notably, the ITT approach, the presence of significant findings across several goal areas is impressive. The existence of program impacts years after program enrollment is a testament to the power and effectiveness of the HFM model in delivering support to families of young mothers.

9.2.1. Child Outcomes

A highlight of this longitudinal study lay in the opportunity to examine whether mothers' receipt of the HFM program influenced how children were developing in the preschool and kindergarten periods. Our previous report examined outcomes two years after program enrollment (average child age was about two years). At that time, no direct effects of the program emerged, for many reasons, including the lack of appropriate assessments of very young children's development, limited variability in our maternal-report child measures, and overall high levels of child health within the state of Massachusetts. An underlying premise of HFM is that parents are the change agents for their children's growth and development and that the role of the program and the home visitor is to empower, educate, and support parents, rather than to work with children directly. In other words, children were not the direct foci or recipients of program services. As such, the best the program can hope for is to have an indirect influence on child outcomes.

In the early childhood study, we chose indicators of child functioning that were developmentally appropriate (e.g., school readiness, emotion regulation, vocabulary) and that might be influenced by parents' behavior and environmental context. For example, a child's ability to regulate emotion stems in part from a child's internalization of the primary attachment relationship and regulation strategies modeled by parents, in addition to their exposure to environmental contexts and interactions with others. Appropriate emotion regulation allows a child to better access educational curricula and modulate behaviors across contexts. Due to the salience of emotion regulation for early childhood, we included a maternal report measure (T4, T5), as well as a direct assessment (story stem completion task) (T5). We also focused on executive functioning (EF) tasks, as defined by working memory, cognitive flexibility, and ability to control or inhibit impulses. EF has been widely demonstrated to predict later school achievement, emerges during preschool age, and is strongly influenced

by both parenting behaviors²⁸ and contextual factors such as socioeconomic status.²⁹

The evaluation revealed that HFM had a positive impact on preschool children's working memory, a component of executive functioning. This finding aligns with results from the evaluation of Healthy Families New York; that study reported that first grade children in the home visiting group were more likely to perform above grade level on behaviors that promoted learning (i.e., cooperating with others, following directions, completing work on time), compared to the first grade children in the control group.^{30,31} No main effects were evident in our kindergarten data using the same indicators, suggesting the robust influence school itself exerts on executive functioning as children make the transition into formal schooling. In future work, incorporating data on school quality might illuminate for whom the program effects remained and for whom they changed—for better or for worse. That is, one cannot expect early effects to remain if the environment shifts in either direction.

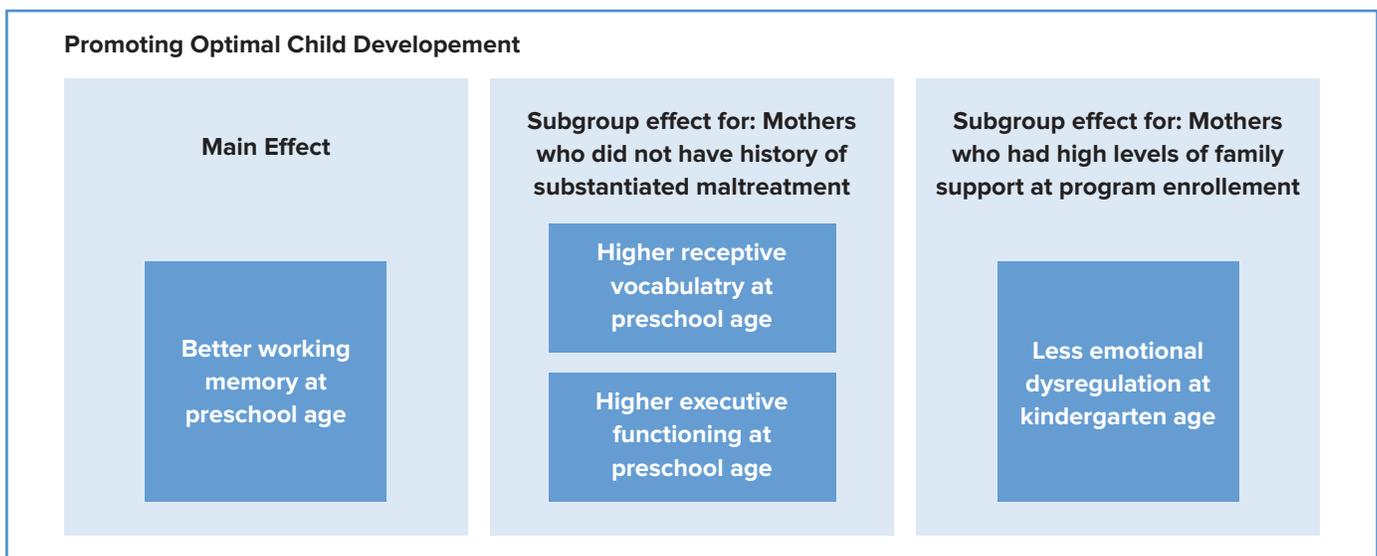


Figure 9.2. Positive HFM Program Impacts on Goal 2: Child Development

In addition to the main effect on child working memory, the evaluation discovered particular subgroups of families that demonstrated program impacts. One such subgroup is mothers who enter the program without a substantiated maltreatment history during their own childhoods. Within this lower-risk group, preschool age HVS children demonstrated higher receptive vocabulary and stronger executive functioning skills than did control group children. For another lower-risk group, mothers with strong family support at program enrollment, kindergarten age HVS children, were less emotionally dysregulated than control group children in a narrative completion task. Conversely, for a subgroup of mothers with higher risk (i.e., those who enter the program with a history of substantiated maltreatment), HVS children were rated by mothers to be more dysregulated than RIO children in the kindergarten period. This finding was not corroborated by the observed measure of emotion regulation for that time point, and may indicate that HFM mothers are more attuned (or perhaps overly sensitive) to their child's dysregulation. See Figure 9.2.

When considering the impact of HFM on child outcomes, it is apparent that mothers enter the program already different from each other in ways that may influence program impacts. For mothers without a maltreatment history or with strong family support, home visitors and parents may have time and the emotional resources to focus on parenting skills and behaviors that promote children's learning. Among mothers who have additional risks in their lives, both parents and home visitors may need to focus efforts on stabilizing the family, providing emotional supports to the mother, or helping the family access necessary resources, in addition to supporting parenting. These conflicting but necessary priorities may result in reduced program impact in this goal area.

9.2.2. Impacts on Education and Economic Stability and Resources

In examining mothers' educational and economic attainment and financial stability (see Figure 9.3), the evaluation data indicated a significant impact of the

HFM program on rates of homelessness experienced by families since the eldest child was born. HVS mothers reported lower rates of homelessness than did control group mothers (28% HVS vs. 41% RIO). An indicator of residential stability, homelessness represents an extreme disruption in family context which can have particularly negative and long-term consequences. Research on long-term effects of homelessness demonstrates a greater risk of health, emotional, behavioral, and developmental problems⁴⁻⁸ for children specifically, not to mention the short-term stress and disruption that unstable housing places on parental stress and coping. The long-term protective effect of preventing or decreasing homelessness is weighty. Our previous report highlighted the salience of housing for families; our current analyses demonstrate that HFM does help mothers secure housing. Although we currently don't understand the mechanisms of this protective effect, we propose that home visitors help mothers navigate the housing process, or that home visitors coach mothers on the advocacy skills mothers need to acquire housing once program engagement ends.

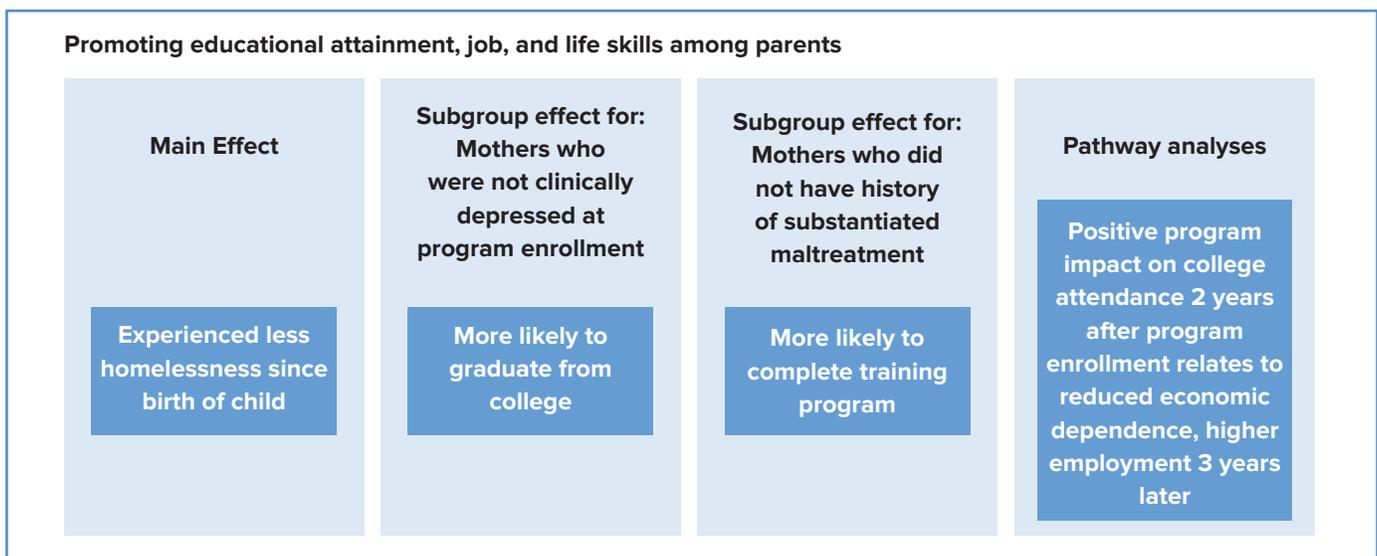


Figure 9.3. Positive HFM Program Impacts on Goal 3: Educational Attainment and Job Skills

Even though HFM reduced homelessness in the program group, the overall rate of homeless for the entire sample, 36%, was striking. This statistic represents the experience of homelessness over a five-year period; family homelessness will vary by number and length of homeless episodes. We defined homelessness as lack of a permanent residence of one's own; it includes living in emergency and transitional living (e.g., motel accommodation or shelters), temporarily living with family/friends, and more traditional definitions such as living on the streets, or in a car. Recent reports show a decrease in the Massachusetts' rate of homelessness among families with children, though the rate (6%) remains at a higher level than that of many other states³² (see Figure 9.4).

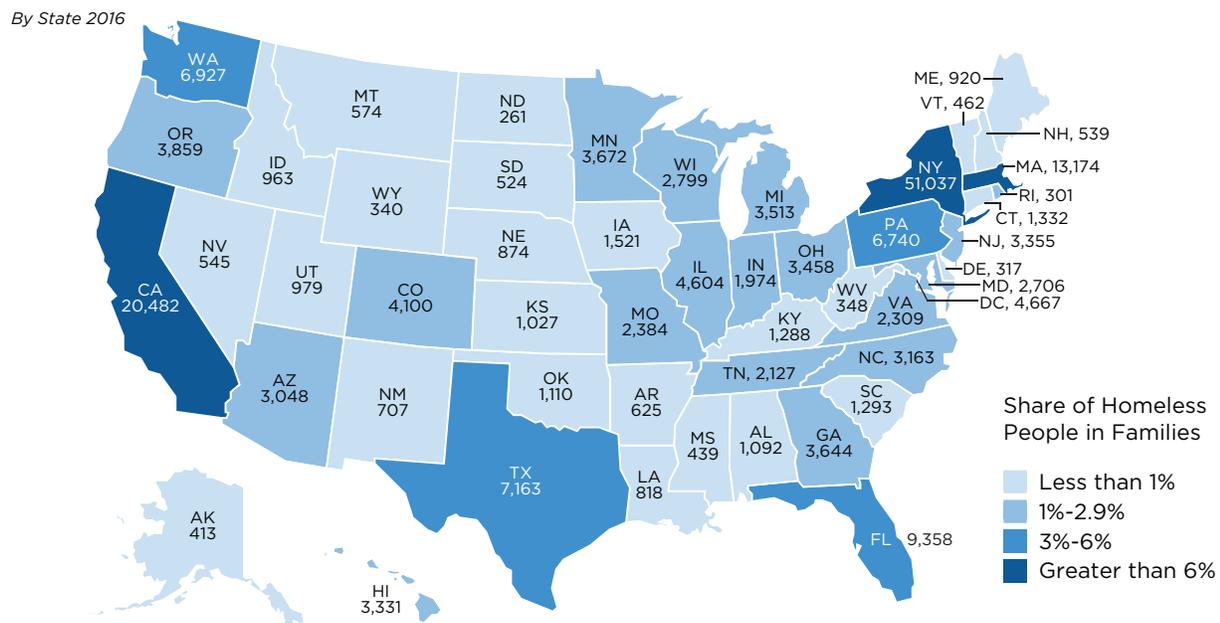


Figure 9.4. Estimates of Family Homelessness, By State

9.2.3. Educational Attainment

Turning to the goal of enhancing educational attainment, we found that HFM had a positive impact on educational attainment (college completion, job training certification) for subgroups of mothers that entered the program with low risk. Specifically, for mothers who entered the program without clinical depression, HVS mothers completed college at a higher rate than control mothers (8% HVS vs. 1% RIO). Similarly, for mothers entering the program without a substantiated history of child maltreatment themselves, HVS mothers were more likely to complete a job training program than were control group mothers (34% HVS vs 18% RIO). Relatedly, our pathway analyses demonstrated that the positive program impact on early college attendance, measured two years post program enrollment, led to higher levels of employment and lower reliance on public assistance two to three years later. Given that continuity, and in light of labor market conditions, we can expect that college and job training completion gives HFM participants an advantage when seeking employment, or in the form of higher earnings in the future.

“Individuals with higher levels of education earn more, pay more taxes, and are more likely than others to be employed. In 2015, median earnings of bachelor’s degree recipients with no advanced degree working full time were \$24,600 (67%) higher than those of high school graduates. Bachelor’s degree recipients paid an estimated \$6,900 (91%) more in taxes and took home \$17,700 (61%) more in after-tax income than high school graduates.”³³

Access to, and use of, child care likely supports mothers’ educational and employment attainment. Although we know general rates of child care use in the longitudinal evaluation sample, the complexity of child care utilization takes time to unpack. Rates of formal preschool and center-based child care were lower than we expected in the preschool period, about 56% for preschool, formal daycare, and Early Head Start combined. Mothers’ rates of employment remained stable across both preschool and kindergarten, and mothers relied heavily on family for child care for preschool age children. Massachusetts is second in the nation (behind Washington, D.C.) in annual cost of child care, which for a four-year-old is higher than the average college tuition (\$12,781, compared to \$10,702 for college); infant care is even costlier at \$17,062 per year.³⁴ Further examination of the difference between formal and informal child care in child educational outcomes, how that difference relates to maternal educational and employment attainment, and what role HFM plays in child care utilization, if any, will help us better understand how young mothers make gains in their own education and economic progress.

9.2.4. Impacts on Maternal Health and Well-Being

The evaluation revealed that the most comprehensive positive program effects lay in the program goal area focused on parental health and well-being (see Figure 9.5). In some ways, this is to be expected as the home visitors work directly with the mothers and while they also support parenting as a skill *per se*, the primary recipient of their energy, efforts, and interaction is the

mother herself. Given this, what is interesting is the degree to which this paraprofessional home visiting program has a positive impact on areas related to mental health, when the program is not specifically a mental health service. For the whole sample, HFM mothers had fewer depressive symptoms than control group mothers during the preschool period, and HFM mothers were less likely to use substances in the past month than control group mothers in the kindergarten period. Both of these findings are stronger for the subgroup of mothers who entered the program with clinical depression. Furthermore, for the subgroup of mothers who were clinically depressed upon entering the program, HVS mothers reported fewer acts of intimate partner violence in the past.

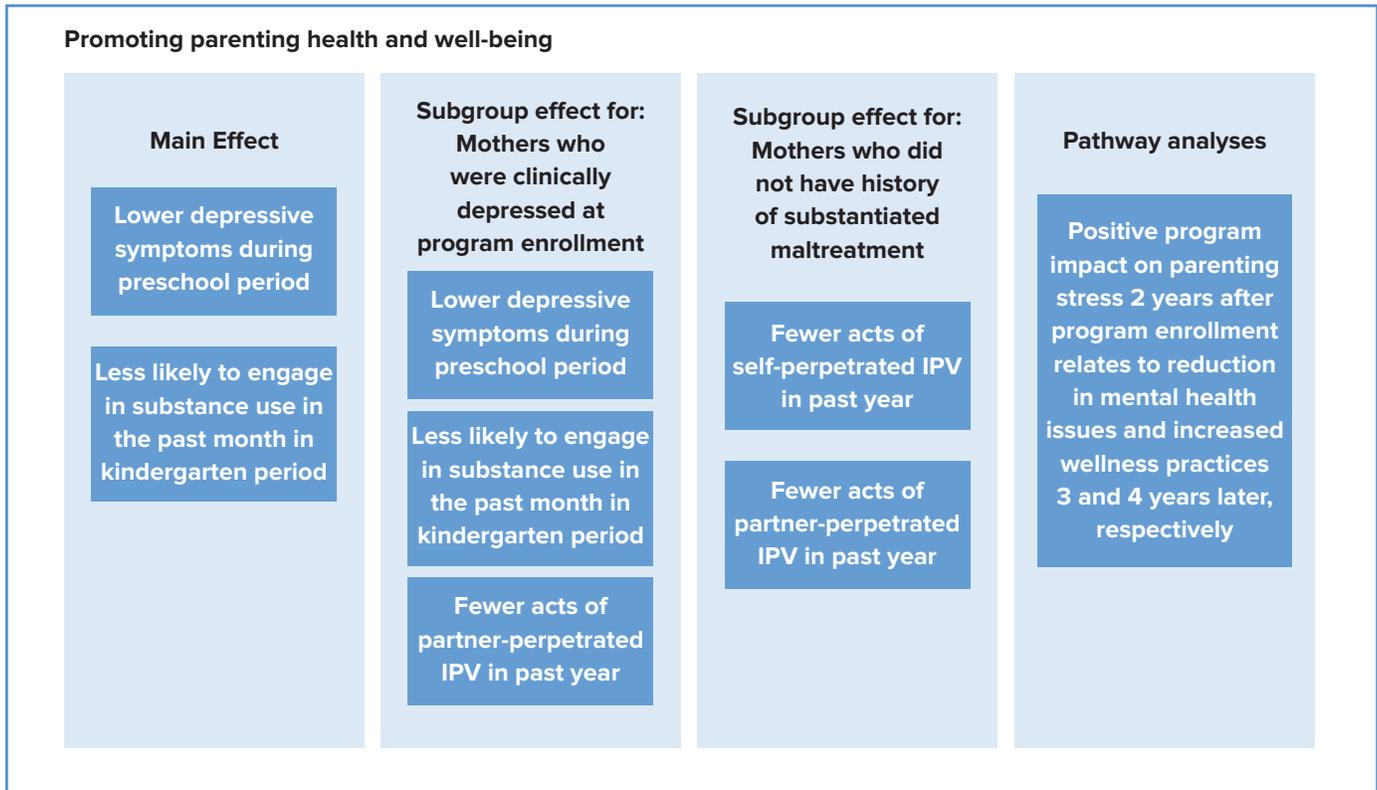


Figure 9.5. Positive HFM Program Impacts on Goal 5: Parental Health and Well-Being

Clearly, HFM is effectively serving mothers with clinical levels of depression. A key question is through what mechanism or combination of mechanisms is HFM affecting change? This goal was established as a critical program focus after the first evaluation¹⁵ and the program has supported greater training of staff in facilitating referrals and in discussing topics related to mental health. Current research on success of referral connections shows us that referral discussions involve maintaining existing connections more often than creating new connections.³⁵ This type of scaffolding may allow participants to persevere with the mental health services they are receiving. The Early Head Start follow-up study revealed a long-term program effect in reducing maternal depression two years after program engagement, just before

kindergarten. The authors point to child and parent factors as contributors to that reduction.³⁶ As other home visiting evaluations have not demonstrated a long-term program effect related to a subgroup of clinically depressed mothers, we surmise that there may be other factors³⁶ at play within HFM service delivery that enables home visitors to so successfully support depressed mothers. In addition to a comfort level with mental health, it may be that the home visitors' focus on advocacy serves as a booster in promoting self-care, or as suggested by the EHS study, it could be that improvements in child behaviors or decreases in parenting stress lead to better health and relationship management for mothers. Lastly, one must consider the larger context of Massachusetts, with a longer history of universal health care coverage, and a broad network of mental health providers.

The overall HFM impact on reduction in substance use extends a finding from our previous evaluation, consolidating the notion that paraprofessional home visitors can effect change in health behaviors, for the long term. While this has clear implications for maternal health, it also has significant implications for maternal capacity for education and employment, and for parenting and child maltreatment. Substance abuse can decrease functionality for work and schooling, and in regard to parenting, a large body of data demonstrates how difficult it is to be an available, sensitive, and responsive caregiver in the face of serious mental health issues or substance abuse.

The last goal area explored is not a stated program goal, as it involves the period of early childhood and therefore extends beyond the reach of program services. However, in collaboration with the Children's Trust, we identified key aspects of early childhood in which the program might expect successful outcomes.

9.2.5. Impacts on Mothers' Navigation of Early Childhood Systems

The last goal area explored is not a stated program goal, as it involves the period of early childhood and therefore extends beyond the reach of program services. However, in collaboration with the Children's Trust, we identified key aspects of early childhood in which the program might expect successful outcomes.

This new goal area considers the developmental trajectory of HFM families and the larger systems in which they find themselves. Parents, regardless of age, have to determine how best to manage the health, educational, and social needs of various individuals in the family. The parents in the HFM program have different, and often additional, obstacles to face in navigating these systems and in accessing resources available to them.

The evaluation revealed a reduction in program mothers' use of the emergency room, a metric that reflects parent' health care utilization practices and has important implications for the larger health care system. Reducing non-emergency ER use has become a key strategy for reducing health care costs³⁷ overall, and has become a

commonly reported health care indicator. In Massachusetts, the average cost of an ER visit, as of 2013, ranged from \$580 to \$700, with an average office visit averaging between \$130 to \$180.³⁸ Future analyses of these data will determine the incidence in which these mothers used the ER appropriately, to calculate more precisely the cost savings involved by this reduction. While the overall rate of their own ER use was lower for HVS mothers as compared to control group mothers (67% HVS vs. 78% RIO), an interesting set of subgroup findings emerged as well. In the subgroups of mothers with higher risks (i.e. a history of substantiated childhood maltreatment in their own childhood or low family support at program enrollment), HVS mothers took their children to the ER at higher rates than control group mothers. At first glance, and from a health-care-cost point of view, this could be seen as a negative effect of the program. However, another interpretation could be that for mothers who begin in HFM with low support, or without a strong parenting model of their own, bringing a child to the ER in times of uncertainty or isolation might actually be the best outcome for the child. There is a risk of taking a child to the ER, as hospital staff are mandated reporters, and the fact that HVS mothers do so willingly could be an indication of: (a) their trust in care providers due to a positive relationship with a HFM home visitor, or (b) a confidence in their parenting, despite their lack of medical knowledge.

We also found positive program impacts for another subgroup, highlighting the possibility of increased trust in providers as a result of HFM. For mothers entering the program with low family support, HVS mothers reported better relationships with teachers or child care providers in the kindergarten period, indicating again that the home visiting relationship could become a replacement for a lack of family support, and furthermore, influence perceptions of, and trust in, care and service providers later on. From an attachment perspective, client-provider relationships that are based in sensitivity, responsiveness,

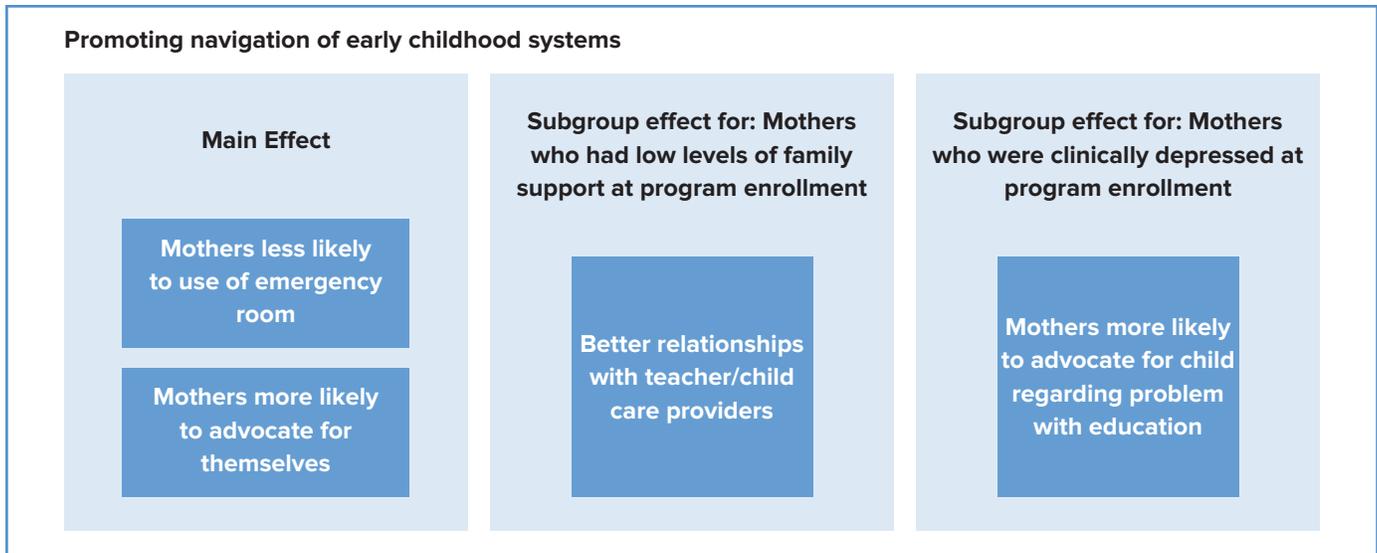


Figure 9.6. Positive HFM Program Impacts on Goal 6: Increase Mothers' Knowledge and Ability to Navigate Early Childhood Systems

and respect, would facilitate changes in the expectations of self and others, and it appears that the HFM model does so for mothers who might not have support early on in their parenting.

Lastly, the evaluation found a main effect of the program on mothers' likelihood to take action, or advocate, for themselves. In addition to an overall program impact on self-advocacy, the program was particularly successful in promoting maternal advocacy in the subgroup of mothers who were clinically depressed at program enrollment. In this subgroup, HVS mothers were more likely than control group mothers to take action on an issue involving their child's education. This particular indicator, advocacy, speaks to a strongly held programmatic view that HFM staff purposefully encourage and model advocacy for their clients. Successful advocacy can be the difference between having a home to live in or being homeless, getting cash assistance or struggling to buy necessities, or receiving the appropriate services for your child or not. A program impact on advocacy skills therefore crosses over to other program areas such as family financial stability, maternal well-being, and child development and our findings reinforce the salience of the program's emphasis on bolstering mothers' advocacy skills. The fact that a maternal advocacy effect appears in the kindergarten period is striking, as that is the first entrée into the formal educational system for many families. Ideally, these advocacy skills will serve families successfully in later years when more advocacy is likely required. Overall, the ability to impact mothers' utilization of systems

(see Figure 9.6) reflects the success of HFM on many levels: in educating mothers about resources, by creating healthy working models about service providers, and in modeling and encouraging advocacy strategies. These impacts demonstrate that the work HFM does early on with mothers, prenatally and during infancy and toddlerhood, becomes internalized in crucial ways that benefit families as they continue through childhood.

9.2.6. Small Effects on Parenting

This goal area for reducing child maltreatment is paramount for HFM, as well as the larger HFA model. At the present time, no home visiting evaluations have demonstrated a program effect on overall reductions in maltreatment during early childhood. Findings related to reducing maltreatment have been discovered for subgroups of mothers when children are in first grade³⁹ and for a reduction in maltreatment reports at a 15-year follow-up.⁴⁰ Thus it is early to expect a program impact on this important area.

The overall rate of substantiated reports since program enrollment, at 38%, is alarming. As a comparison, a recent study of adolescent mothers in California reports showed that 23.6% of children of teen mothers in that sample had maltreatment reports, with 7.6% substantiated;⁴¹ this period represents the time from birth to five years. To better understand these high rates, one must consider the larger context of maltreatment screenings in the state of Massa-

chusetts. Due to several highly publicized and tragic cases in 2013 and 2015,^{42,43} the state has substantially increased funding to the Department of Children and Families (DCF), and rates of screenings have increased dramatically.⁴⁴ With this increased surveillance across the state, the likelihood of finding a program impact, even at later time points, decreases. Given this, we shift our emphasis onto parenting indicators, such as parenting behaviors and parenting stress, which have been demonstrated to be

important predictors of child health and outcomes.

Though there were no main effects for either parenting behaviors or stress, several notable subgroup findings emerged (see Figure 9.7). For mothers entering the program with low family support, HVS mothers reported less parenting stress during the preschool period than control group mothers. For mothers entering the program with clinical depression, HVS mothers were less likely to use corporal punishment in the kindergarten period than

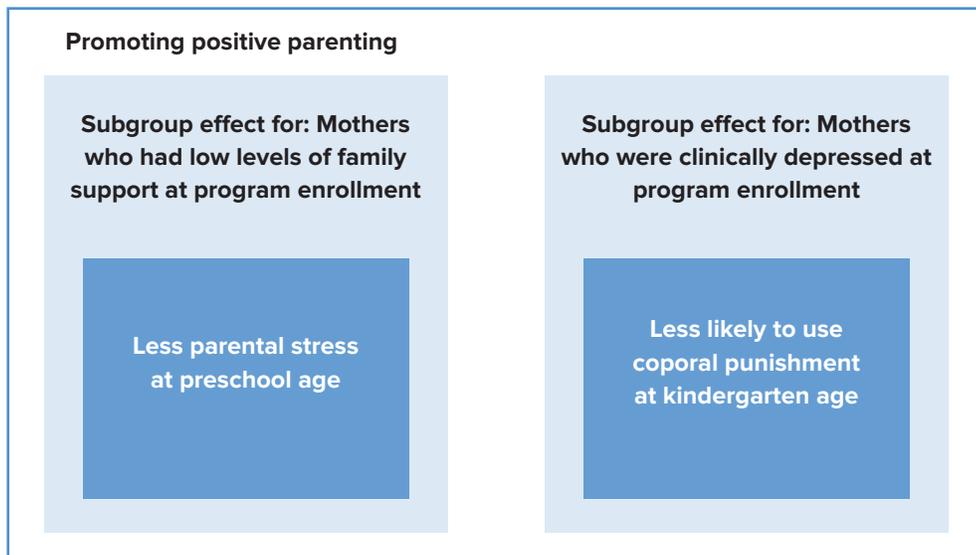


Figure 9.7. Positive HFM Program Impacts on Goal 1: Promoting Positive Parenting

control group mothers. These findings reinforce the notion that focusing on parenting behaviors like discipline, or ways to manage parenting stress, is a tangible and effective approach for home visitors.

These current findings extend similar findings in our previous report on this cohort demonstrating the positive impact HFM has on reducing parental stress for mothers. As we have shown through our mediation analyses, HFM affected mothers' mental health at T4 and wellness practices at T5 indirectly through parenting stress measured 3-4 years prior. While the link between parenting stress and mental health (particularly maternal depression) is well documented,⁴⁵ this analysis illustrates how short-term program effects can translate into long-term program effects.

9.2.7. Differential Impacts for Vulnerable Subgroups

It would be remiss of the evaluation not to contrast the consistency of success the HFM program has with mothers who are clinically depressed at program entry with the challenges presented by the mothers who enter the program with a childhood history of substantiated maltreatment. The HFM program has effectively served mothers with clinical depression at program entry by demonstrating positive program effects in the areas of parental discipline; reduction in depressive symptoms, substance use, and partner-perpetrated IPV; and increasing maternal advocacy for child. All of the findings for this subgroup of mothers showed a positive program effect. The HFM program also effectively serves mothers who enter the program without depression, particularly in the area of college completion.

In contrast, all of our findings involving the subgroup of mothers who have experienced substantiated childhood maltreatment are mixed at best. The program currently is more effective for mothers who do not have a history of substan-

tiated maltreatment, and demonstrates many positive program effects for that subgroup in the areas of child development, job training program completion, and self- and partner-perpetrated IPV.

As childhood maltreatment is a strong predictor of teen parenthood^{46,47} and was present at a rate of over 50% in this current sample, this subgroup will likely always comprise a substantial portion of the target HFM population. A clear challenge for HFM lies in how to best support their home visiting staff in recognizing mothers' trauma histories, and to provide tools and resources for staff to utilize as they strive towards serving this vulnerable group of mothers. Given the success of their initiative on depression and their track record of delivering an organized, consistently implemented program, determining effective strategies for working with and supporting parents with experiences of childhood maltreatment could represent the next area upon which HFM might focus program efforts.

We proceed below with a brief discussion of findings related to program operations.

9.3. Discussion of HFM Program Operations

Our previous report detailed various aspects of HFM program operations: program utilization, program fidelity to model, participants' individual fidelity, as well as in-depth qualitative analysis of the home visitor-client relationship. All these are discussed at length within that report.¹ To examine how the level of participant program engagement was associated with outcomes of interest, we chose the most robust indicator of program utilization: number of home visits received. This indicator correlated strongly with other indicators of program utilization, such as duration in program and number of secondary activities. We confirmed that the MHFE-2EC sample did not differ significantly from the original evaluation sample in terms of receipt of home visits.

Findings emerged from analyses within the HVS program group in two key areas: parenting behaviors and rapid repeat birth. Mothers who received more visits had less parental distress, were more likely to use non-violent discipline during the preschool period, and experienced fewer repeat births within two years of their first child when compared to mothers with fewer visits. This reduction in repeat birth within two years of their first child among mothers who received more home visits is significant, as there were no main effects in this program goal area. This goal area represents a highly personal domain; effecting change in it could simply only be possible when a home visitor-client relationship is particularly well-established and close.

Interestingly, mothers who received more visits perceived their children to be more difficult in kindergarten, suggesting that help with parenting may have played a role in increasing their program participation or, conversely, that other factors exacerbating parenting stress may have kept them in the program longer. We also found that mothers with more home visits reported doing fewer literacy activities with their children in kindergarten. One explanation of this could be that increased program participation resulted in greater trust in providers for mothers and their children, and that these mothers felt comfortable leaving teaching responsibilities to others, including other family members and teachers.

9.4. Conclusions on HFM Impacts

While the effect sizes of our evaluation findings are modest, the overall narrative of the evaluation findings continues and strengthens the evidence base for the HFM program. The question of whether short-term effects are maintained is affirmed in the areas of parenting stress and reductions in risky behavior. The presence of "sleepier effects," or effects on areas that we could not measure at the time of program enrollment, is supported in regard to child executive functioning, as well as maternal depression. The program findings presented here extend our own previous findings, but corroborate findings from other longitudinal home visiting evaluations, lending even more credence to the effectiveness of the HFM model in supporting young families.

CHAPTER 10. IMPLICATIONS AND OPPORTUNITIES

This longitudinal evaluation investigates the impact of the HFM program several years after the delivery of program services. As a result, we focused primarily on outcomes within the program goal areas, as opposed to details of program operations. Nonetheless, below we highlight areas for the program to consider:

Target most relevant program goals. Our findings demonstrate that although HFM continues to successfully impact change in all five program goal areas, it is not reasonable to expect goal attainment in all areas, for every family. One explanation is that certain key characteristics of mothers, families, and their contexts at program enrollment play a substantial role in determining for whom the program works and in what ways. Program staff can use this knowledge to best support each participant towards success for whichever goals are most salient or achievable for that family. For example, mothers who enter the program with lower risks may be better able

to focus on their own educational attainment, whereas mothers who enter the program with higher risks, such as a history of substantiated childhood maltreatment or low family supports, may want or need to focus on parenting or connecting to resources. Maternal characteristics can also play a role in the timing or sequence of goal areas to highlight at particular times.

Restructure early visits to include guidance on referral connection and housing. Acknowledging that there will likely be a proportion of mothers that engage with the program “lightly,” or for a short duration, programs should ensure that the content of the first few visits includes appropriate referral information in several domains and guidance about making referral connections. In light of the high incidence of homelessness in the MHFE-2EC sample, specific guidance on steps to ensure housing, or options if housing becomes unstable, is warranted. As the home visiting field emphasizes the idea of a light touch for certain families, the program might consider extending fewer visits over a longer duration, to increase the likelihood that mothers will stay in the program. Given the broad and serious consequences of homelessness on the health and development of children, in the context of the challenges regarding housing in Massachusetts, we encourage the program to prioritize referrals to housing early on, and to provide general curricula and information on housing, even if it is not an immediate concern. Giving mothers guidelines and resources to access if the issue of housing does become a problem could further decrease the incidence of homelessness (either initial or recurring) for families.

Continue flexible service modalities in order to extend program duration. HFM has already incorporated electronic outreach methods into its outreach practices. A logical extension of that would be a service modality in which phone or video calls serve as the primary means of communication, with level of service varying according to family needs. For example, a family may engage with weekly home visiting enthusiastically for a certain amount of time, but change to monthly visits, followed by bi-weekly or monthly phone or Skype calls, with an occasional periodic in-person home visit. This type of flexibility could increase duration of time in the program in a more time- and cost-efficient manner for both clients and home visitors. It also allows for a continued relationship with a particular home visitor if a family or home visitor changes location. One possibility would include investing in technology such as tablets, smartphones, or data plans to allow home visitors the flexibility to connect with mothers over video chats, Facetime, or Skype. Relatedly, the program could offer a more flexible struc-

ture of services for mothers who need a lighter dosage at various times as individual and family needs change through infancy and toddlerhood. Another option is to offer check-in options every few months, emphasizing the idea that the home visitor and HFM are available as a resource. Designating one or two program staff as “light touch” staff, with a greater caseload consisting of less concentrated dosage across their clients, could allow for this kind of flexibility.

Increase training/resources for staff on maltreatment and trauma. When clients enter the program with their own maltreatment histories, program staff may face particular challenges effecting change in parenting and self-care behaviors. Thus, awareness of this history is particularly important to ascertain, as it allows HFM to best support clients and staff working with these clients. The likelihood that at least one in two participants have experienced maltreatment is sobering, but not insurmountable. Several evidence-based approaches demonstrate positive program impacts on parenting behaviors in vulnerable parents, many of which involve filming mothers and children, and providing for video feedback. One example, an “Insightfulness Assessment”⁴⁸ asks mom to narrate what the baby is experiencing when the video is played back, in order to understand (and change) maternal representations of her child’s thoughts, emotions, and behavior. This taps into both mothers’ and children’s experience and allows for reflection within a safe and positively reinforcing relationship. A suggestion for HFM is to incorporate concentrated training opportunities in these intervention techniques for interested staff as part of a career ladder/professional development track. While it might not be possible for all staff to receive this training, providing specialized training opportunities for one or two individuals at each program site may allow for more intensive services for the families who could benefit most. This also may serve the dual purpose of investing in staff, which could decrease staff turnover.

10.1. Implications for HFM within Communities and across Sectors

While the intent of this longitudinal evaluation focused on HFM program impacts for the overall sample, what proves most illustrative of HFM’s success and challenges lies in the subgroup analyses. A universal approach may have merit, but it is clear that HFM is not a “one size fits all” program, and that certain participant characteristics

require that extra or concentrated efforts be provided in order to foster goal attainment. Given these substantial challenges, we offer the following thoughts:

- **Ensure “in-house” expertise.** Invest in evidence-based approaches to support training on parent-child interaction interventions for more vulnerable parents. HFM training and supervision policies already adhere to high program standards, but additional training for supervisors and some staff on new methods could empower the program as a whole to work with high-risk dyads with greater confidence.
- **Continue to strengthen cross-agency collaborations.** The power of a good referral, for example, for mental health, housing, or financial assistance, often depends on the relationships between individuals at various agencies at local, state, or federal levels. While HFM endeavors to model, and guide parents, in effective advocacy strategies, we know that program staff spend a great deal of effort, as they should, in connecting clients to services and service providers that will complement HFM services. In addition, a recent examination of home visitor referral patterns demonstrated that home visitors spend a great deal of their time facilitating and maintaining the connections that mothers already have.³⁵ These connections are key, as other services provide tangible and intangible assistance that the HFM program is not designed to provide. Furthermore, our colleagues’ examination of agency networks⁴⁹ shows that agency collaboration can hinge on the presence of particular individuals within the agencies; if one person leaves, the connection may be ruptured, compromising the ability to connect clients to needed services. Therefore, investing in shared knowledge of agency personnel, fostering relationships between HFM and other agency staff, and promoting rapport between upper management, as well as frontline staff, will ensure that critical referrals are completed at the participant level.

10.2. Implications for Future Research

We include here a few immediate areas for further analyses of the MHFE-2EC data:

1. The extent of HFM’s positive impact on mothers who were clinically depressed at program enrollment was unexpected. Positive impacts were seen in three of five HFM goal areas—in parenting behavior, college graduation rates, and in decreased
- health risk behaviors—as well as in the early childhood goal area regarding maternal advocacy. Going forward, we will further investigate the mechanism for these positive impacts (e.g., number of referrals made, types of support provided, program utilization profiles of participants) to help the program better understand the work it is doing well.
2. We will also take this approach in exploring the program’s impact on reducing homelessness. One direction is to investigate whether the program has a stronger impact for any additional subgroups. We will also dig deeper into program referral patterns, as well as maternal narratives/timelines, in order to better understand how homelessness is prevented among young families. Examining various pathways will also help us understand the mechanism of this program impact. Prevention of homelessness might result from service or resource referrals, or by a focus on strengthening economic self-sufficiency through educational attainment or job skills training, or by strengthening a mother’s capacity for positive relationships so that she is more likely to develop and maintain stable relationships that prevent homelessness.
3. We will more closely examine how mothers use other programs and services in addition to HFM to gain knowledge of the impact of complementary services on outcomes. For some mothers, services used sequentially with HFM could be most effective and for others, concurrent service utilization may be more effective. It is also important to pursue the notion of “passing the baton” to other service providers—future research will focus on service usage following the end of HFM program engagement, with more nuanced analyses of resources used by both program and control groups.
4. Our pathway analyses yielded several interesting long-term program effects. We will continue using pathway analyses with preschool data to predict kindergarten outcomes and outcomes from the current (elementary-school age) wave of data collection. For example, we will examine the role of child care as mediator of the program on later school or behavioral outcomes.
5. Of particular interest to both the evaluation and HFM is the role of fathers and mothers’ relationship partners in supporting both mother and child. Given the increasing stability of mothers’ relationships, we will examine the social supports and connections

in families' lives. We will also examine the role of father involvement in HFM on families' well-being.

6. Another priority for the evaluation is a closer look at the child maltreatment data. We will examine the implications of timing of maltreatment in a child's developmental history—infancy, preschool, school age, and the incidence and effect of multiple reports and substantiations. We will use survival analysis techniques to understand whether HFM affects the likelihood of maltreatment recurrence for young mothers over time.
7. We are interested in exploring economic outcomes in greater depth and will use Department of Transitional Assistance data, along with our own data on mothers' histories of employment and public assistance use to better understand patterns of employment for these young mothers and if and how the HFM program impact those patterns.

10.3. Final Thoughts

The Maternal, Infant, and Early Childhood Home Visiting Program (MIECHV), as funded by the Affordable Care Act (ACA), created an expansion of home visiting services in the U.S. and allowed for this longitudinal evaluation of a well-established, evidence-based home visiting model. Results from this longitudinal evaluation clearly demonstrate that the positive impacts of HFM extend well beyond the time of program engagement. As families transition into the new roles and relationships associated with early childhood, there is evidence that HFM has provided an important foundation that fosters positive personal and parenting trajectories. HFM is conceptualized as a prevention program; results from this report demonstrate that it is also an intervention program, particularly for mothers who come into the program with clinical levels of depressive symptoms. The evidence of positive long-term program impacts, both direct and indirect, for mothers with a range of life circumstances and risks at enrollment highlights the effectiveness of the flexibility within the universal HFM model.

Within a new political and economic climate, and indeed with the possible roll-back of the ACA, federal funding for home visiting, as well as many preventative health care services and community-based supports, is in jeopardy. The loss of these likely will affect the many vulnerable and low-income families that HFM serves. The burden will then come to the state, along with private entities, to further the community-based strategy and critical

public health initiative that HFM represents. The findings of this evaluation are of critical importance in providing evidence that HFM serves in a preventative capacity, not only during the period when families are receiving services, but also beyond the time of program engagement. HFM also serves as a valuable intervention for more vulnerable groups of young mothers and children, and is effective in promoting maternal and child health and well-being in ways that will reduce the economic burden of teen parenting in the future.

APPENDIX 1. FIVE-TIERED APPROACH TO EVALUATION

This evaluation of HFM is rooted in Jacobs's Five-tiered Approach to evaluation (see Table A1.1), a developmental model that moves evaluation activities from a primary focus on descriptive and process-oriented information to an emphasis on program effects.^{2,16,17} Tier One activities produce needs and demand assessments, and usually are conducted prior to the program's implementation. Evaluation activities at Tiers Two and Three are directed at program processes: They describe program staff, services, clients, and costs; examine program implementation compared to model standards; and provide feedback to programs for improvement. Tiers Four and Five focus on outcome evaluation activities, assessing the extent to which a program is meeting its shorter-term and longer-term goals. The primary difference between Tier Four and Tier Five is the use of an experimental design in Tier Five. When such scientific rigor is possible, researchers are more confident that changes they observe in participants are the result of the intervention being studied.

The first cohort evaluation (the Massachusetts Healthy Families Evaluation [MHFE-1]) was initiated in 1997 and completed in 2005.¹⁵ MHFE-1 focused on evaluation activities in Tiers Two, Three, and Four: program monitoring and accountability, quality review in relation to model and program standards, and measurement of outcomes. It employed a non-experimental design, relying on sources of comparison data that included state and nationwide historical data on key indicators and extant data from studies of adolescents and young parents. Using a mixed methods approach, data were collected from a sample of 361 HFM participants, at six-month intervals, at four different time points over a period of 18 months. An ethnographic substudy, conducted in three communities, explored participants' beliefs about parenting, childrearing, and help-seeking, and the extent to which HFM services were consonant with those beliefs. The findings

from the first evaluation phase were promising; however, the non-experimental design precluded our ability to definitively attribute positive changes to the HFM program.

The second cohort evaluation (MHFE-2) began in 2007.¹ MHFE-2, by virtue of its experimental design, was a Tier Five evaluation, and included research activities at all tiers except Tier One. Data generated at Tier Two allowed for a full description of HFM clients, their schools, and communities, as well as a description of the HFM programs in which they enrolled. Tier Three data provided documentation of HFM program operations, including

an assessment of program-level fidelity (i.e., the extent to which a program is implemented according to the operational standards articulated for it). At Tiers Four and Five, evaluation activities focused on determining whether HFM achieved its intermediate and longer-term outcomes. The randomized, controlled trial (RCT) design implemented at Tier Five allowed us to establish whether changes in outcomes could be attributed to the program. Data collected for this study also provided for a multi-faceted examination of the complex ecologies of first-time teenage mothers and their community contexts.

Table A1.1. Summary of Five-Tiered Approach to Evaluation

Tier	Purposes of Evaluation	Types of Evaluation Activities
Tier One: Needs Assessment	<ul style="list-style-type: none"> • To document the size and nature of a public problem • To determine unmet need for services in a community • To propose program and policy options to meet needs • To set a data baseline from which later progress can be measured • To broaden the base of support for a proposed program 	<ul style="list-style-type: none"> • Review existing community, county, and state data • Determine additional data needed to describe problem and potential service users • Conduct “environmental scan” of available resources • Identify resource gaps and unmet need • Set goals and objectives for intervention • Recommend one program model from range of options
Tier Two: Monitoring and Accountability	<ul style="list-style-type: none"> • To monitor program performance • To meet demands for accountability • To build a constituency • To aid in program planning and decision making • To provide a groundwork for later evaluation activities 	<ul style="list-style-type: none"> • Determine needs and capacities for data collection and management • Develop clear and consistent procedures for collecting essential data elements • Gather and analyze data to describe program along dimensions of clients, services, staff, and costs
Tier Three: Quality Review and Program Clarification	<ul style="list-style-type: none"> • To develop a more detailed picture of the program as it is being implemented • To assess the quality and consistency of the intervention • To provide information to staff for program improvement 	<ul style="list-style-type: none"> • Review monitoring data • Expand on program description using information about participants’ views • Compare program with standards and expectations • Examine participants’ perceptions about effects of program • Clarify program goals and design

<p>Tier Four: Achieving Outcomes</p>	<ul style="list-style-type: none"> • To determine what changes, if any, have occurred among beneficiaries • To attribute changes to the program • To provide information to staff for program improvement 	<ul style="list-style-type: none"> • Choose short-term objectives to be examined • Choose appropriate research design, given constraints and capacities • Determine measurable indicators of success for outcome objectives • Collect and analyze information about effects on beneficiaries
<p>Tier Five: Establishing Impact</p>	<ul style="list-style-type: none"> • To contribute to knowledge development in the field • To produce evidence of differential effectiveness of treatments • To identify models worthy of replication 	<ul style="list-style-type: none"> • Decide on impact objectives based on results of Tier 4 evaluation efforts • Choose appropriately rigorous research design and comparison groups • Identify techniques and tools to measure effects in treatment and comparison groups • Analyze information to identify program impacts

APPENDIX 2. INVERSE PROBABILITY ATTRITION WEIGHTS

Inverse probability weights (IPW) were created to adjust for any biases due to sample attrition over time. At T1, 684 mothers participated (excluding 20 agency-only participants who were not targeted at T4) with 490 mothers retained at T4 (72% of the original sample). IPW recalibrate the data so they become more representative of the original 684 mothers. Specifically, IPW give greater weight to those who had a lower chance of participating at T4 and less weight to those who had a higher chance of participating based on selected variables.

IPW were computed by regressing T4 participation (0=dropped out, 1=participated at T4) on T1 background and demographic characteristics and state agency data collected before and after program enrollment. The selection of variables was based on association with sample attrition and retention (see Chapter 3), as well as lack of missing data to avoid listwise deletion in the regression. We retained only those variables that met entry criterion for the forward or background selection models ($p < 0.3$) or that were part of a significant two- or three-way interaction. The initial logistic regression models tested all second- and third-order interactions, but the final model only included those that were statistically significant (see Table A2.1).

Table A2.1. Variables Used to Create T4 IPW

Variable	Description
1. Home visiting program group	HVS or RIO ^{bc}
2. Race/ethnicity	White, Black, Hispanic, or other non-Hispanic
4. Place of birth	U.S., Puerto Rico, or non-U.S. ^a
3. Single relationship status (T1)	Single or not single ^{ab}
6. Living arrangements (T1)	Alone/roommates/institution, with adult relatives, or with partner
7. High school/GED status (T1)	Dropped out, in progress, or completed
5. Parenting status at study enrollment	Parenting vs. pregnant ^b
8. Median neighborhood income (T1)	2010 U.S. Census block ^c
9. DTA cash assistance	Received vs. did not receive ^c
10. MHFE-2 study status	Participated in T1 phone interview only, participated in some T1 phone interview and some other phone or in-person interview at T1-T3, or participated in all T1-T3 phone and in-person data collection

Note. Variables that share the same superscripts indicate the second- and-third order interactions in the final logistic regression model.

Finally, the weights were created by taking the inverse of the predicted probability of T4 participation. Three participants with high values on the weights (range = 5-8) were top-coded at 4, with the remaining difference in weight between their original weight value and 4 redistributed among all participants so that the sum of the weights still totaled 684, the targeted T1 sample size.

A number of checks was carried out to determine the efficacy of the weights in ensuring the T4 sample was representative of the T1 sample. First, we regressed the weight on the variables in Table A2.1 to ensure higher weights were observed for participants with characteristics related to attrition, which they were. Second, we examined descriptive statistics for the weighted and unweighted T4 sample on T1 demographic and background characteristics, and found that the weighted T4 sample was representative of the T1 sample. Finally, we tested the weights in some regression models, replicating MHFE-2 program effects using the weighted T4 sample.

The sampling frame for T5 data collection was the 490 young mothers who participated at T4. Between T4 and T5, 45 mothers were lost due to attrition. Similar to the creation of the T4 attrition weights, T5 participation (0 = dropped out after T4, 1 = participated at T5) was regressed on T1 background and demographic characteristics and state agency data collected before and after program enrollment, including second- and third-order interactions (see Table A2.2).

Table A2.2. Variables used to create T5 IPW

Variable	Description
1. Home visiting program group	HVS or RIO
2. Race/ethnicity	White, Black, Hispanic, or other non-Hispanic
4. Place of birth	U.S., Puerto Rico, or non-U.S.
3. Single relationship status (T1)	Single or not single ^a
6. Living arrangements (T1)	Alone/roommates/institution, with adult relatives, or with partner ^{bde}
7. High school/GED status (T1)	Dropped out, in progress, or completed ^b
5. Parenting status at study enrollment	Parenting vs. pregnant ^a
8. Median neighborhood income (T1)	2010 U.S. Census block ^{ce}
9. DTA food stamps	Received vs. did not receive ^d
10. DTA cash assistance	Received vs. did not receive ^c
11. MHFE-2 study status	Participated in T1 phone interview only, participated in some T1 phone interview and some other phone or in-person interview at T1-T3, or participated in all T1-T3 phone and in-person data collection

Note. Variables that share the same superscripts indicate the second-and-third order interactions in the final logistic regression model.

To create the T5 weights, the predicted probabilities of mothers' T4 and T5 participation were multiplied together, and the inverse of this joint probability was computed. Six participants with high values on the weights (range = 5-21) were top-coded at 4, with the remaining difference in weight between their original weight value and 4 redistributed among all participants. A ratio adjustment was used to ensure the weights totaled 684, the targeted T1 sample size.

APPENDIX 3: MEASURES

The table below includes all outcome measures used in this report, as well as further detail on the mediators (i.e., measures used for the pathway analyses), moderators (i.e., measures used for subgroup analyses), growth curve analyses, and control variables. New measures or measures used in a different format from the previous evaluation are indicated with an asterisk (*). Further details about the measures appear after the table.

Table A3.1. Summary of Outcome Measures Used in the Final Report

Analytic Area	Construct	Measure
Outcomes	Goal 1: Prevent Child Abuse and Neglect by Supporting Positive, Effective Parenting	<ul style="list-style-type: none"> • Conflict Tactics Scale – Parent Child (CTSPC) <ul style="list-style-type: none"> • Non-violent Discipline (Chronicity) (T4, T5) • Corporal Punishment (Prevalence) (T4, T5) • Department of Children and Families (DCF) data <ul style="list-style-type: none"> • Presence of Maltreatment Report(s) (Regardless of Substantiation) (T5) • Presence of Substantiated Maltreatment Report(s) (T5) • Mother-Child Dyadic Synchrony (observed) (T4)* • Parenting Stress Index (PSI) <ul style="list-style-type: none"> • Difficult Child (T4, T5) • Parental Distress (T4, T5) • Parent-Child Dysfunctional Interaction (T4, T5)
	Goal 2: Achieve Optimal Health, Growth, and Development in Infancy and Early Childhood	<ul style="list-style-type: none"> • Bracken School Readiness Assessment* <ul style="list-style-type: none"> • Composite Standard Score (T4, T5) • Descriptive Classification – Delayed (T4, T5) • Child’s General Health (T4, T5)* • Emotional Dysregulation* <ul style="list-style-type: none"> • Emotion Regulation Checklist (ERC) (T4, T5) • Story Stem Completion Task (T5)* • Executive Functioning* <ul style="list-style-type: none"> • Behavior Regulation/Self-Control (Head-Toes-Knees-Shoulders) (T4, T5) • Cognitive Flexibility (Dimension Change Card Sort) (T4, T5) • Working Memory (Corsi Block Task) (T4, T5) • Working Memory (Digit Span) (T4, T5) • Number of Diagnosed Health Conditions (Past Year) (T5)* • Parent Involvement in Literacy-Related Activities (Home Literacy Environment Questionnaire; HLEQ) (T4, T5)* • Receptive One-Word Picture Vocabulary Test (ROW-PVT) (T4)*
	Goal 3: Encourage Educational Attainment, Job, and Life Skills	<ul style="list-style-type: none"> • Basic Resources (Family Resources Scale; FRS) (T4, T5) • Homelessness (Since HFM Enrollment) (T5)* • Mother Finished Training Program (T5) • Mother Graduated from College (AA or BA) (T5) • Maternal Employment (T4, T5) • Residential Mobility (Past Year) (T4, T5)

	Goal 4: Prevent Repeat Pregnancies During the Teen Years	<ul style="list-style-type: none"> Repeat Birth Within Two Years of First Child's Birth (T4)*
	Goal 5: Promote Parental Health and Well-Being	<ul style="list-style-type: none"> Conflict Tactics Scale – Partner (CTSPC2) <ul style="list-style-type: none"> Mother-Perpetrated Intimate Partner Violence (T4, T5) Partner-Perpetrated Intimate Partner Violence (T4, T5) Maternal Depression (Center for Epidemiologic Studies Depression Scale; CES-D) (T4, T5) Mother Received Mental Health Services after Program (T4, T5) Number of Treated Illnesses/Chronic Conditions (Past Year) (T5)* Number of Diagnosed Mental Health Disorders (Past Year) (T5)* Personal Mastery (Pearlin Mastery Scale; PMS) (T4, T5) Substance Use (Past Month; Youth Risk Behavior Survey; YRBS) (T5)*
	Goal 6: Navigating Early Childhood	<ul style="list-style-type: none"> Advocacy* <ul style="list-style-type: none"> Maternal Advocacy (Educational Setting) (T5) Self-Advocacy (Household) (T5) Awareness of Resources (AR) (T4) Emergency Room/Urgent Care Visits for Child (T4, T5)* Emergency Room/Urgent Care Visits for Mother (T4, T5)* Parent-Caregiver Relationship Scale (PCRS) (T4, T5)* Parent-Teacher Involvement (T5)*
Moderators		<ul style="list-style-type: none"> Maternal Depression (CES-D) (T1) Mother's Childhood History of Substantiated Maltreatment (DCF) Perception of Family Support (Personal Network Matrix; PNM) (T1)
Mediators – Model 1		<ul style="list-style-type: none"> Parental Distress (PSI) (T3) Maternal Depression (CES-D) (T4) Attachment (ASQ) (T4)* Personal Mastery (PMS) (T4) Youth Risk Behavior (YRBS) (T5) <ul style="list-style-type: none"> Wellness score* Risk Engagement score*

Mediators - Model 2		<ul style="list-style-type: none"> • College Attendance (T3) • Maternal Employment (T4) • Cash Assistance Receipt (T4) • Food Stamps Receipt (T4) • Mental Health Diagnoses (T5)
Trajectory Analyses		<ul style="list-style-type: none"> • Maternal Depression (CES-D) (T1-T5) • Maternal Age at Interview (T1-T5) • Parenting Onset
Program Operations		<ul style="list-style-type: none"> • Number of Home Visits
Control Variables		<ul style="list-style-type: none"> • Maternal Age at TC birth (in years) • Target Child's Age (T4, T5) • Maternal Race and Ethnicity • Target Child's Sex

Below we describe the measures used in analyses, organized by the six goal areas.

Goal 1: Prevent Child Abuse and Neglect by Supporting Positive, Effective Parenting

Conflict Tactics Scale – Parent-Child (CTS-PC). The Conflict Tactics Scale - Parent-Child (CTSPC) is a 35 item self-report questionnaire designed to assess the extent to which parents carry out specific acts of aggression and/or neglect, regardless of child injury.⁵⁰ The CTS-PC was used to assess mothers' discipline strategies and aggression toward the child. We examined two subscales: Non-Violent Discipline and Corporal Punishment (“Ordinary”). Respondents indicated how often they engaged in specific behaviors in the past year using a 6-point Likert scale ranging from “None” to “More than 20 times.” Past year prevalence scores were calculated as a binary variable, where 1= at least one behavior endorsed as having occurred in the past year.

- **Non-Violent Discipline (Chronicity) (T4, T5).** This subscale consisted of four items (e.g., “You put your child in ‘time out’”), and assessed positive (non-abusive) discipline methods.
- **Corporal Punishment (Prevalence) (T4, T5).** This subscale assessed the degree to which parents use spanking, slapping, or shaking, and had three items (e.g., “You spanked your child on the bottom with your bare hand”).

Department of Children and Families (DCF) Data. We used records obtained from the Department of Children and Families (DCF) to summarize information pertaining to the victimization of the target child. We constructed the following three variables into dichotomous variables (0 = no report on file; 1 = at least 1 one report on file):

- **Presence of Substantiated Maltreatment Report(s) (for mother) (T1)** – used in moderation analyses
- **Presence of Maltreatment Report(s) (Regardless of Substantiation) (T5)**
- **Presence of Substantiated Maltreatment Report(s) (T5)**

Mother-Child Dyadic Synchrony (observed) (T4). Dyadic Synchrony (Also known as the Interactional Synchrony Coding Scheme)⁵¹ assesses coordination and balance within parent-child interactions. Observational data were collected during the T4 in-person research interview from a subset of mothers who consented to being video recorded. Mothers and children participated in a five-minute structured teaching task in the family's home. The dyad was given a set of magnetic blocks and

was asked to work together to build a variety of shapes and structures based on pictures on a sheet of directions. The task was designed to be challenging for the child to complete on his or her own. Maternal-child synchrony was coded from the videotaped interactions using the interactional synchrony assessment.⁵¹

Parenting Stress Index (PSI). The Parenting Stress Index Short Form (PSI-SF) is a 36 item self-report questionnaire of parenting stress.⁵² We used several subscales of the PSI-SF to examine the extent to which the mothers experienced stress in their role as parents. Mothers indicated the degree to which they agreed with statements (e.g., “I feel trapped by my responsibilities as a parent,” “My child rarely does things for me that make me feel good”) using a 5-point Likert scale, ranging from 1 = Strongly disagree to 5 = Strongly agree. Each subscale consisted of 12 items and was scored by adding the items, resulting in sum scores which could range from 12 to 60. A higher score indicates higher stress on all subscales.

- **Parental Distress (T3, T4, T5).** Measures the sense of parenting competence, stresses associated with restrictions on a parent's life, conflict with child's other parent, social support, and depression.
- **Parent-Child Dysfunctional Interaction (T4, T5).** Assesses the extent to which the mother believes that her child does not meet her expectations and their interactions are not satisfying. High scores in this sub-scale indicate that the mother may see the child as a disappointment, feels rejected or alienated by/from the child, or has not properly bonded with the child.
- **Difficult Child (T4, T5).** Assesses how easy or difficult the mother perceives her child to be.

Goal 2: Achieve Optimal Health, Growth, and Development in Infancy and Early Childhood

The Bracken School Readiness Assessment, 3rd Edition (BSRA-3). The BSRA-3⁵³ was used to assess child's school readiness. The measure consists of 85 items, which represent one of the five fundamental academic concepts, including: Colors (10 items), Letters (15 items), Numbers/Counting (18 items), Sizes/Comparisons (22 items), and Shapes (20 items). Colors items (e.g., “Show me which color is red”) measure children's knowledge of primary colors, secondary colors, and those identified as basic color concepts for all languages. The Letters items assess knowledge of upper and lowercase letters (e.g., “Show me the A”); the Numbers/Counting (e.g., “Show me the one”) items assess knowledge of single- and double-digit numerals and number values

of a set of objects. The Sizes/Comparisons items (e.g., “Which animal is big?”) assess knowledge of concepts that describe one or more dimensions and a child’s ability to match, differentiate or compare objects based on one or more of their salient characteristics. Finally, the Shapes items (e.g., “Show me the star”) assess knowledge of one-, two-, and three-dimensional shapes. Participants answer the questions by pointing to the picture that represents the concept named by the examiner.

- **Composite Standard Score (T4, T5).** The raw score converted to a norm-referenced standard score based on the age.
- **Descriptive Classification - Delayed (T4, T5).** Indicates the rate of a child’s conceptual development based on the normal distribution of standard scores for the respective age group. Delay was categorized as a score of 85 or lower.

Child General Health (T4, T5). During the phone interview, mothers were asked to rate the target child’s health on a scale from 1 = Poor to 5 = Excellent.

Emotional Dysregulation. Emotional dysregulation was measured through maternal report at both time points, as well as in an observed, video-recorded child assessment at T5.

- **Emotion Regulation Checklist (ERC) (T4, T5).** An adapted version of the ERC⁵⁴ was used to measure processes central to emotionality and regulation, including affective lability, intensity, valence, flexibility, and situational appropriateness of emotional expressions. Mothers were instructed to indicate how often their child exhibits the 12 behaviors or emotional states described (1 = Rarely/Never to 4 = Almost Always), and a mean score was computed.
- **Story Stem Completion Task (T5).** A narrative completion task using four of the MacArthur Story Stem Battery⁵⁵ story stems were completed with children in their homes, and then coded with The Attachment Focused Coding System for Story Stems (AFCS).⁵⁶ These story stems are designed to tap into the child’s internal working models; codes represent parent supportive and rejecting behaviors, as well as child behaviors and management of emotion. Child Emotional Dysregulation measures the level of emotional organization or disorganization in response to the story stems (1 = No aggression, to 5 = Extremely violent or bizarre behavior), and a binary score was created reflecting whether any dysregulation was present.



Executive Functioning. Within the child assessment protocol, several aspects of executive functioning were measured, each representing a key feature of executive functioning, behavioral regulation (inhibitory or self-control), cognitive flexibility, or working memory.

- **Behavior Regulation/Self-Control (Head-Toes-Knees-Shoulders; HTKS) (T4, T5).** The Head-Toes-Knees-Shoulders^{57,58} was used to measure behavioral regulation and self-control. Children were asked to play a game where they are instructed to respond to the examiner’s commands (“touch your head,” “touch your toes,” “touch your knees,” and “touch your shoulders”) by touching the “opposite” part of their bodies from what the examiner commanded. Participants respond to each question by touching or pointing to their heads, toes, knees, or shoulders. For each correct response, the participant was awarded two points, a self-correct (defined as making any discernable motion toward the incorrect response but ending with the correct response) was awarded one point, and an incorrect answer was awarded 0 points. Participants move on to the next phase only if they received a score of 4 or more. The measure consisted of two phases: the Head-to-Toes Task (HTT, 10 items including two types of paired commands, “touch your head” & “touch your toes”) and HTKS (20 items, with two new paired commands, “touch your shoulders” and “touch your knees”). The total scores on the HTT range from 0 to 20 points, for HTKS - from 0 to 40 points, and the total measure ranged from 0 to 60.
- **Cognitive Flexibility (Dimensional Change Card Sort; DCCS) (T4, T5).** The DCCS⁵⁹ was used to measure cognitive flexibility, a subset of executive functioning. Children were shown two target cards (e.g., a blue rabbit and a red boat). Next, children were given test cards, which differed in color and shape, in a quasi-random order. Children were instructed

to sort the test cards according to one dimension. The measure consisted of three phases: the pre-switch phase (the child sorts cards according to color; six test cards), the post-switch phase (shape; same set of six test cards), and the border phase (children sort by color if cards have borders, and by shape if cards have no borders; 12 cards). Children scored one point for each correctly completed trial. Higher scores for post-switch and border version subscales indicate cognitive flexibility; cognitive inflexibility is demonstrated if children proceed to sort cards by the first dimension in the post-switch phase and do not pass to the border version.⁵⁹

- **Working Memory (Corsi Block-Tapping Task; CORSI) (T4, T5).** The Corsi Block-Tapping Task⁶⁰ was used to assess participants' working memory by evaluating their ability to repeat block sequences shown to them. The task consists of nine wooden cubes with numbers written on the side that is facing the administrator. The examiner taps a sequence of blocks in a pseudo-random order, increasing in difficulty (i.e., involving more taps). The child watches the administrator tap blocks in a specified sequence, which the child has to repeat in the correct sequential order. The proportion score reflects the highest level the child got to relative to the total number of levels (eight on the Corsi Block Task), adjusting for inconsistency.
- **Working Memory (Digit Span; DS) (T4, T5).** The Digit Span measure is a subtest of The Pediatric Examination of Educational Readiness at Middle Childhood (PEERAMID)^{61,62} and was used to examine working memory. The task is comprised of digits forward (DF) and digits backward (DB) components. The DF subscale consists of eight levels, each of which contains six lists (sets of digits), starting with 2-digit. The examiner recites the digits from the record form and the child recalls the digits that were just stated. If the child successfully recalls 4 of 6 lists, the examiner is able to move on to the next level, which adds one digit to the list. Testing stops if the child recalls three lists incorrectly within a level. A proportion score was calculated based on the number of lists successfully completed to the total number of levels (eight for DF).

Number of Diagnosed Health Conditions (Past Year) (T5). During the phone interview, mothers were asked if their child has been diagnosed with a major health condition (e.g., asthma, autism, diabetes) in the past year and a sum score was created (range = 0-6).

Parent Involvement in Literacy-Related Activities (Home Literacy Environment Questionnaire; HLEQ) (T4, T5). We used the HLEQ⁶³ to measure parents' involvement in literacy-related activities. Participants were instructed to rate 10 items (e.g., "About how many times per week do you read to your child?", "About how many times per week does your child ask to be read to?") on a 7-point Likert scale (0 = Never to 6 = Daily), and a sum was computed.

Receptive One-Word Picture Vocabulary Test 4 - Spanish-Bilingual Edition (ROW-PVT-4: SBE) (T4). The ROWPVT-4: SBE⁶⁴ was used to assess children's English or Spanish receptive vocabulary skills. ROWPVT-4: SBE measures total acquired vocabulary and is intended for use with—and was normed on—a bilingual population of individuals who speak Spanish and English with varying levels of proficiency. The measure consists of 180 questions (e.g., "mailman (cartero)," "spilling (derramar)," and "gossiping (chisme)," with four picture options per question shown side by side. Participants answer the questions by pointing to one of the four illustrations that they believe best matches the object, action, or concept verbalized by the examiner. The ROWPVT-4:SBE is administered in either Spanish or English and participants are permitted to respond in either language (Martin, 2013). A standard score was calculated, using participant's chronological age, the raw score, and the norm tables provided in the manual, with higher scores reflective of more advanced receptive vocabulary.

Goal 3: Encourage Educational Attainment, Job, and Life Skills

Basic Resources (Family Resources Scale; FRS) (T4, T5). Mothers were administered 14 items from the Family Resources Scale (FRS)⁶⁵ to assess perceived adequacy of the most basic economic needs (e.g., "food for 2 meals a day", "house or apartment", "money to buy necessities"). Mothers were asked to choose the response that best described how well each need was met on a consistent basis in the family (responses ranged from 0 = Not at all enough to 4 = Almost always enough). A mean score was calculated and rescaled to range from 0 (all resources inadequate) to 100 (all resources adequate).

Homelessness (Since HFM Enrollment) (T5). During the phone interview, mothers indicated whether they had been homeless (e.g. not having a place to live, including temporary housing such as transitional living, shelters, a motel, living with family/friends, on the streets, or other temporary informal situations) at any time since their eldest child was born. A binary variable was created (0 = never homeless, 1 = experienced homelessness).

Mother Finished Training Program (T5). During the phone interview, mothers indicated whether they had finished any of a variety of job training programs. A binary variable was created (1 = completion of training program).

Mother Graduated from College (AA or BA) (T5). During the phone interview, mothers indicated whether they had received a bachelor's or an associate's degree. A binary variable was created (1 = college graduate).

Maternal Employment (T4, T5). Mothers indicated whether they were employed full- or part-time (= 1).

Residential Mobility (Past Year) (T4, T5). During the phone interview, mothers indicated how many times they had moved in the past year.

Goal 4: Prevent Repeat Pregnancies during the Teen Years

Repeat Birth (T4). During the phone interview, mothers were asked about births subsequent to the TC and the date of these births. We created a binary variable indicating whether mother had a subsequent birth within two years of TC's birth. A binary variable was created (1 = rapid repeat birth).

Goal 5: Promote Parental Health and Well-Being

Conflict Tactics Scale – Partner (CTS2S). We used the revised, short form CTS2S⁶⁶ to assess the extent to which partners engage in psychological or physical attacks on each other. The CTS2S consists of 20 items, which describe specific acts perpetrated by the respondent and by the partner (e.g., “I insulted or swore or shouted or yelled at my partner,” “My partner pushed, shoved, or slapped me”). In order to measure total exposure to violence, we asked participants to think about all romantic partners in the past year. To assess the total number of endorsed IPV acts participants experienced in the past year, we summed the number of behaviors mothers perpetrated or experienced in the past year (range = 0-8 for self- and partner-perpetrated scales), with higher counts indicating higher number of reported violent acts:

- **Mother-Perpetrated Intimate Partner Violence (T4, T5).**

- **Partner-Perpetrated Intimate Partner Violence (T4, T5).**

Maternal Depression (Center for Epidemiological Studies Depression Scale; CES-D) (T1-T5). Mothers reported on their depressive symptoms using the CES-D, a 20-item self-report questionnaire designed to measure depressive symptoms in the general population.^{19,67,68} The 20 items focused on depressive symptoms experienced over the past week (e.g., “I felt sad”), and answers were on a 4-point Likert scale ranging from 0 = Not at all to 3 = A lot. Responses were summed to compute a total depressive symptoms score where higher scores indicated higher levels of depressive symptoms. Scores of 16 or greater indicate clinical levels of depressive symptoms.

Mother Received Mental Health Services after Program (T4, T5). During the phone interview, mothers indicated whether they had received treatment or taken medication for a mental health condition since the end of the program.

Number of Treated Illnesses/Chronic Conditions (Past Year) (T5). During the phone interview, mothers indicated whether they had been treated for any major physical illness or health conditions in the past year (e.g. diabetes, high blood pressure, migraines). Positive responses were summed to create a total number for each participant (range = 0-5).

Number of Diagnosed Mental Health Disorders (Past Year) (T5). During the phone interview, mothers indicated if they had been diagnosed with any mental health conditions in the past year (e.g. depression, anxiety disorder, eating disorder). Positive responses were summed to create a total number for each participant (range = 0-4).

Personal Mastery (Pearlin Mastery Scale; PMS) (T4, T5). We used the Pearlin Mastery Scale (PMS)⁶⁹ to measure mother's Personal Mastery. The PMS is a 7-item measure of self-concept and references the extent to which individuals perceive themselves in control of forces that significantly impact their lives. The measure included seven items (e.g., “I have little control over the things that happen to me”), and answers were on a 5-point Likert scale ranging from 1 = Strongly agree to 5 = Strongly disagree. Responses were averaged to create a mean score where higher scores indicated greater mastery.⁷⁰

Substance Use (Past Month) (Youth Risk Behavior Survey; YRBS) (T5). Mothers completed the national YRBS⁷¹ survey on youth health risk behaviors. We created a measure of mothers' substance use (binge drinking, marijuana use, cocaine use) in the past month, based on individual answers to three separate YRBS questions, each coded from 0 = No use in the past month to 4 = Used more than 20 times, and a mean score was computed.

Goal 6: Increase Mothers' Knowledge and Ability to Navigate Early Childhood Systems

Advocacy. Within the in-person interview, mothers were asked about possible behaviors and strategies they might use in hypothetical situations related to a household dilemma (Self-Advocacy) or an educational concern for their child (Maternal Advocacy). Mothers indicated how likely they would be to do a series of behaviors (e.g., waiting, talking to someone, asking family and friends) on a 4-point scale (1 = Would not do this to 4 = Would do this), and binary variables were created reflecting scores of 3 or higher.

- **Maternal Advocacy (Education Setting) (T5).**
- **Self-Advocacy (Household) (T5).**

Awareness of Resources (AR) (T4). Awareness of Resources Survey (AR) is a self-report measure assessing participants' knowledge of the availability of various services in their neighborhood. Participants were first asked to think about the area they defined as their neighborhood. They were then provided a list of eight resources (e.g., Boys and Girls Scouts, Boys and Girls Clubs, YMCA; a bank; a day care center, a library) and instructed to indicate whether each resource existed in their area (1 = Yes). A sum score was created, in which higher scores indicate awareness of a higher number of community organizations and resources. A binary score was created, indicating whether a mother was aware of at least 4 of the 8 community resources.

Emergency Room/Urgent Care Visits for Child (T4, T5). During the intake, mothers indicated how many times they took their eldest child to the emergency room and/or the urgent care (T5 only) since the birth of their child (T4) or in the past year (T5). A binary variable was created (1 = at least one ER/UC visit).

Emergency Room/Urgent Care Visits for Mother (T4, T5). During the intake, mothers indicated how many times they went to the emergency room and/or the urgent care (T5 only) since the birth of their child (T4) or in the past year (T5). A binary variable was created (1 = at least one ER/UC visit).

Parent-Caregiver Relationship Scale (PCRS) (T4, T5). The PCRS⁷² was used to measure global and specific aspects of parents' and caregivers' perceptions about their relationships. Mothers were instructed to answer 14 questions (e.g., "This caregiver is someone you can rely on"), based on their knowledge of the caregiver with whom they have the most contact with as a care provider. Participants answer the questions using a 5-point scale (1 = Strongly disagree to 5 = Strongly agree), and a mean score was computed.

Parent-Teacher Involvement (PTI) (T5). The PTI is a measure developed by the Fast Track Project to gauge the relationship between parents and teachers, specifically parent's involvement at school, parent's endorsement of child's school, and frequency of parent-teacher contact subscales.⁷³ Mothers were given a list of 17 behaviors associated with their relationship with their child's teacher (e.g., "You enjoy talking with your child's teacher") and were instructed to indicate how frequently these behaviors occurred for them on a 5-point scale (0 = Never to 4 = More than once per week). A mean score was created.

Additional Indicators used in Moderation Analyses

Personal Network Matrix (PNM) (T1). The PNM is a self-report questionnaire designed to assess mothers' perceptions of the reliability of their support networks.⁷⁴ Mothers were asked to rate the extent to which they could depend on seven different family members (e.g., spouse/partner, parents, siblings, etc.) for help or assistance on a 5-point Likert scale (0 = Not at all to 4 = All of the time), and a mean score was computed.

Additional Indicators used in Mediation Analyses

Attachment Style Questionnaire/Discomfort with Closeness Subscale (T4). The Attachment Style Questionnaire (ASQ) is used to measure dimensions of adult attachment, including positive and negative views of self and others, in adolescents and adults.⁷⁵ Mothers indicate how much they agreed or disagreed with statements using a 6-point scale (1 = Totally disagree to 6 = Totally agree). The discomfort with closeness subscale (mean of 10 items; e.g., "I find it hard to trust other people") was used.

Wellness Practices and Health Risk Engagement (T5). Mothers reported on their T5 wellness practices and risk engagement using the Youth Risk Behavior Surveillance System (YRBSS).⁷¹ We used the eight wellness practices items (e.g., "eats at least one serving of fruit per day") and 12 risk engagement items (e.g., "carried a weapon") to create two proportion scores that ranged from 0-1 assessing the average number of wellness and risk behaviors relative to the total number of items. Higher scores indicated greater wellness practices and risk engagement.

College Attendance (T3). Mothers indicated whether they had completed at least one year of college at T3 (1 = completed at least one year of college).

Received Cash Assistance (T4). Mothers indicated whether they currently received cash assistance (Transitional Aid to Families with Dependent Children [TAFDC]) at T4 (1 = received cash assistance).

Received Food Stamps (T4). Mothers indicated whether they currently received food stamps (Supplemental Nutrition Assistance [SNAP]) at T4 (1 = received food stamps).

Appendix 4. TECHNICAL APPENDIX FOR TRAJECTORY ANALYSES

Our analytic strategy permitted examination of within-mother change over time in depression symptomatology (Level 1) as well as between-mother variation in the expected mean of depression at age 16 (random intercept, π_{0i}) and linear change in depression scores over time (random slope, π_{1i}) at Level 2. These models were estimated using full maximum likelihood (ML). Model building, when possible, examined changes in model fit between two nested models.⁷⁶⁻⁷⁸

In MLM participants are represented by the data in interviews in which they participated. If a participant missed a time point, that participant is not removed from analyses, but rather the data that are present are used. MLM also enables flexibility across time by allowing both time-varying and time-invariant (i.e., characteristics that do not change over time).

A4.1. Model Building Strategy

First, the baseline model for growth over time was tested and an intraclass correlation coefficient (ICC) was calculated to evaluate that there was sufficient variation in depression scores over time across participants in order to merit the use of MLM. We then examined whether this change was linear (i.e., a steady rate of change) or quadratic (i.e., representing acceleration or deceleration over time). The linear change model best represented the data. Next, the control variables were added to the Level 2 equations for random intercept and slope. We then examined the effect of parenting onset and HFM impact by incorporating the relevant time varying variables to the Level 1 model (π_{2i} , π_{3i} , respectively).

A4.2. Equations

Unconditional Model for Individual Growth

Level 1 model:

$$CESD_{ij} = \pi_{0i} + \pi_{1i} (AGEY_{ij}) + \varepsilon_{ij}$$

Level 2 model:

$$\pi_{0i} = \gamma_{00} + \xi_{0i}$$

$$\pi_{1i} = \gamma_{10} + \xi_{1i}$$

Composite model:

$$CESD_{ij} = \gamma_{00} + \gamma_{10}(AGEY_{ij}) + \xi_{0i} + \xi_{1i} + \varepsilon_{ij}$$

Conditional Model for Discontinuous Growth

Level 1 model:

$$CESD_{ij} = \pi_{0i} + \pi_{1i} (AGEY_{ij}) + \pi_{2i} (PostParentingy_{ij}) + \varepsilon_{ij}$$

Level 2 model:

$$\pi_{0i} = \gamma_{00} + \gamma_{01} (AgeBirth_i) + \gamma_{02} (Enroll_i) + \gamma_{03} (OthChild_i) + \gamma_{04} (RaceEth_i) + \xi_{0i}$$

$$\pi_{1i} = \gamma_{10} + \gamma_{11} (AgeBirth_i) + \gamma_{12} (Enroll_i) + \gamma_{13} (OthChild_i) + \gamma_{14} (RaceEth_i) + \xi_{1i}$$

$$\pi_{2i} = \gamma_{20}$$

Composite model:

$$CESD_{ij} = \gamma_{00} + \gamma_{10}(AGEY_{ij}) + \gamma_{20}(PostParentingy_{ij}) + \gamma_{01} (AgeBirth_i) + \gamma_{02} (Enroll_i) + \gamma_{03} (OthChild_i) + \gamma_{04} (RaceEth_i) + \gamma_{11} (AgeBirth_i * AGEY_{ij}) + \gamma_{12} (Enroll_i * AGEY_{ij}) + \gamma_{13} (OthChild_i * AGEY_{ij}) + \gamma_{14} (RaceEth_i * AGEY_{ij}) + \xi_{0i} + \xi_{1i} + \varepsilon_{ij}$$

Conditional Model for Discontinuous Growth including HFM as Time Varying Predictor

Level 1 model:

$$CESD_{ij} = \pi_{0i} + \pi_{1i} (AGEY_{ij}) + \pi_{2i} (PostParentingy_{ij}) + \pi_{3i} (HFM_{ij}) + \varepsilon_{ij}$$

Level 2 model:

$$\pi_{0i} = \gamma_{00} + \gamma_{01} (AgeBirth_i) + \gamma_{02} (Enroll_i) + \gamma_{03} (OthChild_i) + \gamma_{04} (RaceEth_i) + \xi_{0i}$$

$$\pi_{1i} = \gamma_{10} + \gamma_{11} (AgeBirth_i) + \gamma_{12} (Enroll_i) + \gamma_{13} (OthChild_i) + \gamma_{14} (RaceEth_i) + \xi_{1i}$$

$$\pi_{2i} = \gamma_{20}$$

$$\pi_{3i} = \gamma_{30}$$

Composite model:

$$CESD_{ij} = \gamma_{00} + \gamma_{10}(AGEY_{ij}) + \gamma_{20}(PostParentingy_{ij}) + \gamma_{30}(HFM_{ij}) + \gamma_{01} (AgeBirth_i) + \gamma_{02} (Enroll_i) + \gamma_{03} (OthChild_i) + \gamma_{04} (RaceEth_i) + \gamma_{11} (AgeBirth_i * AGEY_{ij}) + \gamma_{12} (Enroll_i * AGEY_{ij}) + \gamma_{13} (OthChild_i * AGEY_{ij}) + \gamma_{14} (RaceEth_i * AGEY_{ij}) + \xi_{0i} + \xi_{1i} + \varepsilon_{ij}$$

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TIER:

<http://ase.tufts.edu/tier/>

The Children's Trust:

<http://childrenstrustma.org/>

Massachusetts' Department of Public Health:

<http://www.mass.gov/eohhs/gov/departments/dph/programs/family-health/home-visiting/>

Health Resources & Services Administration (HRSA):

<https://mchb.hrsa.gov/maternal-child-health-initiatives/home-visiting-overview>

Home Visiting Evidence of Effectiveness:

<https://homvee.acf.hhs.gov/>